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GEOTHERMAL WORKING GROUP

2010

Chavez, Carl J, EMNRD

From: Michael Albrecht [michael.albrecht@tbapower.com]
Sent: Thursday, March 08, 2012 8:53 PM
To: michael.albrecht@tbapower.com
Subject: Geothermal project capacity available

We got some capacity available for geothermal drilling planning, resource assessment, exploration, exploration support services and other related tasks. If any of your projects can use some related services please call me at (801) 828-0114 to talk about it. Our drilling engineering associates and exploration geologists worked in different geothermal scenarios and under challenging conditions like drilling 35,000 ft deep. All that at very reasonable costs.

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Thank you,

Michael Albrecht
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Executive Order 2010-001: New Mexico Clean Energy Economy Action

Report from the Deep Source Geothermal Commercialization Working Group to the Green Jobs Council and Clean Energy Development Council:

New Mexico Geothermal Resource Assessment and Data Base

Steve Lucero, Energy Conservation and Management Division Geothermal Energy Program Manager

December 1, 2010

Executive Order 2010-001 establishes directives for the Energy Minerals and Natural Resources Department (EMNRD) and New Mexico Tech (NMT) to convene a "Geothermal Group" to oversee the development of a statewide geothermal resource assessment and data base and develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource:

> *"EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010."*

This report summarizes the work that was conducted in 2010 to meet the directives of this executive order.

Geothermal Group Meetings

The first meeting of the Geothermal Group was held on February 11, 2010 in Santa Fe and chaired by EMNRD. These meetings were held to (a) develop a geothermal resource assessment and database and (b) to make technical and policy recommendations to accelerate development of New Mexico's deep-source geothermal resources.

Three presentations were made: a review of geothermal energy in New Mexico by Jim Witcher, an overview of the proposed geothermal database being prepared by New Mexico Tech from Dr. Mark Person, and a presentation on geothermal project development from Michael Albrecht, president of TBA Power. The Group consisted of representatives from: EMNRD (Energy, Conservation and Management (ECMD) and Oil Conservation Divisions (OCD)), the Economic Development Department, Office of the State Engineer, New Mexico Tech, New Mexico State University, Los Alamos National Laboratories, the New Mexico Bureau of Geology and Mineral Resources, the New Mexico Consortium, various geothermal consultants, and representatives of the geothermal industry. Discussion at this first meeting focused on the scope of work for the geothermal database. The group provided input on the database work and other technical geothermal parameters for this project.

Completed action items from the February 11th meeting included: making presentations available to the group on the New Mexico Consortium webpage, researching seismic hazards associated with Enhanced Geothermal Systems (EGS) projects and making this information available on the New Mexico Consortium webpage (www.newmexicoconsortium.org), continuing work relating to defining the state regulatory process for geothermal projects, collecting policy recommendations from the group and developing a governmental services agreement contract between New Mexico Tech and EMNRD on the database.

Enhanced Geothermal Systems are defined as geothermal power technologies that do not require natural convective hydrothermal resources, they "enhance" and/or create geothermal resources in hot dry rock through hydraulic stimulation. When natural cracks and pores will not allow for sufficient flow rates, the permeability can be increased by pumping high pressure cold water (even waste water) down an injection well into the rock. Water travels through fractures in the rock, capturing heat until it is forced out of a second borehole as very hot water, which is converted into electricity using either a steam turbine or a binary power plant system. All of the water, now cooled, is injected back into the ground to heat up again in a closed loop.

The second and final meeting of the Geothermal Group was held on June 16, 2010 in Santa Fe and chaired by EMNRD. Six presentations were made: a summary of the 2010 Enhanced Geothermal Systems Conference in Reno, Nevada by Dr. Kurt Anderson of NMSU, an update on the nationwide geothermal database effort, a summary of the NM Tech statewide geothermal database work proposal and scope of work by Dr. Mark Person, a description of the Department of Energy funding opportunity (DOE FOA 00318) for geothermal projects from LANL, and a comprehensive description of the New Mexico state regulatory process for geothermal projects presented by New Mexico OCD legal staff. Technical and policy recommendations were collected from the group.

Statewide Geothermal Resource Assessment Project

On September 9, 2010, NM Tech and EMNRD entered into a contract through a governmental services agreement to develop a statewide geothermal resource assessment project. This project is funded with DOE American Recovery and Reinvestment Act funding, with the sum of both contracts in the total amount of $200,000 and scheduled to be completed by March 2012.

This contract is the first of two contract phases to develop a statewide geothermal resource database. The first phase is primarily a data collection effort, which entails the collection of statewide geothermal energy data, geochemical sampling data and hydrothermal modeling.

This project will develop an updated assessment of the State of New Mexico's geothermal resources and make this information available to the public. This will involve synthesizing existing data sets from various state agencies, national labs and universities. New Mexico Tech will develop maps of geothermal potential and the degrees of exploration and also collect new geochemical data from hot springs and groundwater wells in order to develop a refined geochemical geothermometer for our state. Finally, the project will develop four basin-scale hydrothermal models of select geothermal areas around the state. This will help evaluate hydrologic window, deep conductive, and magmatic exploration play concepts.

This phase will run concurrently with phase two, which will be conducted through a second contract to incorporate the Phase-one data into a web-based GIS interface. This contract is integral to meeting the directive of the executive order.

EMNRD OCD Geothermal Regulatory Developments

In 2010, OCD staff conducted a series of meetings attended by representatives of multiple state and federal agencies for the purpose of discussing the state regulatory process for geothermal projects (referred to as the "Geothermal Regulations-Programs Stakeholder Meeting Group"). The anticipated increased interest in geothermal energy projects in New Mexico has prompted OCD, along with other state agencies, to work collaboratively toward a clearer, more uniform inter-agency understanding of the state regulatory processes as they have been established under existing laws and regulations, and particularly in light of the 2007 New Mexico Court of Appeals case which served to clarify the definition of a "geothermal resource" under New Mexico Law.

Attendees at the Geothermal Stakeholder meetings in 2010 included representatives from state agencies including Office of the State Engineer, OCD, ECMD, Environment Department, Construction Industries Division and Regulation and Licensing Department, as well as representatives from the federal agencies the Bureau of Land Management (BLM)and Minerals Management Service (MMS). OCD Geothermal Regulations do not supersede other applicable federal, state and/or local regulations; consequently, geothermal projects in New Mexico may ultimately involve multiple agencies, each responsible for administering different regulations as they apply to a given project. It is therefore important that agencies with the potential for authority over or involvement in geothermal projects be clear regarding both their regulatory authority and obligations, and those of the other agencies likely to be involved in such projects.

In the course of the Geothermal Stakeholder meetings, representatives of the various agencies have coordinated and clarified each agency's role in the geothermal application and permit process for a variety of types of geothermal projects. The Geothermal Stakeholder meetings succeeded in generating:

- a written summary of each agency's role in the regulatory and permitting process;
- a common, cross-agency understanding of how geothermal projects are permitted pursuant to existing statutes and rules;
- a process for coordination and open communication between agencies;
- an updated OCD geothermal resource web page; and
- a full set of updated, proposed OCD geothermal forms (to be submitted to the Oil Conservation Commission for proposed approval and adoption).

The Geothermal Stakeholder Group also addressed the issue of clarifying the distinction between true geothermal projects and *non*-geothermal energy projects under New Mexico's definition of a geothermal resource. Specifically, the issue of ground source heat pumps / heat exchange systems, sometimes called "geothermal heat pumps," was raised and discussed. To the extent that these systems typically do not utilize a naturally-occurring geothermal reservoir, but rather use the earth to "store" heat (generally produced by people, the sun, appliances, etc.) for later retrieval and use, they are not true geothermal resources under New Mexico law. The permitting process, and the agencies with regulatory authority and obligations relating to these *non*-geothermal projects, were also clarified and confirmed in the course of the Geothermal Stakeholder meetings.

It was generally agreed that while these systems are not geothermal under New Mexico law, because of the technology they employ, and because of the "common name" sometimes used of "geothermal heat pump," individuals seeking information regarding the permitting of ground source heat pumps may believe them to be geothermal in nature, and may therefore incorrectly begin by making inquiry with the OCD. Measures have therefore been taken to include information regarding these systems on the OCD Geothermal Website Resource Page for the specific purpose of informing the applicant that such systems are <u>not</u> geothermal, and for directing the applicant to the proper agencies for inquiry and application processing.

Geothermal energy projects discussed by the Stakeholder Group included: conventional open-loop injection and production well systems; enhanced geothermal systems; and projects involving geothermal co-production with oil and gas production. Geothermal co-production with oil and gas production projects are permitted under both oil and gas regulations (for the oil or gas production and/or the produced water disposal aspects of the project) and geothermal regulations (for the geothermal energy production aspect of the project), but are not typically permitted under the Water Quality Control Commission (WQCC) Regulations as Class V Geothermal Wells. However, under certain site conditions any potential discharge from this type of application could trigger a requirement for a WQCC discharge permit by the OCD.

OCD is committed to developing a clear permitting process as well as to protecting our state's limited water resources by adhering to the state WQCC Regulations where applicable. OCD has developed a *Geothermal Website Resource Page* that contains clickable hyperlinks to enable operators to easily access information and forms regarding the permitting of geothermal projects: (<u>http://www.emnrd.state.nm.us/ocd/documents/OilConservationDivisionGeothermalApplicationProcess8-18-2009.pdf</u>)

OCD has also developed a draft document that lists the permitting requirements for projects involving the co-production of geothermal energy with oil and gas production in anticipation of a need to begin processing this type of application. The Stakeholder meetings, in conjunction with the Geothermal Working Group working on the Governor's Executive Order, have been very productive and informative for all participating state agencies. OCD legal and technical staff have invested significant time and effort toward developing a functional regulatory path, anticipating the need to work in tandem with various other state regulatory agencies, as each agency does its part to fulfill its designated obligations relating to the administration and permitting of geothermal projects in New Mexico.

Geothermal Co-production from Oil and Gas Production Symposium

ECMD staff, with assistance from the New Mexico Consortium and New Mexico Tech attempted to organize a symposium entitled 'Geothermal Production from Oil and Gas Development.' This symposium was to be focused on New Mexico geothermal resources, specializing in the development of existing oil and gas wells for geothermal electrical production. The symposium was planned for early fall 2010 in Albuquerque; however, due to the current state of the economy, government budget cuts, and other various factors over the course of the past year, a determination was made to not schedule the symposium for 2010 as originally planned.

First, without a funding source, it was extremely difficult to retain the necessary technical speakers for this symposium. Second, although organizers made contact with a number of oil and gas industry representatives, extending invitations to attend and participate at various levels in this symposium, none expressed an interest in either attending or participating in the symposium.

Symposium organizers corresponded via email with technical experts concerning this specific technology in the context of its potential for application in New Mexico. These email discussions have raised doubts regarding whether the necessary conditions exist in New Mexico to render geothermal co-production from oil and gas production practicable and/or whether such technology is economically feasible in New Mexico. ECMD staff has met with OCD legal and technical staff to determine the regulatory approach to these projects and will continue to collect more information on this subject to determine whether a symposium on this topic is worthwhile.

2010 New Mexico Statewide Geothermal Working Group Meeting

ECMD staff worked with New Mexico State University and New Mexico Consortium staff to plan the 2010 New Mexico Geothermal Energy Working Group meeting. The meeting was originally scheduled for September 15-16, 2010 in Las Cruces. However, as found in the planning for the above mentioned symposium, the lack of funding failed to generate sufficient interest for attendance and participation. Less than five people committed to speaking and presenting at this symposium. After receiving less than 10 attendance confirmations for the meeting, the meeting was cancelled. ECMD, the New Mexico Consortium and TBA Power have agreed to coordinate the next meeting in the spring of 2011 in Los Alamos.

These meetings needed to attract companies and individuals with possible interest in commercial-scale investment in New Mexico's geothermal resources and those who would derive business from such investments. We needed to offer useful information about available resources and incentives for investment. The first would include surface infrastructure as well as geothermal and hydrologic information. The second would include expediting the permitting process, financing opportunities and insurance/legal matters. Unfortunately, we were not ready or able to offer either - or at least nothing really new. Several invitees declined invitations with comments along the lines of "I've heard all of this before. What's changed?"

Policy and Technical Recommendations:

During the February and June 2010 meetings, numerous discussions were held that brought forth topics to promote geothermal energy projects in New Mexico. Comments were provided to ECMD through email correspondence following these meetings as well. These topics can be narrowed down to the following subjects,: Public Safety Considerations, Finance, Water Resources, Geothermal Resources, Applications with Methods of Heat Extraction, Environmental Considerations, Technical Considerations, Policy Considerations, Transmission of Electricity, and Public Education and Outreach.

1. Finance Options

Financing incentives and assistance are important mechanisms for facilitating renewable energy project development. Commercial geothermal power companies with sufficient upfront capital resources necessary for the implementation of projects in New Mexico are highly desirable as they would not be hindered by financial obstacles. The state of New Mexico has geothermal tax credits available through the Advanced Energy Tax Credit. However, up-front project capital costs and incentives are important to address, as well.

Michael Albrecht of TBA power has proposed the advancement of state sponsored loan programs to assist with this. Mr. Albrecht also suggests the development of a program where drilling equipment is purchased by the state and made available through a loan program to private developers for exploration projects. The private company would then pay for labor and equipment maintenance for each project. The state would benefit from this type of program because instead of investing in geothermal in New Mexico on a per-project basis, the state would be making a one-time investment for a drill rig that would then serve multiple, statewide projects for many years, and the availability of the equipment would also likely be an incentive to developers.

2. Technical Considerations

SEISMICITY: The Geothermal Group discussed potential seismic hazards associated with EGS projects. It was noted that geophysical and seismic stability issues will need to be carefully addressed for these projects. In particular, geothermal projects in highly fractured and faulted zones will need to be analyzed for these hazards, especially near populated areas. Blind injection into these types of areas carries the potential for not only failed projects, but for disastrous outcomes. Project locations in isolated areas are preferred due to these concerns, as well as for aesthetic reasons (*i.e.*, noise, large pits, etc.), and may result in less opposition from water rights owners and the general public during the permit process. ECMD provided information on EGS seismic hazards including guidance documents on the New Mexico Consortium Geothermal webpage. OCD staff commented that due to the excessive hydraulic forces exerted on strata, EGS applications should be performed under controlled conditions and with created fracture systems, away from aforementioned geologic conditions and population centers,. Conversely, generally speaking, shallow low pressure open-loop recirculation (injection and production wells) or closed-loop or banked heat exchange geothermal systems may operate in the above mentioned areas without any concerns. *Note: As discussed above, heat exchange projects are not "geothermal" under New Mexico law.*

GENERAL TECHNICAL CONSIDERATIONS: OCD notes the following general considerations will need to be addressed with regard to geothermal projects: adequate fresh water resources and aesthetics (large pits, large footprint of facilities, noise from well testing and daily operations, etc.); depletion of hydrologic and hydrogeologic resources from evaporation and fresh makeup water needed for daily cooling tower operations; presence of naturally occurring hydrogen sulfide gas in areas with subsurface carbonaceous formations; and subsidence and stability issues at geothermal project sites. Noise abatement is addressed by Geothermal Rule 19.14.31.8 NMAC, and if more specific or additional regulatory limits regarding noise abatement are contemplated, those already established by the State of Colorado would be useful as guidance.
In addition, with regard to geothermal power projects, specifically, geothermal power companies should be encouraged to propose more innovative, alternative heat transfer systems (such as air, Freon, recycling and reuse of pumped ground water) to reduce the consumption of fresh water resources in the project area. The implementation of such innovative alternatives could also serve to minimize OSE water appropriation issues that could prevent projects from reaching fruition. Absent the above, geothermal power projects should be located near prolific fresh water resources, and the assistance of the OSE should be requested to achieve this.

POLLUTION PREVENTION: OCD also commented that to minimize impacts to the environment, pollution prevention and waste minimization procedures (i.e., environmentally friendly chemicals, biocides or technologies that will prevent ground water contamination, control scale, fouling and corrosion problems without the application of toxic chemicals) should be considered for use in these projects. Any pits or ponds constructed under the "permanent pit" provision of an OCD issued discharge permit should meet the minimum permanent pit requirements of OCD Rule Part 17. Liners that are resilient to high-temperatures should be used (examples are: (CSPE-R (Chlorosulfonated Polyethylene- Reinforced); EPDM (Ethylene Propylene Diene Monomer); and FPP-R (Flexible Polypropylene- Reinforced)). Pits constructed for geothermal wells and for which no discharge permit is applicable must comply with the mandates of Geothermal Rule 19.14.25.8 NMAC.

BLOW-OUT PREVENTION: The general requirements for blow out prevention (BOPE) with regard to geothermal wells are set out in Geothermal Rule 19.14.102.8 NMAC. Additional conditions may be imposed where a discharge permit is involved. In general, surface pressures are low in high temperature geothermal wells, thus reducing the requirements for high pressure BOPE that are frequently imposed for oil and gas well projects. However, flow rates are generally high, requiring larger choke, vent, and flow lines than those normally needed for oil and gas wells with a low-pressure BOPE setup. Special equipment, unique to the geothermal industry, is used to deal with the drilling conditions encountered in a steam environment.

INCREASED POWER GENERATION: The Geothermal Group also discussed the point that geothermal power facilities often have a large area of land or surface area with nested systems such as solar, wind, etc. Operators should be encouraged to increase other renewable power generation at these facilities. Geothermal facilities are also excellent for producing hydrogen to complement power production under high temperatures, which could drive other types of renewable power systems.

3. Water Resources and Siting

NM OCD provided valuable input for this report on the protection of state water resources as this pertains to the siting of geothermal power production projects:

SITING: It is preferred that geothermal projects be sited in areas with prolific water resources (that could provide make-up water for cooling towers, etc.) rather than in areas with scarce water resources. In New Mexico, fresh water is generally considered a scarce resource. With regard to cooling tower systems of geothermal power generation projects, Commercial geothermal power companies are therefore be encouraged to develop and propose more innovative, alternative cooling systems (*i.e.*, air, Freon, recycling and reuse of pumped ground water) directed at circumventing the water scarcity and OSE water appropriation issues that exist in New Mexico.

Preferred siting requirements for geothermal power facilities should also include isolation from populated areas with marginal OSE water appropriation(s), residential water wells, etc. This is also based on aesthetic and public safety considerations (*i.e.*, noise from well testing operations; large pits; injection into faults and shattered bedrock zones are more susceptible to geophysical seismic events). Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources. Where possible, operators should endeavor to develop enough onsite water storage to allow for the recycling of some amount of geothermal water for the purpose of cooling newly produced water, minimizing the use of fresh surface water and/or ground water as cooling tower water.

PITS: Geothermal companies will be required to meet the requirements of Geothermal Rule 19.14.25.8 NMAC regarding pits, and may be required to meet additional requirements set forth in the form of a discharge permit (which may then trigger Part 17 of the OCD Rules regarding pits). Special consideration may be required to address liners appropriate for handling the thermal properties of the discharge.

CORROSION PREVENTION AND CEMENTING REQUIREMENTS: Operators will be required to comply with Geothermal Rule 19.14.34.8 NMAC, requiring periodic corrosion surveillance of surface wellhead equipment, pipelines, subsurface casing and tubing, and with Geothermal Rule 19.14.27.8 NMAC regards cementing and casing requirements.

4. Transmission of Electricity

Existing and new transmission lines are also important considerations for developing geothermal projects in New Mexico. The Geothermal Group briefly discussed this topic at its meetings. Developers should be encouraged to focus on transmission grid assessment, and on development in areas with already-identified deep-source geothermal resources to convey power inter- and intra- state. Renewable energy developers should collaborate with geothermal operators to foster the development of new technologies in superconductive wire lines for the purpose of minimizing the loss of electrical power down-transmission-grid, and to achieve maximum efficiency in power storage.

Use of EGS technology gives greater flexibility in siting facilities close to existing transmission lines. Siting geothermal facilities near to or within other power generation facilities with similar transmission needs would be useful. Conversely, siting wind or solar facilities near geothermal facilities would avoid unnecessary duplication of effort. These share some siting considerations with geothermal facilities.

5. Public Education and Outreach

It was suggested by Michael Albrecht that New Mexico should consider further promoting the state's geothermal resources. One possible strategic venue for such promotion that was suggested is the annual national Geothermal Resources Council meeting. Albrecht suggested that the state compile information and send representatives to the next meeting to host a booth directed at addressing New Mexico geothermal economic development. Also, several meeting participants have expressed the need for a New Mexico representative at the annual Geothermal Resources Council Meeting, typically held in the fall in Nevada or California.

A case can be made that geothermal energy production is the "greenest" of renewable energy technologies. It requires the smallest surface area and has the least visual impact of these technologies. Unlike solar or wind, geothermal production works 24/7. The principal downsides of geothermal energy production lie in the potential for water consumption, water pollution, and the production of adverse seismic activity. The first two can be addressed with proper reinjection technology and the last by suitable siting with respect to geologic formations and human populations. Seismic activity, in any case, is likely be more of a public relations matter than a cause for real public concern.

6. Oil and Gas Coproduction

NM OCD has provided the Group with input on geothermal co-production projects:
Based on currently available information, geothermal co-production with oil and gas in New Mexico appears to be most suited to the northwestern region of New Mexico due to geothermal activity and the geothermal gradient in that area. Potential projects should focus on deeper geothermal gradient brine water resources in the oil and gas fields of NW New Mexico that are nearby to existing or newly constructed transmission grids. Geothermal co-production with oil and gas may be applicable to NW New Mexico where geothermal activity coupled with the geothermal gradient (~1.35 °F/100 Ft.) and well depth (> 7,000 md), may facilitate binary cycle geothermal power production (~197°F) by steam generation using glycol working fluids. Further investigation will be needed to research this topic for project feasibility in New Mexico, and additional to promotion of this concept within the oil and gas industry will also be necessary.

7. Policy Considerations for Administration and Permitting

Geothermal development in New Mexico would be considerably helped by a streamlining of the entire permitting process. Many agencies are involved and investors are understandably reluctant to embark on projects where the time, risks and costs associated with the permitting processes for exploration, land acquisition, resource development, and production are significant. Ideally we would establish a single lead agency as the point of contact for all potential investors and participating parties. The various other agencies, under coordination from the designated lead agency, should separately establish procedures that can be conducted in parallel with one another rather than serially. We should make "one stop shopping" available to potential investors.

NM OCD provided numerous comments on this topic:

PROMOTION OF GEOTHERMAL ENERGY PROJECTS: Numerous discussions addressing the promotion of geothermal energy projects in New Mexico occurred at the February and June 2010 Geothermal Group meetings, as well as via email correspondence following those meetings amongst meeting attendees and ECMD. These topics can be narrowed down to the subjects of current geothermal technologies; energy production; land use and mineral resource rights; and permitting.

It has been suggested that a request could be made to the State Land Office and the Bureau of Land Management to develop maps in geothermal resource areas where they lease land, similar to those for oil and gas leasing in the state, in an effort to promote exploration and production of the geothermal resource. Additionally, New Mexico Tech and/or OSE could help to develop ground water maps where plentiful fresh water resources (makeup water for cooling towers) are available near identified geothermal resource areas to help sustain long-term geothermal projects. For example, Placitas or Rincon, New Mexico may not have sufficient fresh water resources to sustain power generation for 10, years let alone 20-30 years, whereas Truth or Consequences very well may have. OSE could also help to identify those locations where water resources or appropriations are absent at identified water resource locations.

OCD JURISDICTION; ADMINISTRATION OF THE ACT: The *Geothermal Resources Conservation Act* [§71-5-1 NMSA 1978] (The Act), and the Geothermal Rules promulgated pursuant to that Act, provide the framework for geothermal administration and permitting of geothermal projects by the OCD in New Mexico. The Act, however, expressly states that it does not supersede the jurisdiction or authority of any other state department or agency to manage, protect and/or utilize state lands or resources. *See* §71-5-6 NMSA 1978. As such, depending on the nature of a given geothermal project, projects are sometimes subject to the mandates of other statutes and rules, in addition to the Act. The result is that the administration and permitting process for geothermal projects frequently requires cooperative (and sometimes even simultaneous) management by multiple state agencies.

A threshold determination is required to determine whether a project falls within the framework of the Act and the associated Geothermal Rules: whether the project constitutes a "geothermal resource" as defined by the Act. The Act defines a "geothermal resources" as "the natural heat of the earth or the energy, in whatever form, below the surface of the earth present in, resulting from, created by or which may be extracted from this natural heat and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances." §71-5-3(A) NMSA 1978.

The only exclusion to this definition as provided by the statute is provided by §71-5-2.1 NMSA which provides that "[w]hen the application of potable water to a beneficial use involves the incidental loss or extraction of heat *and* the water is 250 degrees Fahrenheit or less, *then that heat is not a geothermal resource...." (Emphasis added)*. The New Mexico Court of Appeals discussed this exclusion in 2007 in the context of exclusion for purposes of payment of royalties, and in so doing, the court clarified that the exclusion is to be literally read as a narrowly defined and limited exclusion. (i.e. regardless of whether the water is above or below 250 degrees, if the extraction or loss of heat is *not* incidental, the heat *is* a geothermal resource; the exclusion only applies where extraction or loss of heat is incidental *and* temperature is below 250 degrees.) *Rosette, Inc. v. U.S. Dept. Of The Interior*, 2007-NMCA-136, 142 N.M. 717, 169 P.3d 704. If a project actually meets the criteria of the exclusion, then that project does not require a geothermal permit through the OCD under the Act.

The Oil Conservation Division (OCD) has general regulatory jurisdiction over all aspects of geothermal development, including: well drilling (Geothermal Resource Conservation Act gives the OCD jurisdiction over location and construction of wells); waste disposal (OCD administers Water Quality Act as applied to geothermal development, approval of "discharge plans" and permitting of Class V geothermal injection wells); and Correlative Rights (OCD must adjust competing claims of owners, and users of the same geothermal reservoir). OCD also has jurisdiction over projects where geothermal water is co-produced with oil or gas. Jurisdiction remains with the OCD regardless of whether the co-produced water's geothermal heat is used if the production of the water is from an aquifer >2,500 feet below the surface, and the water contains > 1,000 ppm Total Dissolved Solids.

OCD already has a process in place for issuing WQCC discharge permits for larger, low and high temperature Class V Geothermal exploration and production wells for power generation, and/or low-temperature geothermal projects in New Mexico. Further, while no such wells have yet been permitted in the state, OCD is aware of the process for permitting geothermal co-production with oil and gas projects, which is similar to UIC Class II Salt Water Disposal Wells under OCD Oil and Gas Regulations (except where operations allow a discharge on site that threatens surface and ground water).

<u>**Summary**</u>

The Geothermal Group provided important information to incorporate into the statewide Geothermal Resource Assessment Database. Federal ARRA funding was critical to moving the project forward to meet the goals of the executive order. There are several actions that the state can take to promote geothermal projects, involving both significant funding and small investments that would make a positive contribution.

<u>**Appendices and References:**</u>

1. Copies of title slides of presentations from the February and June Geothermal Group meetings are attached with this report. For more information on these reports, please contact Steve Lucero, ECMD Geothermal Energy Program Manager at 476-3324 or stephen.lucero@state.nm.us.

2. New Mexico Geothermal Resources Map, November 2003, Idaho National Engineering and Environmental Laboratory.

3. Dr. Kurt Anderson (NMSU) email to EMNRD on November 11, 2010:

"Our objective should be the commercial scale production of electric power from geothermal resources within New Mexico. This imposes certain requirements such as temperature, flow rate, and source lifetime upon any particular resource.

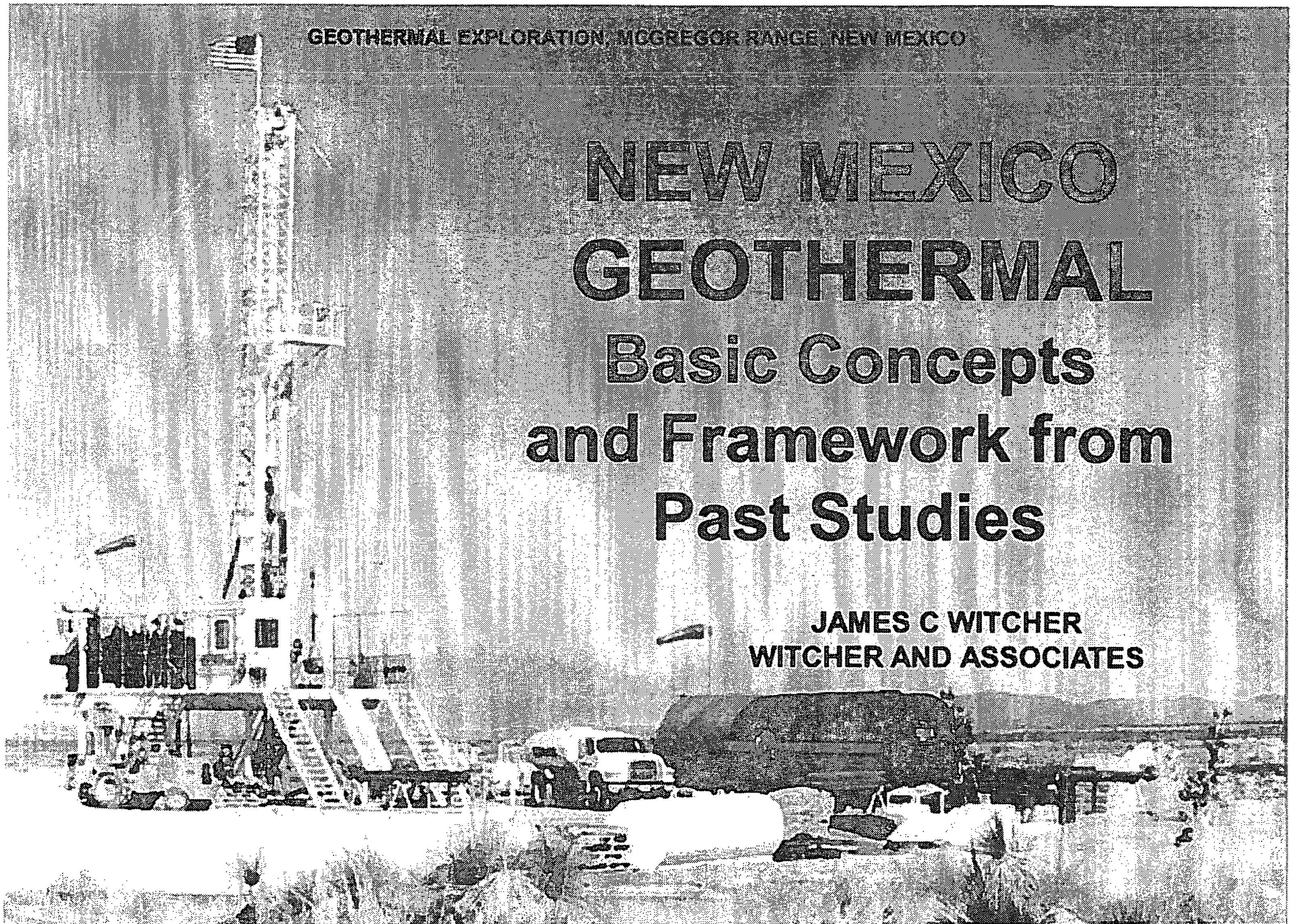
Suitably hot hydrothermal resources are relatively scarce in New Mexico, even more so than elsewhere in the United States. Indeed, water in any form is a scarce resource in the desert southwest. Consequently, our state's potential for significant geothermal energy production at commercial scales lies in the exploitation of EGS techniques applied to hot dry rock (HDR) resources. Generally speaking one has to drill deeper but, at least, one knows that the "resource" is likely to be there before one begins. The main question, then, is whether or not the rock strata are sufficiently unfaulted and unfractured, yet still weak enough, for the creation of a confined reservoir by high pressure water injection. Water resources would be required for the initial creation of the reservoir (and to compensate for any leakage during production) but would otherwise be minimal. Reinjection is to the reservoir, of course. Suitable sites are also those least likely to pose seismic problems, or lead to contamination of existing water resources, during the initial reservoir development process or during production. The ubiquity of hot dry rock (HDR) sources at depth also means that suitable sites can be found relatively far from population centers or facilities which might be adversely affected by such seismic activity that might result for geothermal development.

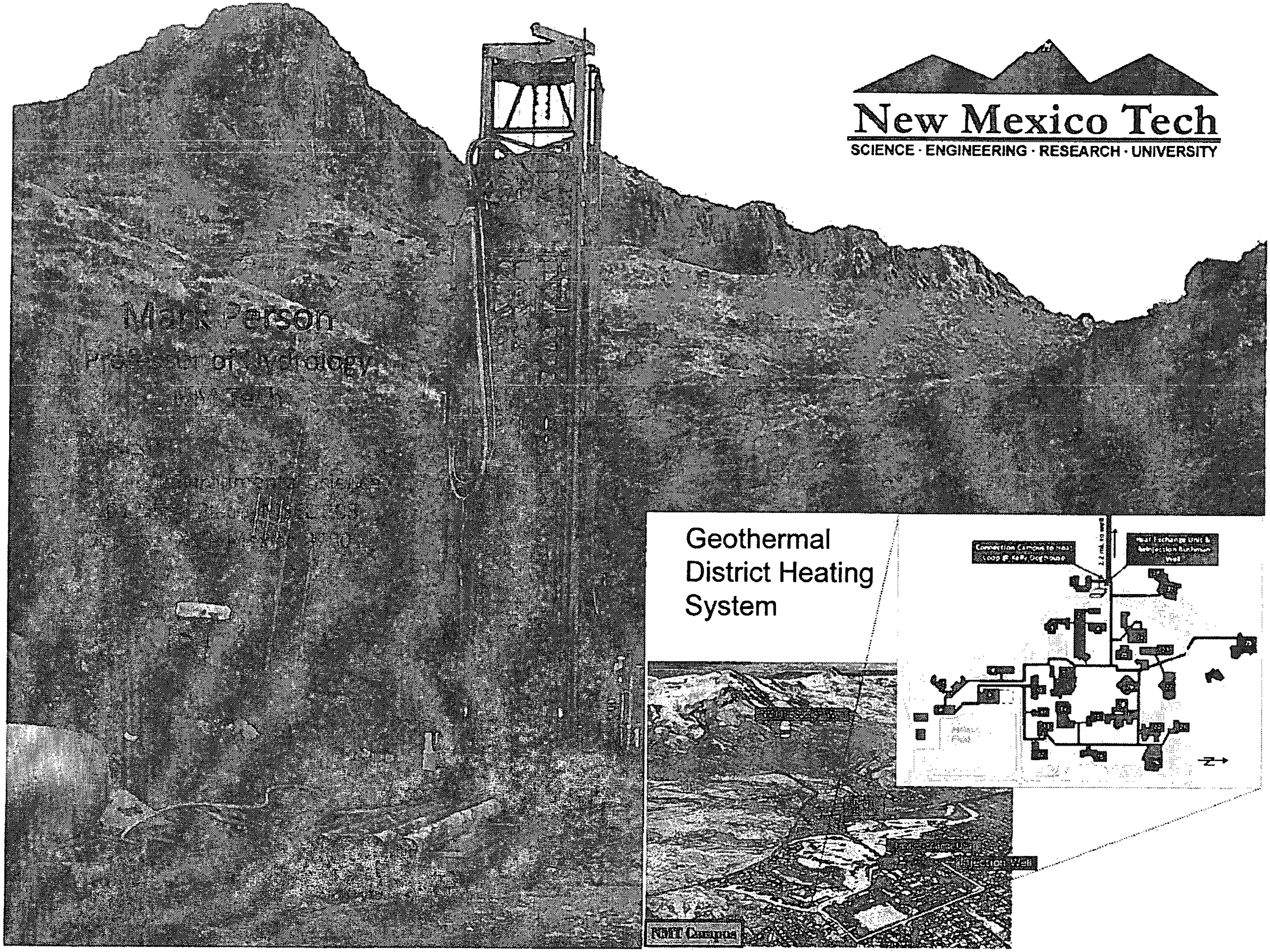
Given the above it is perhaps unfortunate that the statewide geothermal assessment project, via the EMNRD Contract with New Mexico Tech, seems (at least to me) to be concentrating its efforts on potential hydrothermal sources. A geological/geophysical search for high temperature unfractured strata at relatively accessible depths (mainly for cost reasons) would be more valuable if the intent is to foster large scale geothermal electric power development.

In any case, closed cycle systems (with extracted hot water being reinjected) should take care of problems associated with associated gases and dissolved materials, groundwater contamination, etc. We should emphasize that high temperature HDR/EGS systems, once established, make relatively small demands upon additional water resources. In operation the principal need might well be for cooling of the secondary fluid in binary electric generating systems. In that case the required cooling water will neither be contaminated nor lost; it is merely warmed before being made available of other uses (including, possibly, reinjection into the shallower and cooler aquifer from which it came).

I remain convinced that the most certain way to encourage geothermal development in New Mexico is for the State to undertake construction of a "prototype" geothermal electric generation plant of significant capacity (more than 10 MWe).

Recommendations
(1) Establish "one stop shopping" for permitting - to speed, shorten, and simplify the process.
(2) Provide financial incentives: Loans and insurance underwriting, investment credits, tax breaks, etc. - to offset some of the investor risks. Provide coordination with infrastructure and customer bases (transmission lines, electric utilities).
(3) Establish a resource database that includes potential HDR as well as hydrothermal resources - to reduce exploration costs and risks. That GIS type database should also include land ownership and jurisdictional information as well as infrastructure (e.g., transmission lines) descriptions.
(4) Construct state funded pilot ("demonstration") project - to show that geothermal electric power production can be done on a commercial scale for reasonable cost."


GEOTHERMAL EXPLORATION, MCGREGOR RANGE, NEW MEXICO
NEW MEXICO
GEOTHERMAL
Basic Concepts
and Framework from
Past Studies
JAMES C WITCHER
WITCHER AND ASSOCIATES


New Mexico Tech
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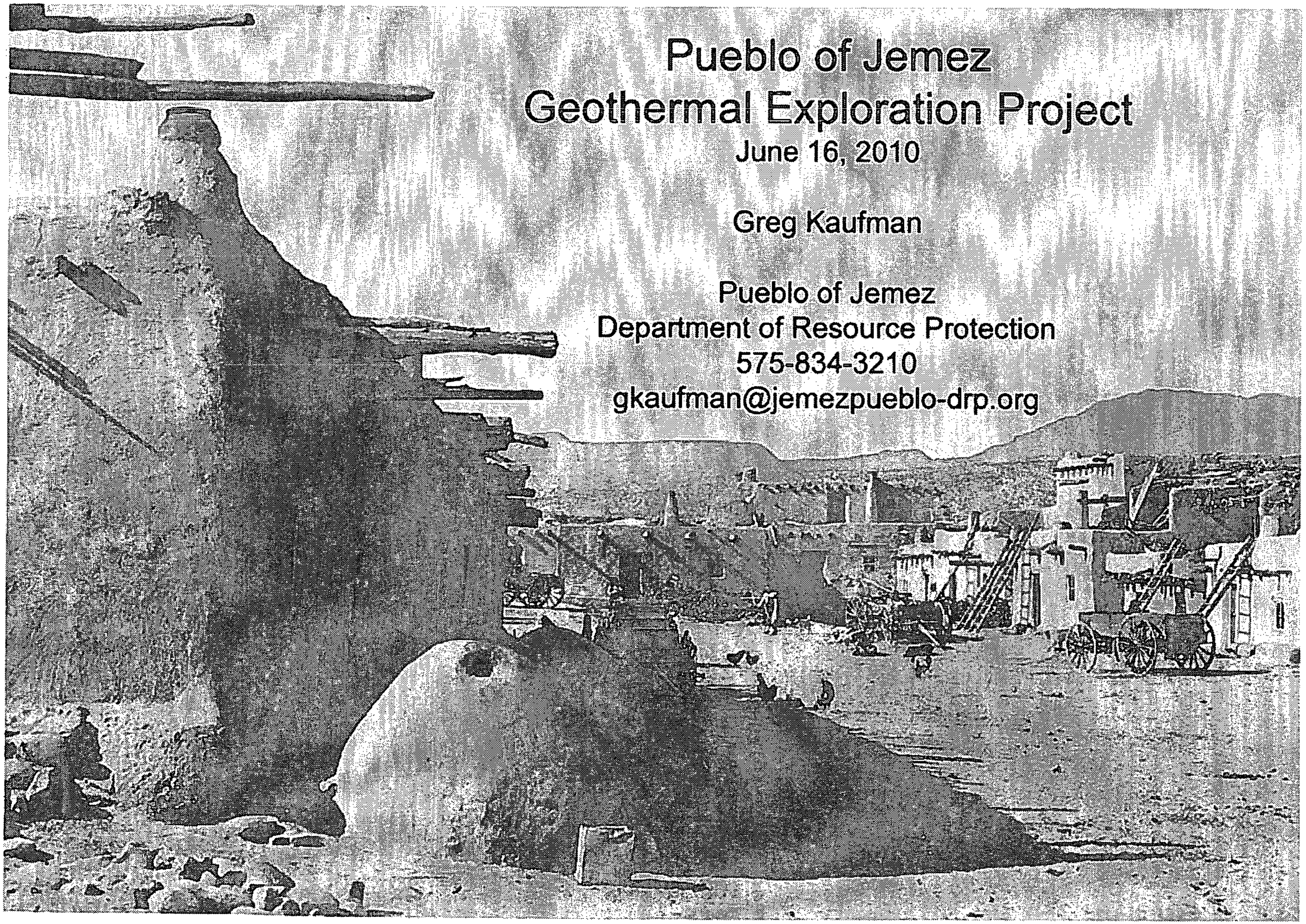
Mark Person
Professor of Hydrology
Geothermal
District Heating
System
NMT Campus


Pueblo of Jemez
Geothermal Exploration Project
June 16, 2010
Greg Kaufman
Pueblo of Jemez
Department of Resource Protection
575-834-3210
gkaufman@jemezpueblo-drp.org

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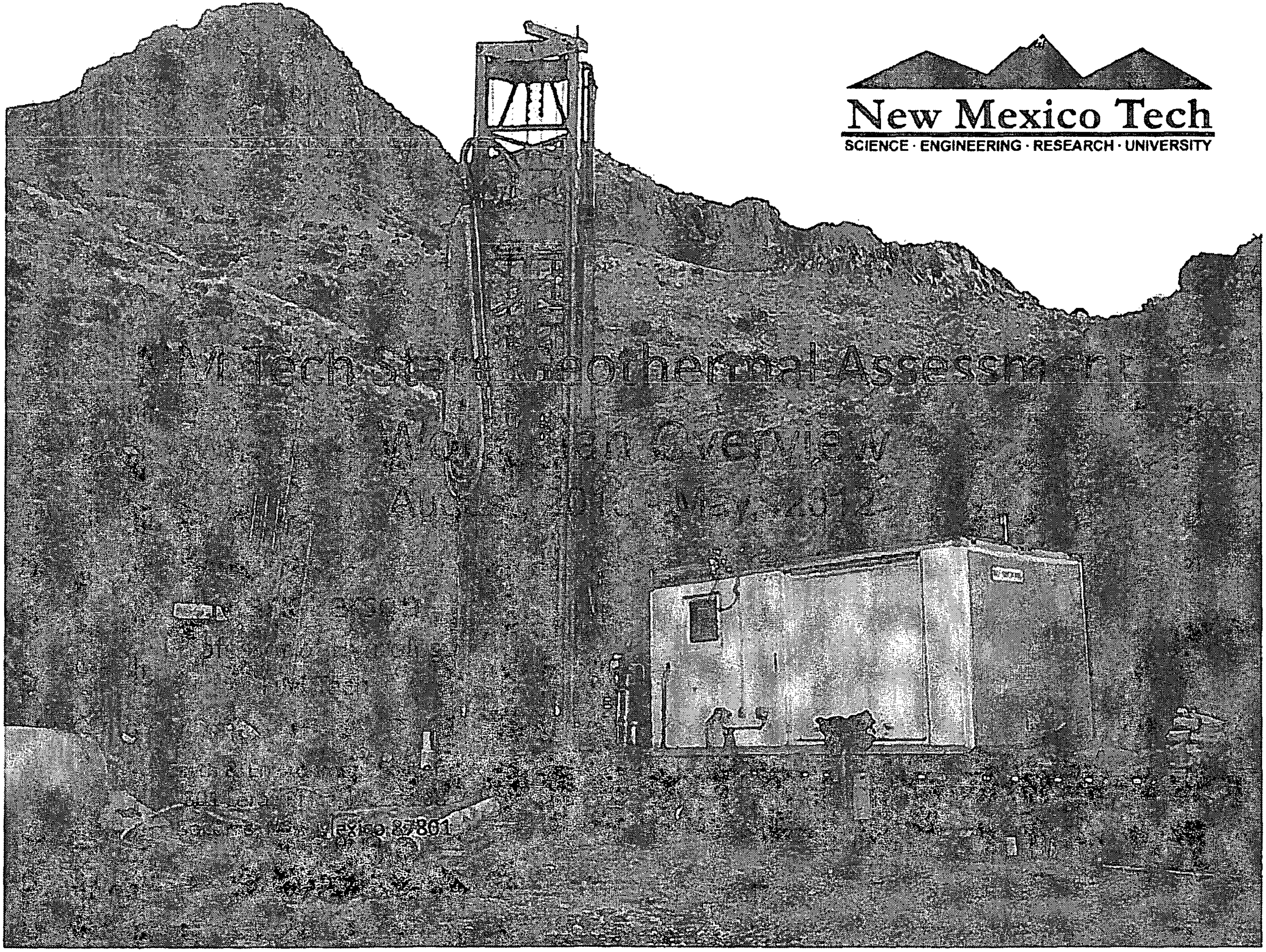

Geothermal Power Commercialization in New Mexico

Deep Source Geothermal Commercialization
Working Group Meeting
Santa Fe, New Mexico
16 June 2010

Kurt Anderson
New Mexico State University & The New Mexico Consortium

DOE FOA
Geopressued Energy Production

(issue date 5/12/10)

Application Due Date: 7/9/10, 11:59 EST

Electricity production from

a) Low temperature resources (below 150^0C)

b) Coproduced fluids

c) Geopressured

Additional direct use and exploitation of chemical, kinetic energy OK

OCD Geothermal Permit Process

Carl Chavez

OCD Environmental Bureau- SF

(505) 476-3490

Ownership of Geothermal Resources

David Brooks

OCD Engineering Bureau- SF

(505) 476-3450

GEOTHERMAL REGULATION IN NEW MEXICO PURSUANT TO THE GEOTHERMAL RESOURCES CONSERVATION ACT:

Ongoing, multi-agency effort to clarify permitting framework pursuant to the Act in light of increased interest in geothermal energy.

June 16, 2010

Mikal M. Altomare, Assistant General Counsel
Energy, Minerals and Natural Resources Dept,
Oil Conservation Division

Chavez, Carl J, EMNRD

From: ron [ron@gis.nmt.edu]
Sent: Friday, November 05, 2010 8:54 AM
To: Chavez, Carl J, EMNRD
Cc: jimwitcher@zianet.com; mjreed@usgs.gov; Altomare, Mikal, EMNRD; Lucero, Stephen A., EMNRD; Bureau; Shari Kelley
Subject: Re: FW: Geothermal Report -OCD revisions (possible addition of Raton Basin into Geothermal Co-Production Section of OCD Draft)

Carl

We are in the process of preparing a statewide (New Mexico) database of bottom-hole temperatures in oil and gas wells as part of the National Geothermal Data Project, which is funded by DOE. It should be more detailed and will have considerably more information than the existing maps put out by the USGS. I think it will be a few months before we will be able to provide the information. I don't know what Jim Witcher may have.

Ron

On 11/5/2010 7:27 AM, Chavez, Carl J, EMNRD wrote:
> Gentlemen:
>
> In case you are aware of any high geothermal temperature gradients in the Raton Basin Area........
>
> Thanks in advance......
>
>
> Carl J. Chavez, CHMM
> New Mexico Energy, Minerals& Natural Resources Dept.
> Oil Conservation Division, Environmental Bureau 1220 South St. Francis
> Dr., Santa Fe, New Mexico 87505
> Office: (505) 476-3490
> Fax: (505) 476-3462
> E-mail: CarlJ.Chavez@state.nm.us
> Website: http://www.emnrd.state.nm.us/ocd/index.htm
> (Pollution Prevention Guidance is under "Publications")
>
>
> -----Original Message-----
> From: Chavez, Carl J, EMNRD
> Sent: Friday, November 05, 2010 7:16 AM
> To: Altomare, Mikal, EMNRD
> Cc: Fesmire, Mark, EMNRD; Sanchez, Daniel J., EMNRD; Martin, Ed,
> EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy,
> EMNRD; Perrin, Charlie, EMNRD; Lucero, Stephen A., EMNRD
> Subject: RE: Geothermal Report -OCD revisions (possible addition of
> Raton Basin into Geothermal Co-Production Section of OCD Draft)
>
> Mikal:
>
> Just one last minute geothermal co-production research item for consideration and I'm not sure whether Mark Fesmire would want to consider it now, but.....
>
> Based on my review of the USGS Report on the OCD's Geothermal Resource Website (i.e., Assessment of Low-Temperature Geothermal Resources of the US- 1982- USGS), the Raton Basin (Colfax County) exhibited a>45 degree Celsius per kilometer temperature gradient (> 113 Fahrenheit per kilometer) contour on Figure 5. Temperature- gradient map of the conterminous United States (based on Guffanti and Nathenson, 1980, fig.1).
>

> If my calculations are correct, this would be the highest geothermal gradient (> 3 F/100 Ft.) in potential New Mexico oil and gas territory based on current available geothermal exploration information. However, a review of the OCD's Low-Temperature Geothermal Files (OCD Online "GTLT") does not contain any geothermal exploration forms from Colfax County.
>
> I'm copying Ed Martin and the rest of the OCD Districts as an FYI in case he or any OCD Staff may be aware of any geothermal anomaly information from OCD District Office 4- Colfax County. Steve Lucero of ECMD is copied as an FYI that OCD may want to include the Raton Basin in the section of Geothermal Co-production as a last minute item addition by the OCD?
>
> Thanks for your consideration. Sorry I didn't notice this sooner......
>
>
> Carl J. Chavez, CHMM
> New Mexico Energy, Minerals& Natural Resources Dept.
> Oil Conservation Division, Environmental Bureau 1220 South St. Francis
> Dr., Santa Fe, New Mexico 87505
> Office: (505) 476-3490
> Fax: (505) 476-3462
> E-mail: CarlJ.Chavez@state.nm.us
> Website: http://www.emnrd.state.nm.us/ocd/index.htm
> (Pollution Prevention Guidance is under "Publications")
>
> -----Original Message-----
> From: Altomare, Mikal, EMNRD
> Sent: Thursday, November 04, 2010 5:20 PM
> To: Lucero, Stephen A., EMNRD
> Cc: Chavez, Carl J, EMNRD; Fesmire, Mark, EMNRD
> Subject: Geothermal Report -OCD revisions
> Importance: High
>
> Steve-
>
> Attached are two versions of the OCD-revised Geothermal report. The first is a version with all of our changes/deletions/additions in track changes format, and the second is a version with all changes accepted (easier to read), except there is one comment directed to you addressing the Albrecht recommendation.
>
> If you have any questions for us regarding the changes we have made, please don't hesitate to ask. I will be in until 4:30 tomorrow (Friday) but am on a flex day on Monday (back in on Tuesday).
>
> Mikal
>
>
> The message is ready to be sent with the following file or link attachments:
>
> EMNRD-Geothermal Recom OCD 11-4-10 track changes.docx EMNRD-Geothermal
> Recom OCD 11-4-10 final with comment.docx
>
>
> Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.
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Ron Broadhead
Principal Petroleum Geologist
New Mexico Bureau of Geology and Mineral Resources a division of New Mexico Tech

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, November 05, 2010 8:05 AM
To: 'mjreed@usgs.gov'; 'jimwitcher@zianet.com'
Subject: FW: Raton Basin and Temperature Gradient Anomaly in USGS LT Report

FYI. Any comments would be appreciated based on the explanation below.... Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Friday, November 05, 2010 8:02 AM
To: Altomare, Mikal, EMNRD; Lucero, Stephen A., EMNRD; Fesmire, Mark, EMNRD
Cc: 'ron@gis.nmt.edu'; VonGonten, Glenn, EMNRD
Subject: Raton Basin and Temperature Gradient Anomaly in USGS LT Report

In the same USGS Report (link: http://energy.usgs.gov/PDFs/USGS_Circular%20892_1983.pdf) this is the Figure 5 explanation.....

Figure 5 shows the map of Guffanti and Nathenson (1980) but with added data from Blackwell and Steele (1981), Dashevsky and McClung (1980), M. C. Gardner (written commun., 1980, Hodge and others (19811, Jessop and Judge (1971), Judge and Beck (19731, W. S. Keys and D. E. Eggers (written commun., 1980), Leonard and Wood (19801, McClung (19801, Perry and others (1980), Roy and others (19801, **Sass** and others (1981), J. H. Scott and J. J. Daniels (written commun., 1980), Shearer (19791, and Urban and others (1978). An important characteristic of these deep temperature gradients is that few of the high gradients shown on the map by Kron and Heiken (1980b) are confirmed by the deeper data. In part, this difference reflects the smaller number of deep drill holes used by Guffanti and Nathenson (1980), but it also reflects the improbability of very high gradients persisting to depths of 600 m except in geothermal areas, as well as the local-areal extent of most high-temperature thermal anomalies. It should be emphasized that the map (fig. 5) is highly generalized and that in areas between temperature-gradient contours, both higher and lower values may be measured on a local scale, especially at shallow (less than 300 m) depths. The temperature gradient map (fig. 5) reflects the combined effects of heat flow and thermal conductivity. Comparison with the heat-flow map (fig. **4)** shows a general coincidence of temperature gradients with heat flow. Gradients less han 25°~/km

and heat flow less than 63 mWlmi (1.5 HPU) predominate east of the 100th meridian, whereas gradients greater than 25'~/km and a heat flow greater than 63 mw/m2 are common in the West. Within the East, part of the southern Appalachians region stands out as a thermal low in terms of both heat flow and temperature gradients, whereas in parts of the Atlantic Coastal Plain, higher than average heat flow is expressed by higher temperature gradients. High temperature gradients in the Northwestern United States and in parts of Colorado and Wyoming approximately correspond to areas of high heat flow. Virtually no heat-flow determinations exist on which a comparison can be based in western Texas, where temperature gradients are low, or in the Gulf Coastal Plain, where inland gradients are high.
This general correspondence between heat flow and temperature gradients suggests that thermal conductivities cluster around some average value on a regional scale, despite smaller scale variations in lithology. Some variations in conductivity, however, are related to regional geologic features, and some temperature gradient anomalies mirror geologic environments but not heat flow. For example, relatively high temperature gradients occur in western Pennsylvania and West Virginia, primarily owing to the low thermal conductivity of the thick sequence of Devonian shale in those States; however, this is not a region of high heat flow except for a small area in south-central New York. Some anomalous temperature gradients are related to local thermal conductivity extremes that are **not** significant on a regional scale; for example, a 13O~/krn gradient in eastern Utah relects the local presence of high conductivity salt.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Altomare, Mikal, EMNRD
Sent: Thursday, November 04, 2010 5:20 PM
To: Lucero, Stephen A., EMNRD
Cc: Chavez, Carl J, EMNRD; Fesmire, Mark, EMNRD
Subject: Geothermal Report -OCD revisions
Attachments: EMNRD-Geothermal Recom OCD 11-4-10 track changes.docx; EMNRD-Geothermal Recom OCD 11-4-10 final with comment.docx

Importance: High

Steve-

Attached are two versions of the OCD-revised Geothermal report. The first is a version with all of our changes/deletions/additions in track changes format, and the second is a version with all changes accepted (easier to read), except there is one comment directed to you addressing the Albrecht recommendation.

If you have any questions for us regarding the changes we have made, please don't hesitate to ask. I will be in until 4:30 tomorrow (Friday) but am on a flex day on Monday (back in on Tuesday).

Mikal

The message is ready to be sent with the following file or link attachments:

EMNRD-Geothermal Recom OCD 11-4-10 track changes.docx EMNRD-Geothermal Recom OCD 11-4-10 final with comment.docx

Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.

Executive Order 2010-001: New Mexico Clean Energy Economy Action

Energy, Minerals and Natural Resources Department

Report on Geothermal Working Group: Resource Assessment and Data Base to the Green Jobs Council and Clean Energy Development Council

November __, 2010

Executive Order 2010-001 establishes directives for the Energy Minerals and Natural Resources Department (EMNRD) and New Mexico Tech (NMT) to convene a "Geothermal Group" to oversee the development of a statewide geothermal resource assessment and data base and develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource:

> *"EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010."*

This report summarizes the work that was conducted in 2010 to meet the directives of this executive order.

<u>Geothermal Group Meetings</u>

The first meeting of the Geothermal Group was held on February 11, 2010 in Santa Fe and chaired by EMNRD. Three presentations were made: a review of geothermal energy in New Mexico by Jim Witcher, an overview of the proposed geothermal database being prepared by New Mexico Tech from Dr. Mark Person, and a presentation on geothermal project development from Michael Albrecht. The Group consisted of representatives from: EMNRD (Energy, Conservation and Management (ECMD) and Oil Conservation Divisions (OCD)), the Economic Development Department, Office of the State Engineer, New Mexico Tech, Los Alamos National Laboratories, the New Mexico Bureau of Geology and Mineral Resources, the New Mexico Consortium, various geothermal consultants, and representatives of the geothermal industry. Discussion at this first meeting focused on the scope of work for the geothermal database. The group provided input on the database work and other technical geothermal parameters for this project.

Completed action items from the February 11th meeting included: making presentations available to the group on the New Mexico Consortium webpage, researching seismic hazards associated with Enhance Geothermal Systems (EGS) projects and making this information available on the New Mexico Consortium webpage, continuing work relating to defining the state regulatory process for geothermal projects, collecting policy recommendations from the group and developing a governmental services agreement contract between New Mexico Tech and EMNRD on the database.

The second and final meeting of the Geothermal Group was held on June 16, 2010 in Santa Fe and chaired by EMNRD. Six presentations were made: a summary of the 2010 Enhanced Geothermal Systems Conference in Reno, Nevada by Dr. Kurt Anderson, an update on the nationwide geothermal database effort, a summary of the NM Tech statewide geothermal database work proposal and scope of work by Dr. Mark Person, a description of the Department of Energy funding opportunity (DOE FOA 00318) for geothermal projects from LANL, and a comprehensive description of the New Mexico state regulatory process for geothermal projects presented by New Mexico OCD legal staff. Technical and policy recommendations were collected from the group.

EMNRD Contract with New Mexico Tech

On September 9, 2010, NM Tech and EMNRD entered into a contract through a governmental services agreement to develop a statewide geothermal resource assessment project. This contract is the first of two contract phases to develop a statewide geothermal resource database. The first phase is primarily a data collection effort, which entails the collection of statewide geothermal energy data, geochemical sampling data and hydrothermal modeling.

This project will develop an updated assessment of the State of New Mexico's geothermal resources and make this information available to the public. This will involve synthesizing existing data sets from various state agencies, national labs and universities. New Mexico Tech will develop maps of geothermal potential and the degrees of exploration and also collect new geochemical data from hot springs and groundwater wells in order to develop a refined geochemical geothermometer for our state. Finally, the project will develop four basin-scale hydrothermal models of select geothermal areas around the state. This will help evaluate hydrologic window, deep conductive, and magmatic exploration play concepts.

This phase will run concurrently with phase two, which will be conducted through a second contract to incorporate the Phase-one data into a web-based GIS interface. This project is funded with DOE American Recovery and Reinvestment Act funding, with the sum of both contracts in the total amount of $200,000 and scheduled to be completed by March 2012. This contract is integral to meeting the directive of the executive order.

EMNRD OCD Geothermal Regulatory Developments

In 2010, OCD staff conducted a series of meetings attended by representatives of multiple state and federal agencies for the purpose of discussing the state regulatory process for geothermal projects (referred to as the "Geothermal Regulations-Programs Stakeholder Meeting Group"). The anticipated increased interest in geothermal energy projects in New Mexico has prompted OCD, along with other state agencies, to work collaboratively toward a clearer, more uniform inter-agency understanding of the state regulatory processes as they have been established under existing laws and regulations, and particularly in light of the 2007 New Mexico Court of Appeals case which served to clarify the definition of a "geothermal resource" under New Mexico Law.

Attendees at the Geothermal Stakeholder meetings in 2010 included representatives from state agencies including Office of the State Engineer, OCD, ECMD, Environment Department, Construction Industries Division and Regulation and Licensing Department, as well as representatives from the federal agencies the Bureau of Land Management (BLM)and Minerals Management Service (MMS). OCD Geothermal Regulations do not supersede other applicable federal, state and/or local regulations; consequently, geothermal projects in New Mexico may ultimately involve multiple agencies, each responsible for administering different regulations as they apply to a given project. It is therefore important that agencies with the potential for authority over or involvement in geothermal projects be clear regarding both their regulatory authority and obligations, and those of the other agencies likely to be involved in such projects.

In the course of the Geothermal Stakeholder meetings, representatives of the various agencies have coordinated and clarified each agency's role in the geothermal application and permit process for a variety of types of geothermal projects. The Geothermal Stakeholder meetings succeeded in generating:

- a written summary of each agency's role in the regulatory and permitting process;
- a common, cross-agency understanding of how geothermal projects are permitted pursuant to existing statutes and rules;
- a process for coordination and open communication between agencies;
- an updated OCD geothermal resource web page; and
- a full set of updated, proposed OCD geothermal forms (to be submitted to the Oil Conservation Commission for proposed approval and adoption).

The Geothermal Stakeholder Group also addressed the issue of clarifying the distinction between true geothermal projects and *non*-geothermal energy projects under New Mexico's definition of a geothermal resource. Specifically, the issue of ground source heat pumps / heat exchange systems, sometimes called "geothermal heat pumps," was raised and discussed. To the extent that these systems typically do not utilize a naturally-occurring geothermal reservoir, but rather use the earth to "store" heat (generally produced by people, the sun, appliances, etc.) for later retrieval and use, they are not true geothermal resources under New Mexico law. The permitting process, and the agencies with regulatory authority and obligations relating to these *non*-geothermal projects, were also clarified and confirmed in the course of the Geothermal Stakeholder meetings.[1]

True geothermal energy projects discussed by the Stakeholder Group included: conventional open-loop injection and production well systems; enhanced geothermal systems; and projects involving geothermal co-production with oil and gas production. Geothermal co-production with oil and gas production projects are permitted under both oil and gas regulations (for the oil or gas production and/or the produced water disposal aspects of the project) and geothermal regulations (for the geothermal energy production aspect of the project), but are not typically permitted under the Water Quality Control Commission (WQCC) Regulations as Class V Geothermal

---

[1] It was generally agreed that while these systems are not geothermal under New Mexico law, because of the technology they employ, and because of the "common name" sometimes used of "geothermal heat pump," individuals seeking information regarding the permitting of ground source heat pumps may believe them to be geothermal in nature, and may therefore incorrectly begin by making inquiry with the OCD. Measures have therefore been taken to include information regarding these systems on the OCD Geothermal Website Resource Page for the specific purpose of informing the applicant that such systems are <u>not</u> geothermal, and for directing the applicant to the proper agencies for inquiry and application processing.

Wells. However, under certain site conditions any potential discharge from this type of application could trigger a requirement for a WQCC discharge permit by the OCD.

OCD is committed to developing a clear permitting process as well as to protecting our state's limited water resources by adhering to the state WQCC Regulations where applicable. OCD has developed a *Geothermal Website Resource Page* that contains clickable hyperlinks to enable operators to easily access information and forms regarding the permitting of geothermal projects. Once the Resource Page is activated, the link to the Page will be accessible from the OCD "Publications" webpage. OCD has also developed a draft document that lists the permitting requirements for projects involving the co-production of geothermal energy with oil and gas production in anticipation of a need to begin processing this type of application. The Stakeholder meetings, in conjunction with the Geothermal Working Group working on the Governor's Executive Order, have been very productive and informative for all participating state agencies. OCD legal and technical staff have invested significant time and effort toward developing a functional regulatory path, anticipating the need to work in tandem with various other state regulatory agencies, as each agency does its part to fulfill its designated obligations relating to the administration and permitting of geothermal projects in New Mexico.

Geothermal Co-production from Oil and Gas Production Symposium

ECMD staff, with assistance from the New Mexico Consortium and New Mexico Tech attempted to organize a symposium entitled 'Geothermal Production from Oil and Gas Development.' This symposium was to be focused on New Mexico geothermal resources, specializing in the development of existing oil and gas wells for geothermal electrical production. The symposium was planned for early fall 2010 in Albuquerque; however, due to the current state of the economy, government budget cuts, and other various factors over the course of the past year, a determination was made to not schedule the symposium for 2010 as originally planned.

First, without a funding source, it was extremely difficult to retain the necessary technical speakers for this symposium. Second, although organizers made contact with a number of oil and gas industry representatives, extending invitations to attend and participate at various levels in this symposium, none expressed an interest in either attending or participating in the symposium. Finally, symposium organizers have corresponded via email with technical experts concerning this specific technology in the context of its potential for application in New Mexico. These email discussions have raised doubts regarding whether the necessary conditions exist in New Mexico to render geothermal co-production from oil and gas production practicable and/or whether such technology is economically feasible in New Mexico. ECMD staff has met with OCD legal and technical staff to determine the regulatory approach to these projects and will continue to collect more information on this subject to determine whether a symposium on this topic is worthwhile.

2010 New Mexico Statewide Geothermal Working Group Meeting

ECMD staff worked with New Mexico State University and New Mexico Consortium staff to plan the 2010 New Mexico Geothermal Energy Working Group meeting. The meeting was originally scheduled for September 15-16, 2010 in Las Cruces. However, as found in the planning for the above mentioned symposium, the lack of funding failed to generate sufficient interest for attendance and participation. Less than five people committed to speaking and presenting at this symposium. After receiving less than 10 attendance confirmations for the meeting, the meeting was cancelled. ECMD, the New Mexico Consortium and TBA Power have agreed to coordinate the next meeting in the Spring of 2011 in Los Alamos.

Technical and Policy Recommendations:

During the February and June 2010 meetings, numerous discussions were held that brought forth topics to promote geothermal energy projects in New Mexico. Comments were provided to ECMD through email correspondence following these meetings as well. These topics can be narrowed down to the following subjects,: Public Safety Considerations, Finance, Water Resources, Geothermal Resources, Applications with Methods of Heat Extraction, Environmental Considerations, Technical Considerations, Policy Considerations, Transmission of Electricity, and Public Education and Outreach.

1. Finance Options

Financing incentives and assistance are important mechanisms for facilitating renewable energy project development. Commercial geothermal power companies with sufficient upfront capital resources necessary for the implementation of projects in New Mexico are highly desirable as they would not be hindered by financial obstacles. The state of New Mexico has geothermal tax credits available through the Advanced Energy Tax Credit. However, up-front project capital costs and incentives are important to address, as well.

Michael Albrecht of TBA power has proposed the advancement of state sponsored loan programs to assist with this. Mr. Albrecht also suggests the development of a program where drilling equipment is purchased by the state and made available through a loan program to private developers for exploration projects. The private company would then pay for labor and equipment maintenance for each project. The state would benefit from this type of program because instead of investing in geothermal in New Mexico on a per-project basis, the state would be making a one-time investment for a drill rig that would then serve multiple, statewide projects for many years, and the availability of the equipment would also likely be an incentive to developers.

Comment [d1]: The OCD would recommend that ECMD consider removing this paragraph discussing Albrecht's suggestion as the proposition would create the risk of liability to the state, and would be difficult to implement, requiring a framework for determining who gets to utilize the equipment when, collecting fees, determing fee amounts, performing maintance and repair work on the equipment, etc.

2. Technical Considerations

SEISMICITY: The Geothermal Group discussed potential seismic hazards associated with EGS projects. It was noted that geophysical and seismic stability issues will need to be carefully addressed for these projects. In particular, geothermal projects in highly fractured and faulted zones will need to be analyzed for these hazards, especially near populated areas. Blind injection into these types of areas carries the potential for not only failed projects, but for disastrous outcomes. Project locations in isolated areas are preferred due to these concerns, as well as for aesthetic reasons (*i.e.*, noise, large pits, etc.), and may result in less opposition from water rights owners and the general public during the permit process. ECMD provided information on EGS seismic hazards including guidance documents on the New Mexico Consortium Geothermal webpage.

OCD staff commented that due to the excessive hydraulic forces exerted on strata, ~~,~~ EGS applications should be performed under controlled conditions and with created fracture systems, away from aforementioned geologic conditions and population centers,. Conversely, generally speaking, shallow low pressure open-loop recirculation (injection and production wells) or closed-loop or banked heat exchange geothermal systems may operate in the above mentioned areas without any concerns. *Note: As discussed above, heat exchange projects are not "geothermal" under New Mexico law.*

GENERAL TECHNICAL CONSIDERATIONS: OCD notes the following general considerations will need to be addressed with regard to geothermal projects: adequate fresh water resources and aesthetics (large pits, large footprint of facilities, noise from well testing and daily operations, etc.); depletion of hydrologic and hydrogeologic resources from evaporation and fresh makeup water needed for daily cooling tower operations; presence of naturally occurring hydrogen sulfide gas in areas with subsurface carbonaceous formations; and subsidence and stability issues at geothermal project sites. Noise abatement is addressed by Geothermal Rule 19.14.31.8 NMAC, and if more specific or additional regulatory limits regarding noise abatement are contemplated, those already established by the State of Colorado would be useful as guidance.

In addition, with regard to geothermal power projects, specifically, geothermal power companies should be encouraged to propose more innovative, alternative heat transfer systems (such as air, Freon, recycling and reuse of pumped ground water) to reduce the consumption of fresh water resources in the project area. The implementation of such innovative alternatives could also serve to minimize OSE water appropriation issues that could prevent projects from reaching fruition. Absent the above, geothermal power projects should be located near prolific fresh water resources, and the assistance of the OSE should be requested to achieve this.

POLLUTION PREVENTION: OCD also commented that to minimize impacts to the environment, pollution prevention and waste minimization procedures (i.e., environmentally friendly chemicals, biocides or technologies that will prevent ground water contamination, control scale, fouling and corrosion problems without the application of toxic chemicals) should be considered for use in these projects.

Any pits or ponds constructed under the "permanent pit" provision of an OCD issued discharge permit should meet the minimum permanent pit requirements of OCD Rule Part 17. Liners that are resilient to high-temperatures should be used (examples are: (CSPE-R (Chlorosulfonated Polyethylene- Reinforced); EPDM (Ethylene Propylene Diene Monomer); and FPP-R (Flexible Polypropylene- Reinforced)). Pits constructed for geothermal wells and for which no discharge permit is applicable must comply with the mandates of Geothermal Rule 19.14.25.8 NMAC.

BLOW-OUT PREVENTION: The general requirements for blow out prevention (BOPE) with regard to geothermal wells are set out in Geothermal Rule 19.14.102.8 NMAC. Additional conditions may be imposed where a discharge permit is involved. In general, surface pressures are low in high temperature geothermal wells, thus reducing the requirements for high pressure BOPE that are frequently imposed for oil and gas well projects. However, flow rates are generally high, requiring larger choke, vent, and flow lines than those normally needed for oil and gas wells with a low-pressure BOPE setup. Special equipment, unique to the geothermal industry, is used to deal with the drilling conditions encountered in a steam environment.

INCREASED POWER GENERATION: The Geothermal Group also discussed the point that Geothermal power facilities often have a large area of land or surface area with nested systems such as solar, wind, etc. Operators should be encouraged to increase other renewable power generation at these facilities. Geothermal facilities are also excellent for producing hydrogen to complement power production under high temperatures, which could drive other types of renewable power systems.

3. **Water Resources and Siting**

NM OCD provided valuable input for this report on the protection of state water resources as this pertains to the siting of geothermal power production projects:

SITING: It is preferred that geothermal projects be sited in areas with prolific water resources (that could provide make-up water for cooling towers, etc.) rather than in areas with scarce water resources. In New Mexico, fresh water is generally considered a scarce resource. With regard to cooling tower systems of geothermal power generation projects, Commercial geothermal power companies are therefore be encouraged to develop and propose more innovative, alternative heat transfer/cooling systems (*i.e.*, air, Freon, recycling and reuse of pumped ground water) directed at circumventing the water scarcity and OSE water appropriation issues that exist in New Mexico.

Preferred siting requirements for geothermal power facilities should also include isolation from populated areas with marginal OSE water appropriation(s), residential water wells, etc. This is also based on aesthetic and public safety considerations (*i.e.*, noise from well testing operations; large pits; injection into faults and shattered bedrock zones are more susceptible to geophysical seismic events). Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources. Where possible, operators should endeavor to develop enough onsite water storage to allow for the recycling of some amount of geothermal water for the purpose of cooling newly produced water, minimizing the use of fresh surface water and/or ground water as cooling tower water.

PITS: Geothermal companies will be required to meet the requirements of Geothermal Rule 19.14.25.8 NMAC regarding pits, and may be required to meet additional requirements set forth in the form of a discharge permit (which may then trigger Part 17 of the OCD Rules regarding pits). Special consideration may be required to address liners appropriate for handling the thermal properties of the discharge.

CORROSION PREVENTION AND CEMENTING REQUIREMENTS: Operators will be required to comply with Geothermal Rule 19.14.34.8 NMAC, requiring periodic corrosion surveillance of surface wellhead equipment, pipelines, subsurface casing and tubing, and with Geothermal Rule 19.14.27.8 NMAC regarding cementing and casing requirements.

4. **Transmission of Electricity**

Existing and new transmission lines are also important considerations for developing geothermal projects in New Mexico. The Geothermal Group briefly discussed this topic at its meetings. Developers should be encouraged to focus on transmission grid assessment, and on development in areas with already-identified deep-source geothermal resources to convey power inter- and intra- state. Renewable energy developers should collaborate with geothermal operators to foster the development of new technologies in superconductive wire lines for the purpose of minimizing the loss of electrical power down-transmission-grid, and to achieve maximum efficiency in power storage.

5. **Public Education and Outreach**

It was suggested by Michael Albrecht that New Mexico should consider further promoting the state's geothermal resources. One possible strategic venue for such promotion that was suggested is the annual Geothermal Resources Council meeting. Albrecht suggested that the state compile information and send representatives to the next meeting to host a booth directed at addressing New Mexico geothermal economic development.

6. **Oil and Gas Coproduction**

NM OCD has provided the Group with input on geothermal co-production projects:
Based on currently available information, geothermal co-production with oil and gas in New Mexico appears to be most suited to the northwestern region of New Mexico due to geothermal activity and the geothermal gradient in that area. Potential projects should focus on deeper geothermal gradient brine water resources in the oil and gas fields of NW New Mexico that are nearby to existing or newly constructed transmission grids. Geothermal co-production with oil and gas may be applicable to NW New Mexico where geothermal activity coupled with the geothermal gradient (~1.35 °F/100 Ft.) and well depth (> 7,000 md), may facilitate binary cycle geothermal power production (~197°F) by steam generation using glycol working fluids. Further investigation will be needed to research this topic for project feasibility in New Mexico, and additional to promotion of this concept within the oil and gas industry will also be necessary.

7. **Policy Considerations for Administration and Permitting**

PROMOTION OF GEOTHERMAL ENERGY PROJECTS: Numerous discussions addressing the promotion of geothermal energy projects in New Mexico occurred at the February and June 2010 Geothermal Group meetings, as well as via email correspondence following those meetings amongst meeting attendees and ECMD. These topics can be narrowed down to the subjects of current geothermal technologies; energy production; land use and mineral resource rights; and permitting.

It has been suggested that a request could be made to the State Land Office and the Bureau of Land Management to develop maps in geothermal resource areas where they lease land, similar to those for oil and gas leasing in the state, in an effort to promote exploration and production of the geothermal resource. Additionally, New Mexico Tech and/or OSE could help to develop ground water maps where plentiful fresh water resources (makeup water for cooling towers) are available near identified geothermal resource areas to help sustain long-term geothermal projects. For example, Placitas or Rincon, New Mexico may not have sufficient fresh water resources to sustain power generation for 10, years let alone 20-30 years, whereas Truth or Consequences very well may have. OSE could also help to identify those locations where water resources or appropriations are absent at identified water resource locations.

OCD JURISDICTION; ADMINISTRATION OF THE ACT: The *Geothermal Resources Conservation Act* [§71-5-1 NMSA 1978] (The Act), and the Geothermal Rules promulgated pursuant to that Act, provide the framework for geothermal administration and permitting of geothermal projects by the OCD in New Mexico. The Act, however, expressly states that it does not supersede the jurisdiction or authority of any other state department or agency to manage, protect and/or utilize state lands or resources. *See* §71-5-6 NMSA 1978. As such, depending on the nature of a given geothermal project, projects are sometimes subject to the mandates of other statutes and rules, in addition to the Act. The result is that the administration and permitting process for geothermal projects frequently requires cooperative (and sometimes even simultaneous) management by multiple state agencies.

A threshold determination is required to determine whether a project falls within the framework of the Act and the associated Geothermal Rules: whether the project constitutes a "geothermal resource" as defined by the Act. The Act defines a "geothermal resources" as "the natural heat of the earth or the energy, in whatever form, below the surface of the earth present in, resulting from, created by or which may be extracted from this natural heat and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances." §71-5-3(A) NMSA 1978.

The only exclusion to this definition as provided by the statute is provided by §71-5-2.1 NMSA which provides that "[w]hen the application of potable water to a beneficial use involves the incidental loss or extraction of heat *and* the water is 250 degrees Fahrenheit or less, *then that heat is not a geothermal resource...." (Emphasis added).* The New Mexico Court of Appeals discussed this exclusion in 2007 in the context of exclusion for purposes of payment of royalties, and in so doing, the court clarified that the exclusion is to be literally read as a narrowly defined and limited exclusion. (i.e. regardless of whether the water is above or below 250 degrees, if the extraction or loss of heat is *not* incidental, the heat *is* a geothermal resource; the exclusion only applies where extraction or loss of heat is incidental *and* temperature is below 250 degrees.) *Rosette, Inc. v. U.S. Dept. Of The Interior*, 2007-NMCA-136, 142 N.M. 717, 169 P.3d 704. If a project actually meets the criteria of the exclusion, then that project does not require a geothermal permit through the OCD under the Act.

The Oil Conservation Division (OCD) has general regulatory jurisdiction over all aspects of geothermal development, including: well drilling (Geothermal Resource Conservation Act gives the OCD jurisdiction over location and construction of wells); waste disposal (OCD administers Water Quality Act as applied to geothermal development, approval of "discharge plans" and permitting of Class V geothermal injection wells); and Correlative Rights (OCD must adjust competing claims of owners, and users of the same geothermal reservoir). OCD also has jurisdiction over projects where geothermal water is co-produced with oil or gas. Jurisdiction remains with the OCD regardless of whether the co-produced water's geothermal heat is used if the production of the water is from an aquifer >2,500 feet below the surface, and the water contains > 1,000 ppm Total Dissolved Solids.

OCD already has a process in place for issuing WQCC discharge permits for larger, low and high temperature Class V Geothermal exploration and production wells for power generation, and/or low-temperature geothermal projects in New Mexico. Further, while no such wells have yet been permitted in the state, OCD is aware of the process for permitting geothermal co-production with oil and gas projects, which is similar to UIC Class II Salt Water Disposal Wells under OCD Oil and Gas Regulations (except where operations allow a discharge on site that threatens surface and ground water).

BALANCING THE PREVENTION OF WASTE OF MULTIPLE COMPETING NATURAL RESOURCES: In addition to its other duties and authority under the Act, the OCD has a duty pursuant to the Act to ensure the "...prevention of waste of potash as a result of geothermal operations in this state." §71-5-6 NMSA. The OCD has a similar duty with regard to the potash in the context of oil and gas operations in this state. Although conflicts between potash mining and drilling in potash areas have been raised in both administrative hearings and the New Mexico courts, to date the issue remains unresolved. Geothermal projects should thus avoid potash mining areas due to the fact that this issue is still unsettled, and litigation could take years to resolve in the courts.

The OCD also has a duty to protect against the waste of oil and gas, and there may be conflicts that arise in balancing different resources that are producible from the same area, but whose production prospects could be impacted by the production of competing resources. To date there is no New Mexico precedent to provide the OCD with guidance with regard to how to evaluate and handle such situations. In the context of administration of the Geothermal Resource Conservation Act and the permitting of geothermal projects, the OCD will be required ensure that geothermal activities do not adversely affect oil, gas or potash production and/or prospective economic resources. The OCD will need to be aware of and consider the potential waste issues involved where geothermal projects are penetrating oil and gas subsurface-producing formations, and from which oil and gas are being (or prospectively will be) produced.

Geothermal Permitting Recommendations

The existing OCD Geothermal forms were last revised in 1978, and pre-date both the ONGARD system and the underground injection control (UIC) program (and the many law and rule changes that have occurred in association with that program). As such, the OCD has prepared draft updated versions of all geothermal forms. Pursuant to Geothermal Rule 19.14.132.8 NMAC, in order to formally implement these form changes, the proposed forms must now be presented to the Commission for formal approval.

The changes that have been proposed to the forms are intended to assist operators in moving through the permitting process smoothly, and to provide the OCD with sufficient information to process applications efficiently and, when appropriate, enable the OCD to refer applicants to any other state agencies with whom the operator will also need to work to obtain approval for the project. The hope is that the OCD will be able to serve as a starting and information gathering point, and that once the process is initiated with the OCD, applicants will then be able to begin working with the other required agencies simultaneously, rather than consecutively, for a more efficient, streamlined process. Once the OCD has obtained the Commission's approval of the updated form-set, these forms will be placed on the OCD website for public access.

Summary

The Geothermal Group provided important information to incorporate into the statewide Geothermal Resource Assessment Database. Federal ARRA funding was critical to moving the project forward to meet the goals of the executive order. There are several actions that the state can take to promote geothermal projects, involving both significant funding and small investments that would make a positive contribution.

OCD Recommendations to ECMD Geothermal Working Group (DRAFT Recommendations)
Last Updated: Carl Chavez- OCD on 10-6-2010

These recommendations will be placed on "OCD Online" under the "Geothermal Working Group" Folder: UIC-999. The OCD provided preliminary comments and/or recommendations on April 9, 2010. Below, the OCD issues its final comments and/or recommendations that focus on technical and policy comments and/or recommendations based on California (California Geothermal Regulation Revisions) and Nevada (Nevada Geothermal Regulations) Regulations.

The EMNRD and Geothermal Working Group Mission are briefly stated below.

"The Geothermal Group shall oversee the development of a State-wide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource."

I. Technical Recommendations:

Site Criteria

1) In NM, fresh water is considered too scarce to use for makeup water in cooling tower systems at geothermal power generation projects; therefore, commercial geothermal power companies must propose more innovative alternative heat transfer systems, i.e., air, Freon.....recycling and reuse (Pollution Prevention/Waste Minimization) of pumped ground water if used, that will circumvent the water scarcity issues and water appropriation issues of the OSE in NM and prevent the advancement of geothermal projects in New Mexico (CChavez);

2) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide adequate make-up water for cooling towers, etc. Note that OCD has already been informed of the scarcity of fresh water in New Mexico and the urgent need for geothermal companies to propose heat transfer and fresh water management systems (pollution prevention and waste minimization) that will not rely on hydrologic and hydrogeologic water resources needed for drinking water, natural resources, parks and recreation, etc. in New Mexico. Geothermal engineering applications must be efficient to minimize loss of the water resource(s) and depletion of hydrologic resources (CChavez);

3) California's new provision for identifying geothermal well producing geothermal fluids at commercial quantities: **A well capable of producing geothermal fluid in commercial quantities**" describes a well:

(A) Supplying geothermal fluid to an existing power plant or other facility for the purpose of generating electricity; or

(B) Production tested and scheduled to supply geothermal fluid to a power plant or other facility for the purpose of generating electricity, for which:

a) An application is pending before the California Energy Commission or the California Public Utilities Commission; or
b) The California Energy Commission or California Public Utilities Commission has approved a site; or
c) A contract has been executed between the supplier and a user and conditions have been fulfilled that commit the user to build a facility; or

(C) Supplying geothermal fluid or completed and scheduled to supply geothermal fluid to facilities existing, under construction, or committed for construction, for any non-electric use of geothermal resources, including but not limited to space heating or food processing; or

(D) Production-tested and, in the operator's opinion, able to supply sufficient geothermal energy to justify construction of a facility to utilize the energy, and designated capable of production by the Supervisor; or

(E) Production-tested and found by the Supervisor, after a public hearing, to be capable of producing sufficient geothermal energy to be a commercially viable geothermal development (CChavez- CA Regs.).

4) Preferred siting requirements for geothermal power facilities should include isolation from populated areas with marginal OSE water appropriation(s), residential water wells, etc. This is also based on aesthetic and public safety considerations (i.e., noise from well testing operations; large pits, injection into faults and shattered bedrock zones are more susceptible to geophysical seismic events (CChavez);

5) Nevada's exemption from water appropriation issues: **NRS 534A.040 Applicability of procedures for appropriation.** A consumptive use of water brought to the surface outside of a geothermal well is subject to the appropriation procedures of chapters 533 and 534 of NRS, except for:
1. Water that is removed from an aquifer or geothermal reservoir to develop and obtain geothermal resources if the water is returned to or reinjected into the same aquifer or reservoir; or
2. The reasonable loss of water:
(a) During a test of a geothermal well; or
(b) From the temporary failure of all or part of a system that removes water from an aquifer or geothermal reservoir, transfers the heat from that water and reinjects that water into the same aquifer or reservoir (CChavez- NV Regs.).

6) **1942.1. Unstable Areas.**
Drilling any wells, including water wells, is prohibited in areas containing fumaroles, geysers, hot springs, mud pots, etc. (unstable areas), unless the Division determines, after a thorough geological investigation, that drilling in an unstable area is feasible. In

this case, a special permit may be issued. The following may be required for a well drilled in an unstable area:

(a) A Division engineer shall be present at the well at all times during the initial phases of drilling until the surface casing has been cemented and the BOPE has been pressure-tested satisfactorily. The Division engineer may observe all drilling operations at the well and if, in his or her opinion, conditions warrant, may order a second or third string of surface casing to be run.

(b) The operator, while drilling the surface casing hole, shall continuously monitor and record the following:

(1) Drilling fluid temperature (in and out);
(2) Drilling fluid pit level;
(3) Drilling fluid pump volume;
(4) Drilling fluid weight; and
(5) Drilling rate.

(c) A drilling fee in addition to the fee specified in CCR Section 1932, up to the maximum of $1,000 per well, depending on the geologic conditions in the area (CChavez- CA Regs.).

7) 1931.5. Unstable Terrain

(a) If the construction of drilling sites, roads, sumps, steam transmission lines pipelines, and other construction attendant to geothermal operations could cause or could be affected by slumping, landslides, or unstable earth geological conditions, the Supervisor shall require that the operator submit a written analysis of the proposed work prior to the commencement of any construction and prior to approving issuing a permit to drill.

(b) At the request of the Supervisor, the report shall be prepared by a civil engineer, licensed in the state and experienced in soils engineering; and if slumping or land sliding could be involved, the requested report shall also be prepared by an engineering geologist, certified in the state and experienced in slope stability and related problems.

(c) No permit to drill shall be approved issued unless the report indicates that the work is planned in such a manner as to reasonably mitigate the problem throughout the life of the project.

(d) Upon completion of any construction authorized by the Supervisor pursuant to this section, the operator shall certify in writing to the Supervisor that the work was carried out according to the approved plans subject only to changes approved by the Supervisor (CChavez- CA Regs.).

8) Noise Abatement (State of Colorado Model):

(a) The goal of this rule is to identify noise sources related to oil and gas operations that impact surrounding landowners and to implement cost-effective and technically-feasible mitigation measures to bring oil and gas facilities into compliance with the allowable noise levels identified in subsection c. Operators should be aware that noise control is most effectively addressed at the siting and design phase, especially with respect to centralized compression and other downstream "gas facilities" (see definition in the 100 Series of these rules).

(b) Oil and gas operations at any well site, production facility or gas facility, shall comply with the following maximum permissible noise levels. Operations involving pipeline or gas facility installation or maintenance, the use of a drilling rig, completion rig, workover rig, or stimulation is subject to the maximum permissible noise levels for industrial zones. The type of land use of the surrounding area shall be determined by the Commission in consultation with the local governmental designee taking into consideration any applicable zoning or other local land use designation.

(c) In the hours between 7:00 a.m. and the next 7:00 p.m. the noise levels permitted below may be increased ten (10) db(A) for a period not to exceed fifteen (15) minutes in any one (1) hour period. The allowable noise level for periodic, impulsive or shrill noises is reduced by five (5) db(A) from the levels shown.

ZONE 7:00 am to next 7:00 pm 7:00 pm to next 7:00 am
Residential/Agricultural/Rural 55 db(A) 50 db(A) Construction commencing after January 1, 2007:

50db (A) 45 db (A)
Commercial 60 db (A) 55 db (A)
Light industrial 70 db (A) 65 db (A)
Industrial 80 db (A) 75 db (A)

In remote locations, where there is no reasonably proximate occupied structure or designated outside activity area, the light industrial standard may be applicable. Pursuant to Commission inspection or upon receiving a complaint from a nearby property owner or local governmental designee regarding noise related to oil and gas operations, the Commission shall conduct an onsite investigation and take sound measurements as prescribed herein. The following provide guidance for the measurement of sound levels and assignment of points of compliance for oil and gas operations:

(1) Sound levels shall be measured at a distance of three hundred and fifty (350) feet from the noise source. At the request of the complainant, the sound level shall also be measured at a point beyond three hundred fifty (350) feet that the complainant believes is more representative of the noise impact. If an oil and gas well site, production facility or gas facility is installed closer than three hundred fifty (350) feet from an existing occupied structure, sound levels shall be measured at a point twenty-five (25) feet from the structure towards the noise source. Noise levels from oil and gas facilities located on surface property owned, leased or otherwise controlled by the operator shall be measured at three hundred and fifty (350) feet or at the property line, whichever is greater. In situations where measurement of noise levels at three hundred and fifty (350) feet is impractical or unrepresentative due to topography, the measurement may be taken at a lesser distance and extrapolated to a 350-foot equivalent using the following formula:

db(A)DISTANCE 2 = db(A)DISTANCE 1 – 20 x log10(distance 2/distance 1)

(2) Sound level meters shall be equipped with wind screens, and readings taken when the wind velocity at the time and place of measurement is not more than five (5) miles per hour.

(3) Sound level measurements shall be taken four (4) feet above ground level.

(4) Sound levels shall be determined by averaging minute-by-minute measurements made over minimum fifteen (15) minute sample duration if practicable. The sample shall be taken under conditions that are representative of the noise experienced by the complainant (e.g., at night, morning, evening, or during special weather conditions).

(5) In all sound level measurements, the existing ambient noise level from all other sources in the encompassing environment at the time and place of such sound level measurement shall be considered to determine the contribution to the sound level by the oil and gas operation(s). d. In situations where the complaint or Commission onsite inspection indicates that low frequency noise is a component of the problem, the Commission shall obtain a sound level measurement twenty-five (25) feet from the exterior wall of the residence or occupied structure nearest to the noise source, using a noise meter calibrated to the db(C) scale. If this reading exceeds 65 db(C), the Commission shall require the operator to obtain a low frequency noise impact analysis by a qualified sound expert, including identification of any reasonable control measures available to mitigate such low frequency noise impact. Such study shall be provided to the Commission for consideration and possible action. e. Exhaust from all engines, motors, coolers and other mechanized equipment shall be vented in a direction away from all occupied buildings.

(6) All facilities within four hundred (400) feet of occupied buildings with engines or motors which are not electrically operated shall be equipped with quiet design mufflers or equivalent. All mufflers shall be properly installed and maintained in proper working order. Attached, as Exhibit A, is a statement giving the basis and purpose of the revisions and such statements are incorporated herein by reference (CChavez- CO Model).

OCD Recommendations to ECMD Geothermal Working Group (DRAFT Recommendations)
Last Updated: Carl Chavez- OCD on 10-6-2010

Pollution Prevention and Waste Minimization

9) OCD would like geothermal companies to meet the technical requirements of either Part 17 or Part 36, since there are guidelines that apply to pit and pond construction, operation, etc. The only criteria that we'd be lacking are liners that handle thermal properties based on the temperature of the discharge. There are some liners that have been reviewed under the aforementioned rules that are temperature resistant, i.e., Chloro-Sulfonated Polyethylene- Reinforced (CSPE- R) or Reinforced Poly Propylene, (RPP). What is not mentioned that would be the type of language in a discharge permit is "an approved liner that can withstand temperatures of the geothermal environment where exploration is occurring." Something to this effect...

Current Geothermal Below-Grade Tanks/Sumps and Pits/Ponds Permit Language:

All pits and ponds, including modifications and retrofits, shall be designed by a registered professional engineer and approved by OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.

The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted or otherwise rendered non-hazardous to wildlife, including migratory birds. Where netting is not feasible, routine witnessing and/or discovery of dead wildlife and migratory birds shall be reported by the owner/operator to the appropriate wildlife agency with notification also provided to OCD in order to assess and enact measures to prevent the above from reoccurring.

The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure and/or visual inspection of cleaned tanks and/or sumps or other OCD-approved methods. The owner/operator shall notify OCD at least 72 hours prior to all testing.

10) Pollution prevention and waste minimization (i.e., magnetic or electricity non-chemical corrosion and scale inhibitor applications, environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals (CChavez);

11) Operations should include pollution prevention and waste minimization applications (i.e., recycling/reuse) whenever or wherever possible. For example, build enough onsite storage to allow recycling or reuse of spent geothermal water for cooling of produced water, avoiding using surface and/or ground water resources (SHayden).

12) **1953. Corrosion Prevention**
All surface wellhead equipment and pipelines and subsurface casing and tubing will be subject to periodic corrosion surveillance in order to safeguard life, health, property and natural resource Prevention methods such as cathodic protection and corrosion inhibitors, as appropriate, may be required to minimize internal and external corrosion. The operator shall visually inspect all wellhead equipment and pipelines for leaks and corrosion at least once a year (CChavez- CA Regs.).

13) **Cement Requirements**

(a) All Portland cements used in plugging and abandonment of high-temperature geothermal wells must include 30-40% silica flour by weight relative to cement, to prevent strength degradation of the cement over time. Other types of cement may be substituted for Portland cement, as approved by the Division. The application of such materials shall be approved by the Division (CChavez- CA Regs.).

(b) All cements in high-temperature geothermal wells must include 30-40% silica flour, by weight relative to cement, to prevent strength degradation of the cement over time. All Portland cements used in plugging and abandonment of high-temperature geothermal wells must include 30-40 percent silica flour by weight relative to cement, to prevent strength degradation of the cement over time. Other types of cement may be substituted for Portland cement, as approved by the Division (CChavez- CA Regs. §1935(d) Casing Requirements & Plug and Abandonment Requirements under the Regs.).

(c) Upgrade existing and newly installed transmission grids (note that there is 40 to 60% electricity loss along conventional electricity lines, but new technologies can significantly reduce this loss if new technology conductive wire and systems are installed) to maximize available electricity through the grid (CChavez);

(d) Transmission grids exist throughout New Mexico's oil and gas exploration and production regions where geothermal co-production may be most suitable in NW New Mexico, but seems to be hampered by water appropriation, and/or other oil/gas/potash mineral rights issues that need to be resolved to eliminate obstacles to geothermal power production and inter-intra state free commerce sales (CChavez);

14) **Geothermal Co-Production with Oil and Gas**

(a) Geothermal Co-production with oil and gas in NM appears to be most suited to NW New Mexico due to geothermal activity and the geothermal gradient (Src.: 19.15.16.10(G)(2)(b) 107A NMAC "Temperature Gradient Curves" NW NM ~1.35

°F/100 Ft.) to elevate bottom hole fluid temperatures to above 200 °F at well depths approaching 7,000 Ft. Geothermal binary cycle power units are estimated in New Mexico to produce steam under ambient surface conditions at ~ 197 °F with a glycol working fluid. Based on geothermal gradients (NW: ~1.35 °F/ 100 Ft. & SE ~1 °F/ 100 Ft.) in New Mexico. In NW NM according to one local wireline operator: about 1degree for every 60 Ft. was recorded in a Dakota Sandstone Formation (Lower Upper Cretaceous) well 7200 Ft. deep with the bottom hole fluid temperature to be estimated at between 190-210 °F. The operator also said near Ignacio, Colorado just north of the New Mexico State Line, the bottom hole temperature can exceed 300 °F (concerns with wireline melt). Also, there are a few places on the Jicarilla Reservation with bottom hole temperatures reach 230 °F. The lack of geothermal activity and low geothermal gradient (~ 1 °F/100 Ft.) in SE New Mexico do not appear conducive to geothermal coproduction with oil and gas even at well depths of 12,000 Ft. (CChavez, REzeanyim, LHill, WJones & CPerrin).

(b) Oil and gas well workover and conversion of existing or plugged and abandoned wells into geothermal co-production and/or WQCC injection wells shall require a minimum surface casing diameter of at least 12 in. (could accept 7 – 12 in.), well integrity requirements, and be in a condition suitable for well work over with appropriate well construction, cementing, etc. Existing oil and gas wells must be located outside of potash areas and cemented properly to prevent interference with oil and gas production and/or prospective production of oil, gas and/or mineral resources (CChavez).

15) Enhanced Geothermal Systems

(a) Enhanced Geothermal Systems (EGS) shall be controlled to allow the use of more efficient geothermal power generating systems (i.e., binary cycle) and cited away from faulted/fractured bedrock areas near populated areas where seismicity is induced by operations whenever possible (CChavez).

(b) Enhanced Geothermal Systems shall not be allowed to inject (blind injection) over fault zones and highly fractured bedrock in populated areas due to seismicity and public safety concerns- See "Geophysical & Seismicity Issues" section (CChavez).

(c) Flash steam or other geothermal engineering applications that waste the heat and/or are not efficient and deplete New Mexico's scarce fresh water hydrologic and hydro- geologic resources should be prohibited (CChavez).

(d) Hot Dry Rock produces little or no producible steam or water; thus, there is little or no chance of blowout except from flashing by liquids used in the circulating system. Any blowout would be of short duration; however, BOPE setup should be similar to high-temperature hydrothermal environment due to unanticipated pockets of fluid that may be encountered (Cchavez).

16) Geothermal Discharge Permit Criteria

(a) Geothermal pits should technically comply with OCD Regulations, i.e., Part 17 "Pits, Closed-Loop Systems, Below-Grade Tanks & Sumps" and/or Part 36 "Surface Waste Management Facility"- design ((selecting liners that are durable and resilient to high-temperatures (CSPE-R (Chlorosulfonated Polyethylene- Reinforced); EPDM (Ethylene Propylene Diene Monomer); and FPP-R (Flexible Polypropylene- Reinforced)); Construction (geotechnical); Operation and Maintenance (CChavez).

(b) Ensure that adequately tested geothermal Blow-Out Prevention Equipment (BOPE) as a function of the geothermal temperature or environment with appropriate drill equipment is adequately specified and approved in the application process (CChavez).

(c) Operators should equip wells with casings of sufficient strength, and with safety devices as may be necessary, in accordance with methods approved by the OCD, and shall use every effort and endeavor effectually to prevent blowouts, explosions, and fires. Additional requirements for casing and blowout prevention equipment (BOPE) and any special geothermal drilling equipment based on the geothermal environment need to be applied during drilling or exploration operations (CChavez).

(d) In general, surface pressures are low in high temperature geothermal wells; thus, reducing the requirements for high pressure BOPE frequently used for oil and gas wells. However, flow rates are generally high requiring larger choke, vent, and flow lines than normally needed for oil and gas wells with a low-pressure BOPE setup. Special equipment, i.e., banjo box is used by the geothermal industry to deal with the unique drilling conditions encountered in a steam environment. Minimum blow-out prevention device setup should be a function of geothermal environment (CChavez).

(e) California's fees: **1932. Fees.**

The appropriate fee, as listed below, shall be paid when the Notice of Intention to Drill is filed. (Refer to CCR Section 1920.1 for definitions of terms and depth limitations.)

(1) $25 Fee.
- **(1)** Shallow low-temperature geothermal well.
- **(2)** Shallow observation well.
- **(3)** Shallow temperature gradient well.

(2) $200 Fee.
- **(1)** Shallow observation temperature gradient well program of up to and including 25 such wells (except as provided in PRC Section 3724.1).
- **(2)** Intermediate depth low-temperature geothermal well.
- **(3)** Intermediate depth observation well.
- **(4)** Intermediate depth temperature gradient well.

(3) $500 Fee.
- **(a)** Intermediate depth observation temperature gradient well program of up to and including 5 such wells.
- **(b)** Development well, other than low-temperature, to any depth.

(c) Deep low-temperature geothermal well.
(d) Injection well.
(e) Deep observation well.
(f) Deep temperature gradient well.

(f) $1,000 Fee. Exploratory well, other than low-temperature, to any depth.

(g) If a Notice of Intention to Drill is canceled, the Division shall refund the fee paid by the operator, minus the Division's administrative costs for processing and reviewing the notice (CChavez- CA Regs.).

(h) High temperature geothermal wells drilled in wildcat areas, or when a particular geothermal well situation is not addressed, the BOPE setup should conform to the requirements for an oil and gas well. Once reservoir characteristics are determined, the requirements may be modified by the OCD (CChavez).

(i) Nevada's 10 day APD review process on 2-yr permit w/ 90 day to provide final approval of APD: **NRS 534A.070 Approval or rejection of application for permit to drill exploratory well; review of application for permit to drill or operate geothermal well; hearing; conditions.**

1. The Administrator of the Division of Minerals of the Commission on Mineral Resources shall approve or reject an application for a permit to drill an exploratory well within 10 days after the Administrator receives the application in proper form. The permit must not be effective for more than 2 years, but may be extended by the Administrator.

2. Upon receipt of an application for a permit to drill or operate a geothermal well, the Administrator of the Division of Minerals shall transmit copies of the application to the State Engineer, the Administrator of the Division of Environmental Protection of the State Department of Conservation and Natural Resources, and the Director of the Department of Wildlife. After consultation with the State Engineer, the Administrator of the Division of Environmental Protection, and the Director of the Department of Wildlife, the Administrator of the Division of Minerals may issue a permit to drill or operate a geothermal well if it is determined that issuance of a permit is consistent with:

(a) The policies specified in NRS 445A.305 and 445B.100;
(b) The purposes of chapters 533 and 534 of NRS; and
(c) The purposes specified in chapter 501 of NRS.

3. The Administrator of the Division of Minerals shall approve or reject the application to drill or operate a geothermal well within 90 days after the Administrator receives it in proper form, unless it is determined that a conflict exists pursuant to subsection 2 or a public hearing is necessary pursuant to subsection 4. Notice of the conflict or need for a public hearing must be provided to the applicant within the 90-day period.

4. The State Engineer and the Administrator of the Division of Minerals may hold public hearings jointly or separately to gather such evidence or information as they deem necessary for a full understanding of all the rights involved and to guard properly the public interest.

5. A permit issued pursuant to this section must include any conditions:

(a) Deemed necessary by the Administrator of the Division of Minerals to carry out the purposes of this section; and

(b) Imposed by the State Engineer consistent with the provisions of chapters 533 and 534 of NRS (CChavez- NV Regs.).

(j) Transfer of well(s) procedure or rule revisions to address sales of geothermal facilities with wells, etc. needed similar to oil and gas regulations (CChavez).

17) Other Renewable Energy Associated with Geothermal

(a) Geothermal power plants are excellent facilities for the coproduction of renewable hydrogen for future batteries, fuel, emission free cars, etc. Geothermal power companies could be provided incentives to coproduce hydrogen as a condition to permitting these types of facilities in New Mexico (CChavez).

18) Geophysical or Seismic Issues

(a) All of the geothermal areas I know of in New Mexico are associated with both fault zones and Tertiary/Quaternary igneous bodies. You may already be familiar with it, but I copied a chart published by the NMBGMR showing the locations of all quakes >4.5 for the last 150 years (attached). The largest on record was 5.8 Magnitude from 1906. My point here is that all of the active fault zones in New Mexico are extensional to trans-tensional and do not tend to lock up and cause large quakes. Quakes that may follow drilling would tend to be smaller than normal due to lubrication of the rocks, so I am not sure why faulted or fractured rocks are excluded (SHayden).

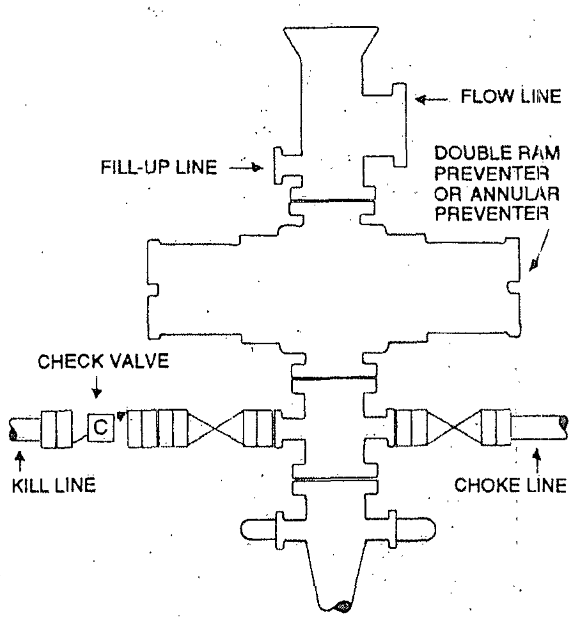
(b) In the early '80s, DOE was planning to drill a "magma tap" and one of the areas they were considering was near Socorro where active dikes are intruding to less than 5 Km below the surface, feeding off of the Socorro Bright Spot (large sill intruding the base of the lithosphere from Bernardo to Magdalena to San Marcial). DOE selected the Long Valley, CA area instead. This might be a good location for a heat exchange type facility. You could hardly cause more quakes there than they already have (SHayden).

19) Drilling & Well Construction Requirements

(a) Hydrothermal environments can be high or low-temperature subsurface environments with reservoirs of producible steam or hot water. Steam reservoirs where fluids are producible as saturated or superheated steam. Steam dominated reservoirs present conditions very different from oil and gas reservoirs; thus, there are differences in drill methods and BOPE requirements. Typically, a well is drilled with mud as the circulating fluid to a point above the first anticipated steam entry. Then, the remainder of the well is drilled with air. Drilling conditions are then underbalanced and are similar to drilling with a controlled flow, since there is no drill mud to provide either blow-out protection or the usual warning signs of a kick (CChavez).

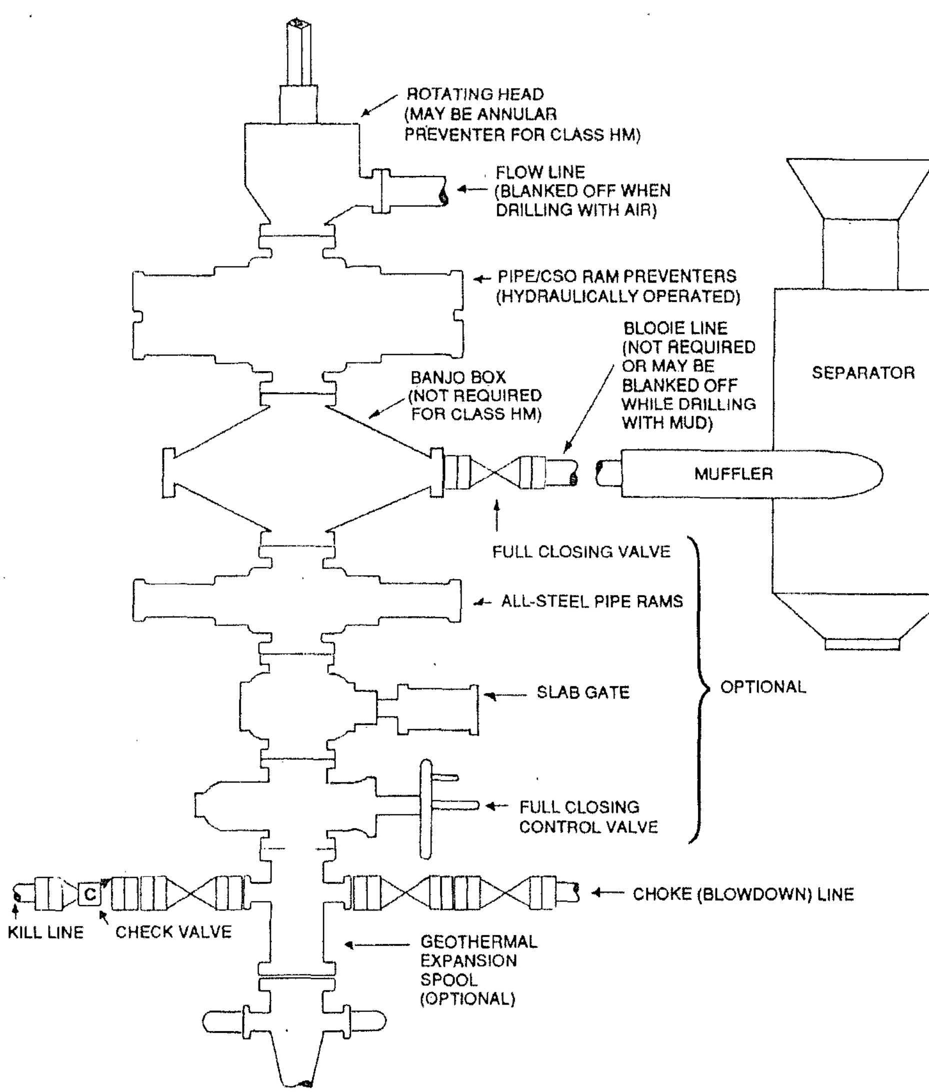
(b) High temperature water-dominated reservoirs in which the temperature of the producible water is higher than the boiling point of water at local atmospheric pressure. Formation fluids can be produced as water or water and steam, depending on the back pressure maintained on the fluid. The conditions are similar to when drilling through high- pressure, gas saturated oil zones or CO_2-saturated water zones in oil and gas fields, and the requirements for BOPE are similar. Hot reservoir water may flash to steam while being circulated out of the well (CChavez).

(c) Low temperature geothermal wells are similar to water wells. Low temperature water dominated reservoirs in which the temperature of the producible geothermal water is lower than the boiling point of water at local atmospheric pressure. The drilling conditions are similar to those encountered in oil and gas drilling, and the requirements for BOPE (see figure provide below) are similar. In other cases, conditions are similar to water-well drilling, and pressure control techniques developed in the water-well industry are adequate (CChavez).

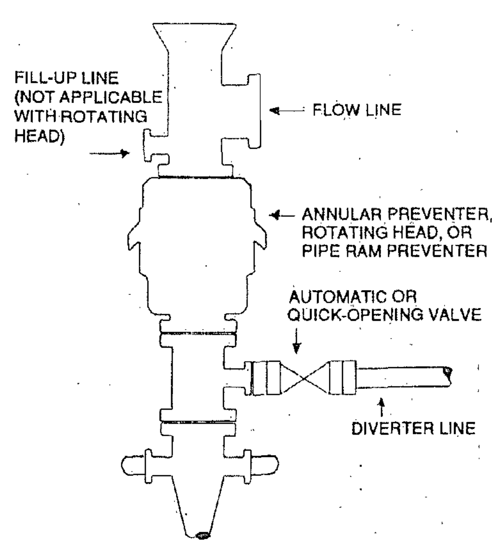


(d) BOPE descriptions and requirements: Elastomer components (e.g., preventer packing elements, ram seals, etc.) must be made of material formulated specifically to tolerate a steam or hot-water environment. All-steel rams in ram-type preventers placed immediately below or above the banjo box, instead of normal ram assemblies that are equipped with elastomer seals (CChavez).

(e) When drilling using air as a circulating fluid in a well drilled into a high-temperature reservoir, the well must be equipped with a BOPE with following setup (see figure provided below): 1) Rotating head; 2) double-ram (pipe and blind) blowout preventer or equivalent equipped with high temp. seals; banjo-box/blooie-line system, or approved substitute; 3) Full-closing gate-type control valve installed between wellhead and the preventer/banjo box stack; 4) kill line (2-inch minimum ID) with a check valve and at least one gate-, ball-, or plug-type control valve installed as close to the wellhead as is practicable; Blowdown line (3-inch minimum ID) and at least two gate, ball, or plug valves installed as close to the wellhead as is practicable. The line must be anchored securely at all bends and as close to the exhaust outlet as is practicable. An alternative to the anchored line, the blowdown line may be connected to one of the ports on the blooie line. At operator's option, the stack may be equipped with a slab gate and all-steel pipe rams between the required full-closing control valve and the banjo box; and 5) Equivalent systems may be approved by the division. (CChavez- CA Regs.).



(f) When drilling using mud or water as a circulating fluid the equipment requirements will vary depending upon which casing string is serving as the anchor string or the BOP stack and the type of fluid being used to circulate the cuttings out of the hole. Well drilled into water-dominated geothermal reservoirs are drilled with drilling mud; however, some may be drilled completely with air, while others are drilled partially with mud and partially with air for certain intervals. Diverter system requirements for the conductor casing is not designed to shut in or halt flow, but rather to route the flow to a safe distance away from the rig floor if a blowout occurs before deeper casing is cemented. Before drilling out the shoe of the conductor pipe, the division will require the following diverter-system equipment (see figure provided below), unless the operator can demonstrate that such equipment is not needed. The diverter system may be a combination of the following devices: **1)** Rotating stripper head; **2)** Remote-controlled, hydraulically operated annular preventer; **3)** Substitute device approved in advance by the division. A large-diameter vent line into the wellbore below the diverter. A 6-in. or larger ID line is recommended. The vent line may be attached to an outlet on the conductor casing, itself, or to a spool mounted between the conductor casing and the diverter with line directed to safe area. A device in a vent line designed to prevent the flow of well fluids through the line during normal well operations, but able to permit flow in an emergency, which may be satisfied as follows: **1)** A riser installed in the vent line with an outlet above the level of the flow line to provide an open-flow diverter system; and **2)** A full-opening control valve, or rupture disk assembly, with a through bore at least equal to the ID of the vent line, mounted in the line near the conductor casing. If manual valve is used, it must be readily accessible and of an easy-opening design. If remotely operated valve is used, it is suggested that the system be designed so the valve opens automatically as the diverter is closed. I a system where the diverter is an annular preventer, a remotely controlled, hydraulically operated valve may be installed so that the opening chamber of the valve is connected to the closing line of the annular preventer. Thus, the valve will be pressured open each time the preventer is closed. (CChavez- CA Regs.).



(g) Conductor pipe shall be cemented at or driven to a maximum depth of 100 feet. Exceptions may be granted if conditions require deeper casing depth (CChavez- Src: CA Regs. §1935.1 Conductor Pipe).

(h) Surface casing shall provide for control of formation fluids, for protection of freshwater zones, and for adequate anchorage for blowout prevention equipment. It shall be cemented into or through a competent bed and at a depth that will allow complete well shut-in without fracturing the formation immediately below the casing shoe. All surface casing shall be cemented with sufficient cement to fill the annular space from the shoe to the surface. In nonexploratory wells, the surface casing requirement shall be determined on the basis of known field conditions. (CChavez- Src: CA Regs. §1935.2 Surface Casing).

(i) Intermediate casing shall be required for protection against anomalous pressure zones, cave-ins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings shall be, if possible, cemented solid to the surface (CChavez- Src: CA Regs. §1935.3 Intermediate Casing).

(j) Production casing may be set above or through the producing or injection zone and cemented above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the zone, to segregate zones, and to prevent movement of fluids behind the casing into freshwater zones. Production casing shall either be cemented with sufficient cement to fill the annular space from the shoe to the surface or lapped into intermediate casing, if run. Casing lapped into an intermediate string, shall overlap at least 100 feet. The lap shall be cemented solidly; and shall be pressure tested to ensure its integrity (CChavez- Src: CA Regs. §1935.4 Production Casing).

(k) BOPE requirements for the surface, intermediate, and production casing before drilling out the shoe of the surface, intermediate, or production casing during mud or air drilling, installed blow-out prevention equipment must include at a minimum the following: 1) an annular preventer or a rotating head. If an annular preventer is used, it must be equipped with a hydropneumatic accumulator-actuating system; 2) A hydraulically operated, double-ram blowout preventer, or an approved substitute, with a minimum working-pressure rating that exceeds the maximum anticipated surface pressure (at the expected reservoir fluid temperature); 3) A kill line (2-in. minimum ID) equipped with a check valve and at least one control valve; 4) A choke line or a blow down line (3-in. minimum ID) equipped with at least two control valves placed as close to the wellhead as is practicable. The line should be anchored securely at all turns and at the end to prevent shipping or vibration damage during use. As an alternative to an anchored line leading away from the wellbore the blow down line may be attached to one of the ports on the blooie line. The Choke and kill lines may be installed on the side openings of the optional expansion spool, if one is installed, as part of the permanent-completion wellhead. This connection will be permitted only if the side opening of the expansion spool are large enough to accept the lines, and if it can be demonstrated to the satisfaction of the division that egress of fluids from the well bore will not be blocked by linear expansion of the inner string(s) of casing; 5) At the option of the operator, a full-closing gate-type control valve installed between the wellhead and the preventer/banjo-box stack; A choke manifold will be required in the following cases: a) when drilling an exploratory well; b) in cases when gas is known to exist; c) cases where abrasive wellbor3e fluids might be encountered. The manifold must be equipped with at least one adjustable choke, a blow down line (with an ID at least as large as the ID of the choke line), and an accurate pressure gauge. The choke should be of the multiple-orifice type or the cylindrical-gate-and seat type. A remote-controlled choke is preferable to one that is controlled manually (CChavez- CA Regs.).

(l) When using mud/water and air/intermittently as a circulating fluid, in addition to the aforementioned BOPE requirement, the following equipment is required when a well is being drilled with air or another gaseous fluid: 1) A banjo box or approved substitute below the preventers; 2) A blooie-line/muffler/separator system; 3) A slab gate and/or ram-type preventer (equipped with all-steel CSO ram assemblies) may be installed between the banjo box and the full-closing control valve; and 4) Heat exchanger or mud cooler when the well is being drilled with mud as the circulating fluid, mud-cooling devices must be used when the temperature of the mud at the flow line is anticipated to be higher than the flash point for a continuous period of more than one hour (CChavez- CA Regs.).

(m) Drilling fluid requires an adequate source of water or drilling mud and weight materials to ensure well control must be readily accessible at the drill site for use at all times (CChavez- CA Regs.).

(n) Low-temperature reservoir BOPE requirements for low-temperature and temperature-observation wells drilled in high heat-flow areas not previously drilled, or areas with a moderate- to high-potential for blowouts: 1) An annular preventer and/or pipe and blind-ram preventers; and 2) A kill line and a blow-down line installed below the preventer. In areas where geological conditions are known and where pressures are known to be at or below hydrostatic pressure, approval may be given for the use of a single diverter stack with a flow line installed below a blowout preventer, gate valve, rotating heard, or approved (equivalent) device. All required low-temperature BOPE equipment must be fully operational at all times (CChavez- CA Regs.).

(o) The following BOPE must be considered for all wells drilled in known or suspected geothermal resource areas: 1) A full-opening safety valve (sized to the working string in use) maintained in the open position on the rig floor at all times while drilling operations are being conducted, and when running casing. While tripping pipe during drilling operations, an operator may choose to make up the valve on the pin end or a joint of drill pipe that is kept readily available for stabbing into the working string. This procedure makes it unnecessary for the rig crew to pick up the valve and attempt to stab it by hand. Also, the hot fluids coming up the working string will be expelled above the crew rather than at the working level; 2) An upper kelly cock installed between the Kelly and the swivel. If the uppermost item in the BOP stack is not a rotating head, a lower Kelly cock may be used; and 3) An internal preventer readily available to the rig crew, or a drill string float installed whenever the well is being drilled with mud or water as a circulating medium (CChavez- CA Regs.).

(p) Facility Maintenance: All wellheads, separators, pumps, mufflers, manifolds, valves, pipelines and other equipment used for the production of geothermal resources shall be maintained in good condition in order to prevent loss of or damage to life, health, property and natural resources. Well cellars shall be covered and kept drained. Grating or flooring shall be installed and maintained in good condition so as to exclude people and animals. Cellars should be protected from as much runoff water as practical. Public access to equipment and facilities shall be controlled by use of individual enclosures, perimeter fencing or other means where it is necessary to protect life, health, and property. The Division may waive some or all of the above requirements for low-temperature geothermal wells (CChavez- Src: CA Regs. §1952 Facilities Maintenance).

20) 1935. Casing Requirements.

(a) All wells shall be cased in such a manner as to protect or minimize damage to the environment, usable ground waters and surface waters (if any), freshwaters, geothermal resources, life, health and property. The permanent wellhead completion equipment shall be attached to the production casing or to the intermediate casing if production casing does not reach to the surface.

(b) All casing strings shall be designed to provide anchorage for blowout prevention equipment and to withstand anticipated collapse, burst, and tension forces with the appropriate design factor provided to obtain a safe operation.

(c) Casing setting depths shall be based upon geological and engineering factors, including but not limited to formation pressures, fracture gradients, lost circulation intervals, and the degree of formation compaction or consolidation. All depths refer to true vertical depth (TVD) below ground level.

(d) All cements in high-temperature geothermal wells must include 30-40 percent silica flour, by weight relative to cement, to prevent strength degradation of the cement over time. Division specifications for casing strings shall be determined on a well-to-well basis. All casing strings reaching the surface shall provide adequate anchorage for blowout-prevention equipment, hole pressure control and protection for all natural resources. The following casing requirements are general but should be used as guidelines in submitting proposals to drill (CChavez- NV Regs.).

21) 1935.1. Conductor Pipe.

Conductor pipe shall be cemented with sufficient cement to fill the annular space from the shoe to the surface at or driven to a maximum depth of 100 feet. Exceptions may be granted by the Supervisor if conditions require deeper casing depth. An annular blowout preventer, or its equivalent, approved by the Division, shall be installed on conductor pipe for exploratory wells and development wells when deemed necessary by the Division. The Division may waive this requirement for low-temperature geothermal wells (CChavez- NV Regs.).

22) 1935.2. Surface Casing.

Surface casing shall provide for control of formation fluids, for protection of shallow usable groundwater freshwater zones, and for adequate anchorage for blowout prevention equipment. Surface casing shall be cemented into or through a competent bed and at a depth that will allow complete well shut-in without fracturing the formation immediately below the casing shoe. All surface casing shall be cemented with sufficient cement to fill the annular space from the shoe to the surface. In non-exploratory wells, the surface casing requirement shall be determined on the basis of known field conditions. The Supervisor may vary these general surface casing requirements, including the adoption of a field rule consistent with known geological conditions and engineering factors. The following requirements may be modified or waived by the Division for low-temperature geothermal wells.

(a) Length of Surface Casing.

(1) In areas where subsurface geological conditions are variable or unknown, surface casing in general shall be set at a depth equaling or exceeding 10 percent of the proposed total depths of wells drilled in such areas. A minimum of 60 meters (about 200 feet) 200 feet and a maximum of 400 meters (about 1,300 feet) 1500 feet of surface casing shall be set.

(2) In areas of known high formation pressure, surface casing shall be set at a depth determined by the Division after a careful study of geological conditions.

(3) Within the confines of designated geothermal fields, the depth at which surface casing shall be set shall be determined by the Division on the basis of known field conditions.

(b) Cementing Point for Surface Casing.

(1) Surface casing shall be cemented through a sufficient series of low permeability, competent lithologic units (such as clay stone or siltstone) to ensure a solid anchor for blowout prevention equipment and to protect usable groundwater and surface water freshwater from contamination.

(2) A second string of surface casing may be required if the first string has not been cemented through a sufficient series of low permeability, competent lithologic units, and either a rapidly increasing thermal gradient or rapidly increasing formation pressures are encountered.

(3) Drilling Fluid Return Temperatures. The temperature of the return drilling fluid shall be monitored continuously during the drilling of the surface casing hole. Either a continuous temperature monitoring device shall be installed and maintained in working condition, or the temperature shall be read manually. In either case, return drilling fluid temperatures shall be entered into the log book after each joint of pipe has been drilled down (every 10 meters, about 30 feet) (CChavez- NV Regs.).

23) **1935.3. Intermediate Casing.**
Intermediate casing shall be required for protection against anomalous pressure zones, caveins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings shall be, if possible, cemented solid to the surface (CChavez- NV Regs.).

24) **1935.4. Production Casing.**
Production casing may be set above or through the producing or injection zone and cemented above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the zone, to segregate zones, and to prevent movement of fluids behind the casing into freshwater zones that contain usable groundwater. Production casing shall either be cemented with sufficient cement to fill the annular space from the shoe to the surface or lapped into intermediate casing, if run. Production casing lapped into an intermediate string shall overlap at least 15 meters (about 50 feet); 100 feet. The lap shall be cemented solidly; and shall be pressure tested to ensure its integrity (CChavez- NV Regs.).

25) **1942.2. Cable Tool Drilling.**
This method of drilling, or any other method of drilling, will be allowed, at the discretion of the Supervisor, with certain stipulations in the following cases only:
(a) Areas where formation pressures are known to be hydrostatic and are known to contain geothermal fluids at shallow depths, and where down-hole temperatures are less than 100 degrees C (212 degrees F) Low-temperature geothermal wells.
(b) Areas where geothermal fluids have been produced from shallow wells, less than 150 meters (500 feet) 500 feet true vertical depth, over a number of years with no known history of a blowout or geyser (CChavez- CA Regs.).

26) **1943. Drilling Fluid Return Temperatures.**
For all high-temperature geothermal wells, the operator shall monitor continuously the temperature of the return drilling fluid. Either a continuous temperature monitoring device shall be installed and maintained in working condition or the temperature shall be read manually. In either case, return drilling fluid temperatures shall be entered into the log book after each joint of pipe has been drilled down (CChavez- CA Regs.).

27) **1931.2. Notice to Convert to Injection Cancellation of Approved Operations.** An operator planning to convert an existing well to an injection or disposal well, even if there will be no change in mechanical condition, must file a Rework/Supplementary Notice with the Division and the Division must approve the notice before injection is

commenced. Division permits to conduct well operations will be cancelled if the proposed operations have not commenced one year from the approval date (CChavez- CA Regs.).

28) **1931.3. Approval to Extend Operations.**
Approval for any proposed operation may be extended for one year if the operator submits a Rework/Supplementary Notice (OGG107-2/09) and receives approval prior to the expiration of the one-year period defined and show good cause for such an extension (CChavez- CA Regs.).

29) **1934.2. Spacing.**
The producing interval of any high-temperature well drilled after the effective date of this section shall be not less than 75 feet from an outer boundary line (CChavez- CA Regs.).

30) **1941. General.**
Blowout prevention and related well control equipment shall be installed, tested, used, and maintained in a manner necessary to prevent an uncontrolled flow of fluid from a well. Blowout-Prevention Equipment (BOPE) installations shall include high temperature-rated packing units and ram rubbers, if available, and shall have a minimum working-pressure rating equal to or greater than the lesser of:

(a) A pressure equal to the product of the depth of the BOPE anchor string in meters times 0.2 bar per meter. (Feet times one (1) psi per foot) feet times one psi per foot.

(b) A pressure equal to the rated burst pressure of the BOPE anchor string.
(c) A pressure equal to 138 bars (2,000 psi). Specific inspections and tests of the BOPE shall be made by the Division. The requirements for such tests will be included in the Division's answer to the notice of intention to drill.
(d) A pressure equal to the fracture pressure at the shoe of the BOPE anchor string.
(e) Where air is used as the drilling medium, a pressure equal to the reservoir pressure of the Formation (CChavez- CA Regs.).

31) **1942. BOPE Guide.**
The Division shall prepare a guide for establishing the blowout prevention equipment requirements specified in the Division's approval of proposed operations. Division of Oil, Gas, and Geothermal Resources publication No. MO 7, "Blowout Prevention in California," shall be used by Division personnel as a technical guide to describe the blowout prevention equipment requirements specified in the Division's approval of proposed operations (CChavez- CA Regs.).

32) **Logging Requirements**

(a) **Electric Logging:** All wells, except temperature gradient and low-temperature wells, shall be logged with an induction electrical log, or equivalent, from total depth to the bottom of the conductor pipe, except in the case where air is used as the drilling medium. This requirement may be waived depending on geologic conditions (CChavez- Src: CA Regs. §1935.6 Electric Logging).

(b) **Mud Logging:** All wells, except temperature gradient and low-temperature wells, shall have recorded a complete and accurate mud log. The log shall show the lithologic charactertics and depths of formations encountered, the depths and temperatures of water-bearing or steam-bearing strata, the temperatures, chemical compositions, and other chemical and physical characterstics of fluids encountered, so far as ascertained (CChavez- Src: CA Regs. §1936.1 Mud Logging).

(c) **1936. Electric Logging.**
All wells, except observation temperature gradient wells and low-temperature thermal wells, shall be logged with an induction electrical log, or equivalent, from total depth to the bottom of the conductor pipe, except in the case where air is used as the drilling medium. This requirement may be waived by the Supervisor and may vary depending on geologic conditions as stated in Section 1935.2(a)(2) (CChavez- CA Regs.).

(d) **1936.1 Mud Logging**
All wells, except temperature gradient and low-temperature wells, shall have recorded a complete and accurate mud log. The log shall show the lithologic characteristics and depths of formations encountered, the depths and temperatures of water-bearing or steam-bearing strata, the temperatures, chemical compositions, and other chemical and physical characteristics of fluids encountered, so far as ascertained (CChavez- CA Regs.).

(e) **1936.2. Directional Surveys.**
The Supervisor may order that a well be directionally surveyed (CChavez- CA Regs.).

33) **Well Testing**

(A) **1954. Well Tests and Remedial Work.**

(1) Requirements. The Supervisor shall require such tests or remedial work as in his or her judgment are necessary to prevent damage to life, health, property, and natural resources, to protect geothermal reservoirs from damage or to prevent the infiltration of detrimental substances into underground or surface water suitable for agricultural, industrial, municipal, or domestic purposes, to the best interest of the neighboring property owners and the public.

(2) Types of Tests.

(a) Casing tests may include, but are not limited to, spinner surveys, wall thickness tests, lap tests, pressure surveys and radioactive tracer surveys.

(i) Spinner surveys
(ii) Wall thickness

(iii) Lap
(iv) Pressure
(v) Radioactive tracer surveys

(b) Cementing tests may include, but are not limited to, cementing of casing, pumping of cement plugs and location and hardness of cement plugs.

(i) Cementing of casing
(ii) Pumping of plugs
(iii) Hardness of plugs
(iv) Depths of plugs

(c) Equipment tests may include, but are not limited to, gauges, thermometers, surface facilities, pipelines, vessels, etc.
(i) Gauges
(ii) Thermometers
(iii) Surface facilities, lines, vessels, etc.
(iv) Blowout prevention equipment. BOPE inspections and/or tests are normally performed on all drilling wells. The supervisor requires that the blowout-prevention equipment be tested prior to drilling out the shoe of the surface casing. A Division engineer must be contacted to witness a pressure test of each preventer of the well prior to drilling out the shoe of the surface casing (CChavez- CA Regs.).

34) 1955. Testing of Idle Wells.
Any high-temperature geothermal well that has not produced or injected for a continuous 30 day period during any consecutive five-year period, must undergo a diagnostic test as approved by the Supervisor. Additional well tests or remedial operations may be required upon a showing of good cause. The appropriate geothermal district office shall be notified before tests are made, as a Division representative may witness the operations (CChavez- CA Regs.).

35) 1966. Surveillance, Notification and Testing Requirements.

(a) Surveillance of waste water disposal or geothermal injection projects is necessary on a continuing basis to establish to the satisfaction of the Supervisor that all water is confined to the intended zone of injection.

(b) When an operator proposes to drill an injection well, convert a producing or idle well to an injection well, or rework an injection well and return it to injection service, the operator shall be required to demonstrate complete casing integrity to the Division by means of a specific test.

(c) To establish the integrity of the casing and the annular cement above the shoe of the casing, within 30 days after injection is started into a well, the operator shall make sufficient surveys to demonstrate that all the injected fluid injectate is confined to the intended zone of injection. Thereafter, such surveys shall be made at least every two years. or more if ordered by Exceptions to the two year testing cycle can be made by the Supervisor or his or her representative. All such surveys shall be witnessed by a Division engineer.

(d) After the well has been placed on injection, a Division inspector shall visit the well site periodically. At these times, surface conditions shall be noted and, if any unsatisfactory conditions exist, the operator shall be notified of required remedial work. If this required work is not performed within 90 days, the approval issued by the Division shall be rescinded. The supervisor may order that the repair work be done immediately if it is determined that damage is occurring at a rapid rate. A chemical analysis of the injectate shall be made and filed with the Division whenever the injectate is changed, or as requested by the Supervisor.

(e) Injection pressures shall be recorded and compared with the pressures reported on the monthly injection reports. Any discrepancies shall be rectified immediately by the operator. A graph of pressures and rates versus time shall be maintained by the operator. Reasons for anomalies shall be promptly ascertained. If these reasons are such that it appears damage is being done, approval by the Division may be rescinded, and injection shall cease. Accurate, operating pressure and volume gauges or pressure and volume recording devices shall be available at all times, and all injection wells shall be equipped for installation and operation of such gauges or devices.

(f) When an injection well has been idle for two years, the Division may inform the operator, by letter, that approval for use of the well for injection purposes is rescinded. If the operator intends to reclaim the well for injection purposes, a Rework/Supplementary Notice shall be filed proposing to demonstrate by specified tests that the injected fluid will be confined to the intended zone of injection. After the well has been placed on injection, a Division inspector shall visit the well site periodically. At these times, surface conditions shall be noted and, if any unsatisfactory conditions exist, the operator shall be notified of required remedial work. If this required work is not performed within the time specified, the approval issued by the Division may be rescinded. The Supervisor may order that the repair work be done immediately if it is determined that damage is occurring at a rapid rate.

(g) Injection pressures shall be recorded and compared with the pressures reported on the monthly injection reports. Any discrepancies shall be rectified immediately by the operator. Reasons for anomalies shall be promptly ascertained. If these reasons are such that it appears damage is being done, approval by the Division may be rescinded, and injection shall cease.

(h) Data obtained from all observation wells (time vs. pressure or temperature), must be maintained and submitted to the Division upon request.

(i) Approval for use of a well for injection purposes may be rescinded by the Supervisor for such reasons as:

(1) Failure to perform and submit required surveys.
(2) Failure to demonstrate the mechanical integrity of the well.
(3) Well has been idle for two years. If the operator intends to reclaim the well for injection purposes, a Rework/Supplementary Notice (OGG107-2/09) shall be filed proposing to demonstrate by specified tests that the injectate will be confined to the intended zone of injection (CChavez- CA Regs.).

36) Well Records

(A) Required Well Records: The operator of any well drilled, redrilled, deepened, reworked or plugged and abandoned shall keep, or cause to be kept, an accurate record of each operation on each well including, but not limited to, the following, when applicable:

(1) Well History: The history shall describe in detail in chronological order on a daily basis all significant operations carried out and equipment used during all phases of drilling, testing, completion, re-completion and plugging and abandonment of the well, including:

(a) Character and depth of all formations, water-bearing strata, water or steam entries, lost circulation zones, and abnormal pressure zones encountered.

(b) Casing size, weight, grade, type, condition (new or used), top, bottom, and perforations; and any equipment attached to the casing.

(c) Casing pressure tests, including date, duration, pressure, and percent bleed-off.

(d) Hole sizes.

(e) Cementing and plugging operations, including date, depth, slurry volume and composition, fluid displacement, pressures, calculated or actual fill, and down-hole equipment.

(f) Drill-stem, leak-off, or other formation tests, including date, duration, depth, pressures, and recovery (volume and description).

(g) BOPE installation, inspections, and pressure/function tests.

(h) Sidetracked casing, tools or other material, collapsed or bad casing, holes in casing, and stuck drill pipe, tubing, or other junk in casing or open hole.

(i) Depth and type of all electrical, physical, or chemical logs, tests, or surveys made.

(j) Production or injection method and equipment.

(2) Well Summary (OGG100-2/09). The well summary report shall accompany the well history report. It is designed to show data pertinent to the condition of a well at the time of completion of work done.

(3) Induction Electric Log.

(4) Mud Log.

(5) Production and Injection Reports (110-S, 110-I and 110W). Operators shall file monthly production and injection reports with the Division each month. These reports shall be submitted in an electronic format acceptable to the Supervisor. Operators submitting data on fewer than twenty-five wells may submit reports in written or electronic form. These reports shall be as accurate as can be reasonably expected using current engineering practices.

(6) Other Records. The following shall also be filed with the Division, if run:

(a) Physical or chemical logs.
(b) Production or injection tests.
(c) Water analyses.
(d) Surveys (including temperature and directional).
(e) Core Record (OGG101-2/09). The core record shall show the depth, character, lithology and fluid content, so far as determined, of all cores, including sidewall samples.

(7) Such other information as the Supervisor may require for the performance of his or her statutory duties.

(CChavez- Src: CA Regs. §1937 Required Well Records).

(37) 1937. Required Well Records

The operator of any well drilled, redrilled, deepened, reworked or plugged and abandoned shall keep, or cause to be kept, an accurate record of each operation on each well including, but not limited to, the following, when applicable:

(A) Well History (OGG103-2/09). The history shall describe in detail in chronological order on a daily basis all significant operations carried out and equipment used during all phases of drilling, testing, completion, re-completion and plugging and abandonment of the well, including:

(1) Character and depth of all formations; water-bearing strata, water or steam entries, lost circulation zones, and abnormal pressure zones encountered.

(2) Casing size, weight, grade, type, condition (new or used), top, bottom, and perforations; and any equipment attached to the casing.

(3) Casing pressure tests, including date, duration, pressure, and percent bleed-off.

(4) Hole sizes.

(5) Cementing and plugging operations, including date, depth, slurry volume and composition, fluid displacement, pressures, calculated or actual fill, and down-hole equipment.

(6) Drill-stem, leak-off, or other formation tests, including date, duration, depth, pressures, and recovery (volume and description).

(7) BOPE installation, inspections, and pressure/function tests.

(8) Sidetracked casing, tools or other material, collapsed or bad casing, holes in casing, and stuck drill pipe, tubing, or other junk in casing or open hole.

(9) Depth and type of all electrical, physical, or chemical logs, tests, or surveys made.

(10) Production or injection method and equipment.

(B) Well Summary (OGG100-2/09). The well summary report shall accompany the well history report. It is designed to show data pertinent to the condition of a well at the time of completion of work done.

(1) Induction Electric Log.

(2) Mud Log.

(3) Production and Injection Reports (110-S, 110-I and 110W). Operators shall file monthly production and injection reports with the Division each month. These reports shall be submitted in an electronic format acceptable to the Supervisor. Operators submitting data on fewer than twenty-five wells may submit reports in written or electronic form. These reports shall be as accurate as can be reasonably expected using current engineering practices.

(4) Other Records. The following shall also be filed with the Division, if run:

(a) Physical or chemical logs.
(b) Production or injection tests.
(c) Water analyses.
(d) Surveys (including temperature and directional).
(e) Core Record (OGG101-2/09). The core record shall show the depth, character, lithology and fluid content, so far as determined, of all cores, including sidewall samples.
(f) Such other information as the Supervisor may require for the performance of his or her statutory duties (CChavez- CA Regs.).

(38) Wastes

A) 1956. Geothermal Wastes and Refuse.

(1) The operator shall dispose of all liquid wastes, including but not limited to water, chemicals, mud, and cement, in such a manner as not to cause damage to life, health, property, freshwater zones, surface waters, natural resources, or be a menace to public safety. Disposal sites for such wastes shall also conform to State Water Resources Control Board and appropriate, Regional Water Quality Control Board regulations.

(2) Dumping harmful chemicals where subsequent meteoric waters might wash significant quantities into freshwaters shall be prohibited. Cement slurry or dry cement shall not be disposed of on the surface.

(3) Unused equipment and scrap attendant to geothermal operations shall be removed from a production or injection operations area and/or stored in such a manner as to not cause damage to life, health, property, natural resources, or become a public nuisance or a menace to public safety. Trash and other waste materials attendant to geothermal operations shall be removed and disposed of properly (Cchavez- CA Regs.).

(39) Closure

A) 1958. Well Site and Lease Restoration.

(1) In conjunction with well plugging and abandonment operations, the operator shall fill any auxiliary holes, such as rat holes, with earth and compacted properly; all construction materials, cellars, and production pads shall be removed and the resulting excavations filled with earth and compacted properly to prevent settling.
(2) Well locations shall be graded and cleared of equipment, trash, or other waste materials, and returned to as near a natural state as practicable. Well site restoration must be completed within 60 days following plugging and abandonment of the well.
(3) Sumps shall be closed in accordance with Regional Water Quality Control Board requirements.
(4) Access roads to well locations generally will not be covered by these regulations; however, any condition that creates a hazard to public safety or property or causes interference with natural drainage will not be acceptable.
(5) Lease Restoration Plan. Prior to the plugging and abandonment of the last well or group of wells on a lease, the operator shall submit a plan and schedule for completing lease restoration. The lease-restoration plan shall also include the locations of any existing or previously removed, where known, sumps, pipelines, and facilities. Lease restoration shall begin within three (3) months and be completed within one year after the plugging and abandonment of the last well on the lease. However, the Supervisor may require or approve a different lease restoration completion date if good cause can be shown (CChavez- CA Regs.).

(40) Authorization to Inject/Dispose

(A) 1960. Definition Approval of Underground Injection and Disposal Projects. Approval must be obtained from this Division before any subsurface injection or disposal project can begin. Injection wells are those used for the disposal of waste fluids, the augmentation of reservoir fluids, pressure maintenance of reservoirs, or for any other purpose authorized by the supervisor. New wells may be drilled and/or old wells may be converted for water injection or disposal service. Notices, bonds and fees are required for drilling or conversion as stated in Article 3.

(1) Geothermal injection wells may inject three types of fluid:

(a) Spent geothermal fluids.

(b) Condensate and Division-approved fluids from power plant operations.

(c) Division-approved supplemental water.

(d) New wells may be drilled and/or existing wells may be converted to injection service (CChavez- CA Regs.).

(41) Application Considerations & Approval

(A) 1961. Projects Data Requirements.

Following is an outline which sets forth the requirements for initiating an injection project. Data and exhibits need only extend or cover the injection zone and zones which will possibly be affected by an injection project:

(1) Letter setting forth the entire plan of operations, which should include:

(a) Reservoir conditions.

(b) Method of injection: through casing, tubing, or tubing with a packer.

(c) Source of injection fluid.

(d) Estimates of daily amount of water to be injected.

(e) Map showing contours on a geologic marker at or near the intended zone of injection.

(f) One or more cross sections showing the wells involved.

(g) Analyses of fluid to be injected and of fluid from intended zone of injection.

(h) Copies of letter or notification sent to neighboring operators if deemed advisable by the supervisor. The operator requesting approval for an injection project must provide the appropriate geothermal district engineer with any data that, in the judgment of the Supervisor, are pertinent and necessary for the proper evaluation of the proposed project. The data required to be filed with the district engineer shall include, but are not limited to, all of the following:

(2) An engineering study, including but not limited to:

(a) Statement of primary purpose of the project.

(b) Reservoir characteristics of each injection zone, such as porosity, permeability, average thickness, areal extent, fracture gradient, original and present temperature and pressure.

(c) Reservoir fluid data, including a fluid analysis of the injection zone.

(d) Casing diagrams, including cement plugs, and actual or calculated cement fill behind casing, of all idle, plugged and abandoned, or deeper-zone producing wells within the area affected by the project, and evidence that plugged and abandoned wells in the area will not have an adverse effect on the project or cause damage to life, health, property, or natural resources.
(e) The planned well-drilling and plugging and abandonment program to complete the project, showing all injection, production, and plugged and abandoned wells, and unit boundaries.

(3) A geologic study, including but not limited to:

(a) Structural contour map drawn on a geologic marker at or near the top of the injection zone in the project area.
(b) Isopach map of each injection zone or subzone in the project area.
(c) At least one geologic cross section through at least one injection well in the project area.
(d) Representative electric log (or other acceptable geophysical log) to a depth below the deepest producing zone (if not already shown on the cross section), identifying all geologic units, formations, and freshwater zones.

(4) An injection plan, including but not limited to:

(a) A map showing injection facilities.
(b) Maximum anticipated surface injection pressure (pump pressure) and daily rate of injection, by well.
(c) Monitoring system or method to be utilized to ensure that no damage is occurring and that the injectate is confined to the intended zone or zones of injection.
(d) Method of injection.
(e) List of proposed cathodic protection measures for the plant, lines, and wells, if such measures are warranted.
(f) Treatment of water to be injected.
(g) Source and analysis of the injectate.
(h) Location and depth of each water-source well that will be used in conjunction with the project.
(i) Copies of letters of notification sent to offset operators. All maps, diagrams, and exhibits must be clearly labeled as to scale and purpose and shall clearly identify wells, boundaries, zones, contacts, and other relevant data. Additional data may be required in order to make a decision. This may include a subsidence model, anticipated declines, pressure build-up model, and reserve estimates (with and without injection) (CChavez- CA Regs.).

(42) 1962. Project Approval.
A written approval of a project will be sent to the operator and such approval will contain those provisions specified by the Division as necessary for safe operations.

Injection shall not commence until approval has been obtained from the Division CChavez- CA Regs.).

(43) Well Workovers

(A) 1963. Notice to Drill New Well or Convert Existing Well.

(1) Prior to the operator doing work on a well, the appropriate notices must be received and approved by the Division. Proposals to drill new wells for injection purposes shall be filed on the Division form entitled Notice of Intention to Drill New Well (OGG105-2/09). Proposals to convert existing wells shall be filed on the Division form entitled Rework/Supplementary Notice (OGG 107-2/09).
(2) Bonds and fees are required for all proposed wells. The bonds and fees for an injection well are the same as those required for a development well.
(3) Injection wells shall conform to the Division's spacing regulations laws (CChavez- CA Regs.).

(B) 1964. Subsequent Work.
A Rework/Supplementary Notice is required for any subsequent work that alters the well casing(s) or changes the use of the well as provided in CCR Section 1966(f) (CChavez- CA Regs.).

(44) Monitoring

(A) 1970. Responsibility
The prime primary responsibility for subsidence detection and abatement mitigation in geothermal areas in the State of New Mexico lie with the Oil Conservation Division.

(B) 1971. Imperial Valley Subsidence Regulations.

(1) Surveys and Bench Marks.

(a) Subsidence bench marks, at well sites, tied to existing first- and/or second-order networks, are required for all wells that will be tested or produced. These bench marks shall be the responsibility of and at the expense of the operator. Surveys shall precede extensive production testing of the well.
(b) All survey work shall be coordinated with the County Surveyor.
(c) All work shall be done under the direct supervision of a Registered Civil Engineer or Licensed Land Surveyor.
(d) An adequate series of bench marks shall be set as required by the Division and shall be tied to existing survey nets.
(e) All field work, computations, etc., shall conform to National Geodetic Survey (N.G.S.) standards. Refer to "Manual of Geodetic Leveling" (1948).
(f) All surveys shall be second-order or better.
(g) All single-point tie-ins shall be double-run. Survey loops between two points on existing surveys may be single-run.

(h) Equipment shall be equal to or better than that accepted by the N.G.S. for second-order surveys. The N.G.S. procedures shall be followed.

(2) Types of acceptable bench marks are:

(a) Brass rod driven to refusal or 9 meters (about 30 feet) and fitted with an acceptable brass plate.
(b) Permanent structure (head walls, bridges, etc.) with installed plate.
(c) Bench marks at well sites shall be situated so as to minimize the possibility of being destroyed during any subsequent work-over activity at the wells. Each bench mark shall be well marked so as to be plainly visible to work-over crews.
(d) Between the well site and the network, bench marks shall be set at one-half mile intervals or as specified by the Division.
(e) Surveys shall be run annually by and at the expense of the operator while well(s) are being produced unless otherwise specified by the Division.
(f) The adjusted data from all surveys shall be submitted to the Division within 60 days after leveling is completed.
(g) Resurveys of the first- and second-order networks shall be coordinated by the Division.

(3) Reservoir Engineering.

(a) Initial bottom-hole pressures and temperatures (allowing a minimum of one month static time) shall be submitted to the Division within thirty (30) days of completion of work.

(b) All preliminary test data shall be submitted to the Division within 30 days of completion of the tests.

(c) Monthly surface recordings of production, injection, temperature, and pressure shall be reported to the Division on the appropriate forms (Sections 1951 and 1965).

(d) Periodic development and review meetings between operators and the Division shall be required (at least one per year).

(C) 1972. Requirements.

(1) The Supervisor may require the operator to detect and mitigate subsidence in geothermal producing areas in the state where ground subsidence is a threat to life, health and property.

(2) The operator shall run surveys annually at its own expense in such areas where well(s) are being produced and/or injected unless otherwise specified by the Division.

(3) Division approved surveying methods for subsidence detection include the following:

(a) Leveling (Second order or better).
(b) Global Positioning System (GPS).
(c) Interferometric Synthetic Aperture Radar (INSAR).
(d) Any new method approved by the Supervisor.
(e) All work shall be done under the direct supervision of a Registered Engineer or Licensed Land Surveyor.
(f) The operator shall submit adjusted data from all surveys to the Division within 60 days after the data has been collected.
(g) Periodic development and review meetings between operators and the Division shall be required (at least one per year).

(D) 1973. Surveys and Benchmarks.

(a) An adequate series of benchmarks shall be set as required by the Division and shall be tied to existing survey nets.

(b) Subsidence benchmarks at well sites, tied to existing first- and/or second-order networks, are required for all production, injection and observation wells within areas designated in CCR Section 1972(a). These benchmarks shall be the responsibility of and at the expense of the operator.

(c) Benchmarks at well sites shall be situated so as to minimize the possibility of being destroyed during any subsequent workover activity at the wells. Each benchmark shall be well marked so as to be plainly visible to work-over crews.

(d) Between the well site and the network, benchmarks shall be set at one-half mile intervals or as specified by the Division.

(e) Types of acceptable benchmarks are:

(1) Brass rod driven to refusal or 30 feet and fitted with an acceptable brass plate.
(2) Permanent structure (head walls, bridges, etc.) with installed plate.
(3) Other benchmarks conforming to National Geodetic Survey (NGS.) standards.

(f) All field work, computations, etc., shall conform to NGS standards.

(g) All single-point tie-ins shall be double-run. Survey loops between two points on existing surveys may be single-run.

(h) Equipment shall be equal to or better than that accepted by the NGS for second-order leveling. The NGS procedures shall be followed.

(i) Resurveys of the first- and second-order networks will be coordinated by the Division.

(j) The requirements of this section do not apply if INSAR is used.

(45) Plug and Abandonment Requirements

(A) 1980. Objectives.

The objectives of abandonment plugging are to block interzonal migration of fluids so as to:

(1) Prevent contamination of the fresh waters freshwaters or other natural resources;
(2) Prevent damage to geothermal reservoirs;
(3) Prevent loss of reservoir energy;
(4) Protect integrity of reservoirs; and
(5) Protect life, health, environment and property and natural resources.

(B) 1981. General Requirements.

The following are general requirements which are subject to review and modification for individual wells or field conditions. The Division may require the witnessing of any or all of the field operations listed below.

(1) A Notice of Intention to plug and abandon Abandon Geothermal Resources Well (OGG108-2/09), must be submitted and Division approval received prior to is required for all wells plugging and abandoning any well. Division permits to plug and abandon a well will be cancelled if the proposed operations have not commenced one year from the approval date. The permit may be extended for one year if the operator submits a Rework/Supplementary Notice (OGG107-2/09) and receives approval prior to the expiration of the one-year period defined and show good cause for such an extension.

(2) A Well History of Geothermal Resources – Geothermal (OGG103-2/09) shall be filed within 60 days after completion of the plugging and abandonment.

(3) The Division's Report of Well plugging Plugging and abandonment Abandonment (OGG159-2/09) will not be issued until the well has been plugged satisfactorily, all records have been filed and the site inspected for final cleanup by a Division engineer.

(4) Subsequent to the plugging and abandonment of the hole, all casings shall be cut off at least 2 meters (6 feet) below the surface of the ground, all concrete cellars and other structures shall be removed, and the surface location restored, as near as practicable, to original conditions. The landowner has the option to assume legal responsibility for a well; however, to do so he or she must have legal clearance from the Division All Portland cements used in plugging and abandonment of high-temperature geothermal wells must include 30-40 percent silica flour by weight relative to cement, to prevent strength degradation of the cement over time. Other types of cement may be substituted for Portland cement, as approved by the Supervisor. The application of such materials shall be approved by the Supervisor.

(5) Good quality, heavy drilling fluid approved by the supervisor shall be used to replace any water in the hole and to fill all portions of the hole not plugged with cement. In low-temperature geothermal wells, other materials may be mixed with cement or replace the cement, as approved by the Supervisor. The application of such materials shall be approved by the Supervisor.

(6) All cement plugs, with the possible exception of the surface plug, shall be pumped into the hole through drill pipe or tubing. Mud fluid having the proper weight and physical characteristics to prevent movement of other fluids into the well bore shall be placed across all uncemented intervals above the lowermost cement plug.

(7) All open annuli shall be filled solid with cement to the surface. Blowout prevention equipment may be required during plugging and abandonment operations. Any blowout prevention equipment and inspection requirements determined necessary by the Supervisor shall appear on the approval to plug and abandon issued by the Division.

(8) A diligent effort shall be made to recover junk when such junk may prevent proper plugging and abandonment either in open hole or inside casing. In the event that junk cannot be removed from the hole and freshwater zones or geothermal zones penetrated below cannot therefore be properly abandoned, cement shall be down-squeezed through or past the junk and a 100-foot cement plug shall be placed on top of the junk. If it is not possible to down-squeeze through the junk, a 100-foot cement plug shall be placed on top of the junk.

(9 In the event that a source containing radioactive material cannot be retrieved from the hole, the operator shall perform the following:

(a) Place a 100-foot standard color dyed (red iron oxide or equivalent red cement dye) cement plug on top of the radioactive tool.

(b) Place a whip stock or other approved deflection device on top of the cement plug to prevent accidental or intentional mechanical disintegration of the radioactive source.

(c) Comply with the DHS regulations in Section 30346 of Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 7, of the California Code of Regulations.

(10) Temperature gradient wells must be abandoned within one year of completion unless a compelling need can be demonstrated to the Supervisor (CChavez- CA Regs.).

(C) 1981.1. Exploratory Well Requirements (No Production Casing).

(1) Base of fresh waters-a minimum of 30 meters (about 100 feet) of cement straddling the interface or transition zone whether behind casing or uncased.

(2) Shoe plug (all casing, including conductor pipe)-straddle with 30 meters (about 100 feet) of cement.

(3 Where the well has been drilled with air, a bridge plug shall be placed at the shoe of the surface casing and the bridge plug shall be capped with at least 60 meters (about 200 feet) of cement.

(4) Surface plug-15 meters (about 50 feet) minimum. May be either neat cement or concrete mix (CChavez- CA Regs.).

(D) 1981.2. Cased Wells. Cased exploratory, uncompleted development, former producing and injection wells.

(1) Geothermal zones—uncased or perforated. Cement plugs shall extend from the bottom of the zone or perforations to 30 meters (about 100 feet) over the top of the zone or perforations.

(2) Liners. Cement plugs shall be placed from 15 meters (about 50 feet) below to 15 meters (about 50 feet) above liner tops.

(c) Casing may be salvaged within protection, if first approved by the Division. A minimum overlap of 15 meters (about 50 feet) is required.

(3) Casing stubs and laps. Cement plugs shall be placed, if possible, from 15 meters (about 50 feet) below to 15 meters (about 50 feet) above top of casing. If unable to enter stub or lap, 30 meters (about 100 feet) of cement shall be placed on the top of the stub or lap.

(4) Fish, collapsed pipe, etc. Cement plugs shall be squeezed, with the use of a retainer or bradenhead, with sufficient cement to fill across the production zone or perforations and to 30 meters (about 100 feet) above the zone or perforations.

(5) Base of fresh waters-a minimum of 30 meters (about 100 feet) of cement straddling the interface or transition zone, whether behind casing or uncased.

(6) Shoe plug (all casing, including conductor pipe)-straddle with 30 meters (about 100 feet) of cement.

(7) Where the well has been drilled with air, a bridge plug shall be placed at the shoe of the surface casing and the bridge plug shall be capped with at least 60 meters (about 200 feet) of cement. Surface plug-15 meters (about 50 feet) minimum. May be either neat cement or concrete mix (CChavez- CA Regs.).

E) **1982. Plugging of Geothermal Zones.**

(1) As a minimum for an open-hole plugging and abandonment, the requirement shall include a cement plug extending from at least 100 feet below the top of the geothermal zone to at least 100 feet above the top of the zone.

(2) As a minimum for a cased-hole plugging and abandonment, the requirement shall include a cement plug extending from at least 100 feet below the top of the uppermost perforated interval to at least 100 feet above the top of the perforations, the top of the landed liner, the casing cementing point, or the geothermal zone, whichever is highest.

(3) As a minimum for plugging open hole across a casing shoe, the requirement shall include a cement plug extending from at least 100 feet below the shoe to at least 100 feet above the shoe. If the hole cannot be cleaned out to 100 feet below the shoe, the cement plug shall be placed as deep as possible.

(4) Where the well has been drilled with air, a bridge plug shall be placed at the shoe of the surface casing and the bridge plug shall be capped with at least 200 feet of cement (CChavez- CA Regs.).

F) **1983. Plugging for Freshwater Protection.**

(1) As a minimum for an open-hole plugging and abandonment, the requirement shall include a cement plug extending from at least 100 feet below the base of the lowermost fresh water zone to at least 100 feet above the base of the zone. This plug may be placed wholly within thick shale if such shale separates the freshwater sands from the brackish or saltwater sands.

(2) If there is cement behind the casing across the base of the lowermost freshwater zone, a 100-foot cement plug shall be placed inside the casing across the base of the zone. If the top of the cement behind the casing is below the base of the lowermost freshwater zone, squeeze cementing shall be required through perforations to protect the freshwater deposits. The amount of cement to be squeezed shall be equal to the theoretical volume to fill 100 linear feet of the annulus plus 50 percent excess, not to exceed the fracture pressure. In addition, a 100-foot cement plug shall be placed inside the casing above the perforations.

(3) Where geologic or groundwater conditions dictate, special plugging procedures may be specified to prevent contamination of useable waters by downward percolation of poor quality surface waters, separate water zones of varying quality, and isolate dry sands that are in hydraulic continuity with groundwater aquifers (CChavez- CA Regs.).

G) **1984. Plugging at a Casing Shoe.**

All casing shoes, including the conductor pipe, shall be plugged with cement from at least 50 feet below the shoe to at least 50 feet above the shoe (CChavez- CA Regs.).

H) **1985. Plugging at a Liner Top.**

All cemented liners, shall be plugged with cement from at least 50 feet below the top of liner to at least 50 feet above the top of liner (CChavez- CA Regs.).

I) 1986. Special Requirements.
The Supervisor, in special cases, may set forth other plugging and abandonment requirements or may establish field rules for the plugging and abandonment of wells. Such cases include, but are not limited to:

(1) The plugging of a high-pressure saltwater zone;

(2) Perforating and squeeze-cementing previously uncemented casing within and above a geothermal zone; and

(3) The plugging of particular zones or specifying cleanout intervals within a well bore (CChavez- CA Regs.).

J) 1987. Surface Plugging and Site Restoration.

(1) The hole and all annuli shall be plugged at the surface with at least a 50-foot cement plug.

(2) All well casings shall be cut off at least 5 feet but no more than 10 feet below the surface of the ground. As conditions warrant, the Supervisor may approve a different cut-off depth.

(3) A steel plate at least as thick as the outer well casing shall be spot welded to the top of the outer casing, after Division approval of the surface plug. The steel plate shall show the well's identification, indicated by the last five digits of the API well number.

(4) After completion of plugging operations, the operator shall remove all concrete cellars and other structures, and restore the surface location, as near as practicable, to its original condition. This restoration shall be completed within 60 days of the placement of the surface plug (CChavez- CA Regs).

K) 1988. Inspection of Plugging and Abandonment Operations.
Plugging and abandonment operations may require witnessing by the Division. The Report on Proposed Geothermal Operations (OGG111-2/09) will specify which operations are to be witnessed. These operations may include, but are not limited to the following:

(1) Inspecting or testing of the Blowout Prevention Equipment.
(2) Witnessing placement and/or location and hardness of a geothermal zone plug, base of fresh water plug, casing shoe plug or surface plug.
(3) Witnessing the mudding of the hole.
(4) Witnessing perforating operations and cementing through perforations.

(5) Inspecting the well site after the surface restoration is complete (CChavez- CA Regs.).

II. Policy Recommendations:

1) Current Geothermal Technologies

(a) Geothermal Co-Production: Focus on deeper geothermal gradient brine water resources in the oil and gas fields of NW New Mexico that are nearby existing or newly constructed transmission grids. Geothermal co-production with oil and gas may be applicable to NW New Mexico where geothermal activity coupled with the geothermal gradient (~ (~1.35 °F/100 Ft.) and well depth (> 7,000 Ft.) may facilitate binary cycle geothermal power production (~197°F) by steam generation using glycol working fluids. SE New Mexico lacks the geothermal activity and the geothermal gradient (~ 1°F/100 Ft.) to generate power by itself even at depths approaching 12,000 Ft. (Cchavez, Lhill & Cperrin);

(b) OCD shall facilitate a permit and bonding process for re-entry into existing oil and gas wells for geothermal co-production with oil and gas that will consist of submittal of C-101, C-102, C-103 (well workover) and C-108 (similar to UIC Class II SWD Well Application) forms under oil and gas regulations and not WQCC regulations. Public notice requirements are specified in the C-108 form (Cchavez);

(c) ©OCD geothermal exploration w/o WQCC discharge permit process for geothermal exploration in existing oil and gas wells in the oil fields of NM? Permit similar to UIC Class II SWD Well under Oil and Gas Regulations (Dbrooks & Cchavez);

(d) Flash steam geothermal engineering systems that inefficiently evaporate and/or deplete the state's hydrologic and hydrogeologic resource(s) should be prohibited in New Mexico. Instead, commercial geothermal power companies should be implementing pollution prevention and waste minimization by sophisticated heat transfer systems so as not to rely on scarce ground water resources in New Mexico for power production (Cchavez).

2) Energy Production

(a) More funding is needed to move NM's geothermal program forward and to maintain the day-to-day upkeep of data to sustain long-term geothermal power production. The nuclear power industry received much more funding for power generation to accomplish the goals of the Federal Government than renewable energy projects are receiving (CChavez).

(b) Oil Conservation Division (OCD) has general regulatory jurisdiction over all aspects of geothermal development, including: well drilling (location and construction of wells); waste disposal (OCD administers Water Quality Act as applied to geothermal development, approves "discharge plans" and permits Class V geothermal injection wells); and Correlative Rights (OCD must adjust competing claims of owners, and users of the same geothermal reservoir) (DBrooks).

(c) Other renewable technologies need to work together and make deals to install nested renewable power generating systems at geothermal power generating facilities and to make more efficient use of existing and upgraded power transmission lines for generating and transmitting electricity from renewable energy systems down the transmission lines. For example, geothermal plants have plenty of surface area to install solar, photo-voltaic and wind energy renewable power systems to boost power production at each facility (CChavez).

(d) Jurisdiction is OCD's where the use of water in geothermal operations (Geothermal Co-production with oil or gas where the water would be produced from the oil and gas well even if its geothermal heat were not used and production of water from an aquifer .2,500 feet below the surface, where the water contains > 1,000 ppm Total Dissolved Solids) (DBrooks).

(e) Geothermal or oil and gas Co-Production (a simplified regulatory environment) using common wells, will be simpler because Water Quality Act discharge permits will (generally) not be required. Water produced from oil and gas wells can be re-injected into the same or a different well pursuant to a Class II injection permit issued through OCD's Engineering Bureau (DBrooks).

(f) Injection over fault lines and highly fractured geothermal rocks and reservoirs should be prohibited to minimize seismicity in geothermal power generation areas- especially in populated areas. EGS applications should be under controlled conditions with created fracture systems away from aforementioned geologic conditions and population centers, while shallow low pressure recirculation or closed-loop or banked heat geothermal systems may operate in the above mentioned areas without any concerns (CChavez).

3) Land Use & Mineral Resource Rights

(a) A need for rulemaking: OCD's Geothermal Rules (developed in the 1980s) need substantial revision to address current geothermal issues, particularly with respect to correlative rights; and OCD looks forward to working with stakeholders, including geothermal developers and other agencies, to develop up-to-date and effective geothermal rules (DBrooks).

(b) Federal Lands: Where US Government owns Minerals, it owns Geothermal resources (DBrooks).

(c) Other Split-Estate Lands: Mineral owner probably owns geothermal resources (DBrooks).

(d) Surface Owner Protection Act: Does not apply (DBrooks).

(e) Geothermal projects should avoid potash mining areas due to the issue of conflicts between potash mining and drilling in potash areas is unsettled and litigation could take years to resolve in the courts (DBrooks).

(f) Ensure that geothermal activities do not adversely affect oil, gas or potash production and/or prospective economic resources. If penetrating oil and gas subsurface producing formations and from which oil and gas being produced or even prospective oil and development. Precedence will be required when situation where contention that geothermal resources will compromise oil and gas production and vice versa (DBrooks).

(g) Geothermal resources as a mineral, from Federally owned mineral perspective, for state depends on whether heat is extracted, but unanswered relative rights on private lands on surface and mineral owners will need to be determined (DBrooks).

(h) Exceptions to OCD Jurisdiction: Heat Exchange Systems (not geothermal); Incidental Use (a limited category of uses of geothermal heat incidental to water use is excluded by statute from OCD jurisdiction; and Indian Lands (Permit from EPA or Tribe required for injection wells and Other OCD jurisdiction may be preempted by federal law or Tribal sovereignty (DBrooks).

(i) OCD Jurisdiction NOT exclusive (Other state agencies have authority over particular aspects of Geothermal Operations (OSE; RLD; PRC; and other agencies) and Local Government (land-use and other regulatory requirements may apply (DBrooks).

(j) Geothermal power producers shall have all mineral, land and water rights issues resolved in advance of geothermal power generation or production application, unless the applicant is willing to undergo a longer-term permit geothermal process with hearings, etc (CChavez).

(k) OCD should strive to resolve land, mineral, and water rights issues in a policy that would allow geothermal co-production of power in oilfields of NM where transmission grid systems are already in present. Geothermal co-production with oil and gas is most likely to occur in NW New Mexico where geothermal activity coupled with geothermal gradient (~1.35°F/100 Ft.) (CChavez).

(l) OSE should help to develop locations in NM with plentiful fresh (makeup water for cooling towers) and non-fresh (geothermal fluids) water resources that will sustain long-term geothermal projects. In example, Placitas or Rincon, NM may not have enough fresh water resource to sustain power generation for 10 years let alone 20-30 years, while TorC, NM may have plenty. OSE could also indicate where water resources or appropriations are lacking (CChavez).

(m) Geothermal versus oil and gas (possible conflicts): oil and gas operators may have concerns about geothermal development adversely affecting existing or potential future oil and gas production from the same or proximate formations; geothermal potential of a formation may be adversely affected by removal or injection of water in the course of oil and gas operations; and OCD has jurisdiction of these issues, but has developed no applicable rules (DBrooks).

(n) Geothermal versus Potash possible conflicts: 1) Conflicts between oil and gas developers and potash developers has been extensive; 2) Geothermal interference with potash mining, though less of a concern than oil and gas, also presents potential problems; 3) OCD has jurisdiction over GT/Potash conflicts. However, OCD's R-11-P (relating to oil and gas versus potash) does not apply; and 4) Extensive and on-going litigation between oil and gas and potash developers indicates potash areas (in Eddy and western Lea Counties) are unlikely candidates for geothermal development in the near future (DBrooks).

(o) Geothermal versus other mining possible conflicts: 1) Neither OCD, nor any other state agency, has jurisdiction over conflicts that could arise between geothermal developments nor mining activities, other than potash mining; and 2) BLM may have jurisdiction over such conflicts on federal land (DBrooks).

(p) Nevada's property rights policy: **NRS 534A.050 Ownership of geothermal resources.** The owner of real property owns the rights to the underlying geothermal resources unless they have been reserved by or conveyed to another person (CChavez- NV Regs.).

4) Permitting

(a) OCD already has a WQCC discharge permit process in place for permitting larger low and high temperature Class V Geothermal exploration and production wells for power generation projects in New Mexico (CChavez);

(b) Change OCD Geothermal Regulations to supersede local and state regulations to streamline the permit process and requirements. Develop MOU(s) and/or cooperative agreements between BLM (i.e., well bonding), CID/RLD (direct heat closed-loop and/or heat storage systems), and OSE (i.e., well permitting, drilling certifications, ...) to help OCD streamline the geothermal commercial power company permit and exploration process to identify more geothermal reservoirs for renewable energy in NM (CChavez);

(c) UIC Class V Geothermal Injection Wells and Geothermal Disposal Wells to be regulated under §20.6.2 et seq. NMAC WQCC Regulations. Since they both serve the same function of injection wells and protection USDWs under the UIC Program. The Class V injection well may inject into fresh water (< 10,000 mg/L TDS) and/or above a USDW for a recirculating geothermal flow system within a fresh water geothermal reservoir and the geothermal disposal well must be constructed similar to an OCD UIC Class II SWD Well to protect USDW(s) to dispose of exempt geothermal wastes. Consequently, both UIC Class V Geothermal Wells and Geothermal Disposal Wells must be bonded under §20.6.2 et seq. NMAC or WQCC Regulations while geothermal production/development wells should be bonded under geothermal bond regulations. Currently, the G-112 references "UIC Class V Well" and "Geothermal Disposal Well." The form "Type of Well" could simply be changed to reflect, "UIC Class V Well or Geothermal Disposal Well", since they are both injection wells.

(d) OCD needs to develop a geothermal resource document for its website for all geothermal applications or projects where heat is extracted from ground water for use or as a mineral (CChavez).

(e) Threshold determination is required regarding whether the project constitutes a "geothermal resource" under New Mexico Law (MAltomare).

(f) Requires cooperative (and sometimes simultaneous) management by multiple state agencies (MAltomare).

(g) 71-5-6 Commission's and Division's Powers and Duties: the division shall have, and is hereby given, jurisdiction over all matters relating to the conservation of geothermal resources and the prevention of waste of potash as a result of geothermal operations in this state. It shall have jurisdiction, authority and control of and over all persons, matters or things necessary or proper to enforce effectively the provision of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] or any other law of this state relating to the conservation of geothermal resources and operations. Provided, however, nothing in this section shall be construed to supersede the authority which any state department or agency has with respect to the management, protection and utilization of the state lands or resources and its jurisdiction (MAltomare).

(h) The commission shall have concurrent jurisdiction and authority with the division to the extent necessary for the commission to perform its duties as required by the Geothermal Resources Conservation Act. In addition, any hearing on any matter may be held before the commission if the division director, in his discretion, determines that the commission shall hear the matter (MAltomare).

(i) § 71-5-7-Power of Commission & Division to Prevent Waste & Protect Correlative Rights The commission and division are hereby empowered, and it is their duty, to prevent the waste prohibited by the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] and to protect correlative rights, as in that act provided. To that end, the commission and division may make and enforce rules, regulations and orders relating to geothermal resources, and to do whatever may be reasonably necessary to carry out the purposes of that act whether or not indicated or specified in any section thereof (MAltomare).

(j) Incidental Use Exclusion; Incidental Loss or Extraction of Heat §71-5-2.1 NMSA When the application of potable water to a beneficial use involves the incidental loss or extraction of heat *and* the water is 250 degrees Fahrenheit or less, *then that heat is not a geothermal resource* for which a royalty is due. In such a case, the use is not governed by laws related to geothermal resources but is simply governed by Chapter 72 NMSA 1978. IN OTHER WORDS: In order to fall within the exclusion to "geothermal resource," all four of the following three requirements must be met:

1. The water is "potable,"
2. The water is being applied to a beneficial use,
3. The heat is being lost or extracted from the water "incidentally," AND
4. The water is 250 °F or less.

WHEN ALL FOUR REQUIREMENTS ARE MET FOR THE EXCLUSION:

- The application/use/project does not require a geothermal permit through the OCD, AND
- No state royalty payments are required pursuant to the Act (MAltomare).

(k) Heat exchange or heat transfer systems commonly referred to as "geothermal" heat pump systems: The engineering and scientific communities prefer the terms "geoexchange" or "ground source heat pumps" because geothermal power traditionally refers to heat originating from deep in the Earth's mantle. Unlike a project tapping into a geothermal reservoir, these systems use the natural heat storage capacity of the earth or ground water to provide energy efficient heating and cooling. The heat pump equipment works like a reversible refrigerator by removing heat from one location and depositing it in another location. *Review: Geothermal Resource is the natural heat of the earth or the energy... present in, resulting from, created by or which may be extracted from this natural heat.* "Geothermal" Heat Pumps do not use the natural heat of the earth. They are thus not Geothermal Resources, and therefore do not fall under the purview of either the Geothermal Resource Conservation Act or the Regulatory Authority of the OCD (MAltomare).

(l) Whenever OCD issues a WQCC discharge permit for a geothermal project, the permit is good for 5-years with a renewal provision. Under WQCC Regulations, there is a $100 filing fee and $1700 geothermal permit fee which will likely be applied to open-system injection well type projects. The OCD will need to use judgment on certain geothermal projects that it issues a discharge permit for on what the permit fee will be, if any (CChavez).

(m) Nevada's 5-Yr. Confidentiality Regulation: **NRS 534A.031 Exploration and subsurface information: Filing with Division of Minerals of Commission on Mineral Resources; confidentiality; release to State Engineer or other agency.** Any exploration and subsurface information obtained as a result of a geothermal project must be filed with the Division of Minerals of the Commission on Mineral Resources within 30 days after it is accumulated. The information is confidential for 5 years after the date of filing and may not be disclosed during that time without the express written consent of the operator of the project, except that it must be made available by the Division to the State Engineer or any other agency of the State upon request. The State Engineer or other agency shall keep the information confidential (CChavez- NV Regs.).

(n) Nevada's policy on geothermal exploration wells: **NRS 534A.060 Permit required to drill or operate geothermal well or drill exploratory well; application.**

(o) A person may not drill or operate a geothermal well or drill an exploratory well without obtaining a permit from the Administrator of the Division of Minerals of the Commission on Mineral Resources and complying with the conditions of the permit.

(p) An application must set forth such information as the Administrator requires by regulation (CChavez- NV Regs.).

5) 1920.2. Field Designation.

The Supervisor may designate geothermal fields for administrative purposes. A field shall contain at least one well capable of producing geothermal resources in commercial quantities. The Supervisor shall establish the boundaries by graphically constructing a one-mile square around each well capable of producing geothermal resources in commercial quantities. Each such well shall be at the center of a square. In the event that there are multiple wells in the field, there shall be a contiguous outer boundary that encompasses all of the wells (CChavez- CA Regs.).

6) 1920.3. Field Rules.

When sufficient geologic and engineering information is available from previous drilling, the supervisor may adopt or amend existing field rules. Operators may make application to the Supervisor for the establishment of field rules, or the Supervisor may establish field rules or change established field rules for any geothermal resource field or area. Before adopting or amending establishing or changing a field rules, the Supervisor shall notify affected persons, distribute the proposed rule or change to affected persons including but not limited to operators, landowners, and any utilities or other commercial users, and allow at least 30 days for them to comment on the proposed rules comments from the affected persons. The Supervisor shall notify affected persons in writing of the adoption new or changed of the field rules (CChavez- CA Regs.).

7) 1950.1.1923. Time Limits.

For the purpose of filing drilling records pursuant to PRC Section 3735, Public Resources Code the 60-day time limit for filing such records shall begin when the Division determines a well is completed, idle, or plugged and abandoned (CChavez- CA Regs.).

Chavez, Carl J, EMNRD

Subject:	Geothermal Production with Oil and Gas Development
Location:	OFS Conference Room, 3rd Floor
Start:	Tue 9/7/2010 9:00 AM
End:	Tue 9/7/2010 9:30 AM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Chavez, Carl J, EMNRD
Required Attendees:	Ezeanyim, Richard, EMNRD; Jones, William V., EMNRD; Brooks, David K., EMNRD; Warnell, Terry G, EMNRD; Altomare, Mikal, EMNRD; VonGonten, Glenn, EMNRD; Chavez, Carl J, EMNRD; Sanchez, Daniel J., EMNRD; Fesmire, Mark, EMNRD; Lucero, Stephen A., EMNRD

ıda:

- **Introduction – Symposium Concept and work to date**
- **Economic Feasibility of Geothermal Coproduction in NM Oil and Gas locations**
- **Is the proposed symposium worthwhile?** *Appears that symposium goes beyond whether Geothermal Coproc can be applied in the oil and gas fields of NM based on the web posting below and the draft proposal recently by ECMD*
  .....Carl Chavez- OCD
- **Action Items**

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Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

Recent New Mexico Consortium Website Posting (noticed 8/26)
http://network.newmexicoconsortium.org/events/2010-new-mexico-geothermal-energy-symposium-geothermal-production-with-oil-and-gas-development

Geothermal Production with Oil and Gas Development

The symposium will be focused on the utilization of existing oil and gas wells for baseload electricity generation. Main goals will be to promote the advantages of coproduction and associated technologies to the oil and gas industry, to discuss the potential for a Geothermal Coproduction Demonstration Project in New Mexico, and the possibilities of partnerships between the oil and gas industry and New Mexico universities, the National Laboratories and the geothermal industry.

What	
When	Oct 01, 2010 from 05:10 PM to 05:20 PM

Where	Albuquerque, NM
Contact Name	Ron Broadhead
Add event to calendar	vCal iCal

The geothermal energy obtained from the wells can be turned into clean, renewable baseload electrical power utilizing modular turbines with binary fluids and will provide enhanced revenue from well with low oil and gas yields and high volumes of water production. The symposium will bring together technical experts from a wide variety of sectors including the oil and gas industry, the geothermal industry, faculty and researchers from New Mexico universities, and scinetists and engineers from Sandia and Los Alamos National Laboratories as well as New Mexico state agencies to discuss technologies and applications of geothermal electricity coproduction in New Mexico.

OCD Geothermal Co-Production DRAFT Recommendation to ECMD (August 2010)

1) Geothermal Co-production with oil and gas in NM appears to be most suited to NW New Mexico due to geothermal activity and the geothermal gradient (Src.: 19.15.16.10(G)(2)(b) 107A NMAC "Temperature Gradient Curves" NW NM ~1.35 °F/100 Ft.) to elevate bottom hole fluid temperatures to above 200 °F at well depths approaching 7,000 Ft. Geothermal binary cycle power units are estimated in New Mexico to produce steam under ambient surface conditions at ~ 197 °F with a glycol working fluid. Based on geothermal gradients (NW: ~1.35 °F/ 100 Ft. & SE ~1 °F/ 100 Ft.) in New Mexico. In NW NM according to one local wireline operator: about 1degree for every 60 Ft. was recorded in a Dakota Sandstone Formation (Lower Upper Cretaceous) well 7200 Ft. deep with the bottom hole fluid temperature to be estimated at between 190-210 °F. The operator also said near Ignacio, Colorado just north of the New Mexico State Line, the bottom hole temperature can exceed 300 °F (concerns with wireline melt). Also, there are a few places on the Jicarilla Reservation with bottom hole temperatures reach 230 °F. The lack of geothermal activity and low geothermal gradient (~ 1 °F/100 Ft.) in SE New Mexico do not appear conducive to geothermal coproduction with oil and gas even at well depths of 12,000 Ft. (CChavez, REzeanyim, LHill, WJones & CPerrin).

2) Oil and gas well workover and conversion of existing or plugged and abandoned wells into geothermal co-production and/or WQCC injection wells shall require a minimum surface casing diameter of at least 12 in. (could accept 7 – 12 in.), well integrity requirements, and be in a condition suitable for well work over with appropriate well construction, cementing, etc. Existing oil and gas wells must be located outside of potash areas and cemented properly to prevent interference with oil and gas production and/or prospective production of oil, gas and/or mineral resources. These projects would be permitted similar to UIC Class II SWD Wells under OCD Program and not under WQCC Regulations. Would likely be a two well system with production from an existing oil and gas and disposal into nearby UIC Class II SWD Well regulated by the OCD.

New Mexico OCD Geothermal Co-production with Oil & Gas Development Update (July 2010)

- Environmental Bureau informed ECMD on 7-27-10 based on Engineering Bureau comments received on 7/23/10 that geothermal co-production in New Mexico may not be viable based on the geothermal gradient from 1 to 1.2 °F/100 Ft. vs. Texas >2 and Wyoming >3. ECMD had proposed a geothermal co-production symposium in September 2010 in Albuquerque, but is now reconsidering. Initiated discussion with District Supervisors and Engineering Bureau for references to geothermal gradients in NM. After inquiry and discussions, NW New Mexico may offer the potential for geothermal coproduction due to geothermal activity in the region (Source: Aztec District Supervisor Charlie Perrin) that appears to compliment the geothermal gradient in wells in San Juan County approaching the 7000 ft. depth. SE New Mexico does not appear to offer any potential for geothermal coproduction based on the low geothermal gradient with District Supervisor Buddy Hill confirming with use of well temperature logs in SE NM.

- Initiated communication and dialogue with OCD District Offices and ECMD on Geothermal Co-production with oil and gas and application in NM. Based on geothermal gradients (NW: 1.35 F/ 100 Ft. & SE 1 F/ 100 Ft.) in NM, NW New Mexico appears to be the only region in NM where geothermal gradient coupled with geothermal activity boost the bottom hole temperature above 200F.

- Researched geothermal gradients in NM and posted under UIC-999 "Geothermal Working Group." According to Charlie Perrin (NW NM) one of the local wire line operators has historically seen about 1 degree F for every 60 Ft. He indicated a Dakota well 7200' deep would be between 190-210 F. He also said up by Ignacio Colorado it can be over 300 (concerns with line melt) And a few places on the Jicarilla reservation 230 degrees F. From Charlie's 107A Rule Chart of NW and SE Geothermal Gradients, NW has about a 1.35F/100 Ft. vs. SE 1 F/ 100 Ft. Geothermal Gradient; however, the NW apparently has locations with geothermal activity within or near oil and gas exploration and/or production that may boost the temperature of well fluids to temperatures conducive of geothermal power generation.

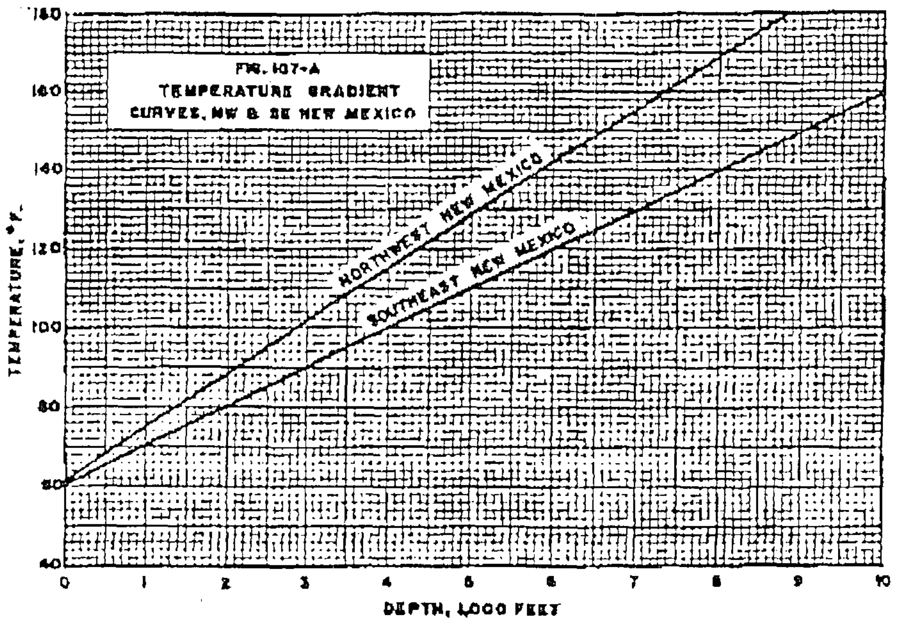


FIG. 107-A
TEMPERATURE GRADIENT
CURVES, NW & SE NEW MEXICO
NORTHWEST NEW MEXICO
SOUTHEAST NEW MEXICO
TEMPERATURE, °F.
DEPTH, 1,000 FEET

Figure 107-A

2010 New Mexico Geothermal Energy Symposium:

Geothermal Production with Oil and Gas Development

<u>Committee and Participants</u>:

- **Administrative Lead**: NM Consortium - Robert Sarracino, Katharine Chartrand
- **State of New Mexico Energy Office:** Steve Lucero (ECMD)
- **Technical Advisors**: Dr. Richard Erdlac (Erdlac Consulting); Jim Witcher (Witcher and Associates); Michael Albrecht (TBA Power); Randy Normann - Perma Works
- **NM Universities**: Ron Broadhead (Principal Senior Petroleum Geologist, NM Tech); Kurt Anderson - NMSU
- **State Regulatory Agencies**: Carl Chavez NM OCD; TBD - Office of the State Engineer; TBD Bureau of Land Management
- **National Laboratories**: Doug Blankenship - Sandia National Labs; Ken Rehfeldt - Los Alamos National Labs
- **NM Oil and Gas Association**: TBD
- **Geothermal Developers:** TBD

<u>Proposed Meeting Location</u>: Albuquerque

<u>Proposed Meeting Timeframe</u>: September 2010, 1 day meeting

<u>Symposium Summary</u>:
A symposium focused on New Mexico resources, specializing in the development of existing oil and gas wells for geothermal electrical production. Geothermal energy produces clean, renewable base load electrical power. This energy can be extracted from various well fluids using compact, modular turbines with binary fluids. These systems are now sized to fit a single well or multiple wells with approximately 120°F fluid temperature differential between produced and cooling temperatures.

This capability to generate power gives a new revenue stream to low yield producers with high water volume and a reason to keep them producing. With systems installed in Chena Hot Springs, Alaska and the Wyoming Rocky Mountain Oil Field Testing Center, the ability to use low temperature fluids is no longer just a concept, it's a reality.

This symposium is being held to bring together a diverse group of technical representatives from the geothermal and oil and gas industries, consultants, university academia and researchers, scientists and engineers from Sandia and Los Alamos National Laboratories and state agencies to discuss the development of geothermal coproduction projects in New Mexico.

Goals:

1. Promote the advantages of this technology for the Oil and Gas Industry:
   - Much of the field technology is grounded in oil and gas industry practices
   - Infrastructure already exists
   - Geothermal development can use existing reservoirs or modify completions after production ends
   - Costs are lower than start-from-scratch geothermal development, with estimated payout in as little as 3 to 5 years
   - Small-scale power plants are designed for "clustering" with additional units or easy transport to other sites to meet changing field needs

2. Discuss the potential for a Geothermal Demonstration Project in New Mexico for the development of geothermal electrical energy at costs competitive with electrical energy generated by fossil fuels.
   a. Co-production of oil/gas with geothermal power generation
      i. Texas tax incentives could be adopted by New Mexico
   b. Converting old oil/gas wells to new geothermal power generation

3. Partnering the New Mexico Universities and Laboratories with the Oil and Gas Industry
   a. Discuss major technology needs
   b. What can universities and the national labs offer?

New Mexico

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW.

Resource Geography

New Mexico contains abundant geothermal resources throughout a large temperature gradient (USDOE 2007a). In a recent update of the geothermal database for New Mexico, 359 discrete thermal wells and springs were identified (NMEMNRD 2007). Resources suitable for most development are concentrated in the west and north-central regions of the state, with high-temperature gradients ranging from 1.6°F to 2.5°F per 100 feet of depth (NMEM 2006). There are no geothermal power plants currently operating; however, direct-use applications are ongoing. The northwest region contains volcanic activity from the Valles Caldera in the Jemez Mountain Range (west of Los Alamos), where the only known high-temperature geothermal system in the state occurs (base temperatures in this system exceed 500°F, 260°C) (USDOE 2007a). During the 1970s and 1980s a large geothermal power project was under development in the Valles Caldera; however, regulatory and resource issues led to the cancellation of the project (demonstration projects revealed inconsistent reservoir permeability and low productivity, though drilling and testing indicated a viable potential of 20 MW) (Fleischmann 2007).

While other potential geothermal resource areas exist, limited research has been done and most areas are without apparent surface manifestations. These areas are high risk, and developers in the state may need government funding to aid with early exploration and to reduce the high investment risk associated with their development. Sites in eight counties (Doña Ana, Grant, Hidalgo, McKinley, Rio Arriba, San Miguel, Sandoval, and Valencia), have been identified as potential geothermal resources (NMEMNRD 2007). The Rio Grande Rift area, specifically near Las Cruces, also needs to be explored in greater detail (Fleischmann 2007).

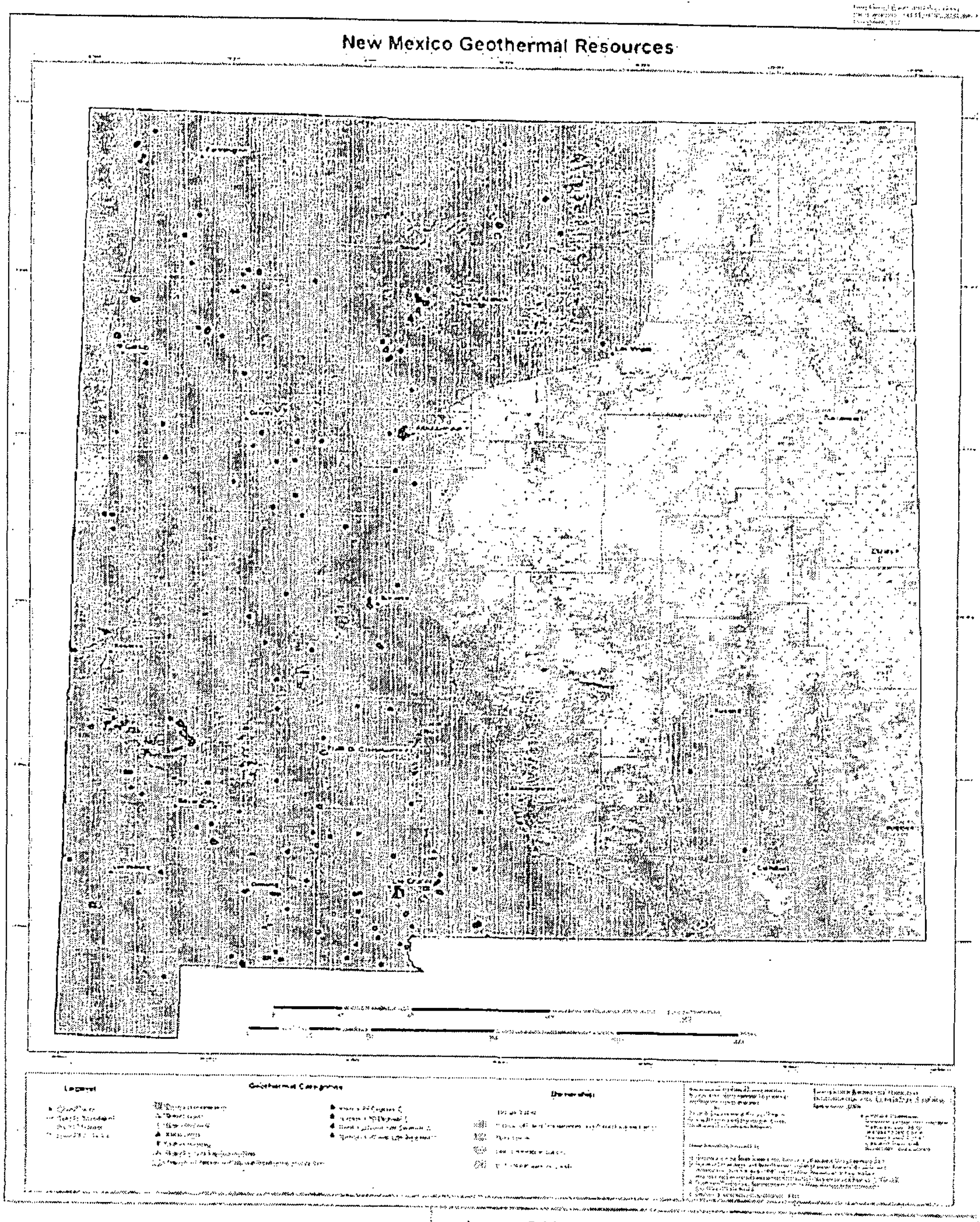
Utilization

There are no geothermal power plants operating; however, current development has included electric power production. An attempt to introduce geothermal electricity production occurred in the southwest at the Burgett Geothermal Greenhouses (near Cotton City) but was suspended due to design problems (NMEM 2006, USDOE 2007a). Drilling has occurred at two locations where small power units will be installed to provide electricity for an aquaculture facility and greenhouse. Other direct-use applications are ongoing (USDOE 2007a).

Technical Capabilities

New Mexico universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. New Mexico State University (NMSU) at Las Cruces conducted geothermal research that resulted in the development of a geothermal space-heating system that at one point heated up to 30 campus buildings such as dorms and athletic facilities. Sandia National Laboratory in Albuquerque is one of the three main national laboratories working on geothermal research and development (USDOE 2007a).

New Mexico



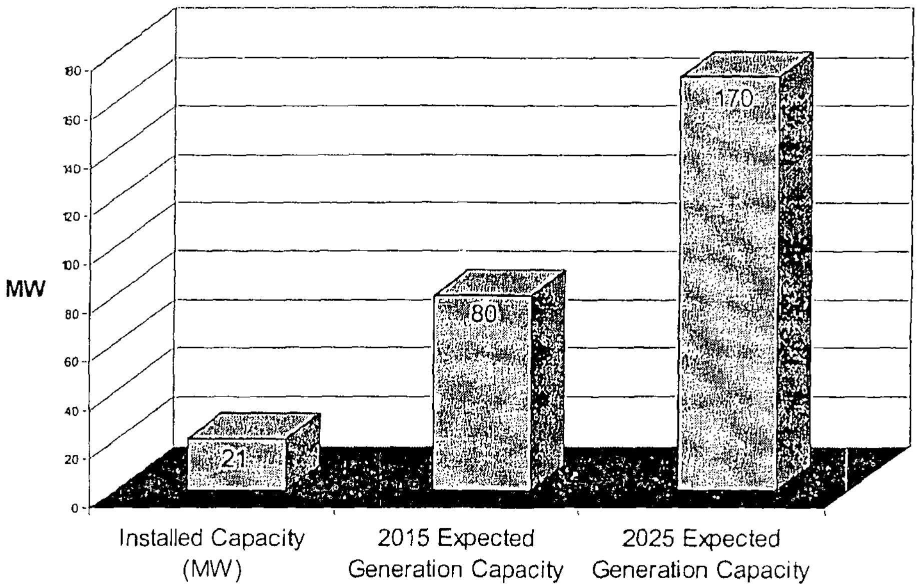
Lacey, 2003e, http://geothermal.id.doe.gov/maps/nm.pdf

New Mexico

Electrical Power Generation and Capacity

In the near term, development is likely for small-scale power. The state has two projects in development, with a total estimated potential of 21 MW. Literature estimates cite a short-term geothermal electricity generation potential of 80 MW and a long-term potential of 170 MW (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW (USGS 2008).

Geothermal Electrical Generation



WGA 2006

Tribal Lands

Tribal lands in New Mexico make up roughly 8.4 percent of its total acreage, and several locations on tribal reservations have been identified as having potential for geothermal development. This includes tribal lands in the San Juan Basin of northwest New Mexico, where considerable oil and gas drilling has occurred and intermediate-temperature fluid has been encountered. Another potential area is in the Jemez Mountains (in the vicinity of Valles Caldera). From 2002-2004, the Pueblo of Jemez worked with USDOE, who cost-shared a feasibility study to install a geothermal direct-use heating facility. The study concluded that there were business opportunities related to geothermal resources, but further drilling is needed before these applications can be developed on the site (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in New Mexico are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_newmexico.html (USDOE 2007h). Tribes for which information is available are listed on the following page.

New Mexico

Tribes with Potential Geothermal Resources in New Mexico
Jicarilla Apache Tribe of the Jicarilla Apache Indian Reservation
Mescalero Apache
Navajo Nation: Northwestern lands in New Mexico Northeastern lands in New Mexico Southwestern lands in New Mexico Southeastern lands in New Mexico Alamo Navajo Chapter Canoncito (Tohajiileeh) Chapter Ramah Navajo Chapter
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Jemez
Pueblo of Laguna
Pueblo of Nambe
Pueblo of Picuris
Pueblo of Pojoaque
Pueblo of San Felipe
Pueblo of San Ildefonso
Pueblo of San Juan
Pueblo of Sandia
Pueblo of Santa Ana
Pueblo of Santa Clara
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zia
Pueblo of Zuni
Ute Mountain Tribe of the Ute Mountain Reservation

New Mexico

Laws and Regulations

New Mexico classifies geothermal resources as Mineral if the fluid produced has a temperature greater than 250°F and as Water if the fluid produced has a temperature less than or equal to 250°F. The state claims ownership of geothermal resources when and where it holds the mineral rights. If the fluid produced is "mineral," the resource is under the primary jurisdiction of the Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department for drilling. This agency coordinates with the US EPA, Region 8, which has authority over wastewater discharge to surface waters in the state. Both of these latter agencies, in addition to the state Environmental Department, have regulatory authority over geothermal discharge permits. The New Mexico State Land Office leases the lands of the state mineral estate (Battocletti 2005).

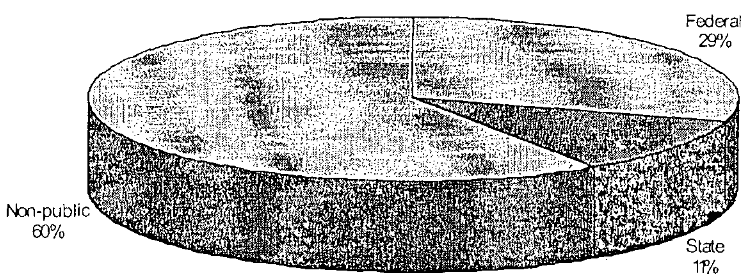
Geothermal fluid under 250°F is considered "water," and the resource is under the primary responsibility of the New Mexico Office of the State Engineer in regards to drilling and permitting. New Mexico does not have comprehensive environmental review statutes.

The state's RPS requires 20 percent renewable energy by 2020 for IOUs, 10 percent for rural co-ops and municipality utilities, with one Kilowatt (KW) of geothermal energy counting as two KW (Richter 2007). In addition to the state's RPS, geothermal resource development qualifies for the US Department of the Interior Energy Efficiency and Renewable Energy's bond program (USDOE 2007). New Mexico has established a Geothermal State Working Group, with leadership from the New Mexico Energy, Minerals, and Natural Resources Department (USDOE 2007a).

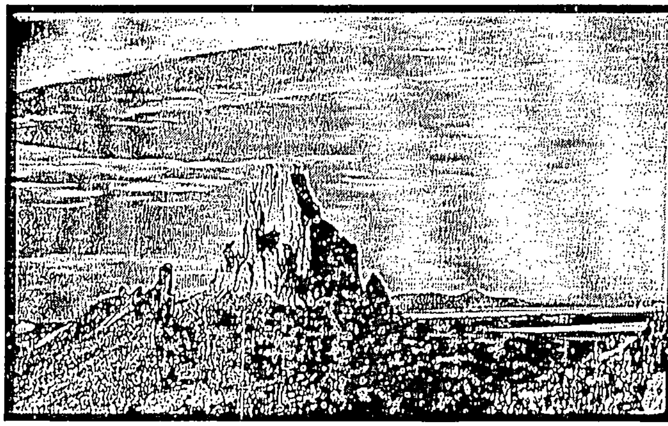
New Mexico does not have GHG laws or pending legislation; however, the state has a GHG reduction target that outlines 2000 levels by 2012, 10 percent below 2000 levels by 2020, and 75 percent below 2000 levels by 2050 (Camp 2007). There is no state funding for geothermal development. Most funding has come from the federal level from the US DOE (USDOE 2007a).

Land Ownership

(77,674,000 total acres)



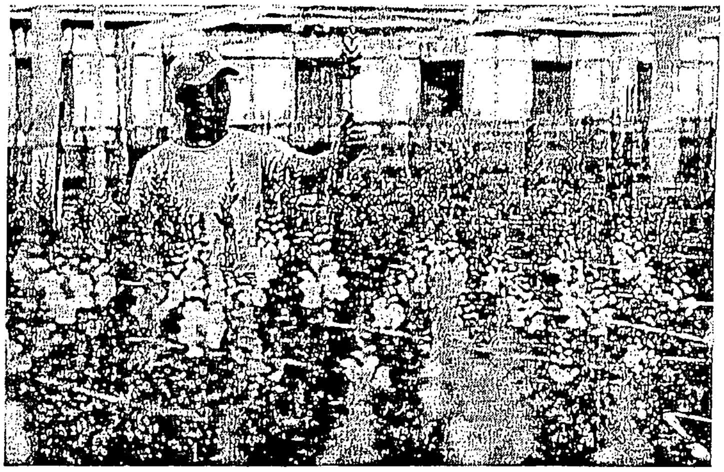
NRCM 2008



New Mexico EARTH MATTERS

Summer 2006

Geothermal Energy in New Mexico



Snapdragons at Burgett Geothermal Greenhouses near Cotton City.

Geothermal energy is the heat energy that is generated and stored in the earth. This heat represents one of the largest energy resources available to mankind. Geothermal energy can be used to produce electricity economically, or the heat may be applied in a direct-use fashion (such as greenhouse heating) for any process that requires large amounts of hot water or low-grade steam less than 300° F. When used in a sustainable manner, geothermal energy is a renewable energy resource. Geothermal energy has a smaller land and environmental footprint than all currently used conventional and renewable energy technologies. Practically no carbon dioxide emissions result from geothermal energy use. Because geothermal energy produces continuous or base load power, electricity production in the United States from geothermal energy was greater than the power produced by wind and solar energy combined over the last ten years. When geothermal energy is applied in a direct-use fashion, substantial energy savings accrue to the user when compared to natural gas. Given the large geothermal resource base in New Mexico and the huge array of potential applications, the environmental and economic benefits to the state could be enormous.

Geothermal Resources

Accessible geothermal resources represent the heat that is stored in the conventionally drillable upper part of the earth's crust. This heat is continually augmented by radioactive decay of natural uranium, thorium, and potassium in the earth's crust, and by heat that is conducted into the crust from the hotter core and mantle below. In other words, the crust acts as a low-grade nuclear reactor, with added heat from the earth's interior. In regions with young and active volcanoes, locally intense heat may be introduced into the crust by magma that rises upward from partially melted regions of the mantle through weaknesses in the crust.

The most economic geothermal resources result from geologic processes that allow convection to concentrate deep-seated heat at economically drillable depths. All current geothermal users in New Mexico use convective resources that naturally circulate water through deep-seated bedrock, sweeping up the heat and transporting it upward into shallow reservoirs. Fault zones can help concentrate and redirect the hot water flow upward. Where these systems intersect the surface, hot springs are found. Heat from active or young volcanoes is not necessarily required for this type of geothermal resource. The subsurface shape of a typical convective geothermal reservoir may resemble a small isolated summer cumulonimbus cloud or thunderhead. The lateral outflow plume of geothermal convection is analogous to the anvil or stretched top of the thunderhead, whereas the upflow zone resembles the rising cauliflower-like bulk of the thunderhead. The most permeable portions of the upflow zone and the shallow lateral discharge are most easily and economically exploited.

Some of the largest geothermal resources in New Mexico are associated with deep and confined (artesian) aquifers or conductive geothermal reservoirs. Temperatures in conductive resources result from the increase in temperature with depth. Most of the western half of New Mexico has high temperature gradients that typically range from 1.6° F to 2.5° F per 100 feet in depth (as opposed to 1.1° F to 1.4° F per 100 feet in depth typically found elsewhere). Because deep wells are required to tap these resources, they have higher upfront costs. However, where large heating loads are required, the overall economics have advantages over fossil fuels.

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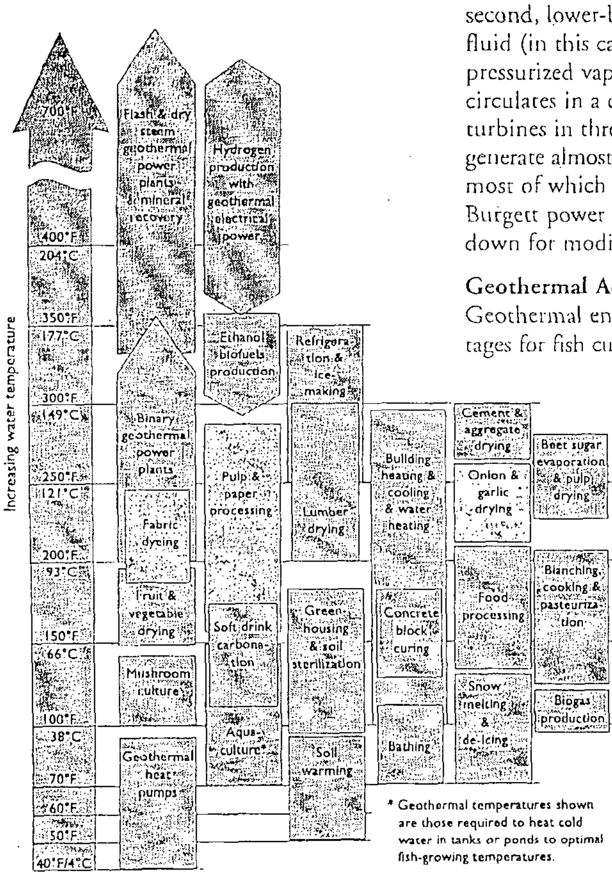
Classification of Uses and Resources

A common geothermal resource classification uses temperature. High-temperature resources are greater than 350° F and are suitable for large-scale electrical generation for sales on the transmission grid. Intermediate-temperature resources are between 190° and 350° F and are increasingly used for smaller-scale power generation for sales over the grid or for on-site power. Low-temperature resources are less than 190° F and at least 15° to 30° F above the local mean annual surface temperature. Low-temperature resources are the most common in New Mexico. They can be used in a variety of direct-use geothermal heating applications, including greenhouses, aquaculture (fish farms), space and district heating, and many industrial uses such as cooking, curing, or drying that require large amounts of low-grade heat. High- and intermediate-temperature geothermal resources may also be used in direct-use applications by "cascading" residual heat from power production to lower-temperature applications, enhancing the overall efficiency and economics of use.



Temperature ranges of applications ideally suited to geothermal energy (modified from Geothermal Energy Uses, courtesy of the Geothermal Education Office, 2005).

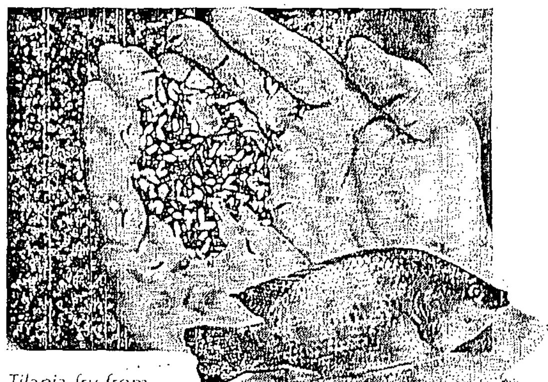
Current Geothermal Use in New Mexico

Electric Power

Geothermal electricity has been produced at the 30-acre Burgett Geothermal Greenhouse in the Animas Valley near Cotton City. The facility extracts energy in a cascaded fashion, whereby 230° F water from geothermal wells is first fed into the power plant heat exchangers at a rate of 1,200 gallons per minute; the 185° F outflow from the power plant is used to heat greenhouses. Electricity is produced with binary-cycle power technology that employs heat exchangers to allow the geothermal water to boil a second, lower-boiling-point working fluid (in this case isopentane). The pressurized vapor of the working fluid circulates in a closed loop to drive turbines in three modular units and to generate almost 1 megawatt of electricity, most of which is used on location. The Burgett power plant is currently shut down for modifications.

Geothermal Aquaculture

Geothermal energy offers several advantages for fish culture. Many species have accelerated growth rates in warm water. Geothermal water can be used as a growth medium, adding to the agriculture receipts in the state without consumptive use of valuable fresh water. The AmeriCulture Tilapia Farm at Cotton City raises tilapia, a tasty warm water fish that is becoming increasingly popular. The AmeriCulture Tilapia Farm is heated with a 400-foot-deep geothermal well, at much lower costs than it could be heated with fossil fuels. From eggs produced on site, AmeriCulture grows and markets tilapia fry to growers and researchers nationwide and sells adult tilapia to restaurants across the Southwest. In addition, AmeriCulture has contracted Barber-Nichols, Inc. of Denver, Colorado, to design a binary-cycle power plant to provide electricity for the fish farm water pumps and refrigeration. Funding is provided through a cost-share grant with the U.S. Department of Energy.



Tilapia fry from eggs produced on site at AmeriCulture, Inc. near Animas, New Mexico.

Geothermal Space and District Heating

The aridity and high elevation of parts of New Mexico create significant heating loads on cold winter nights. Where shallow geothermal resources co-exist with large heating demands, geothermal space and district heating have cost advantages over fossil fuels. A district geothermal heating system on the New Mexico State University campus in Las Cruces was in operation from 1982 until 2004. It used as much as 260 gallons per minute of 147° F water, pumped from a depth of 744 to 971 feet with a campus geothermal well. Geothermal water was passed through a heat exchanger to heat fresh water that was fed into hot water loops on campus as needed. The cooled geothermal water was injected back into the reservoir margin beneath the campus golf course. Geothermal water was used to heat dorms, academic buildings, and athletic facilities on the eastern third of the campus. The system also provided hot water for showers in the dorms and athletic facilities. At present, the

Site	County	Installed heating capacity, million Btu/hour	Annual energy use, billion Btu/year	Annual energy savings	Use
NMSU/SWTDI	Doña Ana	0.5	1.4	$14,000	aquaculture
Masson Radium Springs Farm	Doña Ana	30.0	79.0	$790,000	16-acre greenhouse
Radium Hot Springs	Doña Ana	0.3	0.8	$8,000	spa
Faywood Hot Springs	Grant	0.9	2.3	$23,000	spa
Gila Hot Springs	Grant	2.1	5.4	$54,000	district heating
Burgett Geothermal Greenhouse	Hidalgo	70.1	184.2	$1,800,000	30-acre greenhouse
AmeriCulture Tilapia Farm	Hidalgo	9.0	23.7	$240,000	aquaculture
Ojo Caliente	Rio Arriba	0.6	1.6	$16,000	spa
Jemez Springs Bath House	Sandoval	0.9	2.3	$23,000	spa
Giggling Star, Jemez Springs	Sandoval	0.6	1.6	$16,000	spa
Charles Motel, T or C	Sierra	0.4	1.0	$10,000	spa
Fire Water Lodge, T or C	Sierra	0.4	1.0	$10,000	spa
Geronimo Springs Museum, T or C	Sierra	0.1	0.3	$3,000	space heating
Hay-Yo-Kay Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
Marshall Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
River Bend Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
Sierra Grande Lodge, T or C	Sierra	0.4	1.0	$10,000	spa
Artesian Bath House, T or C	Sierra	0.4	1.0	$10,000	spa
TOTALS		117.9	309.6	$3,057,000	

Estimated annual energy use and savings for geothermal applications in New Mexico. Figures assume an annual 30 percent use of installed geothermal direct-use heating capacity.

geothermal injection well requires replacement, and the system needs upgrades after 22 years of service.

At Gila Hot Springs, a 300-foot-deep flowing well provides 165° F water for geothermal heating of a trailer court, rental cabins, store, and several homes. The New Mexico Institute of Mining and Technology at Socorro is currently assessing the feasibility of installing a campus geothermal district heating system in conjunction with a cost-share grant from the U.S. Department of Energy.

Geothermal Greenhouses

The best-known use of geothermal energy in New Mexico is for greenhouses. Geothermal greenhouses account for nearly half of the greenhouse acreage in the state. New Mexico leads the nation in geothermal greenhouse acreage. The success and growth in the geothermal greenhouse industry in New Mexico can be attributed to several factors, including abundant sunshine and low humidity, inexpensive land, co-existence of geothermal resources with fresh water, a good agricultural labor force, and favorable shallow geothermal resources. Current geothermal greenhouses use wells less than 1,000 feet deep, with resource temperatures ranging from 143° to 230° F.

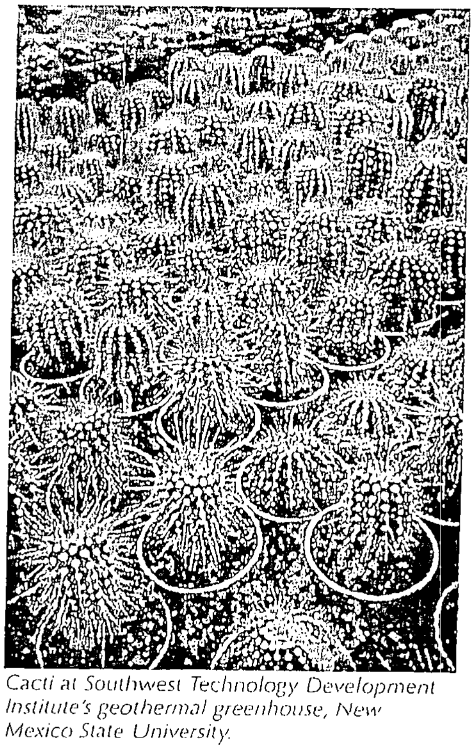
Geothermal Heat Pumps

Ground-coupled heat pumps allow space heating and cooling through the use of heat exchange loops that are buried horizontally in the ground or installed vertically in wells. In winter, heat is extracted from the earth and concentrated by the heat pump for indoor heating. In summer, indoor heat is removed and placed in the ground. Several large geothermal heat pump installations heat and cool public schools in New Mexico.

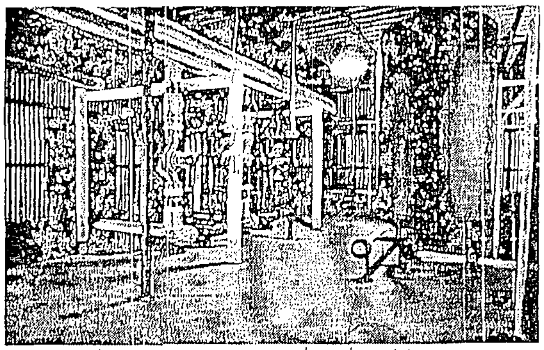
Economic Impact

The geothermal heating cost for New Mexico geothermal greenhouses is currently less than $1.50 per million Btu, compared to more than $11 per million Btu for natural gas with boiler losses. This represents a savings of more than $2.5 million for the state's two large geothermal greenhouses. Geothermal greenhouse sales are estimated at $27 million and rank among the top ten in agriculture sector gross receipts in the state.

The Burgett Geothermal Greenhouse (30 acres) near Cotton City is probably the largest business in Hidalgo County. The Masson Radium Springs Farm geothermal greenhouse (16 acres) is the largest employer in northern Doña Ana



Cacti at Southwest Technology Development Institute's geothermal greenhouse, New Mexico State University.



Heat exchangers, pumps, and tank at Masson Radium Springs Farm geothermal greenhouses. Heat exchangers are used to transfer heat from geothermal water to a closed-loop fresh water heating system.

County. Geothermal spas at Ojo Caliente, Jemez Springs, Faywood Hot Springs, Gila Hot Springs, and the many spas in Truth or Consequences attract important tourism dollars to New Mexico.

Future Potential

Geothermal development resembles oil and gas in leasing, royalties, and drilling. Exploration and evaluation of geothermal resources borrow methodologies used in oil and gas, ground water, and mineral exploration. Geothermal energy is environmentally friendly. In most cases, spent geothermal fluids are injected back into the reservoir. With the use of heat exchangers, harmful scaling and corrosion is eliminated and fluids can be isolated from both the natural environment and surface geothermal equipment.

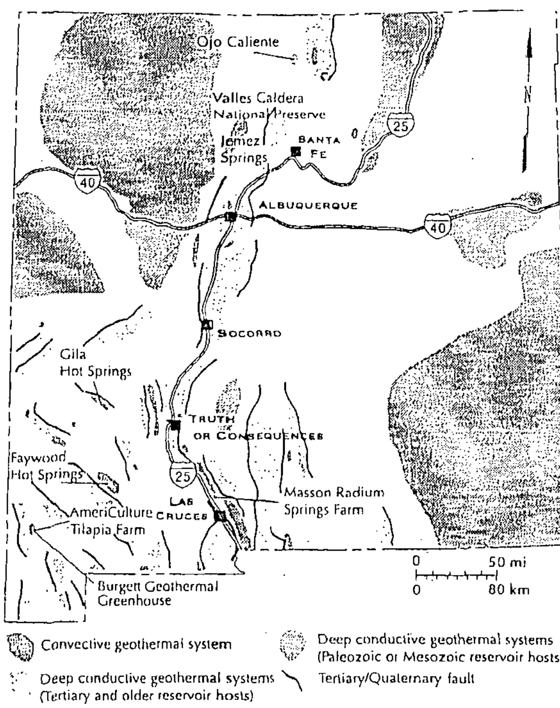
One impediment to geothermal growth is the initial capital costs associated with resource exploration, testing, and well drilling. However, geothermal energy has the advantage of low operations and maintenance costs, without the volatility associated with fuel costs. Most of the surface equipment used by geothermal operations is "off the shelf" and has well-known engineering characteristics and costs. This is especially true with direct-use installations.

The Valles caldera in the Jemez Mountains has proven geothermal reserves capable of generating as much as 20 megawatts or more of power. This resource has a probable magmatic heat source. Environmentally sensitive development of the Valles geothermal resource could provide royalty income to sustain and operate the Valles Caldera National Preserve and provide cost-stable power to the surrounding pueblos.

Small-scale geothermal electric power at less than 20 megawatts is likely in the next few years at several sites in New Mexico. Some of the generation is likely to be done in conjunction with cascaded direct use in a combined heat and power mode.

With the passage of the Energy Policy Act of 2005, formerly unfair federal royalty rules for direct-use geothermal energy are being modified to allow for an equitable fee structure that should encourage additional growth. In recent years, the U.S. Department of Energy has sponsored an outreach program, *Geopowering the West*, to educate the public and to encourage the development of all forms of geothermal energy. The Web site for the *Geopowering the West* is found at www.eere.energy.gov/geothermal/gpw/

Geothermal energy is a potentially powerful vehicle for rural economic development in New Mexico. Future uses of geothermal energy may include chile and onion drying, cheese and milk processing, and process heat for biofuels refining. Small-scale electrical power generation is very likely to expand in the cascaded mode with direct-use development. Because deep-seated saline water and oil field brines may be hot, geothermal desalinization and power generation may augment enhanced recovery of oil and gas and help sustain both our valuable water supply and our petroleum industry. For instance, oil field water flood operations could extract the heat of deep-seated oil field brines to generate geothermal binary-cycle power before reservoir injection for enhanced oil recovery. The power would be used for pump jacks and other oil field electricity requirements or placed on the transmission grid. The heat may also have use in multistage vacuum distillation of brines to produce desalinated water. The accessible geothermal resource base in New Mexico is vast, and the options for economic use are growing.



Geothermal resources in New Mexico.

—James C. Witcher
Witcher and Associates
Las Cruces, New Mexico

Jim Witcher is a geologist with nearly three decades of experience with geothermal exploration and development.

For More Information

The following Web sites offer a wealth of information on geothermal energy resources and development.

U.S. Department of Energy
www.energy.gov
Geothermal Education Office
www.geothermal.marin.org
Geothermal Energy Association
www.geo-energy.org
Geothermal Resources Council
www.geothermal.org
National Renewable Energy Laboratory
www.nrel.gov

All photos by Rob Williamson, courtesy of National Renewable Energy Laboratory. Adult tilapia inset on page 2 courtesy of Damon Seawright of AmeriCulture Tilapia Farm.

WBR ARTICLE

Using geothermal energy in oilfield picking up steam

By Wyoma Groenenberg

August 20, 2010 --

CASPER — The concept of using geothermal energy for power generation using co-produced fluids from existing oil, gas and industrial infrastructure is a hot topic in the energy generation industries.

The two-day Geothermal in the Oilfield Symposium, the first of its kind in the country, was held in Casper Aug. 18-19. Speakers and participants from all over the nation from various industries, utilities, academia and companies learned about current and future activities using hot water from oil and gas fields to produce electricity.

The concept is being tested at the Rocky Mountain Oilfield Testing Center (RMOTC) in the Teapot Dome oilfield. The project focuses on oil wells that produce much higher volumes of water than oil, said Jim Nations, RMOTC's public relations program manager.

Electric pumps are used to extract the remaining oil or gas. The oil and water are separated, and then the water is passed through a heat exchanger that is part of an Organic Rankine Cycle generator.

In the heat exchanger vessel, heat passes from the water (about 190 degrees Fahrenheit) and is used to boil liquid isopentane, a hydrocarbon compound. The resulting isopentane gas spins a turbine connected to a generator, which produces electricity, Nations explained. The isopentane is then cooled, which condenses it back to a liquid state, and is reused over and over again in a closed loop/circuit for the working fluid.

The electricity can be used by the oilfield operator to continue the cycle of extracting the fossil fuels or could be sent to the power grid. There is little or no environmental impact from this process; the oil field infrastructure of roads, wells and power lines are already in place to take advantage of this unique method of power production.

According to Will Gosnold from the University of North Dakota, electricity is the highest expense in extraction projects. Students under his supervision at UND used data from the past 15 years to estimate what the cost savings would be by utilizing geothermal power to generate electricity at well sites.

The conclusion showed that the concept would pay for itself in about seven years. In a 25-year span, the estimates showed that companies could be making an additional $2.5 million over that period by using this model, Gosnold said.

At the RMOTC testing site, Nations said the water is not potable, but it is low enough in total dissolved solids to be discharged into the Little Teapot Creek without further cleanup. The water is collected in ponds before discharge and benefits wildlife and agriculture downstream. The electricity produced is about 220 kilowatts.

"It could be a win-win situation for oilfield operators and energy producers in the future," Nations said.

At the Casper conference, several speakers described the potential for using geothermal energy in the oilfields in Wyoming, Montana, Colorado, North Dakota, Utah, Texas and Oregon. Others discussed the feasibility and economics in using the concept, the nation's resource estimates and others.

The first day of the conference was field trips to Alcova to see the area's different geological formations, including the Alcova Anticline, Tensleep Formation, fractures, different rock types and more. In the afternoon, participants visited the RMOTC site, where a geothermal installation is located and being studied.

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USING GEOTHERMAL ENERGY IN OILFIELD PICKING UP STEAM

submit a comment

* denotes a required field

Your Name

Your Email

Your Location

comment text (maximum 1000 characters)

Submit Your Comment!

Chavez, Carl J, EMNRD

From: Porter, Jodi, EMNRD
Sent: Monday, August 02, 2010 4:30 PM
Subject: PR-EMNRD Statewide Electricity Transmission Task Force Met Today
Attachments: PR-EMNRD-OFS-TransmissionTaskForce.pdf

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Jim Noel
Cabinet Secretary

Karen W. Garcia
Deputy Cabinet Secretary

Office of the Secretary

NEWS RELEASE

Contact:
Jodi McGinnis Porter, 505-476-3226 or 505-690-1689

August 2, 2010

Statewide Electricity Transmission Task Force Met Today

SANTA FE, NM – Governor Richardson's Task Force on statewide electricity transmission planning met for the first time tod; to begin discussions on developing new transmission lines for exporting renewable energy like wind and solar power produced in New Mexico to other states. The Task Force has the responsibility to address financing and cost recovery, ident potential projects, and steps to take to grow the statewide electricity transmission grid on a 5-year, 10-year, and 20-year planning horizon.

"We have an opportunity to strategically put New Mexico in the driver's seat when it comes to creating green jobs and capitalizing on our vast renewable energy resources," said Jim Noel, Cabinet Secretary for New Mexico Energy, Minerals an(Natural Resources Department. "The development and export of New Mexico's world-class solar and wind resources would stimulate the state's economy for years to come."

Governor Richardson created the Task Force last month. It comprises a diverse mix of individuals whose interest vary from renewable energy generation, public utility, environmental and land owner interests. Its mission is to assist the New Mexicc Renewable Energy Transmission Authority in creating a blueprint of New Mexico's future renewable energy transmission system. Development of this system would create jobs in New Mexico's hard hit rural areas.

New Mexico currently has over 15,000 megawatts of renewable energy projects waiting to connect to the state's existing transmission system. This represents over $25 billion of in-state capital investment and hundreds of construction and operations jobs stalled due to the transmission bottleneck.

New Mexico is uniquely situated amidst the three electric grids in the United States. The Tres Amigas Super Station is a proposed project that would link these three electric grids. The project, which would be located near Clovis, could establish New Mexico as the energy-trading hub for the country.

The Task Force will meet at least four more times and will issue a report of its recommendations on November 1, 2010.

#30#

The Energy, Minerals and Natural Resources Department provides resource protection and renewable energy resource development services to the public and other state agencies.

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E-mail: jodi.porter@state.nm.us
Website: www.emnrd.state.nm.us

Chavez, Carl J, EMNRD

From: Black, Herb [Herb.Black@boemre.gov]
Sent: Friday, July 30, 2010 8:11 AM
To: Chavez, Carl J, EMNRD
Cc: Cobb, Lawrence
Subject: New MMS name and geothermal royalty calculation input.
Attachments: Reorganization%20Structure.pdf

Carl;

Good morning. Thank you for the update on all your hard work on geothermal, I think its great!

The only thing I am wondering is about geothermal royalties, that being my current area of concentration. I remember that in one of your documents there was a reference to the old Federal direct use royalty calculation method which used two meters, one for input to the facility and one for output after the heat was extracted. That method is no longer in use for new Federal leases.

The new Federal method for direct use is to use only the output meter and assume an input temperature and that the volume is the same before and after extraction. The temperature and volume are then entered into a "fee schedule" and read directly from that, instead of having to do a calculation. Its MUCH simpler.

Likewise, for electrical generation, we now have implemented a "percent of gross proceeds" royalty method for new leases, instead of the cumbersome "netback" method that many of the old leases still use.

I am not aware of how New Mexico is going to calculate/charge for royalties on state leases, for direct use or electrical generation.

If there is any input you would like on that, I would be more than happy to give it.

As for the name of our agency, we have a new one which will be in effect until October 1, at which time it will change again. Right now, our parent bureau has changed from MMS to BOEM (Bureau of Ocean Energy Management, Regulation, and Enforcement). Within that bureau, my division is still MRM (Minerals Revenue Management). Under that, my particular group is RV (Royalty Valuation), under AV, (Asset Valuation), which is under AM (Asset Management) So, the string is: BOEM/MRM/AM/AV/RV.

However, starting October 1, MRM is becoming a separate Office under the Secretary of Interior, called the Office of Natural Resources Revenue (ONRR). We will no longer be a bureau or part of BOEM and will report directly to the Assistant Secretary for Policy, Management, and Budget. No one knows yet, but we assume that my current group will still be AM/AV/RV under ONNR.

There is a schematic attached above.

Thanks so much Carl for allowing me to participate in your phone conferences; its been very interesting to me. Please let me know if I can be of any further assistance.

Herb

Herb Black
Geologist
Royalty Valuation
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303-231-3769
herb.black@mms.gov

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From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Friday, July 30, 2010 5:47 AM
To: Black, Herb
Subject: RE: Declined: Geothermal Regulations & Programs Stakeholders Teleconference Meeting

Herb:

Good morning. If you could provide your full details of you new agency name within the DOI, etc. for our records, that would be appreciated.

If you have any key recommendations to share, OCD would appreciate them. OCD is attempting to follow California and Nevada's lead on the regulatory and technical (i.e., high-temp BOPE, special drill equipment, etc.) side.

Pulling together OCD's final Policy and Technical Recommendations for the report to the Governor on December 1, 2010 with recommendations to streamline the process for commercial geothermal power companies to receive all applicable permits. NM's scarce fresh water resources make geothermal power generation a real challenge and we are hoping the companies will propose pollution prevention, waste minimization and heat transfer solutions that minimally stress the fresh water hydrologic and hydrogeologic systems wherever they are located—isolation preferred. Also, concerns with aesthetics and seismicity......

Thanks for your participation.

Carl J. Chavez, CHMM

New Mexico Energy, Minerals & Natural Resources Dept.

Oil Conservation Division, Environmental Bureau

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E-mail: CarlJ.Chavez@state.nm.us

Website: http://www.emnrd.state.nm.us/ocd/index.htm

(Pollution Prevention Guidance is under "Publications")

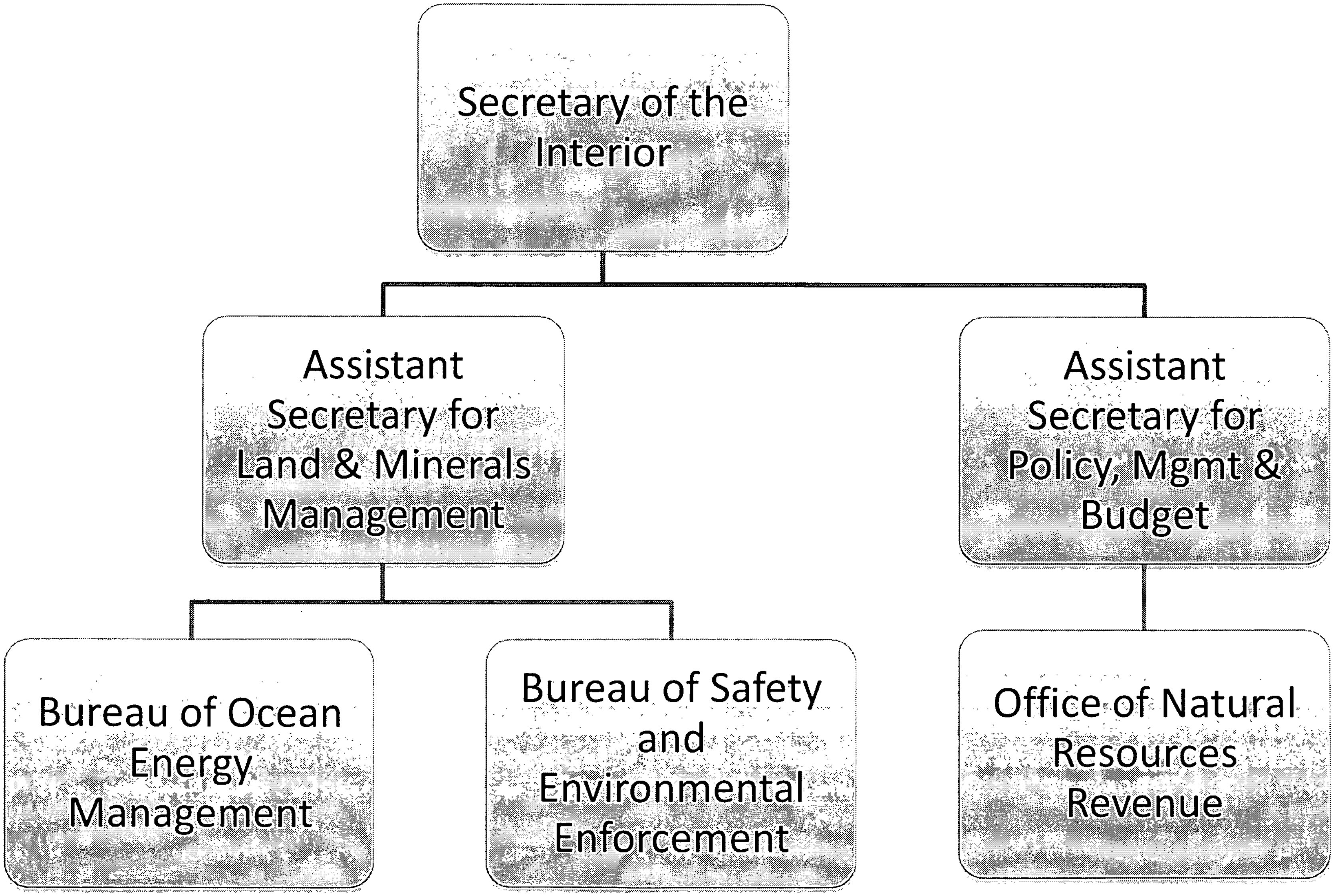
-----Original Appointment-----
From: Black, Herb [mailto:Herb.Black@boemre.gov]
Sent: Thursday, July 29, 2010 6:15 PM
To: Chavez, Carl J, EMNRD
Subject: Declined: Geothermal Regulations & Programs Stakeholders Teleconference Meeting
When: Wednesday, August 04, 2010 10:00 AM-12:00 PM (GMT-07:00) Mountain Time (US & Canada).
Where: Oil Conservation Division 3rd Floor Conference Room (Wendell Chino Bldg.) 1220 South St. Francis Dr., Santa Fe, NM 87505

Thanks for the invitation Carl. However, I will be on leave and can't attend.

Best of luck!

Herb

Post-reorganization Structure



Bureau of Ocean Energy Management

Mission – Responsibly manage the sustainable development of the ocean's energy resources through renewable energy and offshore conventional energy

Office will perform the following functions:

- Conduct five year planning processes
- Process and approve leasing activities
- Develop new structure of expanding renewable energy opportunities

Bureau of Safety and Environmental Enforcement

Mission - Assure highest level of safety and environmental standards and performance in the production of all offshore energy activities

Office would incorporate the following functions:

- Creation of standards
- Inspections
- Enforcement

Natural Resources Revenue Service

Mission: Assure full realization of value of public energy resources for the benefit of the American people

Existing revenue management function to be placed under the Assistant Secretary for Policy, Management and Budget (PMB)

- Eliminates conflicts associated with revenue collection being commonly managed with resource management and safety and environmental enforcement
- Greater operational alignment within PMB will support improved performance

Approach to Reform

- Objective is to remove potential conflicts and enhance Interior's ability to pursue each element of the MMS mission:
  - Operational safety ;
  - Environmental protection;
  - Full and efficient collection of all payments due; and
  - Responsible and sustainable management of offshore energy development
- Goal is to enhance Interior's performance and accountability through greater functional independence and oversight while maintaining an effective process

Chavez, Carl J, EMNRD

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Sent: Thursday, July 29, 2010 8:59 AM
To: Chavez, Carl J, EMNRD; Ezeanyim, Richard, EMNRD
Cc: Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD
Subject: RE: Draft G-112 Geothermal Application Form

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degree per 100 foot gradient here and from some of the stuff you sent earlier, it appears East Texas has a 2 degrees per 100 foot gradient. I think the North Slope of Alaska is hot also.

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Hope this helps a little?

If you need a petroleum engineer. Terry or Richard may have more time than myself to look the latest report over and make suggestions?

Will

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To: Chavez, Carl J, EMNRD
Subject: RE: Draft G-112 Geothermal Application Form

Carl

According to one of the local wire line operators
They have historically seen about 1degree for every 60'
He indicated a Dakota well 7200' deep would be between 190-210
He also said up by Ignacio Colorado it can be over 300 (concerns with line melt)
And a few places on the Jicarilla reservation 230 degrees.

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Sent: Thursday, July 29, 2010 9:34 AM
To: Hill, Larry, EMNRD; Ezeanyim, Richard, EMNRD; Michael Albrecht
Cc: Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Jones, William V., EMNRD; Sanchez, Daniel J., EMNRD; Altomare, Mikal, EMNRD; Brooks, David K., EMNRD; Warnell, Terry G, EMNRD
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Buddy:

If the minimum binary cycle power unit steam generation w/ ethylene glycol working fluid is around 197F, and if we assume this is a bottom hole temperature in SE NM, by the time fluid is brought to surface and routed into the units, there will be significant temperature loss?

I've copied Michael Albrecht to see if he can help us conclude what we think we know based on NM geothermal gradients. Unless, we have locations within our oil and gas patches in NW and SE NM where there is geothermal activity to boost bottom hole temperature, I don't think NM has much to offer geothermal co-production with oil and gas in NM.

Thanks.

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E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Jones, William V., EMNRD
Sent: Wednesday, July 28, 2010 9:30 AM
To: Chavez, Carl J, EMNRD
Cc: Ezeanyim, Richard, EMNRD
Subject: RE: Draft G-112 Geothermal Application Form

Carl:
Richard E. knows about these gradients. I believe he said that NW NM has about 2degrees/100 feet at the most – which does not compare favorably with the 3/100 gradient mentioned below for some parts of Wyoming.

Will

From: Chavez, Carl J, EMNRD
Sent: Wednesday, July 28, 2010 5:51 AM
To: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD
Cc: Lucero, Stephen A., EMNRD; Jones, William V., EMNRD; Sanchez, Daniel J., EMNRD; Warnell, Terry G, EMNRD; Ezeanyim, Richard, EMNRD; VonGonten, Glenn, EMNRD
Subject: FW: Draft G-112 Geothermal Application Form

FYI, NM may have too low of geothermal gradients to make it happen in NM according to Will Jones (see msg. below). Will may be thinking of just SE NM. Not sure about geothermal gradients in NW NM......?

Here is some more information on the Wyoming Low-Temp. Geothermal Co-Production Project:

http://www.renewableenergyworld.com/rea/news/article/2010/01/oil-production-waste-stream-a-source-of-electrical-power

"the local geothermal gradient is 3.0°F per 100 feet of depth (55 C per km). This compares with an average thermal gradient for the southern Powder River Basin of 2.2°F per 100 feet."

You should go to the conference in Wyoming!

Stephen Lucero
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Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

From: Chavez, Carl J, EMNRD
Sent: Tuesday, July 27, 2010 7:19 AM
To: Jones, William V., EMNRD; Ezeanyim, Richard, EMNRD; Brooks, David K., EMNRD; Altomare, Mikal, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD
Subject: FW: Geothermal in the Oil Field, RMOTC Meeting and ORC Tour, Wyoming

Wyoming's talking about low-temp co-geothermal power production....... Huh?

Carl J. Chavez, CHMM
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(Pollution Prevention Guidance is under "Publications")

From: Lucero, Stephen A., EMNRD
Sent: Tuesday, July 27, 2010 8:32 AM
To: Chavez, Carl J, EMNRD
Subject: RE: Draft G-112 Geothermal Application Form

Thanks for sharing this information Carl. At this point, I am considering postponing the coproduction symposium to the spring. I am buried in ARRA projects and haven't had a chance to get started on the symposium.

Steve

Stephen Lucero
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From: Chavez, Carl J, EMNRD
Sent: Tuesday, July 27, 2010 6:15 AM
To: Lucero, Stephen A., EMNRD
Cc: Brooks, David K., EMNRD; Altomare, Mikal, EMNRD; Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; Ezeanyim, Richard, EMNRD
Subject: FW: Draft G-112 Geothermal Application Form

Steve:

I wanted to share the highlighted sections below with you, since the ECMD is planning a symposium in September 2010 focused on geothermal co-production. Perhaps we should meet with our Engineering Bureau to reconfirm what Mr. Jones has indicated in his message below.

below from our Engineering Bureau. NM oil and gas wells that are 10,000 to 12,000 ft. total depth with geothermal gradients listed below at most would range from 195F to 219F, but could be as low as 175F to 195F. Mr. Albright from the Geothermal Working Group informed me that in NM binary cycle power generation units may generate power at about 197F.

Thank you.

Carl J. Chavez, CHMM
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Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Jones, William V., EMNRD
Sent: Friday, July 23, 2010 11:11 AM
To: Chavez, Carl J, EMNRD
Cc: Altomare, Mikal, EMNRD; Warnell, Terry G, EMNRD; Lowe, Leonard, EMNRD; Ezeanyim, Richard, EMNRD
Subject: RE: Draft G-112 Geothermal Application Form

Carl:
Here you go.. I have no time to focus on this or expertise on this matter, but ...

I looked over the earlier proposal and made a comment – you seem to be doing just fine. Since then, I did talk to Richard E. about the geothermal gradient in New Mexico, since he looked at that during the cementing issues. Apparently New Mexico's gradient is not nearly as hot as East Texas and some other areas of the country. We probably have a 1 to 1.2 degree per 100 foot gradient here and from some of the stuff you sent earlier, it appears East Texas has a 2 degrees per 100 foot gradient. I think the North Slope of Alaska is hot also.

Since you asked, I do have a couple of suggestions:

a. From what I read of this report and guidance – I think it should be limited to proposing gathering of data as geothermal companies move in and defining what legal role the OCD should have.
b. This is really a heat transfer problem which is in the purview of Mechanical Engineering. The only real M.E. we have here in Santa Fe is Leonard Lowe. Have you asked him to look this concept over?

c. The other people doing this is the water well drilling companies. The do this around Santa Fe all the time now especially on the well-to-do housing. They drill a 200 foot hole and install poly pipe to circulate fluids down to act as a heat exchanger. I did talk to one of them. They get a ME first to design the system before starting work.
d. Looks like other states have better prospects for using old oil wells as heat sources and the concept will be tried in the best locations first. We should not get anyone's hopes up for using NM oil wells for heat extraction. I don't think it should be mentioned.

Hope this helps a little?

If you need a petroleum engineer. Terry or Richard may have more time than myself to look the latest report over and make suggestions?

Will

From: Chavez, Carl J, EMNRD
Sent: Thursday, July 22, 2010 6:26 AM
To: Jones, William V., EMNRD
Cc: Altomare, Mikal, EMNRD
Subject: Draft G-112 Geothermal Application Form

Hey Will. Did you get a chance to look over that G-112 draft I sent you a couple of weeks back? I think Mikal wants to meet to discuss with us? Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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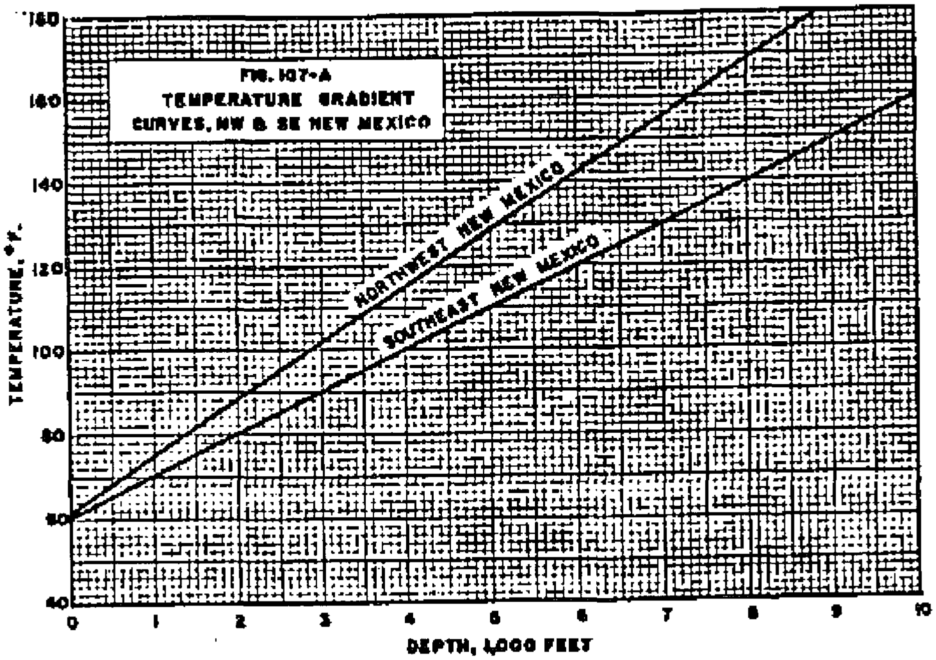


FIG. 107-A
TEMPERATURE GRADIENT
CURVES, NW & SE NEW MEXICO
NORTHWEST NEW MEXICO
SOUTHEAST NEW MEXICO
TEMPERATURE, °F.
DEPTH, 1,000 FEET

Figure 107-A

New Mexico

Resource Geography

New Mexico contains abundant geothermal resources throughout a large temperature gradient (USDOE 2007a). In a recent update of the geothermal database for New Mexico, 359 discrete thermal wells and springs were identified (NMEMNRD 2007). Resources suitable for most development are concentrated in the west and north-central regions of the state, with high-temperature gradients ranging from 1.6°F to 2.5°F per 100 feet of depth (NMEM 2006). There are no geothermal power plants currently operating; however, direct-use applications are ongoing. The northwest region contains volcanic activity from the Valles Caldera in the Jemez Mountain Range (west of Los Alamos), where the only known high-temperature geothermal system in the state occurs (base temperatures in this system exceed 500°F, 260°C) (USDOE 2007a). During the 1970s and 1980s a large geothermal power project was under development in the Valles Caldera; however, regulatory and resource issues led to the cancellation of the project (demonstration projects revealed inconsistent reservoir permeability and low productivity, though drilling and testing indicated a viable potential of 20 MW) (Fleischmann 2007).

ESTIMATED CAPACITY

The USGS (2008) estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW.

While other potential geothermal resource areas exist, limited research has been done and most areas are without apparent surface manifestations. These areas are high risk, and developers in the state may need government funding to aid with early exploration and to reduce the high investment risk associated with their development. Sites in eight counties (Doña Ana, Grant, Hidalgo, McKinley, Rio Arriba, San Miguel, Sandoval, and Valencia), have been identified as potential geothermal resources (NMEMNRD 2007). The Rio Grande Rift area, specifically near Las Cruces, also needs to be explored in greater detail (Fleischmann 2007).

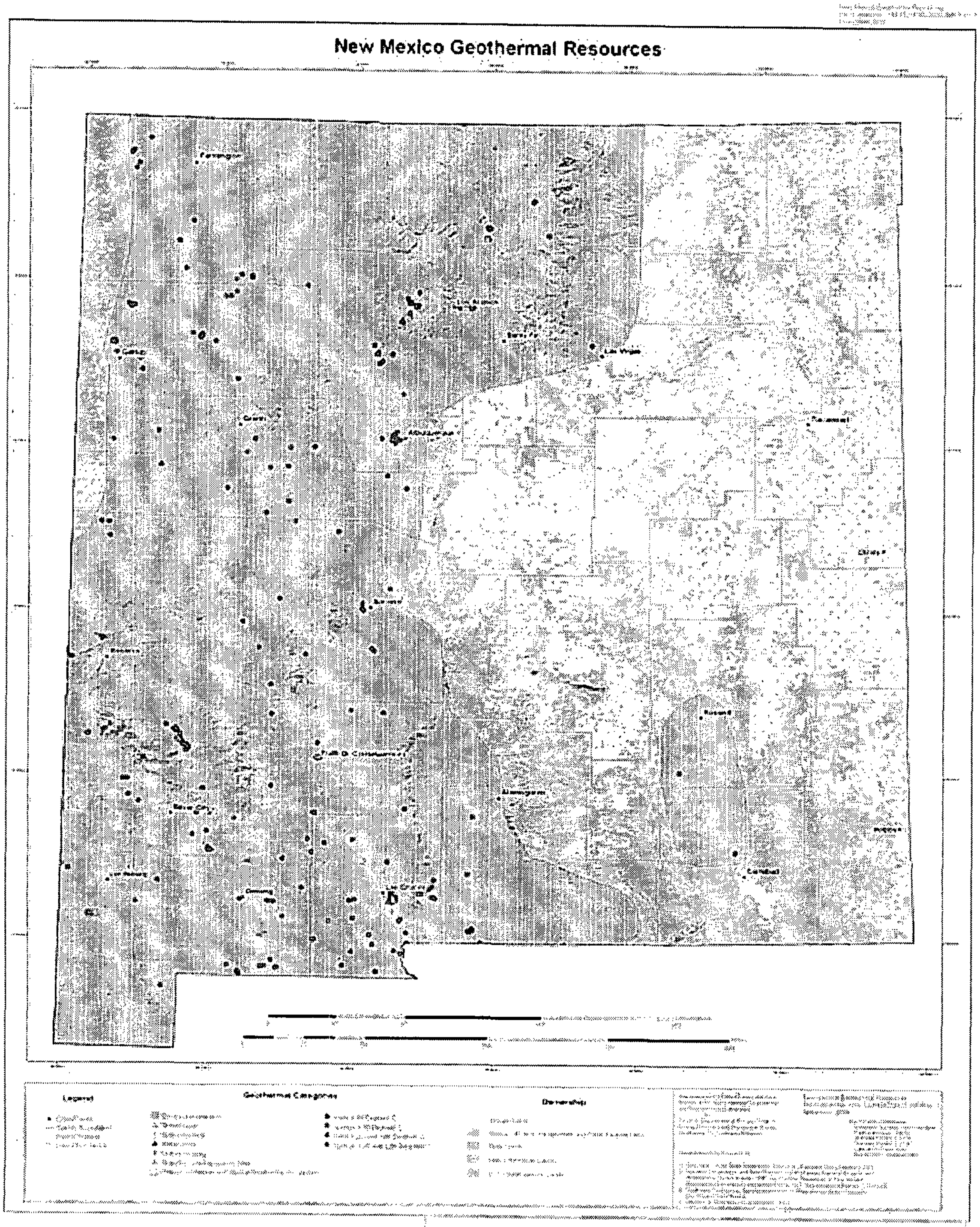
Utilization

There are no geothermal power plants operating; however, current development has included electric power production. An attempt to introduce geothermal electricity production occurred in the southwest at the Burgett Geothermal Greenhouses (near Cotton City) but was suspended due to design problems (NMEM 2006, USDOE 2007a). Drilling has occurred at two locations where small power units will be installed to provide electricity for an aquaculture facility and greenhouse. Other direct-use applications are ongoing (USDOE 2007a).

Technical Capabilities

New Mexico universities, state agencies, and private firms contribute technical capabilities to the local and national geothermal communities. New Mexico State University (NMSU) at Las Cruces conducted geothermal research that resulted in the development of a geothermal space-heating system that at one point heated up to 30 campus buildings such as dorms and athletic facilities. Sandia National Laboratory in Albuquerque is one of the three main national laboratories working on geothermal research and development (USDOE 2007a).

New Mexico



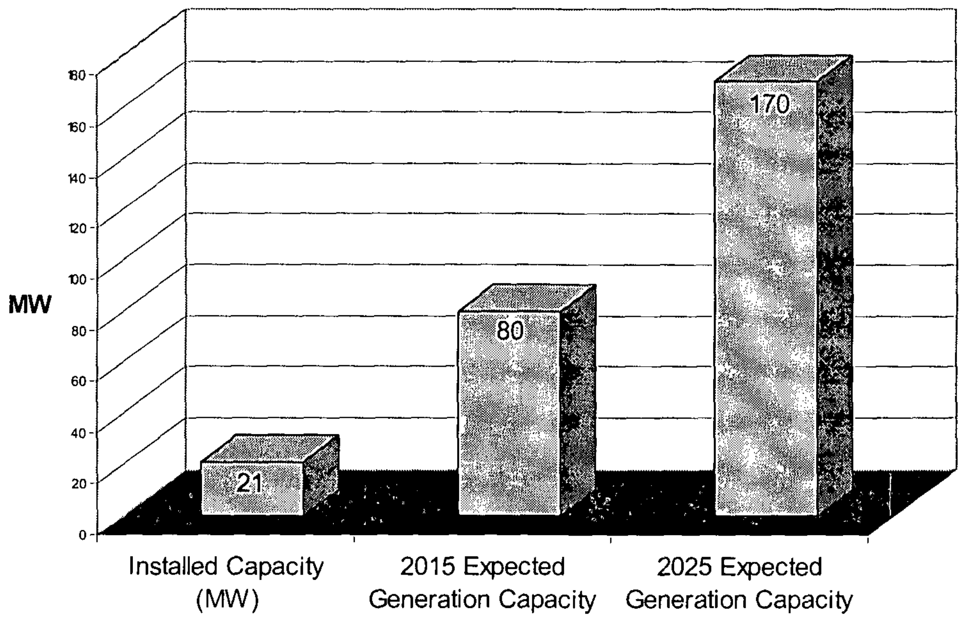
Lacey, 2003e, http://geothermal.id.doe.gov/maps/nm.pdf

New Mexico

Electrical Power Generation and Capacity

In the near term, development is likely for small-scale power. The state has two projects in development, with a total estimated potential of 21 MW. Literature estimates cite a short-term geothermal electricity generation potential of 80 MW and a long-term potential of 170 MW (WGA 2006). The USGS report titled *Assessment of Moderate- and High-Temperature Geothermal Resources of the United States* estimates a mean probability of electrical power generation for identified geothermal resources on all lands in New Mexico during the next 30 years at 170 MW, with a total low-high range of 53 MW to 343 MW (USGS 2008).

Geothermal Electrical Generation



WGA 2006

Tribal Lands

Tribal lands in New Mexico make up roughly 8.4 percent of its total acreage, and several locations on tribal reservations have been identified as having potential for geothermal development. This includes tribal lands in the San Juan Basin of northwest New Mexico, where considerable oil and gas drilling has occurred and intermediate-temperature fluid has been encountered. Another potential area is in the Jemez Mountains (in the vicinity of Valles Caldera). From 2002-2004, the Pueblo of Jemez worked with USDOE, who cost-shared a feasibility study to install a geothermal direct-use heating facility. The study concluded that there were business opportunities related to geothermal resources, but further drilling is needed before these applications can be developed on the site (Fleischmann 2007). Maps and data for geothermal resources on tribal lands in New Mexico are available through the DOE tribal energy program at: http://www1.eere.energy.gov/tribalenergy/guide/geo_newmexico.html (USDOE 2007h). Tribes for which information is available are listed on the following page.

New Mexico

Tribes with Potential Geothermal Resources in New Mexico
Jicarilla Apache Tribe of the Jicarilla Apache Indian Reservation
Mescalero Apache
Navajo Nation: Northwestern lands in New Mexico Northeastern lands in New Mexico Southwestern lands in New Mexico Southeastern lands in New Mexico Alamo Navajo Chapter Canoncito (Tohajiileeh) Chapter Ramah Navajo Chapter
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Jemez
Pueblo of Laguna
Pueblo of Nambe
Pueblo of Picuris
Pueblo of Pojoaque
Pueblo of San Felipe
Pueblo of San Ildefonso
Pueblo of San Juan
Pueblo of Sandia
Pueblo of Santa Ana
Pueblo of Santa Clara
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zia
Pueblo of Zuni
Ute Mountain Tribe of the Ute Mountain Reservation

New Mexico

Laws and Regulations

New Mexico classifies geothermal resources as Mineral if the fluid produced has a temperature greater than 250°F and as Water if the fluid produced has a temperature less than or equal to 250°F. The state claims ownership of geothermal resources when and where it holds the mineral rights. If the fluid produced is "mineral," the resource is under the primary jurisdiction of the Oil Conservation Division of the New Mexico Energy, Minerals, and Natural Resources Department for drilling. This agency coordinates with the US EPA, Region 8, which has authority over wastewater discharge to surface waters in the state. Both of these latter agencies, in addition to the state Environmental Department, have regulatory authority over geothermal discharge permits. The New Mexico State Land Office leases the lands of the state mineral estate (Battocletti 2005).

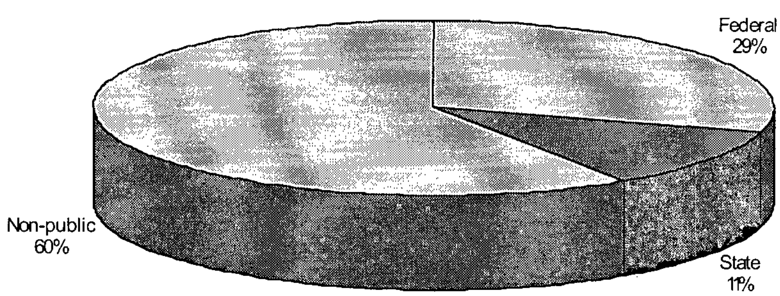
Geothermal fluid under 250°F is considered "water," and the resource is under the primary responsibility of the New Mexico Office of the State Engineer in regards to drilling and permitting. New Mexico does not have comprehensive environmental review statutes.

The state's RPS requires 20 percent renewable energy by 2020 for IOUs, 10 percent for rural co-ops and municipality utilities, with one Kilowatt (KW) of geothermal energy counting as two KW (Richter 2007). In addition to the state's RPS, geothermal resource development qualifies for the US Department of the Interior Energy Efficiency and Renewable Energy's bond program (USDOE 2007). New Mexico has established a Geothermal State Working Group, with leadership from the New Mexico Energy, Minerals, and Natural Resources Department (USDOE 2007a).

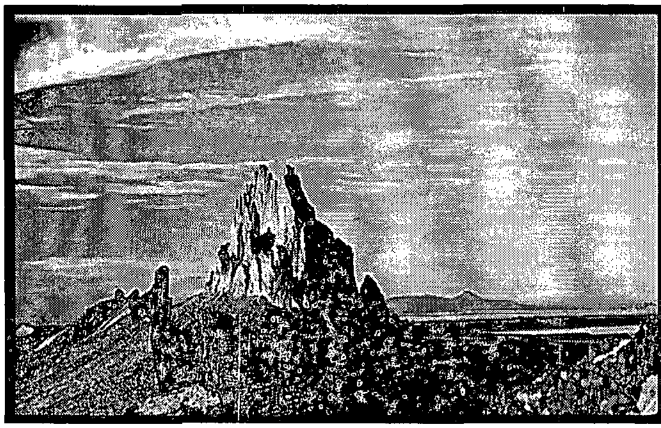
New Mexico does not have GHG laws or pending legislation; however, the state has a GHG reduction target that outlines 2000 levels by 2012, 10 percent below 2000 levels by 2020, and 75 percent below 2000 levels by 2050 (Camp 2007). There is no state funding for geothermal development. Most funding has come from the federal level from the US DOE (USDOE 2007a).

Land Ownership

(77,674,000 total acres)



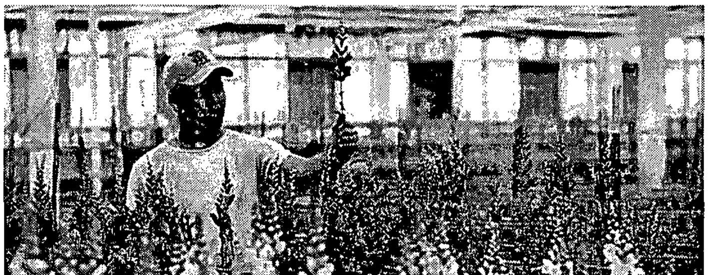
NRCM 2008



New Mexico EARTH MATTERS

Summer, 2006

GEOTHERMAL ENERGY IN NEW MEXICO



Snapdragons at Burgett Geothermal Greenhouses near Cotton City.

Geothermal energy is the heat energy that is generated and stored in the earth. This heat represents one of the largest energy resources available to mankind. Geothermal energy can be used to produce electricity economically, or the heat may be applied in a direct-use fashion (such as greenhouse heating) for any process that requires large amounts of hot water or low-grade steam less than 300° F. When used in a sustainable manner, geothermal energy is a renewable energy resource. Geothermal energy has a smaller land and environmental footprint than all currently used conventional and renewable energy technologies. Practically no carbon dioxide emissions result from geothermal energy use. Because geothermal energy produces continuous or base load power, electricity production in the United States from geothermal energy was greater than the power produced by wind and solar energy combined over the last ten years. When geothermal energy is applied in a direct-use fashion, substantial energy savings accrue to the user when compared to natural gas. Given the large geothermal resource base in New Mexico and the huge array of potential applications, the environmental and economic benefits to the state could be enormous.

Geothermal Resources

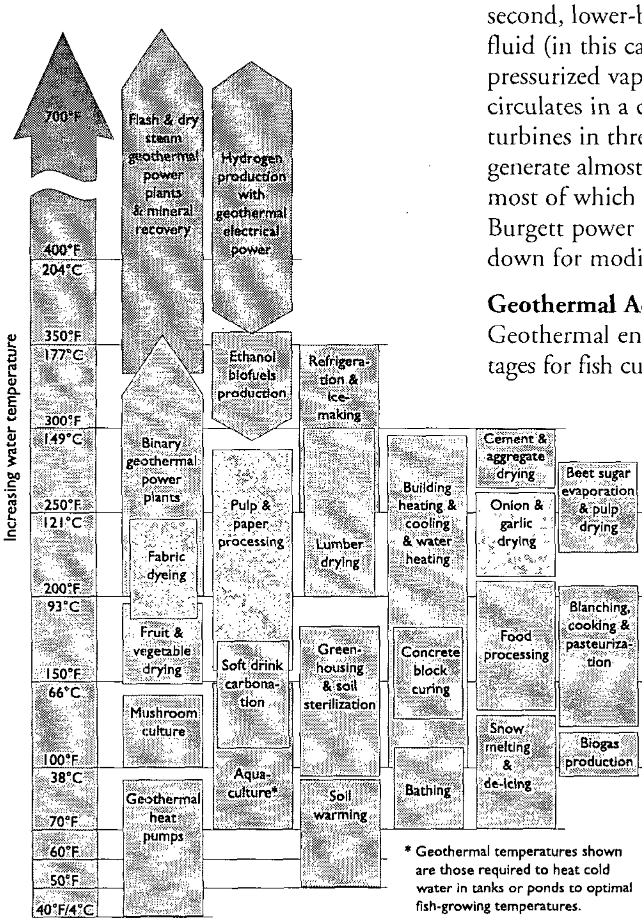
Accessible geothermal resources represent the heat that is stored in the conventionally drillable upper part of the earth's crust. This heat is continually augmented by radioactive decay of natural uranium, thorium, and potassium in the earth's crust, and by heat that is conducted into the crust from the hotter core and mantle below. In other words, the crust acts as a low-grade nuclear reactor, with added heat from the earth's interior. In regions with young and active volcanoes, locally intense heat may be introduced into the crust by magma that rises upward from partially melted regions of the mantle through weaknesses in the crust.

The most economic geothermal resources result from geologic processes that allow convection to concentrate deep-seated heat at economically drillable depths. All current geothermal users in New Mexico use convective resources that naturally circulate water through deep-seated bedrock, sweeping up the heat and transporting it upward into shallow reservoirs. Fault zones can help concentrate and redirect the hot water flow upward. Where these systems intersect the surface, hot springs are found. Heat from active or young volcanoes is not necessarily required for this type of geothermal resource. The subsurface shape of a typical convective geothermal reservoir may resemble a small isolated summer cumulonimbus cloud or thunderhead. The lateral outflow plume of geothermal convection is analogous to the anvil or stretched top of the thunderhead, whereas the upflow zone resembles the rising cauliflower-like bulk of the thunderhead. The most permeable portions of the upflow zone and the shallow lateral discharge are most easily and economically exploited.

Some of the largest geothermal resources in New Mexico are associated with deep and confined (artesian) aquifers or conductive geothermal reservoirs. Temperatures in conductive resources result from the increase in temperature with depth. Most of the western half of New Mexico has high temperature gradients that typically range from 1.6° F to 2.5° F per 100 feet in depth (as opposed to 1.1° F to 1.4° F per 100 feet in depth typically found elsewhere). Because deep wells are required to tap these resources, they have higher upfront costs. However, where large heating loads are required, the overall economics have advantages over fossil fuels.

Classification of Uses and Resources

A common geothermal resource classification uses temperature. High-temperature resources are greater than 350° F and are suitable for large-scale electrical generation for sales on the transmission grid. Intermediate-temperature resources are between 190° and 350° F and are increasingly used for smaller-scale power generation for sales over the grid or for on-site power. Low-temperature resources are less than 190° F and at least 15° to 30° F above the local mean annual surface temperature. Low-temperature resources are the most common in New Mexico. They can be used in a variety of direct-use geothermal heating applications, including greenhouses, aquaculture (fish farms), space and district heating, and many industrial uses such as cooking, curing, or drying that require large amounts of low-grade heat. High- and intermediate-temperature geothermal resources may also be used in direct-use applications by "cascading" residual heat from power production to lower-temperature applications, enhancing the overall efficiency and economics of use.

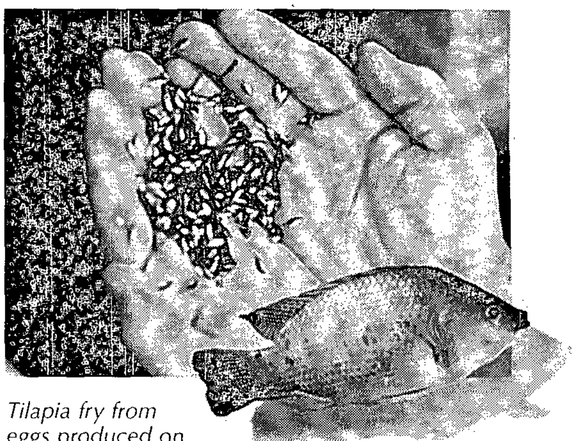


Temperature ranges of applications ideally suited to geothermal energy (modified from Geothermal Energy Uses, courtesy of the Geothermal Education Office, 2005).

Current Geothermal Use in New Mexico

Electric Power

Geothermal electricity has been produced at the 30-acre Burgett Geothermal Greenhouse in the Animas Valley near Cotton City. The facility extracts energy in a cascaded fashion, whereby 230° F water from geothermal wells is first fed into the power plant heat exchangers at a rate of 1,200 gallons per minute; the 185° F outflow from the power plant is used to heat greenhouses. Electricity is produced with binary-cycle power technology that employs heat exchangers to allow the geothermal water to boil a second, lower-boiling-point working fluid (in this case isopentane). The pressurized vapor of the working fluid circulates in a closed loop to drive turbines in three modular units and to generate almost 1 megawatt of electricity, most of which is used on location. The Burgett power plant is currently shut down for modifications.



Tilapia fry from eggs produced on site at AmeriCulture, Inc. near Animas, New Mexico.

Geothermal Aquaculture

Geothermal energy offers several advantages for fish culture. Many species have accelerated growth rates in warm water. Geothermal water can be used as a growth medium, adding to the agriculture receipts in the state without consumptive use of valuable fresh water. The AmeriCulture Tilapia Farm at Cotton City raises tilapia, a tasty warm water fish that is becoming increasingly popular. The AmeriCulture Tilapia Farm is heated with a 400-foot-deep geothermal well, at much lower costs than it could be heated with fossil fuels. From eggs produced on site, AmeriCulture grows and markets tilapia fry to growers and researchers nationwide and sells adult tilapia to restaurants across the Southwest. In addition, AmeriCulture has contracted Barber-Nichols, Inc. of Denver, Colorado, to design a binary-cycle power plant to provide electricity for the fish farm water pumps and refrigeration. Funding is provided through a cost-share grant with the U.S. Department of Energy.

Geothermal Space and District Heating

The aridity and high elevation of parts of New Mexico create significant heating loads on cold winter nights. Where shallow geothermal resources co-exist with large heating demands, geothermal space and district heating have cost advantages over fossil fuels. A district geothermal heating system on the New Mexico State University campus in Las Cruces was in operation from 1982 until 2004. It used as much as 260 gallons per minute of 147° F water, pumped from a depth of 744 to 971 feet with a campus geothermal well. Geothermal water was passed through a heat exchanger to heat fresh water that was fed into hot water loops on campus as needed. The cooled geothermal water was injected back into the reservoir margin beneath the campus golf course. Geothermal water was used to heat dorms, academic buildings, and athletic facilities on the eastern third of the campus. The system also provided hot water for showers in the dorms and athletic facilities. At present, the

Site	County	Installed heating capacity, million Btu/hour	Annual energy use, billion Btu/year	Annual energy savings	Use
NMSU/SWTDI	Doña Ana	0.5	1.4	$14,000	aquaculture
Masson Radium Springs Farm	Doña Ana	30.0	79.0	$790,000	16-acre greenhouse
Radium Hot Springs	Doña Ana	0.3	0.8	$8,000	spa
Faywood Hot Springs	Grant	0.9	2.3	$23,000	spa
Gila Hot Springs	Grant	2.1	5.4	$54,000	district heating
Burgett Geothermal Greenhouse	Hidalgo	70.1	184.2	$1,800,000	30-acre greenhouse
AmeriCulture Tilapia Farm	Hidalgo	9.0	23.7	$240,000	aquaculture
Ojo Caliente	Rio Arriba	0.6	1.6	$16,000	spa
Jemez Springs Bath House	Sandoval	0.9	2.3	$23,000	spa
Giggling Star, Jemez Springs	Sandoval	0.6	1.6	$16,000	spa
Charles Motel, T or C	Sierra	0.4	1.0	$10,000	spa
Fire Water Lodge, T or C	Sierra	0.4	1.0	$10,000	spa
Geronimo Springs Museum, T or C	Sierra	0.1	0.3	$3,000	space heating
Hay-Yo-Kay Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
Marshall Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
River Bend Hot Springs, T or C	Sierra	0.4	1.0	$10,000	spa
Sierra Grande Lodge, T or C	Sierra	0.4	1.0	$10,000	spa
Artesian Bath House, T or C	Sierra	0.4	1.0	$10,000	spa
TOTALS		**117.9**	**309.6**	**$3,057,000**	

Estimated annual energy use and savings for geothermal applications in New Mexico. Figures assume an annual 30 percent use of installed geothermal direct-use heating capacity.

geothermal injection well requires replacement, and the system needs upgrades after 22 years of service.

At Gila Hot Springs, a 300-foot-deep flowing well provides 165° F water for geothermal heating of a trailer court, rental cabins, store, and several homes. The New Mexico Institute of Mining and Technology at Socorro is currently assessing the feasibility of installing a campus geothermal district heating system in conjunction with a cost-share grant from the U.S. Department of Energy.

Geothermal Greenhouses

The best-known use of geothermal energy in New Mexico is for greenhouses. Geothermal greenhouses account for nearly half of the greenhouse acreage in the state. New Mexico leads the nation in geothermal greenhouse acreage. The success and growth in the geothermal greenhouse industry in New Mexico can be attributed to several factors, including abundant sunshine and low humidity, inexpensive land, co-existence of geothermal resources with fresh water, a good agricultural labor force, and favorable shallow geothermal resources. Current geothermal greenhouses use wells less than 1,000 feet deep, with resource temperatures ranging from 143° to 230° F.

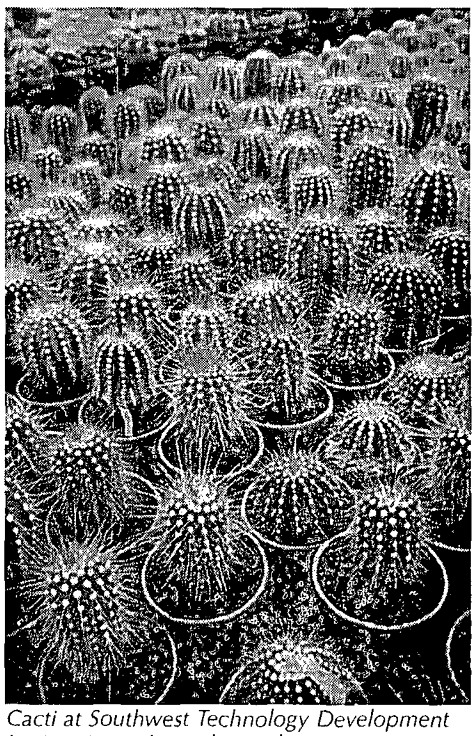
Geothermal Heat Pumps

Ground-coupled heat pumps allow space heating and cooling through the use of heat exchange loops that are buried horizontally in the ground or installed vertically in wells. In winter, heat is extracted from the earth and concentrated by the heat pump for indoor heating. In summer, indoor heat is removed and placed in the ground. Several large geothermal heat pump installations heat and cool public schools in New Mexico.

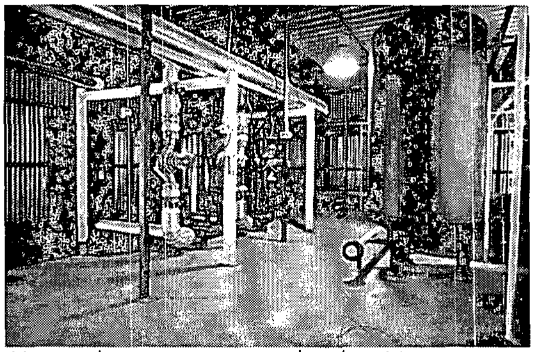
Economic Impact

The geothermal heating cost for New Mexico geothermal greenhouses is currently less than $1.50 per million Btu, compared to more than $11 per million Btu for natural gas with boiler losses. This represents a savings of more than $2.5 million for the state's two large geothermal greenhouses. Geothermal greenhouse sales are estimated at $27 million and rank among the top ten in agriculture sector gross receipts in the state.

The Burgett Geothermal Greenhouse (30 acres) near Cotton City is probably the largest business in Hidalgo County. The Masson Radium Springs Farm geothermal greenhouse (16 acres) is the largest employer in northern Doña Ana



Cacti at Southwest Technology Development Institute's geothermal greenhouse, New Mexico State University.



Heat exchangers, pumps, and tank at Masson Radium Springs Farm geothermal greenhouses. Heat exchangers are used to transfer heat from geothermal water to a closed-loop fresh water heating system.

County. Geothermal spas at Ojo Caliente, Jemez Springs, Faywood Hot Springs, Gila Hot Springs, and the many spas in Truth or Consequences attract important tourism dollars to New Mexico.

Future Potential

Geothermal development resembles oil and gas in leasing, royalties, and drilling. Exploration and evaluation of geothermal resources borrow methodologies used in oil and gas, ground water, and mineral exploration. Geothermal energy is environmentally friendly. In most cases, spent geothermal fluids are injected back into the reservoir. With the use of heat exchangers, harmful scaling and corrosion is eliminated and fluids can be isolated from both the natural environment and surface geothermal equipment.

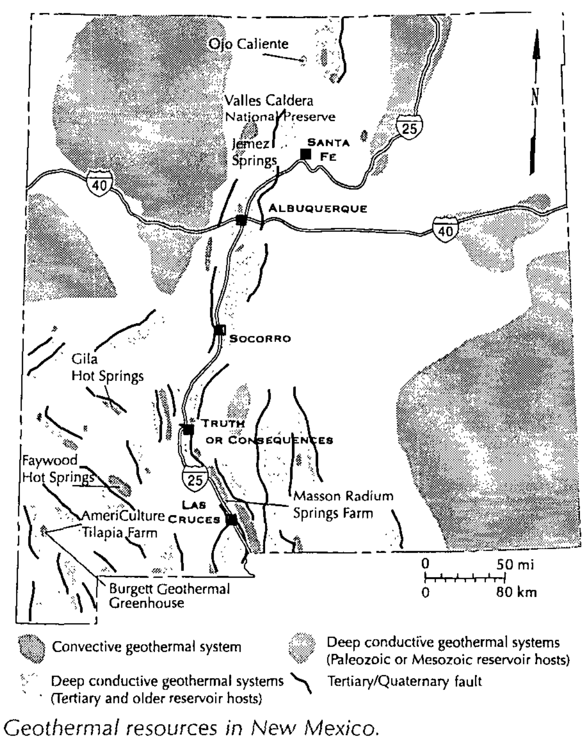
One impediment to geothermal growth is the initial capital costs associated with resource exploration, testing, and well drilling. However, geothermal energy has the advantage of low operations and maintenance costs, without the volatility associated with fuel costs. Most of the surface equipment used by geothermal operations is "off the shelf" and has well-known engineering characteristics and costs. This is especially true with direct-use installations.

The Valles caldera in the Jemez Mountains has proven geothermal reserves capable of generating as much as 20 megawatts or more of power. This resource has a probable magmatic heat source. Environmentally sensitive development of the Valles geothermal resource could provide royalty income to sustain and operate the Valles Caldera National Preserve and provide cost-stable power to the surrounding pueblos.

Small-scale geothermal electric power at less than 20 megawatts is likely in the next few years at several sites in New Mexico. Some of the generation is likely to be done in conjunction with cascaded direct use in a combined heat and power mode.

With the passage of the Energy Policy Act of 2005, formerly unfair federal royalty rules for direct-use geothermal energy are being modified to allow for an equitable fee structure that should encourage additional growth. In recent years, the U.S. Department of Energy has sponsored an outreach program, *Geopowering the West*, to educate the public and to encourage the development of all forms of geothermal energy. The Web site for the *Geopowering the West* is found at www.eere.energy.gov/geothermal/gpw/

Geothermal energy is a potentially powerful vehicle for rural economic development in New Mexico. Future uses of geothermal energy may include chile and onion drying, cheese and milk processing, and process heat for biofuels refining. Small-scale electrical power generation is very likely to expand in the cascaded mode with direct-use development. Because deep-seated saline water and oil field brines may be hot, geothermal desalinization and power generation may augment enhanced recovery of oil and gas and help sustain both our valuable water supply and our petroleum industry. For instance, oil field water flood operations could extract the heat of deep-seated oil field brines to generate geothermal binary-cycle power before reservoir injection for enhanced oil recovery. The power would be used for pump jacks and other oil field electricity requirements or placed on the transmission grid. The heat may also have use in multistage vacuum distillation of brines to produce desalinated water. The accessible geothermal resource base in New Mexico is vast, and the options for economic use are growing.



Geothermal resources in New Mexico.

—James C. Witcher
Witcher and Associates
Las Cruces, New Mexico

Jim Witcher is a geologist with nearly three decades of experience with geothermal exploration and development.

For More Information

The following Web sites offer a wealth of information on geothermal energy resources and development.

U.S. Department of Energy
www.energy.gov
Geothermal Education Office
www.geothermal.marin.org
Geothermal Energy Association
www.geo-energy.org
Geothermal Resources Council
www.geothermal.org
National Renewable Energy Laboratory
www.nrel.gov

All photos by Rob Williamson, courtesy of National Renewable Energy Laboratory. Adult tilapia inset on page 2 courtesy of Damon Seawright of AmeriCulture Tilapia Farm.

Staff Profile

Marshall Reiter

Principal Senior Geophysicist

Marshall Reiter grew up in Pittsburgh, Pennsylvania, and graduated from the University of Pittsburgh with a B.S. degree in physics. An interest in geophysics was sparked by Robert Stoneley, a visiting professor from Cambridge, and Marshall continued his education in geophysics at the University of Utah and Virginia Polytechnic Institute. His Ph.D. research on heat flow in southwestern Virginia caught the attention of Allan Sanford, professor of geophysics at the New Mexico Institute of Mining and Technology, and Marshall was offered a teaching position in January 1970. During his years in the department, Marshall and his students' geothermal studies identified the Rio Grande rift as a ribbon of high heat flow from central Colorado to El Paso.

Marshall moved from the college division of New Mexico Tech to the New Mexico Bureau of Geology and Mineral Resources in April 1975, although he continued to direct graduate students' research. From the late 1970s through the early 1980s he and the students collected heat-flow measurements in deep hydrocarbon wells to establish the regional heat-flow gradient below ground water flow. Their work suggested a lower crust-upper mantle heat source beneath the San Juan Mountains in southwestern Colorado, an interpretation that is consistent with recently published seismic investigations.

Geothermal studies continue to be Marshall's main research interest as well as rock and earthquake mechanics. Tracking the thermal history of the San Juan Basin led Marshall and his students back to new hydrogeothermal investigations in the Socorro area. In his current research Marshall uses terrestrial heat flow measurements in the pursuit of regional hydrologic information. Geophysicists have long recognized that the conductive geothermal gradient within the earth can be disturbed by ground water flow, thus skewing the measurements of terrestrial heat flow. Conversely, they realized that temperature logs not only provide heat-flow data but can also reveal characteristics of the hydrologic regime. Marshall and his colleagues at New Mexico Tech have been able to: (1) estimate rates of both horizontal and vertical (up and down) ground water flow, (2) locate geologic features that control ground water flow patterns, and (3) estimate regional recharge. Marshall has studied and interpreted heat-flow data and their possible correlation to hydrologic data throughout New Mexico: from the San Juan Basin and southeastern boundary of the Colorado Plateau to the Albuquerque Basin and along the Rio Grande rift in the Socorro area, Jornada del Muerto, Roswell Basin, and Pecos River valley.

During the past few years Marshall has begun applying his geothermal studies in the Albuquerque Basin to climate change. In the Southwest, heat transfer in the vadose zone, the unsaturated zone above the water table, is typically dominated by conduction. Monitoring temperatures in the vadose zone may enable one to observe changing trends in ground surface temperature possibly related to changes in climate. Loss of natural vegetation and paving during urbanization seem to result in ground surface heating at one study site in the Albuquerque Basin.

Measurements of subsurface temperature gradients and heat flow can also serve to determine the depth and temperature at the base of the crustal layer where most continental earthquakes occur. Marshall is currently comparing the subsurface temperature gradients along the San Andreas fault in California with those along the Coyote fault near Socorro, New Mexico.

In his 36+ years at New Mexico Tech, Marshall has published more than 60 papers in professional journals and serial publications. Marshall and his wife, Bonnie, have two sons and a daughter, and one grandson. Bonnie taught at Socorro Middle School for 12 years as a reading specialist. Since retiring from teaching, Bonnie often accompanies Marshall on field trips to help with the measurements.

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Cover photo of Ship Rock, New Mexico
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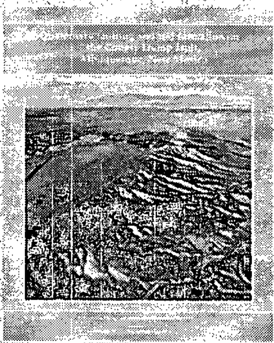
Circular 212—Quaternary faulting and soil formation on the County Dump fault, Albuquerque, New Mexico by J. P. McCalpin, S. S. Olig, J. B. J. Harrison, and G. W. Berger, 2006, 36 pp., ISBN 1-883905-18-4. $10.00 plus shipping and handling.

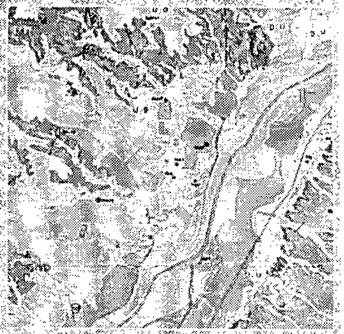


The Albuquerque–Santa Fe urban corridor is one of the fastest growing areas in the western United States. Twenty-seven Quaternary-age faults have been identified within 40 km of downtown Albuquerque. The faults are associated with the Rio Grande rift and are responsible for 10 earthquakes of MMI (Modified Mercalli Intensity) V or greater since 1849.

The County Dump fault is a 35-km-long, north-trending normal fault that is located in an area of suburban development west of the Albuquerque metropolitan area. The fault dips eastward under the city.

This study describes the recent activity of the County Dump fault and assesses its potential earthquake hazard. To more fully understand the fault's paleoseismic history, the authors undertook a study that included measuring the height of the scarp formed by the fault, opening multiple trenches across the fault, describing stratigraphic and structural features in the trenches and sampling soil horizons exposed, and collecting samples for thermoluminescence dating. The pattern observed in the trenches suggests that the fault moves at intervals of about 20,000–40,000 years and results in displacements of approximately 1 m or less. The last three ground ruptures have estimated ages of 30,000, 45,000, and 80,000 years ago. The publication includes detailed 2-color trench profiles and perspective drawings.

Open-file Report (OFR) 496—Preliminary geologic map of the Albuquerque–Rio Rancho metropolitan area and vicinity, Bernalillo and Sandoval Counties, New Mexico, compiled by Sean Connell, 2006. Available in electronic format only.



This digital geologic map is a compilation of sixteen 7.5-minute quadrangles and comprises an area of 2,500 square kilometers of the Albuquerque Basin of north-central New Mexico. Prepared at a scale of 1:50,000, the map depicts the geology underneath the cities of Albuquerque and Rio Rancho and surrounding areas. It was completed in order to better characterize geologic controls on ground water resources and geologic hazards in this rapidly growing urban region. It is currently available in electronic format only, free on the bureau's Web site at www.geoinfo.nmt.edu/publications/ or it may be purchased on CD ROM for $10 plus shipping. Digital files currently available include three plates, as follows:

Plate 1a: Geologic map and explanation (6.3 Mb PDF)
Plate 1b: Geologic map with shaded relief (21.9 Mb PDF)
Plate 2: Geologic cross sections & derivative maps (5.2 Mb PDF)

Digital GIS data and graphics files will be available soon, as well as a report on the geology of the map area. A printed map sheet (1:50,000) of this compilation will be available in 2007.

A complete list of open-file reports published by the New Mexico Bureau of Geology and Mineral Resources is available on our Web site. Some of these reports are available for free downloading directly from the site; all are available in electronic format on CD ROM for $10.00 plus shipping through the Publication Sales Office. For more information, visit our Web site at www.geoinfo.nmt.edu or call us at 505-835-5490.

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	Date			Origin Time			Approximate Location		Maximum Intensity		
No.	Mon	Day	Year	Hr	Min	Secs	Lat (N)	Long (W)	(Modified Mercalli)	Estimated Md	Nearby City
1.			1869				34.1	106.9	VII	5.2	Socorro
2.	Sep.	7 ,	1893				34.7	106.6	VII	5.2	Belen
3.	Oct.	31 ,	1895	12			34.1	106.9	VI	4.5	Socorro
4.			1897				34.1	106.9	VI	4.5	Socorro
5.	Sep	10 ,	1904				34.1	106.9	VI	4.5	Socorro
6.	Jul.	2 ,	1906	10	15		34.1	106.9	VI	4.5	Socorro
7.	Jul.	12 ,	1906	12	15		34.1	106.9	VII to VIII	5.5	Socorro
8.	Jul.	16 ,	1906	19			34.1	106.9	VIII	5.8	Socorro
9.	Nov.	15 ,	1906	12	15		34.1	106.9	VIII	5.8	Socorro
10.	Dec.	19 ,	1906	12			34.1	106.9	VI	4.5	Socorro
11.	May	28 ,	1918	11	30		35.5	106.1	VII to VIII	5.5	Cerrillos
12.	Feb.	5 ,	1931	4	48		35.0	106.5	VI	4.5	Albuquerque
13.	Feb.	21 ,	1935	1	25		34.5	106.8	VI	4.5	Bernardo
14.	Dec.	22 ,	1935	1	56		34.7	106.8	VI	4.5	Belen
15.	Sep.	17 ,	1938	17	20		33.3	108.5	VI	4.5	Glenwood
16.	Sep.	20 ,	1938	5	39		33.3	108.5	VI	4.5	Glenwood
17.	Sep.	29 ,	1938	23	35		33.3	108.5	VI	4.5	Glenwood
18.	Nov.	2 ,	1938	16	0		33.3	108.5	VI	4.5	Glenwood
19.	Jan.	20 ,	1939	12	17		33.3	108.5	VI	4.5	Glenwood
20.	Jun.	4 ,	1939	1	19		33.3	108.5	VI	4.5	Glenwood
21.	Nov.	6 ,	1947	16	50		35.0	106.4	VI	4.5	Albuquerque
22.	May	23 ,	1949	7	22		34.6	105.2	VI	4.5	Vaughn
23.	Aug.	3 ,	1955	6	39	42	37.0	107.3	VI	4.5	Dulce
24.	Jul.	23 ,	1960	14	16		34.4	106.9	VI	4.5	Bernardo
25.	Jul.	3 ,	1961	7	6		34.2	106.9	VI	4.5	Socorro
26.	Jan.	23 ,	1966	1	56	39	37.0	107.0		4.8	Dulce
27.	Jan.	5 ,	1976	6	23	29	35.9	108.5		4.7	Gallup
28.	Nov.	29 ,	1989	6	54	39	34.5	106.9		4.7	Bernardo
29.	Jan.	29 ,	1990	13	16	11	34.5	106.9		4.6	Bernardo
30.	Jan.	2 ,	1992	11	45	35	32.3	103.2		5.0	Eunice

Chavez, Carl J, EMNRD

From:	Chavez, Carl J, EMNRD
Sent:	Friday, June 25, 2010 2:33 PM
To:	Brooks, David K., EMNRD; Altomare, Mikal, EMNRD; Lucero, Stephen A., EMNRD
Cc:	Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD
Subject:	Geothermal Working Group Meeting Minutes 6-16-2010 (Hotel Santa Fe Kiva Room)
Attachments:	Meeting Minutes Final 6-16-2010.pdf

FYI, please find attached meeting minutes from the above subject meeting.

OCD's record expert is on vacation and these minutes will be posted on OCD Online "UIC-999" in a couple of weeks.

Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Geothermal Working Group Meeting Minutes
Hotel Santa Fe, Kiva Room
(June 16, 2010)

June 16, 2010 Deep Source Geothermal Commercialization Meeting Sign In Sheet

Last Name	First Name	Affiliation	Email
Hall	Jason	Glorieta Geoscience	Hall@glorietageo.com
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Sarracino	Robert	New Mexico Consortium	robert.sarracino@nmc-la.org
Kelkar	Sharad	Los Alamos National Lab	kelkar@lanl.gov
Chavez	Carl	NM OCD	carlj.chavez@state.nm.us
Albrecht	Michael	TBA Power	michael.albrecht@tbapower.com
Anderson	Kurt	NMSU/NMC	kurt@nmsu.edu
Altomare	Mikal	NM OCD (EMNRD)	mikal.altomare@state.nm.us
Kaufman	Greg	Pueblo of Jemez	gkaufman@jemezpueblo-org.org
Person	Mark	NM Tech	mperson@nmt.edu

Time	Lead Group	Topic
0900-0930	1) NM ECMD - Steve Lucero	Welcome, Introductions, Executive Order 2010-001, Working Group Goals, Summary of February meeting, Contract Status
0930-0945	2) NMSU - Kurt Anderson	Reno Conference Update, Annual NM working group meeting
0945-1000	3) NM Tech - Dana Ulmer-Scholle	Update on Nationwide geothermal database effort

1000-1030	4) NM Tech - Mark Person	NM Tech - Database work proposal and scope of work
1030-1045	*Break*	
1045-1115	5) All	Group Input: Database scope of work, parameters, format
1115-1130	6) LANL - Ken Rehfeldt	DOE FOA -00318 Funding Opportunity
1130-1145	7) NM ECMD/All	Morning Session Wrap-Up, Discussion
1145-1300	*Lunch*	
1300-1400	8) NM OCD - Mikal Altamore, Carl Chavez, David Brooks	NM Geothermal Energy Project Regulations
1400-1430	9) All	Group Discussion - Regulations, Policy Recommendations
1430-1500	10) NM ECMD/All	Action Items, Next Meeting
1500	11)	Meeting Adjourn

1) Steve Lucero ECMD:
   - Governor's Exec. Order driver for this meeting.
   - Work Group Goals: Summarize Feb. 11, 2010 meeting: Contract develop between NMT and state DB development is over 2 yrs. in the making. ECMD allotted money under its American Recovery Funds to fund clean projects for state. An amount of $200K was allocated to fund work on the NM Tech Geothermal Database. Draft of contract has been prepared. Mark Smith is EMNRD Council working on contract for ECMD. Task 1: SOW, NM Tech land use data sets in GIS format, chemical geothermometers, other modeling, and data sets incorporated into web based format for public consumption. Hydrothermal modeling, develop plan details, SOW, budget, timeline. Task 2: data sets. Geothermometers, geothermal modeling, geothermal assessment, deliverables. Plan, GIS Data Sets, Geochemistry. Geothermometer, hydrothermal model & Geothermal Assessment to be completed by 4/ 2012 @ $200K. Feb 2010 meeting highlights: Jim Witcher's 8 key parameters: NMOCD permit process, NM OSE, EGS projects, Europe project w/ seismic hazards, and will incorporate Mike Albright Georesources ranking system into database. Action items: presentations to group available on NM Consortium webpage. Seismic risks, research

available on NM Consortium Webpage. Good info. ID development regulatory approach and make info. straight forward. Develop contract w/ NM Tech to get database running within one to two months of signing contract. Collect policy recommendations from the group. Feedback from group since Feb. meeting: Went over Carl Chavez's handout regarding ECMD examples with questions from ECMD on some of OCD's preliminary recommendations. Brendan Miller and data available at end. Public access to db and seismicity issues. Example: EGS example in Europe where seismic event killed geothermal project. ECMD collecting input.

- ECMD organizing Co-Geo Symposium in Albuquerque in September 2010 that will likely involve OCD, BLM, OSE and geothermal power companies interested in Co-Geothermal oil and gas production.
- Renewable Energy Goals: 10% by 2011 (close to that now at 10%) and 20% by 2020 (renewable and geothermal will be very important to achieve this goal).

2) Kurt Anderson Reno Conference. Emphasis Hot Dry Rock (HDR or EGS) Geothermal (Geothermal only mentioned 5 times during entire conference):
   - Electrical generation on commercial scale technology and new technologies: costs and risks attracting commercial investment
   - Risk of EGS and induced seismicity and public perception. Seismicity is a major issue as public perception is an issue
   - Identify and characterize State resources
   - Clarify and streamline the permit process
   - Provide incentives for commercial development
   - Construct a pilot electric generating facility
   - How many years for payoff depends on the permit process.
   - Lots of recommendations from industry capitalists: tax incentives, agreements w/ utility company to buy power once HDR Power Plant is constructed. "Build it and they will come" mentality.
   - Geothermal database: temperature, stratigraphy, hydrology, land ownership, surface and subsurface rights jurisdictions.... other and geothermal as part of db.
   - Permit process: clarify agency jurisdictions, clarify agency requirements, and designate a lead agency: one stop shopping, encourage parallel (contingency) permitting, speed up the permitting process.
   - Incentives: resource database, fast track permitting, providing marketing; utility agreements, subsidies & tax incentives.
   - Demonstrate that: accessible resources can be developed; the technology works; and that electricity can be produced and marketed at a reasonable cost.
   - HDR is really of interest. In NM, Fenton Hill was a pilot project. Fenton Hill shut down. A non-steady heat supply killed project and was never commercially applied. Once done w/ Jemez Pueblo geothermal project, will get ball rolling on Fenton Hill.

It is currently designated as a "Wilderness Area" that will require a change in law to open up again. Politics will be involved. HDR/EGS emphasis because scare fresh water supplies and ground water appropriations are an issue and HDR poses little threat to water resources, once the reservoir charged, add makeup water only to address leakage and evaporation. Currently, no HDR electric power generating plant running, except in France. Australia is working on a 25MW plant.

- To attract investment, the state needs to provide up front risk. NM good for HDR due to water issue.
- Geothermal Energy needs serious marketing and public education effort. As green and renewable energy source, geothermal is in competition with solar, wind, and bio fuels for funding resources and investment funding.
- NM must compete w/ other mostly western states for geothermal investors or investment.
- The NM geothermal working group meeting is scheduled to be in Las Cruces from 9/15-16, 2010. Starts after lunch on 15th. until dinner in evening and runs all day on 16th to 4 p.m. Working on invitation list. Want to invite Alta Rock EGS as work at the Geysers in CA has ended due to seismic reasons. Why are they drilling and injecting into Permian zones? Going to kill industry. Pick EGS locations where they won't create earthquakes from nearby fault zone(s). Some poor decision making going on…? Don Brown recommends drilling into base bedrock pressure free from seismic activity to avoid creating seismicity from geothermal operations.

3) Sherry Kelley- NM Tech. Database Presentation:

- American Association of State Geologist proposal to build national database. Involves each state agency in 48 states, and to gather data. One month ago in Washington, DC. Project review workshop and at meeting the lead institution was the Arizona Geologic Survey. AZ specifies data it wants to see in the National database that they want included.
- NM Tech given forms to fill out developed SOW. Work project budget and NM Tech finally got contract 2 weeks ago. Last 2 weeks making sure NM tech is happy with contract and rework budget for 3 year project. SOW will evolve over 3 years.
- SOW for year one developed by Ron Broadhead (NMBMG) and Jim Witcher (Independent Contractor) SOW, list of things put together in database for active faults in NM. Quaternary faults exist, but NMBMG will develop updated state map throughout NM to take new data from state and update Quaternary Faults map.
- Second, database shows volcanic rocks < 5M YO. Temperature as f (depth) database.
- Marshal Reiter is retiring and Sherry has inherited Marshal's job. There is a bookcase full of notebooks crammed with temp. as f (depth) data to convert to digital form and protocol database with input from AZ Geological Survey. Jim Witcher's industry data collection is available. Jim can refer you to the Nevada Hunt

Energy data. In addition, to measured temp. as f (depth) data, can also extract bottom hole temp. data from well logs. Dave Blackwell (SMU) has database with extracted bottom hole data from NM and has agreed to share information with NM. To interpret bottom hole temperatures need lithology of wells and thermal conductivity. NM Tech is gathering this information. Jim Witcher has other databases and will focus on that data during first year. AZ wants to show folks at DOE that NM Tech is making progress. A list of hot springs and wells in NM. List of permeability and porosity in certain areas of the state. Lots of water chemistry. NM Tech has a full plate but no funding has arrived on campus yet. Wait for AZ. What are database tools? Under DOE contract to AZ Geologic Survey, AZ just got DOE funding and is now distributing it to state agencies as subcontracts.

- NM Tech was allocated $410K for the project. Michael Albright says infrastructure, surface resources, land ownership… Power lines point to renewable energy authority corridor proposals last week. It is now viewable on website and he wants industry feedback. Decide on funding amount to be spent in areas where EGS is feasible in a few years. Need feedback on whether to add more lines (go to: www.renewableenergyauthority.com). Just started first 30-day comment period and now is time to comment, revise and then another comment period will ensue. RITA process and locate anywhere there is geothermal development need to know if power grid is or are too far away, but resource exists, identify corridor and leave up to state to move forward. Customers and access essential or we're just wasting time. A great opportunity to comment. Michael will send out e-mails and for comments and put them on the maps. Need feedback in next 4-weeks.

4) Mark Person NM Tech Update on SOW to be conducted on state-wide geothermal assessment.

- Lots of overlap w/ Sherry. Slim-hole drill project base of "M" Mtn. 2.2 Miles from campus to feed campus geothermal energy in next 2 years.
- Project team: Mark, Dr. Fred Phillips and Andy Campbell (isotope). Two grad students Trevor and Jessica MS Projects. GIS Specialist David Butler, and Senior Undergrad. Team in place with funding ready to go.
- Proposed data sets: location, depth, existing oil gas and water wells, bottom hole temp. from select oil gas wells, water table depth, ground water cation and silica concentrations, seismicity, ground deformation, temp. at depths of 1, 2, 4 and 6 km, shallow heat flow, distribution of young < 2 M YO volcanic rocks., distribution of Cenozoic. Confining units, land use information, gravity and aeromagnetic maps, land ownership maps depicting state, federal and private land ownership. Where Cenozoic is eroded and faulted, best locations for geothermal. Some sources: NMBGMR, NMOCD, OSE, USGS, Jim Witcher and Associates, ranking methodologies: modeled after Nevada. Company wants raw data, can download,

statistically relate wide list of parameters- hot springs, power generation. How do they correlate with known geothermal anomalies? Go to areas where no wells, deep water tables, and emulate NV ranking methodology.

- Invited Mark Cuba to give talk on Oct. 7, 2010 on basin range geothermal resources. Will send out email invites. Yes, geochemical geothermometers may read much higher temp. than really exists. Assumption is volcanic rocks, but not conditions of NM. NV research center is exploring using reaction pack geothermal modeling. Take water sample and look at rocks for action path modeling to refine thermometry estimates and use for states database. Add resonance time. Fast flow, ~2000 year old and no time to equilibrate with rock in flow path. See age to see how affects age and geothermometry.
- Co-sampling major trace elements to assess geochemistry and C-14 age dates.
- Better geothermometer calibrated to NM. Good thing to do.
- NM Tech well drilled was 100°F to mid. final temp. of 41°C, may be warmer deeper. How long was well in static state was about 1 month. Weren't drilling with fluids, drilled w/ air so temp. would not be disturbed by drill process. Re-measured temp. profile. At shallow depths great geothermal gradient. Isothermal at 500 ft. would have liked 45F.
- Didn't do spinner test to see if there is down flow? No. Fiber optic cable pumping was implemented to see what zones fluids were coming from. Spinner test would show flow, down flow could pick up at 1000 ft. could be misleading? Additional measurements: ran out of funding. Sampling included 50 samples run for major ions, isotopes, C-14 and purchased geochemistry Software. Modeling: Pros-1: Data integrator: geology, geochemistry, hydrology, thermal data integrated in single analysis, and Pros-2: Cheap (can put models together in 2 weeks). The Con is garbage in, garbage out (models are only as good as input data, geology, heat flow data...).
- Apply model to Socorro geothermal well anomaly. High salinity (2000 mg/L). Geothermal cross sections can be developed to interpret geothermal to understand plumbing.
- Geothermal project update: slim hole production well pipeline to campus. $800K insulated pipe connected to existing refurbished hot water loop system. Need 800 gpm @ 65°C production at 150°F, but temp on 41°C. Still use, but cost goes up. Thermal anomaly occurring at hydrogeologic window. Fault block motion severed playa. Magdalena aquifer find path of least resistance at Woods Tunnel. Map out windows in geothermal assessment.
- Project is dead because state didn't match funds. NM Tech. needed $1. 5 M but no state matching funds. Original well drilled for production. Permit from OSE for geothermal well. Temp below geothermal resource. Permit through OSE and happy to apply from OCD. Need matching funds because district heating $. Cap $2M and

project now 3.5M due to heat pumps and grant didn't allow any new drilling. Could re-drill injection well. Payback in 4 yrs. to state. Save 0.5 M per year, but $ evap. DOE wanted to give NM Tech $, but couldn't buy heat pumps. Process of going to legislature to ask for priority funding to start again by reapply. Project dead now. $6M project. Cap is $2M. Need significant matching funds from state. How about tax credits? Carbon offsets credits? Heated now with natural gas $800K/yr. Tax credit for innovative use, SLO would issue royalties and they may have been misapplying the statute. NM Tech not sure it even needs geothermal and deliberately accessing for heat, it is geothermal use.

- Well has open hole from 500 to 600 ft. bgl. Cemented to 300 ft. and cemented at bottom of casing w/ 20 ft. of cement drilled through. Possible leakage downward. Head grade 0.1 upward. No downward. 1100 ft. well. WT @ 250 ft. Forced convection systems driven by GW movement.
- Rio Grande valley 80 mwatts/ M2 where temp gradient flat cool GW descending. Drilled at "Woods Tunnel" w/ 300 mW/M2 anomaly where steep gradient.
- Water table map is consistent with his high water table huge head drop into the Socorro basin 4600 ft. inter basin transfer of fluid breach in confining unit, and hydrologic data is consistent w/ heat flow. Important depth to water table and interpret where heat flow anomalies are located.
- Planned system is 4 heat pumps at $400K each to add to project. If state gives 2M, can save $500K per year in heating costs. Return on Investment is 4 yrs.
- One issue is salinity that is about 2000 mg/L TDS. Shallow wells used in the area for water supply are at about 500 ppm TDS. Production well salinity is much higher at 2000 mg/L TDS used for cattle, etc. Won't inject into shallow zone, but will inject into deep injection wells into playas. Reinjection well is proposed to go into playa or below at NM Tech campus. Pipe down and re-inject at 2000 ft. and why added capital needed.
- Michael Albright asked if NM Tech would accept private investors? Mark can give information and how would state university collaborate with private entities? Purchase power from new entity? DOE Grant FOA 318 application w/ DOE? Matching grant $2M.

5) Greg Kaufman Pueblo of Jemez (gkaufman@jemezpueblow-drp.org):
   - Awarded grant $4.995,844 from DOE for Innovative Exploration Techniques for Geothermal Assessment at Jemez Pueblo. Manages projects and field work.
   - Familiar with location, pueblo lands 3 of them. Right on Jemez R. relief valve for Valles Caldera. Numerous hot springs, i.e., Jemez Hot Springs. Very little additional hot water wells or springs south or downstream because heat may be building up to the south under pueblo land at Owl, Salt and Indian Springs, which are culturally important to Jemez Pueblo.

- No disturbance of springs during religious events is allowed.
- Water samples from Indian springs chemical analysis estimate water temperatures at depth to be around 305°F. Hope this proves true when well drilled.
- There was an artesian flowing Indian Springs well along the Jemez River that BIA capped. Previously damaged by truck. BIA capped well flow to river and use was non-potable and used for cattle. The temperature of surface flow was 140°F. There was high arsenic and Manganese and other metals in the well, which was about 200 ft. deep seated in alluvium. Will focus on water temperature, chemistry of constituents formed with temperature estimated from chemicals. Goal is to drill 3000 ft. down to estimated major heat resource. Won't redrill old well.
- Three phase project: Phase 1 resource evaluation by NM Tech (Sherry) is involved and has generated a 1:6000 scale geologic map over a 6 sq. mile area around Indian Springs; located 2 seismic line placement locations; completed shaker studies to locate first slim-hole well one well at a time; and analyze seismic data from LANL. New computer model will generate 3-d MRI under pueblo at this location.
- Preliminary map of Indian Springs Well and Salt Springs. Red lines show faults mapped by Harry and Jamie Gardner. Hwy 4 runs thru area. 10.5 miles of seismic line to be conducted and dealing with NEPA impact study from lines. Seismic studies fall into categorical exclusion under DOE and DEPA.
- Do cultural resource survey and biological assessment. In order to void the categorical assessment, NM Tech started the biological assessment. The cultural assessment must be completed before this stage in DOE format and submitted to DOE for approval.
- Phase 2 Drilling: drill first slim hole up to 3000 ft. deep, core and do test to locate 2nd hole.
- Phase 3 Well Testing: includes drilling of second hole. List of down hole tests; 3d magnetic telluric survey, electrical conductivity, FEC, fractured surface area, flow rates, heat content and heat transfer rate of the geothermal resource. Use of telluric survey results to locate and drill 2nd well.
- District heating w/ underground pool of warm water, may do greenhouse and other geothermal farming activities. Agriculture use of geothermal water fits culture of Jemez Pueblo. Fish farming is another possibility. District heating where pueblo wants to build light industrial park to be heat building(s) with geothermal. If water is hot enough to generate power, reinject hot water, keep pressure up for binary cycle system. Arsenic may be toxic and the only value would be the extracted heat. Where will you reinject? This issue is beyond the scope of this project. Monitor water levels. The electrical transmission line to the Jemez substation Jemez Mt. Coop, the Jemez Pueblo is currently negotiating to sell them power.

6) Sherad DOE funding announcement. LANL. DOE FOA:

- Comments from final report on HDR Project.
- Sherad (LANL) indicated LANL was working on an annual summary report in their spare time from HDR Project.
- Hopefully come up w/ final report in next 2 months. Lots of politics surrounding the Fenton Hill Project. Forestry Department issues may be main obstacle? There are also dumping concerns… This year's report on HDR could be placed on NM Consortium Website and the group was receptive of this.
- DOE FOA Grant (Phase 1) calls for proposals that started on May 12, 2010 and ends July 9, 2010. Electric Production from low temp. geothermal resources (below 150°C or 302°F), co-geothermal production fluids (geopressured). Add direct use and exploitation of chemical, kinetic energy. Geopressured may be more applicable to TX? Co-produced fluids are of interest to NM? Yes, specifically want to see geothermal heat as a source of geothermal energy and can include chemical and kinetic, but definitely want geothermal.
- Project phases: Phase I Feasibility, Design, and Study Funding w/ Ceiling of $750K over duration of 10 months to make a determination to proceed with Phase II; Phase II: Procurement, Install, and Commissioning; and Phase III: Operation and Maintenance. This proposal deadline is only for Phase I and dependent on success and funding from Congress next year. Cost Share: recipient at least 20% for Phase I, 50% Phase II and III. Phase I: 15-20 awards. Phase II and III: 5 awards. Brief summary of San Juan Basin in COP, but not interested yet… Suggestions to field project interest let Steve Lucero know. Sherad will forward information to Steve Lucero of ECMD to consider posting on the ECMD Renewable Energy Website.
- Summarized Steve Lucero's morning notes before lunch. Rita- published corridors for meeting and wants feedback on transmission grids for geothermal. Went over Carl's notes to Steve Lucero for more group discussion before lunch.

7) David Brooks Ownership of Geothermal Resources (note: see presentation at OCD Online "UIC-999" (Geothermal Working Group):
   - Who owns geothermal resource? Heat, it is a mineral. Via Vidal is what precipitated geothermal regulations around 1981, but never happened.
   - 3 aspects: 1) well drill, 2) waste disposal (NM WQA & Regs of WQCC) & 3) correlative rights (no rules in place at moment and experience to know how we will regulate it as learn more about states geothermal resources).
   - Exceptions to OCD regulatory authority: heat exchange systems not geothermal.
   - Limited exception for incidental use of heat for potable water.
   - Indian lands regulated by EPA and BIA or Tribes.
   - OCD jurisdiction is not exclusive. Other state agencies have authority to extent of their developments and cases of conflict and OCD Regs. may pre-empt them. Co-

regulation between various agencies possible. Geothermal uses shallow water and requires a water right involving OSE. Local govt. could step in too.

- Use of water in geothermal Operations, the operator must generally have a water right by appropriating the water and permit from OSE or buying an existing water right to change the use if different from the present use, unless qualifies for production of geothermal w/o water under O&G. If producing deep source geothermal may not need water right because of 2500 ft. limitation to top of aquifer below 2500 ft. and greater than 1000 ppm TDS then water may not be subject to OSE.
- Class II fluids w/ oil and gas a WQCC permit not required, but a Class II SWD permit required, which would be simpler than WQCC permits (administrative process).
- Conflict between oil and gas and geothermal develop. No rules to address affects to oil and gas. Potash in Eddy and W Lea County movement of water underground salt and water gets into potash, leach out and problem. Extensive litigation in state and federal forms for many years to come. Potential conflict with other mining activities other reasons. OCD only concerned with potash.
- OCD Geothermal rules are currently not adequate as the geothermal industry is now developing. Current geothermal regulations were developed in the 1980s based on the existing O&G Program and associated regulations. Takes time to develop rule regiment and be done. Have to develop stakeholder contacts and will take a couple of years to get done from start to finish.
- Surface owner protection act does not apply, it's about oil and gas operations. Correlative rights: claims between subsurface owners of neighboring tracts. What is basis? How to establish value by heat, use, acreage....? Will take rule changes. Most practical way is specific to the reservoir..... Water rights and owner uses water for injection wells, is this beneficial use of water? What if I consume water by injecting into ground for purpose to pressure up reservoir- beneficial use. If just disposing, not beneficial use

8) Mikal Altomare: What OCD has been doing (note: see presentation at OCD Online "UIC-999" Geothermal Working Group)?
   - Where OCD is heading and permit process will look like.
   - Heat pumps aren't geothermal resources under OCD Regs. Requires cooperation between multiple agencies and streamline process as you go to one agency to the next.
   - Protect waste and correlative rights that are ill defined and will be difficult tasks in the future w/ stakeholders and industry and assistance from experts.

- Key definitions: Incidental use and confusion w/ 250°F threshold. Will apply in few situations….? In 2007 Court of Appeals in NM, stated "In other words" to meet 4 requirements.
- Draft geothermal generic form review based on the above.
- Education will be required to let people know if using heat from water deliberately, need to seek geothermal permit from OCD. UIC Manual keys on "Bottom Hole" temperature to establish reservoir temperature. How will OCD make determination? Fact finding or hearing process? OCD hasn't ironed it out yet. Suggest state avoids mention of "royalty." Heat exchange and transfer not geothermal resource to be regulated by OCD.
- Noodle diagram presented to show what state agency handles what?

9) Carl Chavez OCD Permit Process (note: see presentation at OCD Online "UIC-999" Geothermal Working Group):
   - Things OCD is doing in line with Governor's Executive Order.
   - OCD Geothermal Resource Webpage with links to application forms, regulations, bonds, etc.
   - Review of Geothermal Forms required for geothermal and bond forms.
   - Examination of Generic Geothermal Application and C-108 Application Forms.
   - Administrative Completeness and Public Notice Process under WQCC.

General Group Comments:

NM is not well represented in booths symposiums and if it wants its geothermal program to be recognized to commercial power companies, it has to do some marketing to entice geothermal power companies to explore NM's geothermal resources. Things like posters and flyers and maybe a map of NM's geothermal resource areas may be all that it takes. EMNRD is on travel suspension, so appearing at symposiums with posters isn't allowed right now. Michael Albright volunteered to display flyers, posters, etc. at his commercial booth at the upcoming GRCC Meetings ~ 7000 attendees? EMNRD must market NMs natural resources. Show OCD's geothermal resource locations for exploration. NV has map showing its resources. CO2 tremendous working fluid as hot dry rock develops and HDR will become more predominant. However, it is more corrosive and it migrates through rock better, but is minus the heat capacity.

Action items:

- EMNRD currently discussing further development of geothermal co-production with Ron Broadhead (NMBMR). EMNRD is working on oil and gas symposium in September of 2010 to be held in Albuquerque. Get OCD tied in on regulations and other technical presentations at that forum. NMOGA, BLM, OSE would also be involved.

- Annual meeting Sept. 15-16, 2010 in Las Cruces. Kurt will send out invitation. Idea for special topic or invited speaker. If feeling talkative let Kurt know.

- Michael Albright will send comments on RITA in next 30 days. Go to the website to view the electric grid corridors he proposed to comment.

- October 7, 2010 Mark Cuba NV Research Center will be at NM Tech to give presentation on geothermal exploration of NV.

- Funding opportunity LANL will send to ECMD Stephen Lucero. Any announcements to Robert Serracino to place on Geothermal Consortium Website.

- ECMD will post draft report to Governor in August for working group to provide final comments on ECMD. ECMD is already developing report based on agency comments/recommendations. The report must be sent by 12/1/2010 and will be posted in draft at the following website: www.nmconsortium.org

- OCD needs to promote or market OCD's geothermal program(s)......

June 16, 2010
Deep Source Geothermal Commercialization
Working Group Meeting
Santa Fe, NM

Time	Lead Group	Topic
0900-0920	NM ECMD - Steve Lucero	Welcome, Introductions, Executive Order 2010-001, Working Group Goals, Summary of February meeting, Contract Status
0920-0935	NMSU - Kurt Anderson	Reno Conference Update, Annual NM working group meeting
0935-0950	NM BGMR – Shari Kelley	Update on Nationwide geothermal database effort
0950-1015	NM Tech - Mark Person	NM Tech - Database work proposal and scope of work
1015-1030	Pueblo of Jemez - Greg Kaufman	Pueblo of Jemez Geothermal Project
1030-1045	*Break*	
1045-1115	All	Group Input: Database scope of work, parameters, format
1115-1130	LANL - Sharad Kelkar	DOE FOA -00318 Funding Opportunity
1130-1145	NM ECMD/All	Morning Session Wrap-Up, Discussion
1145-1300	*Lunch*	
1300-1400	NM OCD - Mikal Altamore, Carl Chavez, David Brooks	NM Geothermal Energy Project Regulations
1400-1430	All	Group Discussion - Regulations, Policy Recommendations
1430-1500	NM ECMD/All	Action Items, Next Meeting
1500		Meeting Adjourn

Chavez, Carl J, EMNRD

From:	Chavez, Carl J, EMNRD
Sent:	Friday, June 18, 2010 6:25 AM
To:	Jones, William V., EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD
Cc:	Sanchez, Daniel J., EMNRD; Ezeanyim, Richard, EMNRD; Lucero, Stephen A., EMNRD; Brooks, David K., EMNRD
Subject:	FW: CA Geothermal Regulations Update

Hey guys. California is in the process of updating its geothermal regulations, (see links provided by Ben Barker of Raser Technologies, which may serve as a primer for OCD consideration in our final technical and policy recommendations (requested by 7/30/2010) to the EMNRD- ECMD for the report due to the Governor in December of 2010.

Steve Lucero of ECMD will be posting the draft report to the Governor on the Geothermal Consortium Website sometime in August 2010. I will route it to each of you for any final feedback to convey to ECMD for the final report.

For an update on OCD geothermal developments, please go to: http://ocdimage.emnrd.state.nm.us/imaging/AEOrderFileView.aspx?appNo=pCJC1004741751 (see "Geothermal Working Group 2010" thumbnail).

Note that ECMD is working to organize an Oil and Gas Geothermal Co-Production Symposium in Albuquerque in September 2010. Various state (OCD, OSE & NMED) and federal (BLM, BIA?..) agencies will be invited to discuss the regulatory issues while industry may present co-geothermal oil and gas power generation projects that may generate power for exploration and production activities in the oil patch and/or focus on power generation from existing deep seated oil and gas wells located away from potash areas and that do not pose a resource threat to oil and gas development. ECMD is on board with OCD and OSE on protecting NM's scare hydrologic and hydrogeologic freshwater resources; development of power grids with latest superconductive material for minimize power loss down the grid; pollution prevention/Waste Minimization initiatives- use of chemicals?; etc. in the oil patch.

Thank you in advance for your participation and assistance. I look forward to receiving your final recommendations on geothermal policy and technical recommendations by July 30, 2010. Please contact me if you have questions.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
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E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Tuesday, April 06, 2010 12:52 PM
To: 'Ben Barker'
Cc: Layne Ashton
Subject: RE: CA Geothermal regulations

Thanks Ben. I will be sending round 1 draft comments to the Geothermal Working Group this Friday and will consider what you have sent for the submittal up through the final report. Thanks again....

Carl J. Chavez, CHMM
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(Pollution Prevention Guidance is under "Publications")

From: Ben Barker [mailto:Ben.Barker@rasertech.com]
Sent: Tuesday, April 06, 2010 10:36 AM
To: Chavez, Carl J, EMNRD
Cc: Layne Ashton
Subject: CA Geothermal regulations

Good Morning Carl,

I hope your Easter break was a nice one.
At our last meeting you invited comment on geothermal regulation and I promised to get some information about California's system, with which I am most familiar. I was pleasantly surprised to find that California is in the midst of a major revision of its Geothermal regulations. I have attached a copy of the pending revised regulations for your convenience. The URL from which to download them directly is:

ftp://ftp.consrv.ca.gov/pub/oil/geothermal/New_Geothermal_Regs.pdf

The revision was overseen by Mike Woods, the long-time CDOGGR Geothermal District Engineer for the Imperial Valley, just before he was promoted to a Dark Side (O&G) job in Sacramento. Mike streamlined the geothermal language and incorporated the appropriate sections of the O&G regulations that CDOGGR supervisors have traditionally relied on only by reference. That sounded to me very much like the task you described yourself facing, so perhaps this document can give you some ideas.

The other attachment is an excerpt of the Geothermal portions of California's blowout prevention manual. I included the table of contents so you can see if you want to retrieve the entire document, but it is too large for my email. Only a small part at the end of Section 4 would apply to moderate temperature resources such as Lightning Dock. The full 27 MB manual can be downloaded in 3 parts from:

http://www.conservation.ca.gov/dog/geothermal/pubs_stats/Pages/instruction_manuals.aspx

Mike has been on an Easter break as well, but I'll try again to reach him today and suggest he give you a call. You might enjoy talking with him as he has great experience in both O&G and Geothermal permitting and oversight. He's also a very nice person. His new phone number in Sacramento is (916) 323-1783.

Hope that helps a bit.

Best regards,
Ben

VP Resource Management
Raser Technologies
5152 N. Edgewood Drive
Provo, UT 84604
801-765-1200 office
801-850-5904 direct
707-508-9963 mobile

Chavez, Carl J, EMNRD

From:	Mike_Smith@blm.gov
Sent:	Thursday, May 06, 2010 9:42 AM
To:	Chavez, Carl J, EMNRD
Cc:	Jay_Spielman@blm.gov
Subject:	Re: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues
Attachments:	pic13973.gif

Carl:

You're welcome. I'll be starting conversations with the BLM State Office regarding a geothermal MOU. I'll look at the UIO-999's, but some of the issues I see right would be eliminating any redundancy in bonding and water quality monitoring. Our State Office will have to be involved if we want this to be a State-wide MOU. This is probably going to take some time. We also have another geologist coming on board at Las Cruces BLM at the end of May, and we have not decided how to divide responsibilities just yet - he may be taking over some of the geothermal program. We'll have to see how things progress, but frankly, I may not be able to report much progress by the next meeting.

Regarding the question of whether a closed-loop heat pump system on Federal mineral estate would require a lease and royalties. I have spoken with Kermit Witherbee, who is the National Geothermal Program Manager for BLM.
and he has informed me that such systems are not subject to Federal lease and royalties, because such systems essentially operate using ambient heat.

Michael Smith
Geologist - BLM
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575-525-4421
Mike_Smith@blm.gov

"Chavez, Carl J, EMNRD" <CarlJ.Chavez@state.nm.us>
05/06/2010 06:05 AM

To
<Mike_Smith@blm.gov>

cc
"Altomare, Mikal, EMNRD" <Mikal.Altomare@state.nm.us>, "Brooks, David K., EMNRD" <david.brooks@state.nm.us>

Subject
Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues

(Embedded image moved to file: pic13973.gif)

Mike:

Thank you for your participation in yesterday's meeting. Based on the miscellaneous discussion of our meeting yesterday, could you please develop a draft MOU for OCD and BLM to consider going forward on geothermal projects? This will help the OCD to focus on this issues and this recommendation was identified in OCD's preliminary recommendations on technical, policy, etc. for the EMNRD Geothermal Working Group based on BLM's suggestion. To view OCD preliminary recommendations on geothermal, please go to OCD Online and search for: "UIC-999" and open the Geothermal Working Group Folder and this is the big picture for OCD right now. BLM is welcome to provide recommendations to the OCD going forward as our next meeting is in June 2010 with a report to the Governor due at the end of December 2010.

I have never developed an MOU, although I've reviewed them and am pre-occupied with two working groups on geothermal. This would place us ahead of the curve I think. Thank you.

Carl J. Chavez, CHMM
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Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Some OCD Initiatives with Stakeholder Agencies
Governor's Executive Order
Making NM the No.1 Leader in Renewable Energy
Carl Chavez- OCD (6/16/2010)

1) OCD has identified with OSE (water appropriation issues) the scarce fresh water resource issues in New Mexico and OCD is working with ECMD to help ensure commercial geothermal power companies are proposing alternative innovative heat exchange or transfer systems with fluids other than just fresh water for heat exchange in their engineering design and constructed systems.

2) OCD/BLM/? Memorandum of Understanding(s) (MOU) between state and/or federal agencies to minimize duplication of efforts and streamlining the commercial geothermal power permit process.

3) OCD determined in February of 2010 that it had full jurisdiction over Geothermal Regulations for low & high temperature geothermal heat extraction, which further streamlines the permit process in No. 2 above.

4) OCD Geothermal Well Bond General Amounts (~$10K Multi-Well & $5K Single-Well) are low and an incentive to commercial power generation company by reducing the cost of geothermal exploration and production in the state.

5) OCD is actively engaging state and federal agencies in evaluating and seeking a more efficient application review

and permit process with updated website resource page, and updated generic geothermal application form to assist applicants, general public, etc. OCD is concurrently working with the geothermal regulations working group (GRWG) (see No. 3 above), which is also helping to compliment the Governor's Executive Order for Renewable Energy Production- "Deep Source Geothermal."

From: Carl Chavez- OCD Environmental Bureau
To: Steve Lucero- ECMD
Date: 6/16/2010

Subject: OCD Technical & Policy Recommendation Examples with Comments

Some preliminary examples provided by ECMD where OCD has commented include the following:

1) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc.

Geothermal and associated evaporation loss of water resource(s) will always be a fundamental concern until commercial power companies design heat transfer systems independent or non-reliant on hydrologic and hydrogeologic water resources for heat exchange and generation of power. Until new engineered systems (i.e., air and ethylene glycol working fluids instead of fresh water) with innovative heat transfer systems are developed, locations with prolific water supplies like the Animas River Valley, Rio Grande Valley or Pecos River Valley may be preferred locations for power plants? In addition, fault and shattered bedrock locations that may be subject to seismic events near populated areas may need to be considered.

2) Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources;

For example, a flash steam system is less efficient than a binary cycle system because the flash steam heat is uncontrolled and evaporates the water resource at a much higher rate; thus, a low efficient system that wastes the geothermal heat or resource).

Designs with heat exchangers that utilize air and/or other working fluids for the exchange of heat in the power generation process would reduce reliance on New Mexico's scarce fresh water resources and also reduce the water appropriation issues of the OSE, which seems to be an obstacle to geothermal power generation permitting. Pollution prevention and waste minimization, i.e., recycling or reuse of the water resource when used, may also help to minimize depletion of fresh water supplies and commercial power companies working in NM need to come up with viable solutions.

3) Pollution prevention and waste minimization (i.e., environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals;

MagTek Inc. (see representative contact info. provided below) has a chemical free water treatment system.

Mr. Jerry C. Davis
CEO / President

122 E. Wisconsin Rd.
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The OCD is aware of other electrical methods that control fouling, scale, rust, etc. without chemical application, which has been forgotten largely due to influence of chemical treatment companies that sell various anti-fouling/corrosion chemical products. There may be certain circumstances when an environmentally friendly biocide is added to a certain treatment system unit, i.e., boiler unit, using the MagTek, Inc. technology. More case-studies and research are needed on magnetic and electric corrosion inhibitor technologies to document the success and understanding of the theory behind these types of technologies.

4) Aesthetic concerns (i.e., noise from well testing; large pits, etc.) need to be developed; Focus on low-quality *or non-fresh* deeper geothermal gradient formation water resources (> 2,500 ft.) in the oil and gas fields of NM accessible to nearby transmission grids;

*Annual well testing may be noisy over a protracted period and may be more appropriate in the oil and gas fields of NM than nearby communities. OCD regulations for "noise" under 19.14.31.8 NMAC are as follows: "***NOISE ABATEMENT:** Adequate noise abatement equipment shall be installed and maintained in good condition to reduce noise to a level approved by the division or its representative on any drilling or producing geothermal resources well located within 1,500 feet of a habitation, school or church. [Recompiled 12/31/01]." Colorado has more definitive regulatory limits on maximum decibel levels allowed and the field monitoring required to determine whether a "noise" violation is occurring from oil and gas field activity.

Co-geothermal power production combined with oil and gas production with existing power grid infrastructure, and at depths greater than 2,500 ft, is not subject to water appropriation by the OSE with exception of any shallow fresh makeup water needed for heat exchange. Spent brine after oil, gas and geothermal heat extraction may be routed to a lined pit and then re-injected into an OCD permitted Class II SWD Well. There may be existing deep oil and gas wells with water temperature thermal gradients high enough to produce power in these fields, but well construction is critical to determining the feasibility of reworking any plugged and abandoned well. This project may be permitted under the NM UIC Program as Class II SWD Wells, which entails an administrative process.

5) Focus on transmission grid assessment and construction into identified deep-source geothermal resource areas to convey power inter-intra state;

Power transmission grids already exist in the oil and gas fields of NM; therefore, it makes sense to produce geothermal power in these types of fields provided a viable geothermal reservoir(s) or resource(s) exists. One goal is power generation to support ongoing operator oil and gas field activities, and the other goal may be to produce commercial power to send down the existing grid system.

6) OCD shall facilitate a permit and bonding process for re-entry into existing oil and gas wells that will consist of submittal of G-101, G-102, G-103 along w/ Unnumbered form and C-108 to expedite geothermal applications (including exploratory single well approach without discharge permit issuance and public notice process?) in the oil fields of NM;

Geothermal Co-Production permit applications will likely be considered an oil and gas UIC Class II Well type application, which may not include the WQCC Regulatory discharge permit framework? The C-108 specifies the main regulatory requirements for injection or disposal wells, which includes public notice and a hearing process based on any public comments received from a notice and the applications are handle by OCD Administratively. The unnumbered or generic form is being revised to address the OCD's recent findings that it is responsible for both low and high temperature (boiling at STP) geothermal extraction of the heat.

7) OCD already has a WQCC process in place for permitting larger geothermal exploration and production projects;

OCD has a Geothermal Resource Page under its "Publications" link of its website. Any project that includes a UIC Class V injection well(s) with the exception of UIC Class II SWD Wells, may likely require a WQCC 20.6.2 NMAC discharge permit from the OCD. A generic geothermal form and C-108 "Application for Authorization to Inject" form submittal. In all cases, the OCD Geothermal G-Forms (G-101-102 and G-103 for existing well workovers) are required to be completed to satisfy OCD Geothermal Regulations. OCD will combine the geothermal component of the application with a WQCC discharge permit to prevent contamination to surface and ground water.

8) OCD geothermal exploration w/o WQCC discharge permit process for geothermal exploration in existing oil and gas wells in the oil fields of NM?;

OCD believes that it may be possible to permit Co-Geothermal Production Wells as UIC Class II Wells under its existing injection well and oil and gas regulations where the activity is considered oil and gas due to primary wastes involved. This would be an administrative process (generic geothermal and C-108 forms) with associated public notice requirements and possible hearing based on public comments received, if any.

9) Develop policy for number 8 above

It may already be formalized in the present OCD UIC Class II application process (generic and C-108) process? Once we receive an application(s), the OCD will follow the appropriate administrative process.

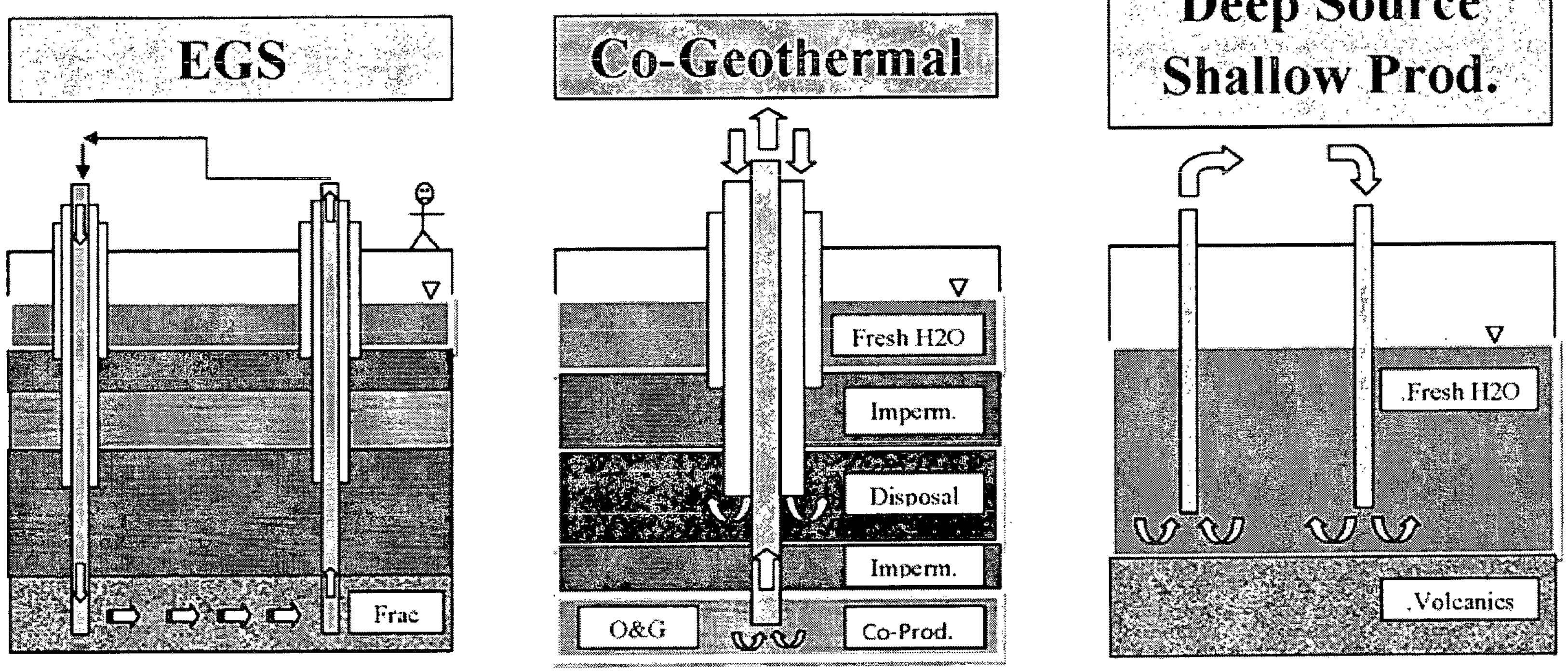
Ownership of Geothermal Resources

David Brooks

OCD Engineering Bureau- SF

(505) 476-3450

Geothermal Power Scenarios



Ownership of Geothermal Resources

<u>Federal Lands</u>: Where US Gov't owns Minerals, it owns Geothermal (GT) resources.

<u>Other Split-Estate Lands</u>: Mineral owner <u>probably</u> owns GT resources.

<u>Surface Owner Protection Act</u> does not apply.

Geothermal Resources Conservation Act

- Oil Conservation Division (OCD) has general regulatory jurisdiction over all aspects of geothermal development, including:
  - Well drilling: location and construction of wells
  - Waste disposal: OCD administers Water Quality Act as applied to geothermal development, approves "discharge plans" and permits Class V geothermal injection wells.
  - Correlative rights: OCD must adjust competing claims of owners and users of the same geothermal reservoir.

<u>Exceptions to OCD Jurisdiction</u>

- <u>Heat Exchange Systems</u>: Not Geothermal

- <u>"Incidental Use"</u>: A limited category of uses of geothermal heat <u>incidental to water use</u> is excluded by statute from OCD jurisdiction.

- <u>Indian Lands</u>:

  Permit from federal EPA or Tribe required for injection wells.

  Other OCD jurisdiction <u>may be</u> preempted by federal law or Tribal sovereignty.

OCD Jurisdiction NOT Exclusive

- Other State Agencies have authority over particular aspects of Geothermal Operations:
  - Office of the State Engineer (OSE) issues permits for water use, except as discussed below.
  - Regulations and Licensing Department (RLD) regulates construction.
  - Public Regulation Commission (PRC) regulates power generation.
  - Other agencies may also be involved.
- Local Government land-use and other regulatory requirements may apply.

Use of WATER in Geothermal Operations

- An OSE permit (or water right is) required <u>except</u> for:

  - <u>Co-production with Oil or Gas</u> where the water would be produced from the oil or gas well even if its geothermal heat were not used.

  - Production of water from an aquifer <u>>2,500 feet below the surface, where the water contains >1,000 ppm Total Dissolved Solids.</u>

    (Certain notice requirements apply. See NMSA 1978 Sections 72-12-26 and 72-12-27.)

GT/O&G Co-Production

(a simpler regulatory environment)

Geothermal/Oil & Gas Co-Production, using common wells, will be simpler because:

- OSE permits will (generally) not be required.

- Water Quality Act discharge permits will (generally) not be required. Water produced from an oil and gas well can be re-injected into the same or a different well pursuant to a Class II injection permit issued through OCD's Engineering Bureau.

GT vs. O&G: Possible Conflicts

- Oil and Gas operators may have concerns about geothermal development adversely affecting existing or potential future oil and gas production from the same or proximate formations.

- Geothermal potential of a formation may be adversely affected by removal or injection of water in the course of oil and gas operations.

- OCD has jurisdiction of these issues, but has developed no applicable rules.

GT vs. Potash: Possible Conflicts

- Conflicts between O&G developers and potash developers have been extensive.
- GT interference with potash mining, though less of a concern that O&G, also presents potential problems.
- OCD has jurisdiction over GT/Potash conflicts. However OCD's R-11-P (relating to O&G vs. Potash) does not apply.
- Extensive and on-going litigation between O&G and Potash developers indicates potash areas (in Eddy and western Lea counties) are unlikely candidates for geothermal development in the near future.

GT vs. Other Mining: Possible Conflicts

- Neither OCD, nor any other state agency, has jurisdiction over conflicts that could arise between geothermal development and mining activities, other than potash mining.

- USBLM may have jurisdiction over such conflicts on federal land.

A Need for Rulemaking

- OCD's Geothermal Rules (developed in the 1980s) need substantial revision to address current geothermal issues, particularly with respect to correlative rights.

- OCD looks forward to working with stakeholders, including GT developers and other agencies, to develop up-to-date and effective GT rules.

GEOTHERMAL REGULATION IN NEW MEXICO PURSUANT TO THE GEOTHERMAL RESOURCES CONSERVATION ACT:

Ongoing, multi-agency effort to clarify permitting framework pursuant to the Act in light of increased interest in geothermal energy.

June 16, 2010

Mikal M. Altomare, Assistant General Counsel
Energy, Minerals and Natural Resources Dept,
Oil Conservation Division

Geothermal Regulation in New Mexico Pursuant to the Geothermal Resources Conservation Act:

- Threshold determination is required regarding whether the project constitutes a "geothermal resource" under NM Law.

- Requires cooperative (& sometimes simultaneous) management by multiple state agencies.

OCD's Role in Geothermal Regulation

71-5-6-COMMISSION'S AND DIVISION'S POWERS AND DUTIES.

A. In addition to its other powers and duties, the division shall have, and is hereby given, jurisdiction over all matters relating to the conservation of geothermal resources and the prevention of waste of potash as a result of geothermal operations in this state. It shall have jurisdiction, authority and control of and over all persons, matters or things necessary or proper to enforce effectively the provisions of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] or any other law of this state relating to the conservation of geothermal resources and the prevention of waste of potash as a result of geothermal operations. Provided, however, nothing in this section shall be construed to supersede the authority which any state department or agency has with respect to the management, protection and utilization of the state lands or resources and its jurisdiction.

B. The commission shall have concurrent jurisdiction and authority with the division to the extent necessary for the commission to perform its duties as required by the Geothermal Resources Conservation Act. In addition, any hearing on any matter may be held before the commission if the division director, in his discretion, determines that the commission shall hear the matter.

OCD's Role in Geothermal Regulation

71-5-7-Power of Commission & Division to Prevent Waste & Protect Correlative Rights

The commission and division are hereby empowered, and it is their duty, to prevent the waste prohibited by the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] and to protect correlative rights, as in that act provided. To that end, the commission and division may make and enforce rules, regulations and orders relating to geothermal resources, and to do whatever may be reasonably necessary to carry out the purposes of that act whether or not indicated or specified in any section thereof.

OCD's Role in Geothermal Regulation

71-5-3. Definitions.

As used in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978]:

A. "**geothermal resources**" means *the natural heat of the earth or the energy*, in whatever form, below the surface of the earth *present in, resulting from, created by or which may be extracted from this natural heat* and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances;

E. "**geothermal reservoir**" means an underground reservoir containing geothermal resources, whether the fluids in the reservoir are native to the reservoir or flow into or are injected into the reservoir;

F. "**geothermal field**" means the general area which is underlaid or reasonably appears to be underlaid by at least one geothermal reservoir;

G. "**low-temperature thermal reservoir**" means a geothermal reservoir containing low-temperature thermal water, which is defined as *naturally heated water, the temperature of which is less than boiling at the altitude of occurrence*, which has additional value by virtue of the heat contained therein and is found below the surface of the earth or in warm springs at the surface;

Incidental Use Exclusion; Incidental Loss or Extraction of Heat

71-5-2.1 NMSA

When the application of potable water to a beneficial use involves the incidental loss or extraction of heat, *and* the water is 250 degrees Fahrenheit or less, *then that heat is not a geothermal resource* for which a royalty is due. In such a case, the use is not governed by laws related to geothermal resources but is simply governed by Chapter 72 NMSA 1978.

IN OTHER WORDS:

In order to fall within the exclusion to "geothermal resource," all four of the following three requirements must be met:

1. The water is "potable,"
2. The water is being applied to a beneficial use,
3. The heat is being lost or extracted from the water "incidentally," AND
4. The water is 250° or less.

WHEN ALL FOUR REQUIREMENTS ARE MET FOR THE EXCLUSION:

- The application/use/project does not require a geothermal permit through the OCD, AND
- No state royalty payments are required pursuant to the Act.

HEAT EXCHANGE/HEAT TRANSFER SYSTEMS – COMMONLY REFERRED TO AS "GEOTHERMAL" HEAT PUMP SYSTEMS

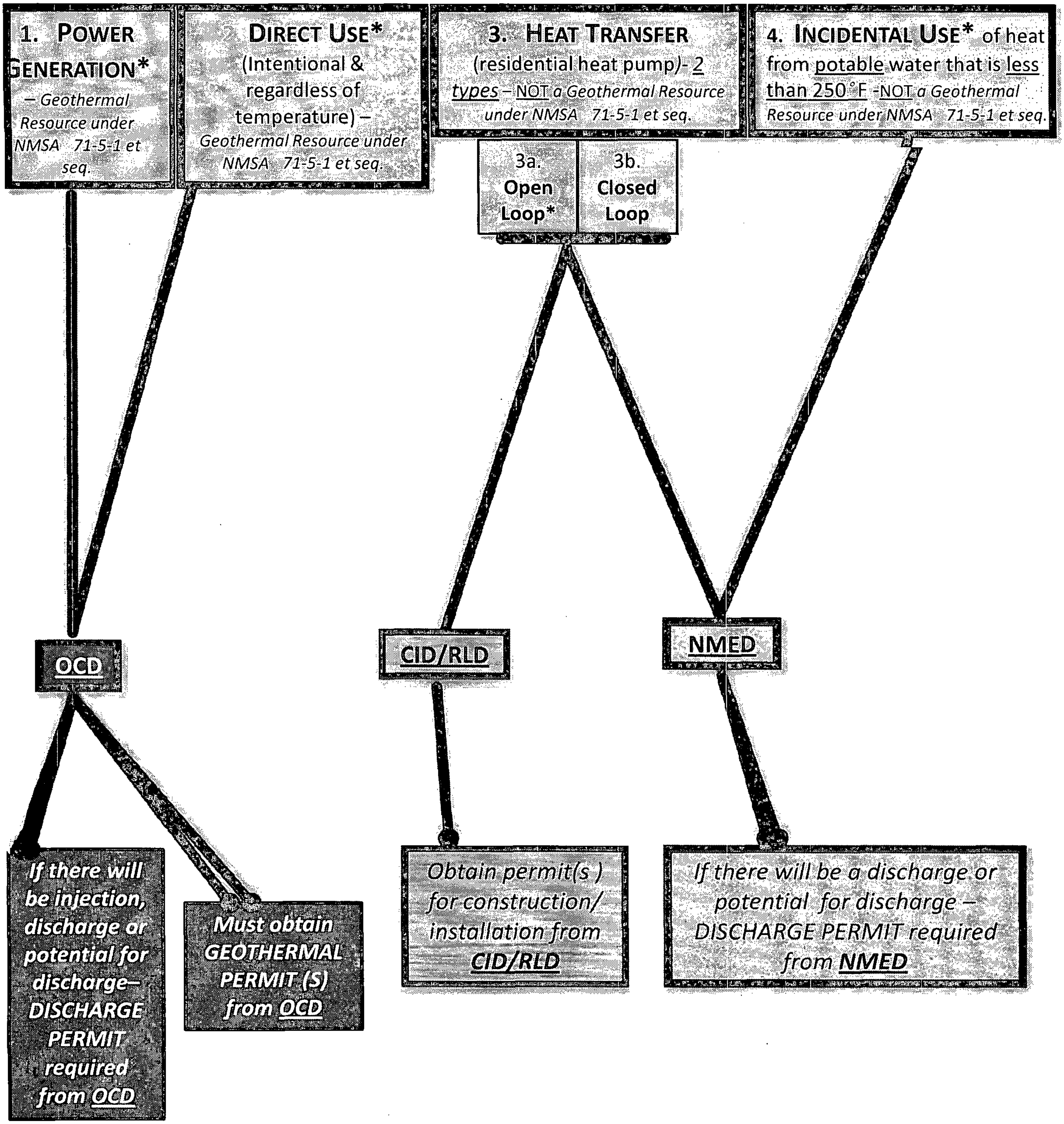
•The engineering and scientific communities prefer the terms "geoexchange" or "ground source heat pumps" because geothermal power traditionally refers to heat originating from deep in the Earth's mantle. *Wikipedia "Geothermal Heat Pump"*

•Unlike a project tapping into a geothermal reservoir, these systems use the natural heat storage capacity of the earth or ground water to provide energy efficient heating and cooling. The heat pump equipment works like a reversible refrigerator by removing heat from one location and depositing it in another location. *Geothermal Heat Pumps, Toolbase Services, www.toolbase.org.*

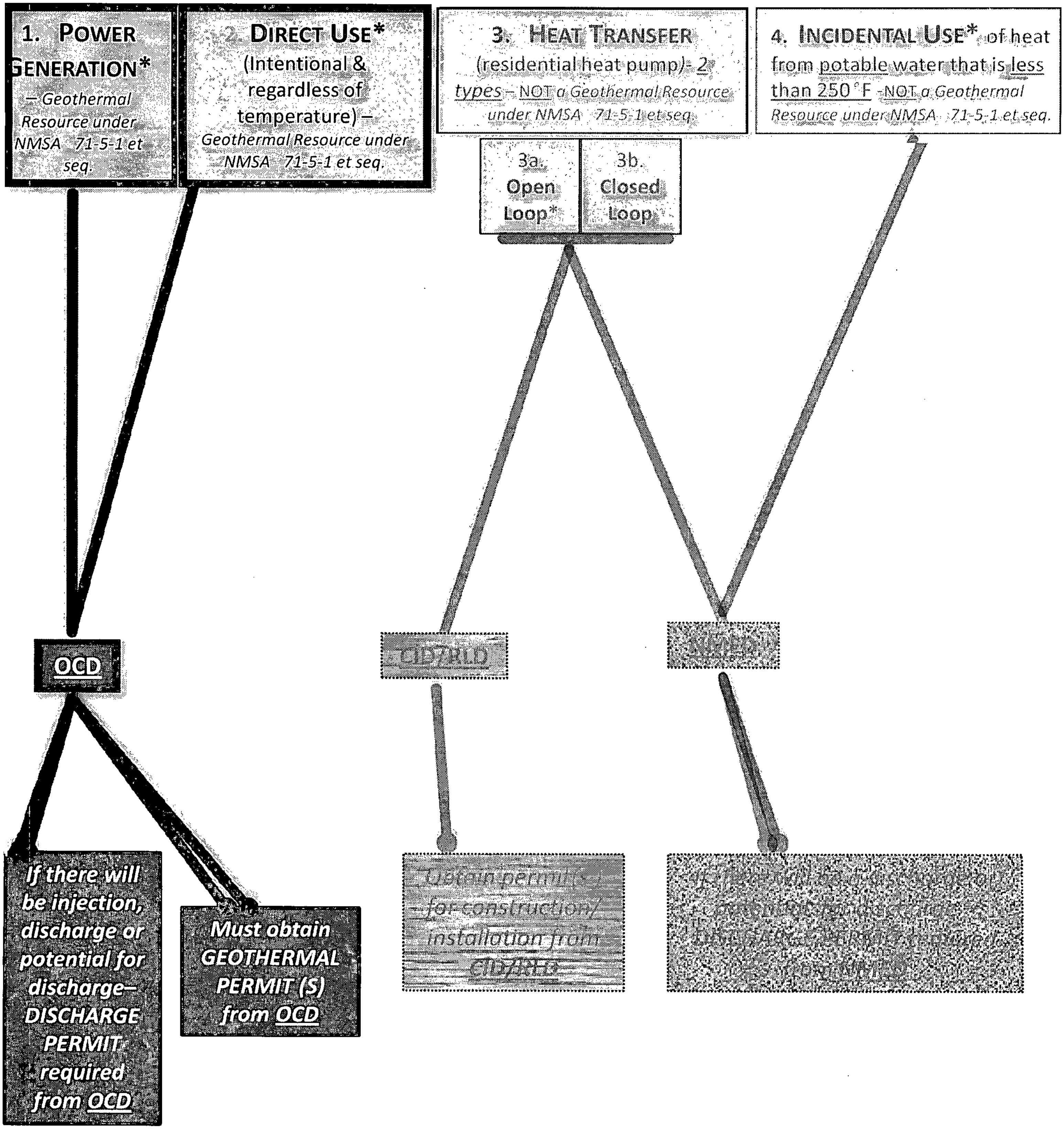
REVIEW:

Geothermal Resource → The natural heat of the earth or the energy... present in, resulting from, created by or which may be extracted from this natural heat.

"GEOTHERMAL" HEAT PUMPS DO NOT USE THE NATURAL HEAT OF THE EARTH. THEY ARE THUS NOT GEOTHERMAL RESOURCES, AND THEREFORE DO NOT FALL UNDER THE PURVIEW OF EITHER THE GEOTHERMAL RESOURCE CONSERVATION ACT OR THE REGULATORY AUTHORITY OF THE OCD.



* **OSE:** With the exception of 3.b, above (*closed loop heat transfer projects*), all other projects potentially involve **water appropriation**. Operators are responsible for ensuring that all **water appropriation** issues are addressed, proper documentation is submitted and permits are obtained through the OSE where required.



* **OSE:** With the exception of 3.b, above (*closed loop heat transfer projects*), all other projects potentially involve **water appropriation**. Operators are responsible for ensuring that all **water appropriation** issues are addressed, proper documentation is submitted and permits are obtained through the OSE where required.

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
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1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Revised June 9, 2010

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR GEOTHERMAL FACILITIES/PROJECTS

(Permit Expires 5-years from date of discharge permit issuance and/or OCD project approval, whichever is later)

☐ New ☐ Renewal ☐ Modification

1. DISTRICT: ______________________ 2. OGRID *(if applicable)*: ______________

3. OPERATOR: ______________________

4. ADDRESS: ______________________

5. CONTACT PERSON: ______________________ PHONE: ______________

6. LOCATION: ________/4 ________/4 Section ________ Township ________ Range ________

**APPLICANT MUST SUBMIT A LARGE SCALE TOPOGRAPHIC MAP SHOWING EXACT LOCATION WITH GPS COORDINATES.

7. Attach documentation specifying the name, telephone number and address of the land/surface owner(s) of the facility site. If the facility site is comprised of more than one parcel, and not all parcels are owned by the same landowner(s), identify what portion of facility site is owned by each by attaching a diagram.

8. Attach documentation specifying the name, telephone number and address of the mineral right's interest holders for the site location, and for each specify what their interest(s) is(are).

9. Attach documentation containing a description of the facility with a diagram clearly indicating the location of fences, pits, dikes and tanks on the facility.

10. Attach documentation identifying all materials that are currently or will be stored or used at the facility during drilling/installation/site construction and/or during the regular course of operations at the facility.

11. Specify whether there will be a **ground water appropriation** associated with the proposed project under the jurisdiction of the Office of the State Engineer (OSE): YES ☐ NO ☐

12. USE DETERMINATION:
    a. Is the primary use of any water involved in the proposed project, the extraction of the heat carried by that water?
       YES ☐ NO ☐ PROJECT DOES NOT INVOLVE WATER ☐
    b. If NO to "a." above, please answer all three following questions:
       i. Is the extraction of heat "incidental" to another beneficial, primary use of the water?
          YES ☐ NO ☐
       ii. Is the water less than 250°F?
          YES ☐ NO ☐
       iii. Is the water potable*?
          YES ☐ NO ☐
          **See WQCC Rule 20.7.10 NMAC regarding drinking water standards.*

13. Attach documentation identifying and describing all present sources of effluent and waste solids. Specification of average quality and daily volume of waste water must be included.

14. Attach documentation identifying and describing all current liquid and solid waste collection/treatment/disposal procedures.

15. Attach documentation specifying all proposed modifications to existing collection/treatment/disposal systems.

16. Attach documentation identifying and describing a routine inspection and maintenance plan for the facility/project that will ensure permit compliance.

17. Attach documentation detailing a contingency plan for the reporting and clean-up of spills or releases at the facility/project.

18. Attach documentation reflecting geological/hydrological information for the facility/project. Documentation of depth to and quality of ground water must be included.

19. Attach documentation detailing a facility closure plan, and any other information necessary to demonstrate compliance with any other OCD or WQCC rules, regulations and/or orders.

20. APPLICANT-DESIGNATED GEOTHERMAL PROJECT TYPE(s):

☐ Open loop (single/multiple well for water withdrawal, water returned to a surface source)

☐ Open loop (single/multiple well for water withdrawal, water returned to a second well)

☐ Standing Column (single well for water withdrawal and water return)

☐ Closed-loop

☐ Other*

** Please note that heat pump systems (open or closed-loop) are **not** considered "geothermal" and are therefore not permitted through the OCD. These projects are handled directly by the Regulation and Licensing Department/ Construction Industries Division (RLD/CID) and, where groundwater is potentially impacted, by NM Environment Dept. (NMED). Inquiries and applications for permits relating to heat pump systems should not be made via this form, and should instead be directed to CID/RLD and to the NMED.*

ADDITIONAL IMPORTANT INFORMATION:

- OCD may require OSE certified water well drillers for certain projects.
- Applicants are responsible for contacting the appropriate Federal, State, Tribal and/or local government agencies responsible for rent, royalty and/or tax assessment.
- OCD approval of this application does not relieve operator of responsibility should their operations pose a threat to ground water, surface water, human health or the environment. In addition, OCD approval does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

21. **CERTIFICATION**: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: ______________________ **Title:** ______________________

Signature: ______________________ **Certification/License #:** ______________________

E-mail Address: ______________________ **Date:** ______________________

Name: ______________________ **Title:** ______________________

Signature: ______________________ **Certification/License #:** ______________________

E-mail Address: ______________________ **Date:** ______________________

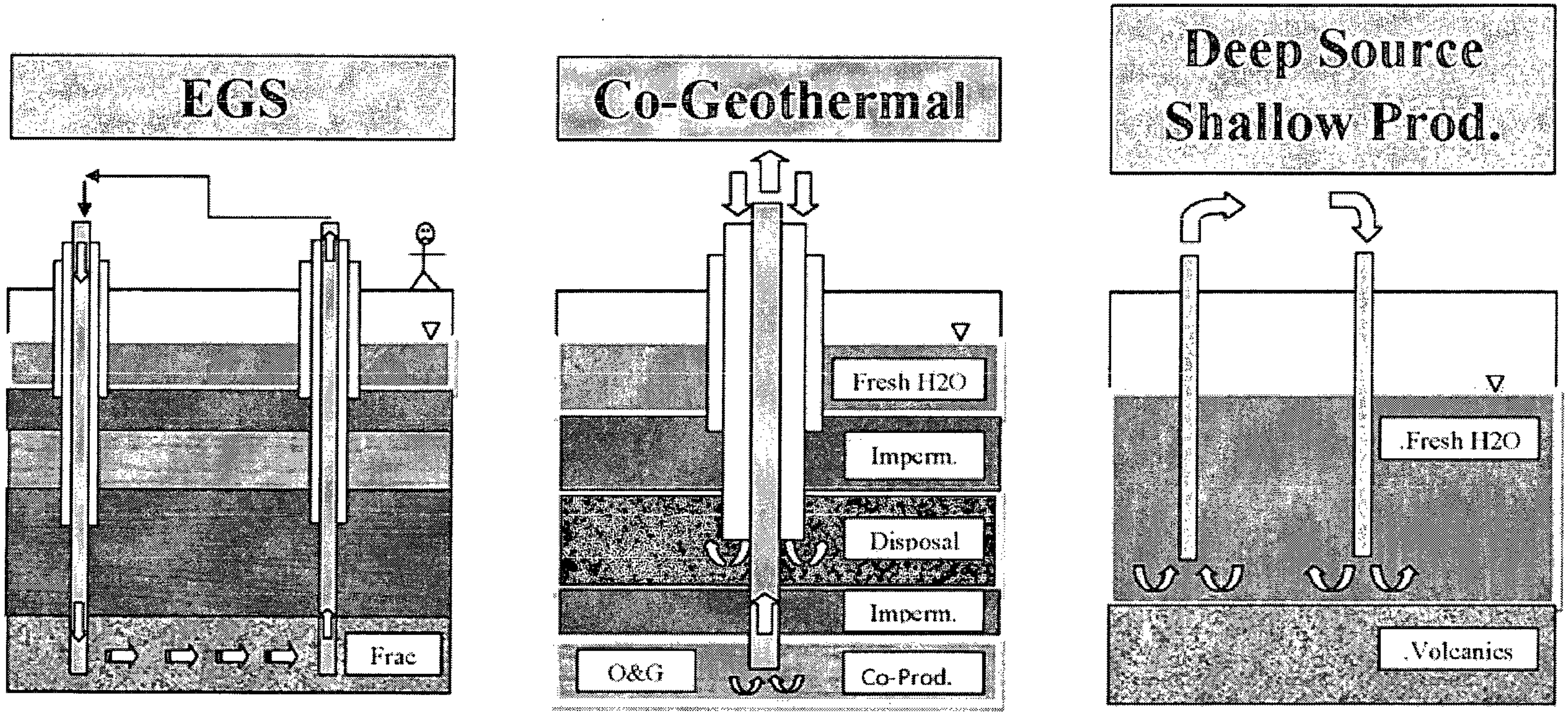
OCD Geothermal Permit Process

Carl Chavez

OCD Environmental Bureau- SF

(505) 476-3490

Geothermal Power Scenarios



Oil Conservation Division (OCD)
Geothermal Power Regulations, Application, Bonding, Forms& Resource Information

(Revised: 08/18/2009)

Geothermal Regulations:

Chapter 71: Energy & Minerals
Article 5: Geothermal Resources Conservation Act
Chapter 71, Article 5 NMSA 1978

Title 19: Natural Resources & Wildlife
Chapter 14: Geothermal Power
Title 19, Chapter 14 NMAC (11-15-83 Recompiled 12-31-01)

Water Quality Control Commission 20.6.2 NMAC (Class V Injection Well Designation)

Application Forms:
Geothermal
Permit to Inject (C-108)

Drilling (G-101 & 102) & Bond Forms (please note that bonds for Class V Injection Wells are handled separately under the WQCC Regulations (UIC Program) while geothermal production or development wells are bonded separately under the "G" Forms and associated geothermal regulations):
Geothermal Exploration & Production Forms (see "Geothermal Well Forms")

Bonding (see "Bond Forms" GT-B-1 and GT-B-2)

	GEOTHERMAL WELL FORMS		
G-101	Application for Permit to Drill, Deepen or Plug Back	PDF	
G-102	Well Location and Acreage Dedication	PDF	
G-103	Sundry Notice	PDF	
G-104	Certificate of Compliance and Authorization to Produce	PDF	
G-105	Well Log	PDF	
G-106	Well Summary Report	PDF	
G-107	Well History	PDF	
G-108	Monthly Production Report	PDF	
G-109	Monthly Purchaser's Report	PDF	
G-110	Monthly Injection Report	PDF	
G-111	Annual Temperature and Pressure Test	PDF	
G-112	Application to Place Well on Injection	PDF	
	UNNUMBERED FORMS		
	Discharge Plan Application for Service Companies, Gas Plants, Refineries, Compressor, Geothermal Facilities and Crude Oil Pump Stations	PDF	DOC
	BOND FORMS		
B-B	$50,000 Blanket Plugging Bond (4/2009 - 7/2009)	PDF	DOC
CBA	Assignment of Cash Collateral Deposit (4/2009 - 7/2009)	PDF	DOC
CBB	Blanket Cash Plugging Bond (4/2009 - 7/2009)	PDF	DOC
OCD-LC	Letter of Credit - To be used to satisfy the financial assurance requirement for wells (4/2009 - 7/2009)	PDF	DOC
GT B-1	Geothermal One Production-Well Plugging Bond -- Surety Bond	PDF	DOC
GT B-2	Geothermal Multi-Production Well Plugging Bond -- Surety Bond	PDF	DOC
	Geothermal Injection-Well Plugging Bond -- Cash Plugging Bond	PDF	
	Geothermal Injection-Well Plugging Bond -- Assignment of Cash Collateral Deposit	PDF	

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State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Revised June 10, 2003

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR SERVICE COMPANIES,GAS PLANTS, REFINERIES, COMPRESSOR, GEOTHERMAL FACILITES AND CRUDE OIL PUMP STATIONS

(Refer to the OCD Guidelines for assistance in completing the application)

☐ New ☐ Renewal ☐ Modification

1. Type: ____________________

2. Operator: ____________________

   Address: ____________________

   Contact Person: ____________________ Phone: ____________________

3. Location: ________/4 ________/4 Section ________ Township ________ Range ________
   Submit large scale topographic map showing exact location.

4. Attach the name, telephone number and address of the landowner of the facility site.

5. Attach the description of the facility with a diagram indicating location of fences, pits, dikes and tanks on the facility.

6. Attach a description of all materials stored or used at the facility.

7. Attach a description of present sources of effluent and waste solids. Average quality and daily volume of waste water must be included.

8. Attach a description of current liquid and solid waste collection/treatment/disposal procedures.

9. Attach a description of proposed modifications to existing collection/treatment/disposal systems.

10. Attach a routine inspection and maintenance plan to ensure permit compliance.

11. Attach a contingency plan for reporting and clean-up of spills or releases.

12. Attach geological/hydrological information for the facility. Depth to and quality of ground water must be included.

13. Attach a facility closure plan, and other information as is necessary to demonstrate compliance with any other OCD rules, regulations and/or orders.

14. CERTIFICATIONI hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: ____________________ Title: ____________________

Signature: ____________________ Date: ____________________

E-mail Address: ____________________

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL
RESOURCES DEPARTMENT

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, New Mexico 87505

FORM C-108
Revised June 10, 2003

APPLICATION FOR AUTHORIZATION TO INJECT

I. *PURPOSE:* ______ *Secondary Recovery* ______ *Pressure Maintenance* ______ *Disposal* ______ *Storage*
Application qualifies for administrative approval? ______ Yes ______ No

II. OPERATOR: ______

ADDRESS: ______

CONTACT PARTY: ______ PHONE: ______

III. WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection. Additional sheets may be attached if necessary.

IV. Is this an expansion of an existing project? ______ Yes ______ No
If yes, give the Division order number authorizing the project: ______

V. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.

VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.

VII. Attach data on the proposed operation, including:

1. Proposed average and maximum daily rate and volume of fluids to be injected;
2. Whether the system is open or closed;
3. Proposed average and maximum injection pressure;
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).

*VIII. Attach appropriate geologic data on the injection zone including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.

IX. Describe the proposed stimulation program, if any.

*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted).

*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.

XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.

XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: ______ TITLE: ______

SIGNATURE: ______ DATE: ______

E-MAIL ADDRESS: ______

* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal: ______

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

(1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.

(2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.

(3) A description of the tubing to be used including its size, lining material, and setting depth.

(4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

(1) The name of the injection formation and, if applicable, the field or pool name.

(2) The injection interval and whether it is perforated or open-hole.

(3) State if the well was drilled for injection or, if not, the original purpose of the well.

(4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.

(5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

(1) The name, address, phone number, and contact party for the applicant;

(2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;

(3) The formation name and depth with expected maximum injection rates and pressures; and,

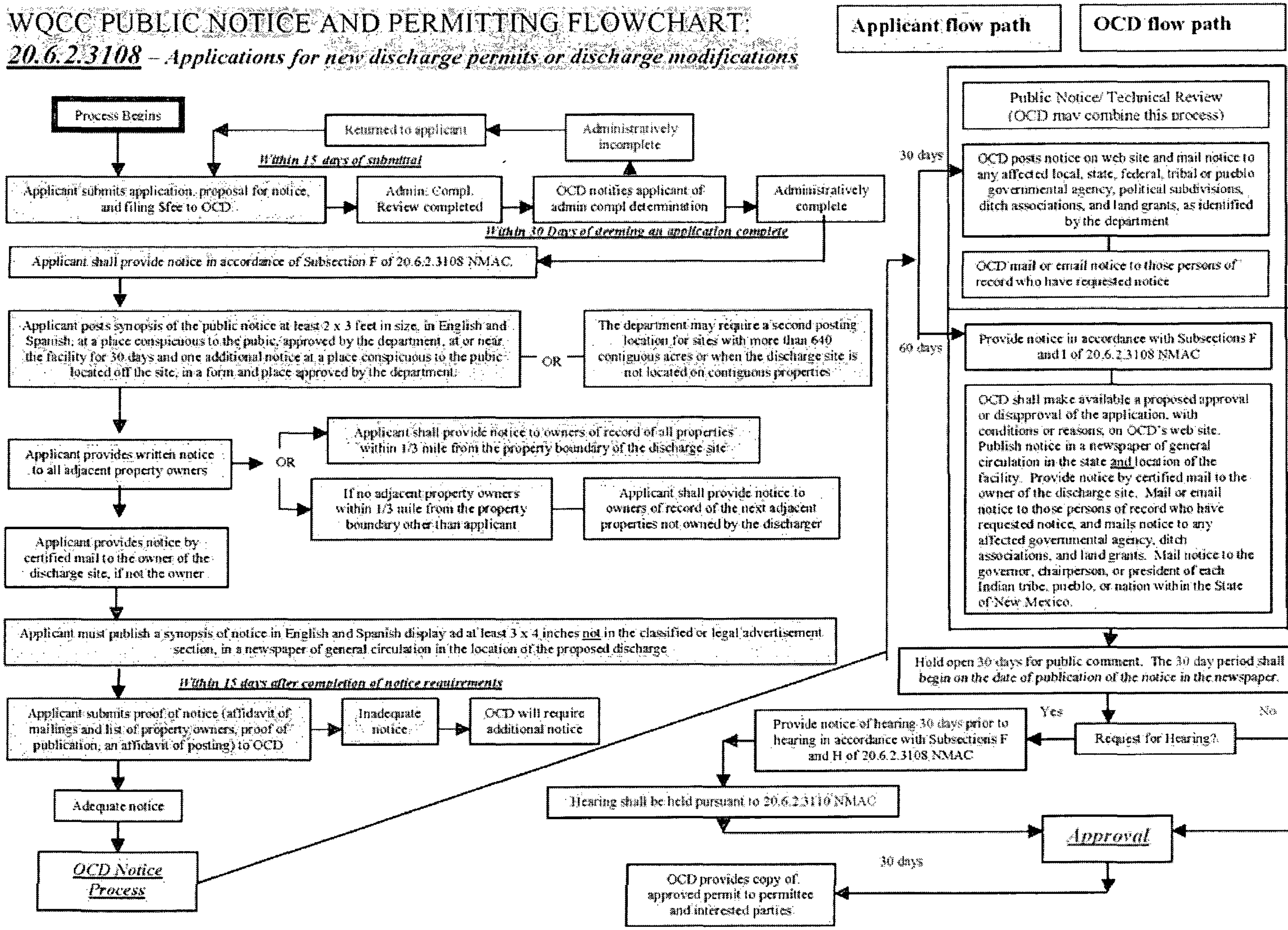
(4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

WQCC PUBLIC NOTICE AND PERMITTING FLOWCHART:

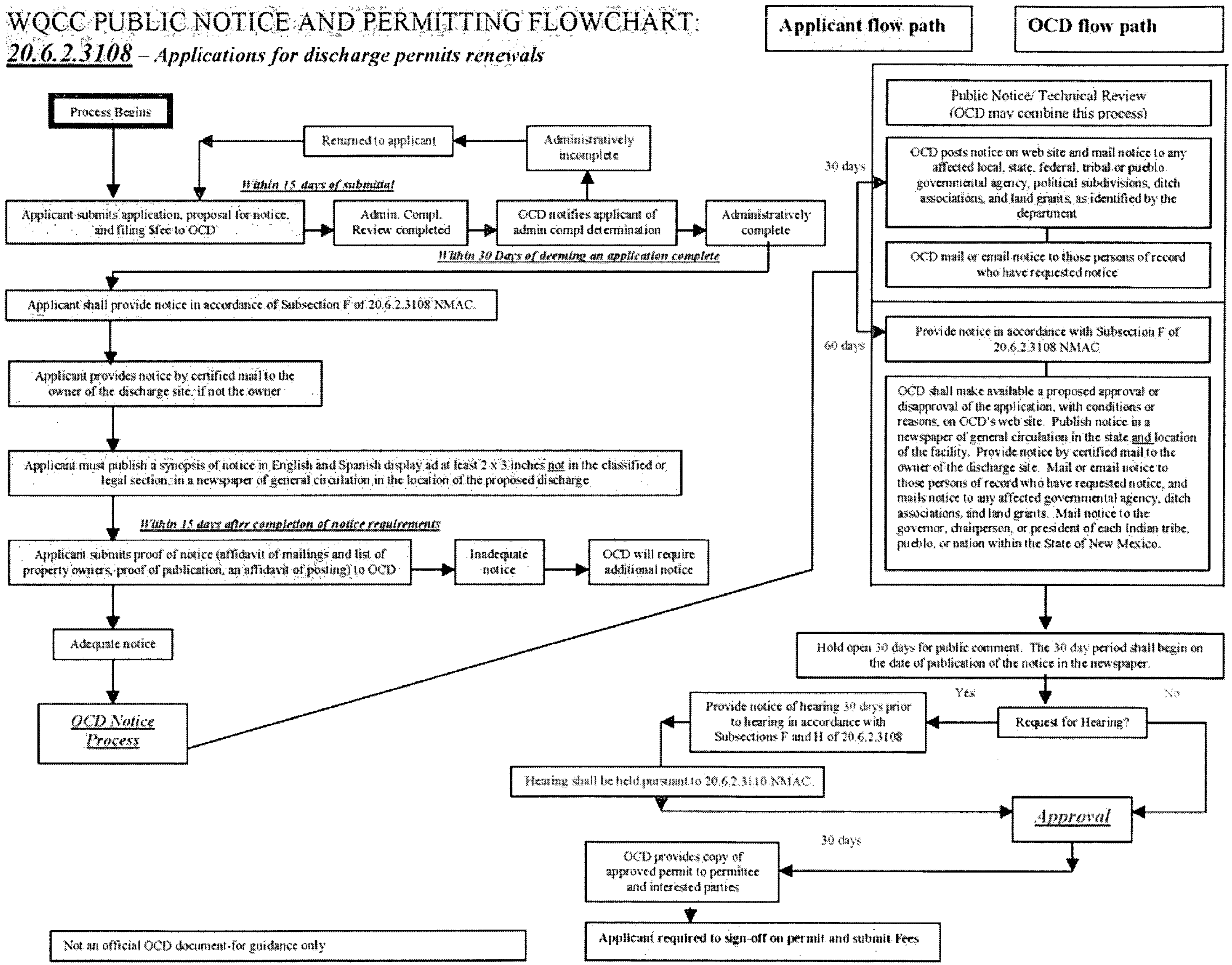
__20.6.2.3108__ – Applications for new discharge permits or discharge modifications



Not an official OCD document-for guidance only

WQCC PUBLIC NOTICE AND PERMITTING FLOWCHART:

__20.6.2.3108__ – Applications for discharge permits renewals



Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Wednesday, June 02, 2010 7:52 AM
To: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; Brooks, David K., EMNRD; Ezeanyim, Richard, EMNRD; Warnell, Terry G, EMNRD; Lucero, Stephen A., EMNRD
Subject: OCD Geothermal Deep-Source Brainstorming Session (Round 2)

Gentlemen:

Re: EMNRD and Geothermal Working Group (Working Group) Mission with Report to be Completed by the End of December 2010. The logistics requires all comments to be received in a timely manner for consideration into the final report; therefore, the deadlines established below place us ahead of the last call for final comments.

The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource.

As you are aware, OCD provided its preliminary comments on the database, technical and policy recommendation (see Mission Statement above) on April 9, 2010 to the ECMD and the Geothermal Consortium. The OCD document may be viewed on OCD Online at "UIC-999" under the "Geothermal Working Group- 2010" thumbnail at http://ocdimage.emnrd.state.nm.us/imaging/AEOrderFileView.aspx?appNo=pCJC1004741751.

The Working Group is now shifting into 3rd Gear as we enter the turn toward the finish line in completion of our mission. Those of you who love geothermal, but were unable to participate in the first round of OCD comments, now get a final opportunity to review the preliminary OCD comments to assess the issues and provide for the record your detailed engineering, technical and policy recommendations for geothermal power, nursery, aquaculture, etc. (see highlighted sentence of mission above) in New Mexico.

Please study the folders under OCD Online "UIC-999" and add your final engineering, technical and policy recommendations to the following "brainstorm" document by Wednesday, July 31, 2010: L:\ENVIRONM\WORD\COMMON\OCD Training\OCD PROGRAMS\UIC PROGRAM\UIC WELLS\UIC Class V Geothermal Well Application Process\Geothermal Work Group 2010\OCD Draft Geothermal Brainstorm Sheet 7-31-2010.doc.

Thank you in advance for your input in this matter. Please contact me if you have questions or wish to discuss geothermal issues.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

OCD Recommendations to ECMD Geothermal Working Group (Preliminary Recommendations)
Last Updated by Carl Chavez- OCD: 4-9-2010

OCD Online Geothermal Work Group Folder: UIC-999

The EMNRD and Geothermal Working Group Mission are briefly stated below.

"The Geothermal Group shall oversee the development of a State-wide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource."

Database Recommendations:

1) Geothermal GIS low and high temperature thematic map resources exist on Google Earth that NMBGMR may want to evaluate and use for its database resources (GlennvG).

2) BLM also has geothermal GIS resources to consider for the database (CarlC)

3) Include OCD Online Geothermal Low Temperature ("GTLT") and High Temperature ("GTHT") geothermal resource information in NMBGMR DB. Low Temperature geothermal resource information in DB as shallow geothermal waters may indicate the presence of deep source high temperature geothermal resource exists in the vicinity and high temperature extraction at shallow depths by commercial power companies are much more economic for companies to tap into (CarlC).

4) OCD shall require all geothermal power generation applicants (low & high temp) to obtain RBDMS OGRID # from the OCD for all future geothermal well installation or well work over geothermal resource work in NM. OCD will also issue API#s for each existing and/or new injection and/or development well for tracking plug and abandonment purposes. The information will be scanned into OCD Online "GTLT" or "GTHT or GTLT". OCD needs to update "who does what?" with associated state stakeholder agencies based on the geothermal regulations. A geothermal regulations stakeholder working group will be created to address future geothermal permit issues. Note that *older low and high-temp. Geothermal wells under OCD jurisdiction at the time were never issued API#s and well information was not entered into an RBDMS tracking system; thus, the "GTLT" TIFF files are scanned in by operator name and county only without database retrieval capability. NMED may need to develop an application and tracking process for all types of geothermal projects it anticipates regulating based on OCD's new interpretation of the Geothermal Regulations.* (CarlC).

5) As database "information" for previously drilled holes; include legal location, total depth, formation at TD, max. temp., and API number where available (WillJ).

OCD Recommendations to ECMD Geothermal Working Group (Preliminary Recommendations)
Last Updated by Carl Chavez- OCD: 4-9-2010

Technical Recommendations:

1) In NM, fresh water may be too scarce to use for makeup water in cooling tower systems at geothermal power generation projects; therefore, commercial geothermal power companies must propose more innovative alternative heat transfer systems, i.e., air, freon.....recycling and reuse of pumped ground water if used, that will circumvent the water scarcity issues and water appropriation issues of the OSE in NM and prevent the advancement of geothermal projects in New Mexico (CarlC);

2) Develop MOU(s) and/or cooperative agreements between BLM (i.e., well bonding), CID/RLD (direct heat closed-loop and/or heat storage systems), and OSE (i.e., well permitting, drilling certifications, ...) to help OCD streamline the geothermal commercial power company permit and exploration process to identify more geothermal reservoirs for renewable energy in NM (CarlC);

3) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc. Note that OCD has already been informed of the scarcity of fresh water in New Mexico and the urgent need for geothermal companies to propose heat transfer systems that will not rely on hydrologic and hydrogeologic water resources needed for drinking water, natural resources, parks and recreation, etc. in New Mexico. Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources (CarlC);

4) Pollution prevention and waste minimization (i.e., magnetic or electricity non-chemical corrosion and scale inhibitor applications, environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals (CarlC);

5) Aesthetic concerns (i.e., noise from well testing; large pits, erecting power plants in populated areas more susceptible to seismic events, etc.) need to be developed;

6) Focus on low-quality deeper geothermal gradient water resources in the oil and gas fields of NM accessible to nearby transmission grids (CarlC);

7) Focus on transmission grid assessment (note that there is 40 to 60% electricity loss along conventional electricity lines, but new technologies can significantly reduce this loss if new technology conductive wire and systems are installed), upgrade, or construction into identified deep and shallow-source high temperature geothermal resource areas to convey power inter-intra state. Transmission grids exist throughout New Mexico's oil and gas exploration and production regions, but seemed to be hampered by water appropriation, and/or other oil/gas/potash mineral rights (CarlC);

8) OCD shall facilitate a permit and bonding process for re-entry into existing oil and gas wells that will consist of submittal of G-101, G-102, G-103 along w/ Unnumbered form and C-108 to expedite geothermal well production/injection applications (including

exploratory single well approach without discharge permit issuance and public notice process...) in the oil fields of NM (CarlC);

9) OCD already has a WQCC discharge permit process in place for permitting larger low and high temperature geothermal exploration for power production projects in New Mexico (CarlC);

10) Other renewable technologies need to work together and make deals to install nested renewable power generating systems at geothermal power generating facilities and to make more efficient use of existing and upgraded power transmission lines for generating and transmitting electricity from renewable energy systems down the transmission lines. For example, geothermal plants have plenty of surface area to install solar, photo-voltaic and wind energy renewable power systems to boost power production at each facility (CarlC).

11) Oil and gas well conversion, work over, and/or re-drill of PA's wells into geothermal production and/or WQCC injection wells shall require a minimum casing diameter of 12 in. (could accept 7 – 12 in. or greater) and be in a condition suitable for well work over with appropriate well construction, cementing, etc. Existing oil and gas wells shall be located outside of potash areas and cemented properly to prevent interference with oil and gas production and/or prospective production of oil, gas and/or mineral resources (CarlC).

12) EGS shall be controlled to allow the use of more efficient geothermal power generating systems (i.e., binary cycle) and cited away from populated areas when possible. Flash steam or other geothermal engineering applications that waste the heat and/or are not efficient and deplete New Mexico's scarce fresh water hydrologic and hydrogeologic resources are prohibited (CarlC).

13) EGS shall not be allowed to inject (blind injection) over fault zones and highly fractured rock areas due to seismicity concerns (siting consideration shall apply) (CarlC).

14) OCD Part 17 Pits, Closed-Loop Systems, Below-Grade Tanks & Sumps shall be followed for "Temporary Pit" construction selecting liners that are resilient to high-temperatures (CSPE-R (Chlorosulfonated Polyethylene- Reinforced); EPDM (Ethylene Propylene Diene Monomer); and FPP-R (Flexible Polypropylene- Reinforced)). Permanent pits and/or evaporation ponds shall comply with OCD Part 36 Surface Waste Management Facilities construction specifications with similar liners as above of acceptable thickness and thermally welded seams (CarlC).

15) Geothermal power plants are excellent facilities for the coproduction of renewable hydrogen for future batteries, fuel, emission free cars, etc. Geothermal power companies could be mandated to coproduce hydrogen as a condition to permitting these types of facilities in New Mexico (CarlC).

16) Would it be possible to develop enough onsite storage to allow recycling some geothermal water for cooling of newly produced water, avoiding using surface water (SHayden)?

17) All of the geothermal areas I know of in New Mexico are associated with both fault zones and Tertiary/Quaternary igneous bodies. You may already be familiar with it, but I copied a chart published by the NMBGMR showing the locations of all quakes >4.5 for the last 150 years (attached). The largest on record was 5.8 magnitude from 1906. My point here is that all of the active fault zones in New Mexico are extensional to transtensional and do not tend to lock up and cause large quakes. Quakes that may follow drilling would tend to be smaller than normal due to lubrication of the rocks, so I am not sure why faulted or fractured rocks are excluded (SHayden).

18) In the early '80s, DOE was planning on drilling a "magma tap" and one of the areas they were considering was near Socorro where active dikes are intruding to less than 5 Km of the surface, feeding off of the Socorro Bright Spot, a large sill intruding the base of the lithosphere from Bernardo to Magdalena to San Marcial. They eventually decided on the Long Valley, CA area. This might be a good candidate for a heat exchange type of facility. You could hardly cause more quakes there than they already have (SHayden).

Policy Recommendations:

1) Recently (February 2010), the OCD determined that OCD Geothermal Resources Act gives it jurisdiction over all geothermal development projects in the state with the exception of incidental use (DavidB).

2) Geothermal projects should avoid potash mining areas due to the issue of conflicts between potash mining and drilling in potash areas is unsettled and litigation could take years to resolves in the courts (DavidB).

3) If penetrating oil and gas subsurface producing formations and from which oil and gas being produced or even prospective oil and development (DavidB).

4) Precedence will be required when situation where contention that geothermal resources will compromise oil and gas production and vice versa (DavidB).

5) Geothermal resources as a mineral, from Federally owned mineral perspective, for state depends on whether heat is extracted, but unanswered relative rights on private lands on surface and mineral owners will need to be determined (DavidB).

6) More funding is needed to move NM's geothermal program forward and to maintain the day-to-day upkeep of data to sustain long-term geothermal power production. The nuclear power industry received much more funding for power generation to accomplish the goals of the Federal Government than renewable energy projects are receiving (CarlC).

7) OCD geothermal exploration w/o WQCC discharge permit process for geothermal exploration in existing oil and gas wells in the oil fields of NM? (CarlC);

8) Geothermal power producers shall have all mineral, land and water rights issues resolved in advance of geothermal power generation or production application, unless the applicant is willing to undergo a longer-term permit geothermal process with hearings, etc (CarlC).

9) OCD should strive to resolve land mineral, land and water rights issues in a policy that would allow geothermal power generation in oilfields of NM where transmission grid systems are already in position (CarlC).

10) OCD shall cover all geothermal power production applications regardless of temperature. New binary cycle geothermal power systems may generate power from 190 to 249F. In the event NMED permits a low-temperature geothermal project and the applicant wishes to co-produce electric power with lower temperature fluids, NMED shall direct the applicant to the OCD for all geothermal power generation and permitting requirements. NMED will handle low-temperature geothermal direct heat applications for warming residences, apartments, buildings, with low-temperature geothermal resources (CarlC)?

11) OCD recommends that its geothermal well forms be used exclusively by the OCD only as the forms convey OCD's geothermal jurisdiction over all geothermal projects in New Mexico. NMED may need to consider and develop forms from BLM, CID/RLD, NMED and/or OSE for projects where well API#, injection into formation(s), etc. is not applicable (i.e., closed-loop direct heat applications) (CarlC).

12) OCD needs to develop a geothermal resource document for its website for all geothermal applications or projects where heat is extracted from ground water for use or as a mineral (CarlC).

13) Flash steam geothermal engineering systems that inefficiently evaporate and/or deplete the state's hydrologic and hydrogeologic resource(s) should be prohibited in New Mexico Instead, commercial geothermal power companies should be implementing pollution prevent and waste minimization sophisticated heat transfer systems so as not to rely on scarce ground water resources in New Mexico for power production (CarlC).

14) OSE should help to develop locations in NM with plentiful fresh (makeup water for cooling towers) and non-fresh (geothermal fluids) water resources that will sustain long-term geothermal projects are located. In example, Placitas or Rincon, NM may not have enough fresh water resource to sustain power generation for 10 years let alone 20-30 years, while TorC, NM may have plenty. OSE could also indicate where water resources or appropriations are lacking (CarlC).

15) Injection over fault lines and highly fractured geothermal rocks and reservoirs should be prohibited to minimize seismicity in geothermal power generation areas- especially in populated areas. EGS applications should be under controlled conditions with created fracture systems away from aforementioned geologic conditions and population centers, while shallow low pressure recirculation or closed-loop or banked heat geothermal systems may operate in the above mentioned areas without any concerns (CarlC).

Chavez, Carl J, EMNRD

From: Lucero, Stephen A., EMNRD
Sent: Wednesday, May 26, 2010 1:00 PM
To: Chavez, Carl J, EMNRD; Altomare, Mikal, EMNRD; Brooks, David K., EMNRD
Subject: RE: June 16th Geothermal DB meeting - request for OCD presentation

Carl- Here is the draft agenda for the meeting, let me know if this will work for you :

Time	Lead Group	Topic
0900-0930	NM ECMD - Steve Lucero	Welcome, Introductions, Executive Order 2010-001, Working Group Goals, Summary of February meeting, Contract Status
0930-0945	NMSU - Kurt Anderson	Reno Conference Update, Annual NM working group meeting
0945-1000	NM Tech - Dana Ulmer-Scholle	Update on Natonwide geothermal database effort
1000-1030	NM Tech - Mark Person	NM Tech - Database work proposal and scope of work
1030-1045	*Break*	
1045-1115	All	Group Input: Database scope of work, parameters, format
1115-1130	NM ECMD - Steve Lucero	DOE FOA -00318 Funding Opportunity
1130-1145	NM ECMD/All	Morning Session Wrap-Up, Discussion
1145-1300	*Lunch*	
1300-1400	NM OCD - Mikal Altamore, Carl Chavez	NM Geothermal Energy Project Regulations
1400-1430	All	Group Discussion - Regulations, Policy Recommendations
1430-1500	NM ECMD/All	Action Items, Next Meeting
1500		Meeting Adjourn

Stephen Lucero
State of New Mexico
Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

From: Chavez, Carl J, EMNRD
Sent: Friday, May 21, 2010 4:24 PM

To: Lucero, Stephen A., EMNRD; Altomare, Mikal, EMNRD; Brooks, David K., EMNRD; Chavez, Carl J, EMNRD
Subject: RE: June 16th Geothermal DB meeting - request for OCD presentation

Steve:

OCD has penciled in the 1 to 2:30 p.m. timeframe, but we will get back with you on what we plan to speak about and the time by COB next Tuesday. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Lucero, Stephen A., EMNRD
Sent: Friday, May 21, 2010 2:49 PM
To: Chavez, Carl J, EMNRD; Altomare, Mikal, EMNRD
Subject: June 16th Geothermal DB meeting - request for OCD presentation

Carl, Mikal

As you have probably seen the announcement, the next Geothermal Database Meeting is taking place on June 16th. I am now working on an agenda. I am thinking about devoting a portion of the afternoon to geothermal regulations.

Are you guys able to attend and give a presentation(s)? I am thinking about allotting from 1pm to 2:30pm for your presentation and group discussion on regulations.

Does that make sense to you guys? Do you think more/less time is needed? Any input on this is appreciated.

Thanks-

Steve

Stephen Lucero
State of New Mexico
Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

From: Lucero, Stephen A., EMNRD
Sent: Friday, April 23, 2010 8:48 AM
To: Chavez, Carl J, EMNRD; Altomare, Mikal, EMNRD
Subject: May 20th Geothermal Database meeting - potential reschedule

Carl, Mikal

This is just a heads up that I am looking to reschedule the geothermal database meeting from May 20^{th} to June 16^{th}. We have some conflicts here at ECMD, as does Mark Person at NM Tech with the 20^{th} date.

I will let you know (via the group distribution email) when I get confirmation from the NM Consortium on the exact date, time and place.

Steve

Steve Lucero
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www.cleanenergynm.org

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, May 07, 2010 9:13 AM
To: Sanchez, Daniel J., EMNRD
Cc: VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Lucero, Stephen A., EMNRD
Subject: FW: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues Between Geothermal Agencies in NM
Attachments: pic13973.gif

Daniel:

FYI ONLY****Still DRAFT in progress****Still DRAFT in progress****Still DRAFT in progress.

Please note that this msg. serves to inform you (OCD Underground Injection Control (UIC) Director) about recent Geothermal Working Group Developments and about streamlining the OCD Geothermal Permit Process in NM when Geothermal applicants apply for permits. They may have to deal with fewer state and federal agencies in the process, i.e., OCD, etc.? OCD Attorneys David Brooks and Mikal Altomare were copied on the BLM message below.

For example, CID/RLD may handle ground water issues associated with low-temp. direct heat applications in shallow GW and review process under their "Directional Boring" for closed-loop license requirements and where OSE would allow CID/RLD oversight. Similarly, the OSE would allow OCD or CID/RLD open-loop oversight whenever there is low-temp. installations occur in shallow GW conditions. OCD's generic application for closed and open loop low-temp. system installations could require OSE Well Driller Certification (Geothermal Regs. cannot pre-empt other agency regs. and OCD must include them where required) for any low-temperature direct heat applications while CID/RLD and/or OCD oversees the permit process without OSE oversight, construction, etc. However, OSE is still responsible for certifying drillers, answering questions on certification, etc. and not OCD. On Geothermal Power Projects, OCD could encourage water well driller certification under OSE, but it could not require it. Rationale: Similar to O&G Drillers who protect fresh water, geothermal drillers also know how to protect fresh water and more experienced with expertise in this type of drilling than a certified water well driller w/o expertise in O&G or geothermal drilling..... OSE would ALWAYS be involved (OSE has permit process) whenever water is appropriated (being removed or added to GW).

In the instance below, where OCD may be entering into an MOU with the BLM to prevent redundancy in certain aspects of our geothermal bonding, etc. These MOUs or Internal Policies, etc. are helping to streamline the OCD Geothermal Permit Process inline with the Governor's Executive Order to make NM the No.1 Renewable Energy State in the Nation.

Please contact me know if you have any questions or concerns. It would appear based OCD's geothermal meetings that agencies that were responsible for geothermal in the past will have to give and take based on the OCD's February findings that it is responsible for all geothermal extraction in the state.

Thank you.

Carl J. Chavez, CHMM
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(Pollution Prevention Guidance is under "Publications")

-----Original Message-----
From: Mike_Smith@blm.gov [mailto:Mike_Smith@blm.gov]
Sent: Thursday, May 06, 2010 9:42 AM
To: Chavez, Carl J, EMNRD
Cc: Jay_Spielman@blm.gov
Subject: Re: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues

Carl:

You're welcome. I'll be starting conversations with the BLM State Office regarding a geothermal MOU. I'll look at the UIO-999's, but some of the issues I see right would be eliminating any redundancy in bonding and water quality monitoring. Our State Office will have to be involved if we want this to be a State-wide MOU. This is probably going to take some time. We also have another geologist coming on board at Las Cruces BLM at the end of May, and we have not decided how to divide responsibilities just yet - he may be taking over some of the geothermal program. We'll have to see how things progress, but frankly, I may not be able to report much progress by the next meeting.

Regarding the question of whether a closed-loop heat pump system on Federal mineral estate would require a lease and royalties. I have spoken with Kermit Witherbee, who is the National Geothermal Program Manager for BLM.
and he has informed me that such systems are not subject to Federal lease and royalties, because such systems essentially operate using ambient heat.

Michael Smith
Geologist - BLM
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575-525-4421
Mike_Smith@blm.gov

"Chavez, Carl J, EMNRD" <CarlJ.Chavez@state.nm.us>
05/06/2010 06:05 AM

To: <Mike_Smith@blm.gov>

cc: "Altomare, Mikal, EMNRD" <Mikal.Altomare@state.nm.us>, "Brooks, David K., EMNRD" <david.brooks@state.nm.us>

Subject: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues

(Embedded image moved to file: pic13973.gif)
Mike:

Thank you for your participation in yesterday's meeting. Based on the miscellaneous discussion of our meeting yesterday, could you please develop a draft MOU for OCD and BLM to consider going forward on geothermal projects? This will help the OCD to focus on this issues and this recommendation was identified in OCD's preliminary recommendations on technical, policy, etc. for the EMNRD Geothermal Working Group based on BLM's suggestion. To view OCD preliminary recommendations on geothermal, please go to OCD Online and search for: "UIC-999" and open the Geothermal Working Group Folder and this is the big picture for OCD right now. BLM is welcome to provide recommendations to the OCD going forward as our next meeting is in June 2010 with a report to the Governor due at the end of December 2010.

I have never developed an MOU, although I've reviewed them and am pre-occupied with two working groups on geothermal. This would place us ahead of the curve I think. Thank you.

Carl J. Chavez, CHMM
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(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Mike_Smith@blm.gov
Sent: Thursday, May 06, 2010 9:42 AM
To: Chavez, Carl J, EMNRD
Cc: Jay_Spielman@blm.gov
Subject: Re: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues
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Michael Smith
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"Chavez, Carl J, EMNRD" <CarlJ.Chavez@state.nm.us>
05/06/2010 06:05 AM

To: <Mike_Smith@blm.gov>
cc: "Altomare, Mikal, EMNRD" <Mikal.Altomare@state.nm.us>, "Brooks, David K., EMNRD" <david.brooks@state.nm.us>
Subject: Draft MOU on Geothermal Bonding & Other Redundancy Streamlining Issues

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New Mexico Geothermal Energy Working Group Meeting
May 19 – 20, 2009
Macey Center, New Mexico Tech, Socorro, New Mexico

Summary of Discussion

Facilitator and Recorder: Lucy Moore

Overview: This conference for the New Mexico Geothermal Energy Working Group was sponsored by a grant provided by the Department of Energy and coordinated by the Energy Conservation and Management Division of the New Mexico Department of Energy, Minerals and Natural Resources. The event included a field trip to the Bosque del Apache Wildlife Refuge the afternoon of the 19th. Participants learned about the wildlife and birds in the area, as well as the geology of this active and interesting part of the state. Richard Chamberlin, Mark Person, Jim Witcher and Colin Cinkoski spoke with the group during the field tour about the geology of the area including Rio Grande Rift structural processes, heat flow and groundwater hydrology. Following the field trip, participants attended a group dinner and heard speakers Roger Cook and David Duchane.

Roger Cook spoke to the group about his work with Perma Works high temperature well monitoring tool technologies for geothermal electricity production. Roger also described work that has been conducted with this technology in Iceland. Horizontal drilling combined with EGS technology was also discussed.

Dave Duchane spoke with the group about the history of the Fenton Hill Hot Dry Rock pilot project in the Jemez Mountains. This project was described in detail from the issues of drilling issues, hydrogeology, groundwater chemistry, flow diagrams, remaining issues, results and future steps.

The next day was filled with presentations and discussion. The following summarizes the highpoints of that discussion and ideas for moving the geothermal agenda forward.

Introductions: Conference organizer Stephen Lucero, ECMD, welcomed the group and emphasized his agency's commitment to supporting geothermal research and projects wherever appropriate. He introduced Lucy Moore, who served as facilitator for the conference. She welcomed Brendan Miller, NM Economic Development Department and head of the Governor's Green Jobs Cabinet. Brendan assured the group of the Governor's commitment to renewable energy, including geothermal.

New Mexico Geothermal Resource Assessment: Jim Witcher: With 30 years experience in geothermal exploration and development, Jim is particularly interested in the low-temperature geothermal resources here in New Mexico.

Jim spoke about geothermal basic technologies and applications in New Mexico. He also provided in depth technical information on geologic conditions that support geothermal resources in New Mexico. Several important topics were presented to the group including: geothermal economics, resource assessment data, resource classification, project case studies and site specific geology. This presentation provided an excellent introduction to the technical presentations for this day.

Discussion: There were questions about the number and types of jobs related to electricity-generating geothermal projects. A participant asked about the relationship between faults and siting conductive geothermal projects. Jim explained that a fault can provide the "hydrogeologic window" necessary for the conductive heat source. In addition, the damaged zone can be permeable, although the core will be less so. There was discussion about the difficulty of locating these zones. Many saw the potential for geothermal-heated and cooled greenhouses in the rural and agricultural parts of southern New Mexico, and perhaps even the Albuquerque and Socorro areas, where fresh water is available. This led to a discussion about the over-appropriated waters of the state, and the need to buy or lease water rights from existing users, or identify water that is so deep (over 2,500 feet) or of such poor quality that the State Engineer has no jurisdiction.

Ground Source Heat Pumps in NM Schools: Pat Gibson: With over 28 years of HVAC and related experience, Pat is now co-owner and vice president of operations for Energy Control Inc. (ECI), Pat described the geothermal work EIC is doing in schools around the state. He installs ground source heat pumps to provide both heat and cooling for the school facilities. The technology is relatively simple, with no cooling towers or boilers, and it provides consistent temperature control year-round. With the pump and other equipment underground, the roof is free of clutter, and the technology is safe from vandalism. Funding can be put together in a variety of ways – bonds, capital outlay, mil levies, etc. School districts are eager to "go green," and geothermal is an attractive option, for existing schools or newly constructed ones, like the latest ECI project, the Amy Biehl School in Santa Fe.

Discussion: Pat explained that at the Amy Biehl School ECI found a consistent temperature of 65 – 67 degrees F at 300 feet. The source can be either above or below the groundwater. Wells are spaced about 20 feet apart. The Amy Biehl School has two vaults with 140 wells and ten circuits. Schools are ideal for these projects because of the large areas – parking lots, playgrounds, etc. – for wells and equipment. Retrofitting is more difficult because ground must be disturbed; installing during construction of a new school is ideal.

REHAU Construction: Phil Marquez: An account manager for REHAU, Phil supports customers in New Mexico, Arizona and Colorado. Phil described REHAU's new PEXa pipe for use in the geothermal gound source heat exchange pump. An alternative to HDPE, the PEXa is proving superior in stability, flexibility, resistance to heat and chemical reactions. The pipe is polyethelene that is 85% cross-linked through a special extruding process. The pipe returns to its original shape if kinked, can bend 5 times its diameter, and stretch 400%. It is available in single or double u-bends.

Discussion: In answer to questions, Phil said that PEXa was about 30% more expensive that HDPE, but that savings could be achieved in installation time and the use of fewer wells. With a longevity of 200 years, repairs are minimal. A disadvantage of PEXa is its sensitivity to ultraviolet rays. Again the question arose about the role of the State Engineer. Although he admitted that it is a gray area, Phil felt that if the wells are dry, no permit is needed.

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Terra Thermal Geothermal Reservoir Engineering: Michael Timlin: CEO of Terra Thermal, Mike offers services in exploration, development and production for geothermal producers. As a reservoir engineer, he plays a role in all three phases of a geothermal project. During exploration he analyzes data, logs and outputs from geoscientists. During development he refines estimates, works with models, reviews injection and re-injection strategies. During production, he monitors the reservoir performance, reviews the well testing plan, refines reserves and performs forecasts. Mike described an electric producing geothermal facility in New Zealand that utilizes a separator that carries dry steam in one pipe and water for transportation in the other. A condenser converts the wet steam to liquid, leaving waste heat to be disposed of. Mike emphasized the importance of identifying a variety of funding – low interest loans, tax credits, etc.

Discussion: There were questions about the model relating to reservoir evaporation and precipitation. The model does not account for precipitation, Mike said. The model also does not depict faults in the cap rock, which would probably result in different vegetation and other effects, like geysers, on the surface. There were also questions about who pays for the plants. Mike said funding is "all over the map," from the companies to government grants to loans and renewable energy credits (REC). The valuation of the REC can vary from \$ 10 to \$ 100 for a megawatt hour. Mike predicts that the federal government will establish a regulated market for trading credits.

Geothermal Studies in the Albuquerque Basin and Along La Ristra Seismic Profile, New Mexico: Marshall Reiter: Marshall has been a professor at the Earth and Environmental

Sciences Department at New Mexico Tech since 1975. He began subsurface temperature logging in 1965, and described to the group his heat flow findings in the Rio Grande region. He believes that there has been an increase in temperature in the region of almost 8 degrees F in the last 25 years, as a result of the vast expanses of asphalt. He and his researchers have also discovered a magma chamber 100 meters thick with liquid of 1200 degrees centigrade, over an area that is approximately 60 miles by 35 miles, and 19,000 feet below Socorro. This hot spot over the Rio Grande rift is in contrast to the relatively cool upper mantle of the neighboring Colorado Plateau. Marshall continues to do monitoring and measuring work in the Albuquerque Basin, and has preliminary data on an upper crustal thermal source in the Belen area south of Albuquerque.

Discussion: During the discussion Marshall emphasized the importance of communication and cooperation among federal and state agencies, the oil and gas industry, and others with an interest and something to offer the geothermal field. There are significant economic implications from the development of geothermal resources, which must be studied and understood.

General Discussion: Prior to lunch, and at the end of the conference, Stephen Lucero asked the group how his program could help those interested in promoting and developing geothermal resources. These two discussions are combined below.

Legal and regulatory issues:
State Lands: There were questions about state lands and how geothermal development is handled. Apparently, it is similar to federal lands, with a competitive bid system, lease and 10% royalty. Some suggested that state land offices may be more interested in pursuing geothermal leases than the feds who are distracted with so many current crises. The contact for the NM State Land Office is Brian Bingham:

Renewable Energy Division Director
Phone: (505)827-1252
E-mail: bbingham@slo.state.nm.us

Definition of heat: A participant asked how heat is defined in New Mexico. In Texas, it is a mineral; in New Mexico, on federal land, heat is a mineral.
In New Mexico, on federal land, heat is a mineral. On state or private land, it depends on the use and temperature. For example, above 250 degrees, it is considered a mineral and falls within the jurisdiction of the Oil Conservation Division (OCD) for power generation and the Office of the State Engineer (OSE) for water adjudicatory issues. Below 250 degrees, it is still a mineral and falls within the jurisdiction of the New Mexico Environment Department (NMED) for direct heat use when wells are installed and/or the OSE for water adjudicatory issues or when heat pumps instead of wells are used for direct heat or geothermal purposes. Heat is not considered a mineral at all if the geothermal extraction is only incidental to a beneficial use of the water, in which case the water is not considered geothermal and it falls only within the jurisdiction of the OSE. Contact person at OCD is Carl Chavez who can be reached at 505-476-3490, carlj.chavez@state.nm.us

Federal BTU meter requirements: There was discussion about the federal requirement of a BTU meter on greenhouses, which was challenged by the OSE. Congress has acted to remove that requirement and replace it with a straight fee on the acreage.

Transmission lines: A participant asked about jurisdiction over transmission lines in New Mexico. WECC, WAPA and others have jurisdiction depending on the area of the state.

Water rights: There is confusion about the jurisdiction of the State Engineer over geothermal resources, given the factors of temperature, depth and quality.

The group was concerned about the need to maintain pressure in the reservoir if water is being lost to either evaporation or cooling towers, or both. Acquiring additional water resources in a water-scarce state, in time of drought, will be a challenge. Participants spoke about the opposition – on economic, cultural, and environmental grounds -- to buying agricultural water rights in many parts of the state.

Water quality: The NM Environment Department, Groundwater Bureau, is concerned with protecting groundwater quality from contamination, such as anti-freeze or other fluids found in groundwater heat source pump systems. The Department issues discharge permits for injection wells. Those wanting more information should contact John Hall 505-827-1049. John suggested anyone planning a project contact him. For larger projects, he asked for a Notice of Intent.

CID: There was an objection to the way that CID regulates the wages of well drillers. The agency mandates the same wage for those drilling shallow wells as those drilling deep wells, perhaps because the activity is publicly funded, suggested a participant. Another was concerned that CID, with jurisdiction over fluids in pumps, require adequate measures to protect the water resources that are encountered in drilling.

Need to enlarge the conversation:

Many spoke of the need to better understand the roles of regulatory and advocacy agencies at the federal, state and local levels with respect to geothermal energy. An intergovernmental regulatory flow chart would be very useful. Other entities and interests were identified that need to be part of the conversation, including public power companies, rural electric coops, oil and gas industry, and state agencies (CID, OSE, NMED, Taxation and Revenue, and more).

There was particular interest in engaging with the oil and gas developers because of their vast experience and data on deep drilling, often encountering [unwanted] water sources. The thought was that these operators have critical knowledge, and a natural interest in maximizing underground resources.

Finally there was a strong recommendation to address potential conflict over geothermal development early. Participants recognize that there are those with a variety of interests – cultural, historical, environmental, agricultural, economic – who may oppose geothermal projects. The projects are very complex, even for the scientifically trained, and educating a skeptical and wary public is a challenge that must be undertaken. Getting together with these interests early, both for educational outreach and for an honest, respectful discussion, will be critical in the ultimate success of any project. A participant suggested the state establish a stakeholder council to begin these discussions immediately, even prior to a site-specific project.

Information gathering:
Participants asked the agency to: 1) compile existing information now scattered among many entities, and to 2) gather new site specific data on potential geothermal sites. Several spoke of the need for good, comprehensive maps and data bases showing geothermal resources, perhaps with overlays showing other relevant information – surface flows, temperatures, distribution lines, land ownership, oil and gas activity, etc. Well logs are now housed in different locations; creating a clearinghouse of data from well logs would be very useful. This kind of data, in one place, clear and accurate, could go a long way toward reducing risk for exploration. A second step should be the development of educational outreach programs to begin familiarizing citizens with the reality of geothermal.

Funding and technical support:
When federal funding is available, it can be lost if state matching funds cannot be found. Anticipating this need and making state matches accessible would help those seeking to propose projects.

A participant also noted that the state program should advocate funding for RITA so that renewable energy transmission lines are available when geothermal electricity is produced.

Project proponents also need help responding to the very quick turnaround for the federal stimulus package funds. Those who want to apply for funds must submit a proposal to NMEMNRD by June 26, 2009. The agency is putting on a "webinar" to offer technical assistance on June 1.

Another participant pointed out that, although money is always needed, there is a wealth of equipment and manpower lying idle. If the state or feds could give an advance credit on royalties, or some other upfront funding mechanism, these resources could be put to work exploring and developing. This kind of incentive could help oil and gas exploration companies and drillers make the move to geothermal, bringing with them vast knowledge of the landscape.

Some pointed out that the industry itself needs help understanding the larger landscape of a geothermal project – the funding, the technology, regulations, natural features, environmental protection needs, cultural and political considerations. These factors, including the human factor, can determine the feasibility of a project.

Industry also often needs help responding to deadlines.

Focus on shallow development:
Some felt that the DOE had little interest in the low temperature geothermal potential in New Mexico. Congress is pressuring the agency to focus on power generation, but participants pointed out that significant reduction in greenhouse gases can be achieved with low temperature

heat exchange systems for heating and cooling buildings. Reducing the demand for power through shallow projects, they said, is a valuable part of the renewable energy picture.

Additional submission: At the end of the conference, Lucy invited participants to contact her with any additional ideas about the role of the NMEMNRD Geothermal Program. Carl Chavez, Oil Conservation Division, EMNRD, offered the following:

> At least two large geothermal projects are recommended to show how valuable, beneficial, and the magnitude of geothermal power production can be in New Mexico. One in the NW where NM Tech indicated there is good potential for high temp geothermal power production; and one in southern NM- McGregor Range? or Dona Ana area where a transmission grid may already be readily available. Certainly, the new power grid should be located near to these big geothermal project areas. EMNRD may want to hire a qualified consultant to provide a recommended list of preferred locations for large geothermal power plant generation with an emphasis on isolated areas or areas with existing grid system(s) with significant resources (i.e., water volume, sustainable flow rate, available hydrogeologic data, testing, etc.) needed to support major power producing operations quickly. The consultant may also be able to assist with SLO preferred locations for geothermal leasing?
>
> Also, the SLO should be contacted to begin laying the foundation for geothermal land leasing sales. The OCD has placed its geothermal high temperature and low temperature information on its OCD Online website in order to observe past geothermal study areas in the State at http://ocdimage.emnrd.state.nm.us/imaging/AEOrderCriteria.aspx (search for "GTLT" or "GTHT" to see locations of past geothermal studies in the OCD files). The State Land Office may want to indentify the locations for future geothermal land leasing?

And, from Roger Cook, PermaWorks:

> It would be great if your office, or some other official group would keep track of all geothermal projects in the state. I would really like to be able to see a total of the electrical cost savings due to using geothermal (at least for commercial uses and the total revenue generated (like the green house project that was reported on). I don't know how big this would be but it should get more significant with time and might be something that would help us get geothermal on the map while we are figuring out the electrical generation part of this.
>
> Drilling in the right spots is clearly a complicated proposition as many of the presentations showed. However, it seems to me the state has a ton of data already. Clearly we need a comprehensive mapping effort to continue to look for new opportunities but I would like to see the state pick 3 - 5 of the best known sites and commit to putting in some electrical generation capabilities - and at least one of these should be reusing an oil or gas well that is used up. My assertion is that if we don't start doing something and getting some electrical generation on-line (like wind and solar) then we will always be left behind. It's not enough to go to meetings and pontificate about how we ought to be

doing geothermal, we need to mount a serious and organized approach and get this off the ground.

I personally agreed with the person who said our number one priority should be going after some of the stimulus money for geothermal power generation. Perhaps if we got the right heads together, we could identify the top choice in the state and go after just one with that money.

If the state is serious about this, you should set up a committee or sub-team and give them the task of getting this thing rolling. Otherwise, I'm afraid folks will just go back and publish more papers and not much of anything will really happen.

Conclusion: Stephen Lucero thanked the group for their attendance and contributions during the day. He said he looks forward to continuing to work in support of geothermal development in the state and in deepening the relationships within the group, as well as expanding to include others.

Summary prepared by Lucy Moore. Please contact her with comments or questions: 505-820-2166 or lucymoore@nets.com

New Mexico Geothermal Energy Working Group Meeting
May 19 – 20, 2009
Macey Center, New Mexico Tech, Socorro, New Mexico

Summary of Discussion

Facilitator and Recorder: Lucy Moore

Overview: This conference for the New Mexico Geothermal Energy Working Group was sponsored by a grant provided by the Department of Energy and coordinated by the Energy Conservation and Management Division of the New Mexico Department of Energy, Minerals and Natural Resources. The event included a field trip to the Bosque del Apache Wildlife Refuge the afternoon of the 19th. Participants learned about the wildlife and birds in the area, as well as the geology of this active and interesting part of the state. Richard Chamberlin, Mark Person, Jim Witcher and Colin Cinkoski spoke with the group during the field tour about the geology of the area including Rio Grande Rift structural processes, heat flow and groundwater hydrology. Following the field trip, participants attended a group dinner and heard speakers Roger Cook and David Duchane.

Roger Cook spoke to the group about his work with Perma Works high temperature well monitoring tool technologies for geothermal electricity production. Roger also described work that has been conducted with this technology in Iceland. Horizontal drilling combined with EGS technology was also discussed.

Dave Duchane spoke with the group about the history of the Fenton Hill Hot Dry Rock pilot project in the Jemez Mountains. This project was described in detail from the issues of drilling issues, hydrogeology, groundwater chemistry, flow diagrams, remaining issues, results and future steps.

The next day was filled with presentations and discussion. The following summarizes the highpoints of that discussion and ideas for moving the geothermal agenda forward.

Introductions: Conference organizer Stephen Lucero, ECMD, welcomed the group and emphasized his agency's commitment to supporting geothermal research and projects wherever appropriate. He introduced Lucy Moore, who served as facilitator for the conference. She welcomed Brendan Miller, NM Economic Development Department and head of the Governor's Green Jobs Cabinet. Brendan assured the group of the Governor's commitment to renewable energy, including geothermal.

New Mexico Geothermal Resource Assessment: Jim Witcher: With 30 years experience in geothermal exploration and development, Jim is particularly interested in the low-temperature geothermal resources here in New Mexico.

Jim spoke about geothermal basic technologies and applications in New Mexico. He also provided in depth technical information on geologic conditions that support geothermal resources in New Mexico. Several important topics were presented to the group including: geothermal economics, resource assessment data, resource classification, project case studies and site specific geology. This presentation provided an excellent introduction to the technical presentations for this day.

Discussion: There were questions about the number and types of jobs related to electricity-generating geothermal projects. A participant asked about the relationship between faults and siting conductive geothermal projects. Jim explained that a fault can provide the "hydrogeologic window" necessary for the conductive heat source. In addition, the damaged zone can be permeable, although the core will be less so. There was discussion about the difficulty of locating these zones. Many saw the potential for geothermal-heated and cooled greenhouses in the rural and agricultural parts of southern New Mexico, and perhaps even the Albuquerque and Socorro areas, where fresh water is available. This led to a discussion about the over-appropriated waters of the state, and the need to buy or lease water rights from existing users, or identify water that is so deep (over 2,500 feet) or of such poor quality that the State Engineer has no jurisdiction.

Ground Source Heat Pumps in NM Schools: Pat Gibson: With over 28 years of HVAC and related experience, Pat is now co-owner and vice president of operations for Energy Control Inc. (ECI), Pat described the geothermal work EIC is doing in schools around the state. He installs ground source heat pumps to provide both heat and cooling for the school facilities. The technology is relatively simple, with no cooling towers or boilers, and it provides consistent temperature control year-round. With the pump and other equipment underground, the roof is free of clutter, and the technology is safe from vandalism. Funding can be put together in a variety of ways – bonds, capital outlay, mil levies, etc. School districts are eager to "go green," and geothermal is an attractive option, for existing schools or newly constructed ones, like the latest ECI project, the Amy Biehl School in Santa Fe.

Discussion: Pat explained that at the Amy Biehl School ECI found a consistent temperature of 65 – 67 degrees F at 300 feet. The source can be either above or below the groundwater. Wells are spaced about 20 feet apart. The Amy Biehl School has two vaults with 140 wells and ten circuits. Schools are ideal for these projects because of the large areas – parking lots, playgrounds, etc. – for wells and equipment. Retrofitting is more difficult because ground must be disturbed; installing during construction of a new school is ideal.

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Raser Technologies Lightning Dock Geothermal Project: Michael Albrecht: Currently a Project Development Manager and Senior Geophysicist with Raser Technologies in Utah, Michael has been involved in the geothermal industry for 20 years and has published several papers. Michael estimates that there are 8,000 MW that could be produced with geothermal resources in 22 countries, an amount which would provide 30 million people with electricity each year. Raser has 400,000 acres of geothermal interests in Washington, Oregon, Nevada, Utah and New Mexico. He explained his company's binary system which uses a heat exchange tank to flash the water to vapor, and then send it through turbines. The vapor is cooled and the resulting water is sent down the injection wells and circulated through hot rocks, to be drawn up again. The two systems are separate; the fluids never mix. There are no emissions. Raser is ready to build the Lightning Dock Project, but it is currently under protest from neighbors. Power capacity tests show temperatures of 200 degrees F at 200 feet, and a production of 4-7 MW.

Discussion: In answer to a question, Michael encouraged others planning projects to prevent, or resolve early on, any disputes. He hoped that those in conflict could sit down together and talk about all possibilities. His company hopes to work with the community to find applications that will be beneficial, even if it means additional permits and negotiation time. In the Lightning Dock situation, flow measurement data is in question. Michael offered to try to obtain the original flow data.

Terra Thermal Geothermal Reservoir Engineering: Michael Timlin: CEO of Terra Thermal, Mike offers services in exploration, development and production for geothermal producers. As a reservoir engineer, he plays a role in all three phases of a geothermal project. During exploration he analyzes data, logs and outputs from geoscientists. During development he refines estimates, works with models, reviews injection and re-injection strategies. During production, he monitors the reservoir performance, reviews the well testing plan, refines reserves and performs forecasts. Mike described an electric producing geothermal facility in New Zealand that utilizes a separator that carries dry steam in one pipe and water for transportation in the other. A condenser converts the wet steam to liquid, leaving waste heat to be disposed of. Mike emphasized the importance of identifying a variety of funding – low interest loans, tax credits, etc.

Discussion: There were questions about the model relating to reservoir evaporation and precipitation. The model does not account for precipitation, Mike said. The model also does not depict faults in the cap rock, which would probably result in different vegetation and other effects, like geysers, on the surface. There were also questions about who pays for the plants. Mike said funding is "all over the map," from the companies to government grants to loans and renewable energy credits (REC). The valuation of the REC can vary from \$ 10 to \$ 100 for a megawatt hour. Mike predicts that the federal government will establish a regulated market for trading credits.

Geothermal Studies in the Albuquerque Basin and Along La Ristra Seismic Profile, New Mexico: Marshall Reiter: Marshall has been a professor at the Earth and Environmental

Sciences Department at New Mexico Tech since 1975. He began subsurface temperature logging in 1965, and described to the group his heat flow findings in the Rio Grande region. He believes that there has been an increase in temperature in the region of almost 8 degrees F in the last 25 years, as a result of the vast expanses of asphalt. He and his researchers have also discovered a magma chamber 100 meters thick with liquid of 1200 degrees centigrade, over an area that is approximately 60 miles by 35 miles, and 19,000 feet below Socorro. This hot spot over the Rio Grande rift is in contrast to the relatively cool upper mantle of the neighboring Colorado Plateau. Marshall continues to do monitoring and measuring work in the Albuquerque Basin, and has preliminary data on an upper crustal thermal source in the Belen area south of Albuquerque.

Discussion: During the discussion Marshall emphasized the importance of communication and cooperation among federal and state agencies, the oil and gas industry, and others with an interest and something to offer the geothermal field. There are significant economic implications from the development of geothermal resources, which must be studied and understood.

General Discussion: Prior to lunch, and at the end of the conference, Stephen Lucero asked the group how his program could help those interested in promoting and developing geothermal resources. These two discussions are combined below.

Legal and regulatory issues:

State Lands: There were questions about state lands and how geothermal development is handled. Apparently, it is similar to federal lands, with a competitive bid system, lease and 10% royalty. Some suggested that state land offices may be more interested in pursuing geothermal leases than the feds who are distracted with so many current crises. The contact for the NM State Land Office is Brian Bingham:

Renewable Energy Division Director
Phone: (505)827-1252
E-mail: bbingham@slo.state.nm.us

Definition of heat: A participant asked how heat is defined in New Mexico. In Texas, it is a mineral; in New Mexico, on federal land, heat is a mineral.
In New Mexico, on federal land, heat is a mineral. On state or private land, it depends on the use and temperature. For example, above 250 degrees, it is considered a mineral and falls within the jurisdiction of the Oil Conservation Division (OCD) for power generation and the Office of the State Engineer (OSE) for water adjudicatory issues. Below 250 degrees, it is still a mineral and falls within the jurisdiction of the New Mexico Environment Department (NMED) for direct heat use when wells are installed and/or the OSE for water adjudicatory issues or when heat pumps instead of wells are used for direct heat or geothermal purposes. Heat is not considered a mineral at all if the geothermal extraction is only incidental to a beneficial use of the water, in which case the water is not considered geothermal and it falls only within the jurisdiction of the OSE. Contact person at OCD is Carl Chavez who can be reached at 505-476-3490, carlj.chavez@state.nm.us

Federal BTU meter requirements: There was discussion about the federal requirement of a BTU meter on greenhouses, which was challenged by the OSE. Congress has acted to remove that requirement and replace it with a straight fee on the acreage.

Transmission lines: A participant asked about jurisdiction over transmission lines in New Mexico. WECC, WAPA and others have jurisdiction depending on the area of the state.

Water rights: There is confusion about the jurisdiction of the State Engineer over geothermal resources, given the factors of temperature, depth and quality.

The group was concerned about the need to maintain pressure in the reservoir if water is being lost to either evaporation or cooling towers, or both. Acquiring additional water resources in a water-scarce state, in time of drought, will be a challenge. Participants spoke about the opposition – on economic, cultural, and environmental grounds -- to buying agricultural water rights in many parts of the state.

Water quality: The NM Environment Department, Groundwater Bureau, is concerned with protecting groundwater quality from contamination, such as anti-freeze or other fluids found in groundwater heat source pump systems. The Department issues discharge permits for injection wells. Those wanting more information should contact John Hall 505-827-1049. John suggested anyone planning a project contact him. For larger projects, he asked for a Notice of Intent.

CID: There was an objection to the way that CID regulates the wages of well drillers. The agency mandates the same wage for those drilling shallow wells as those drilling deep wells, perhaps because the activity is publicly funded, suggested a participant. Another was concerned that CID, with jurisdiction over fluids in pumps, require adequate measures to protect the water resources that are encountered in drilling.

Need to enlarge the conversation:

Many spoke of the need to better understand the roles of regulatory and advocacy agencies at the federal, state and local levels with respect to geothermal energy. An intergovernmental regulatory flow chart would be very useful. Other entities and interests were identified that need to be part of the conversation, including public power companies, rural electric coops, oil and gas industry, and state agencies (CID, OSE, NMED, Taxation and Revenue, and more).

There was particular interest in engaging with the oil and gas developers because of their vast experience and data on deep drilling, often encountering [unwanted] water sources. The thought was that these operators have critical knowledge, and a natural interest in maximizing underground resources.

Finally there was a strong recommendation to address potential conflict over geothermal development early. Participants recognize that there are those with a variety of interests – cultural, historical, environmental, agricultural, economic – who may oppose geothermal projects. The projects are very complex, even for the scientifically trained, and educating a skeptical and wary public is a challenge that must be undertaken. Getting together with these interests early, both for educational outreach and for an honest, respectful discussion, will be critical in the ultimate success of any project. A participant suggested the state establish a stakeholder council to begin these discussions immediately, even prior to a site-specific project.

Information gathering:
Participants asked the agency to: 1) compile existing information now scattered among many entities, and to 2) gather new site specific data on potential geothermal sites. Several spoke of the need for good, comprehensive maps and data bases showing geothermal resources, perhaps with overlays showing other relevant information – surface flows, temperatures, distribution lines, land ownership, oil and gas activity, etc. Well logs are now housed in different locations; creating a clearinghouse of data from well logs would be very useful. This kind of data, in one place, clear and accurate, could go a long way toward reducing risk for exploration. A second step should be the development of educational outreach programs to begin familiarizing citizens with the reality of geothermal.

Funding and technical support:
When federal funding is available, it can be lost if state matching funds cannot be found. Anticipating this need and making state matches accessible would help those seeking to propose projects.

A participant also noted that the state program should advocate funding for RITA so that renewable energy transmission lines are available when geothermal electricity is produced.

Project proponents also need help responding to the very quick turnaround for the federal stimulus package funds. Those who want to apply for funds must submit a proposal to NMEMNRD by June 26, 2009. The agency is putting on a "webinar" to offer technical assistance on June 1.

Another participant pointed out that, although money is always needed, there is a wealth of equipment and manpower lying idle. If the state or feds could give an advance credit on royalties, or some other upfront funding mechanism, these resources could be put to work exploring and developing. This kind of incentive could help oil and gas exploration companies and drillers make the move to geothermal, bringing with them vast knowledge of the landscape.

Some pointed out that the industry itself needs help understanding the larger landscape of a geothermal project – the funding, the technology, regulations, natural features, environmental protection needs, cultural and political considerations. These factors, including the human factor, can determine the feasibility of a project.

Industry also often needs help responding to deadlines.

Focus on shallow development:
Some felt that the DOE had little interest in the low temperature geothermal potential in New Mexico. Congress is pressuring the agency to focus on power generation, but participants pointed out that significant reduction in greenhouse gases can be achieved with low temperature

heat exchange systems for heating and cooling buildings. Reducing the demand for power through shallow projects, they said, is a valuable part of the renewable energy picture.

Additional submission: At the end of the conference, Lucy invited participants to contact her with any additional ideas about the role of the NMEMNRD Geothermal Program. Carl Chavez, Oil Conservation Division, EMNRD, offered the following:

> At least two large geothermal projects are recommended to show how valuable, beneficial, and the magnitude of geothermal power production can be in New Mexico. One in the NW where NM Tech indicated there is good potential for high temp geothermal power production; and one in southern NM- McGregor Range? or Dona Ana area where a transmission grid may already be readily available. Certainly, the new power grid should be located near to these big geothermal project areas. EMNRD may want to hire a qualified consultant to provide a recommended list of preferred locations for large geothermal power plant generation with an emphasis on isolated areas or areas with existing grid system(s) with significant resources (i.e., water volume, sustainable flow rate, available hydrogeologic data, testing, etc.) needed to support major power producing operations quickly. The consultant may also be able to assist with SLO preferred locations for geothermal leasing?
>
> Also, the SLO should be contacted to begin laying the foundation for geothermal land leasing sales. The OCD has placed its geothermal high temperature and low temperature information on its OCD Online website in order to observe past geothermal study areas in the State at http://ocdimage.emnrd.state.nm.us/imaging/AEOrderCriteria.aspx (search for "GTLT" or "GTHT" to see locations of past geothermal studies in the OCD files). The State Land Office may want to indentify the locations for future geothermal land leasing?
>
> And, from Roger Cook, PermaWorks:
>
> It would be great if your office, or some other official group would keep track of all geothermal projects in the state. I would really like to be able to see a total of the electrical cost savings due to using geothermal (at least for commercial uses and the total revenue generated (like the green house project that was reported on). I don't know how big this would be but it should get more significant with time and might be something that would help us get geothermal on the map while we are figuring out the electrical generation part of this.
>
> Drilling in the right spots is clearly a complicated proposition as many of the presentations showed. However, it seems to me the state has a ton of data already. Clearly we need a comprehensive mapping effort to continue to look for new opportunities but I would like to see the state pick 3 - 5 of the best known sites and commit to putting in some electrical generation capabilities - and at least one of these should be reusing an oil or gas well that is used up. My assertion is that if we don't start doing something and getting some electrical generation on-line (like wind and solar) then we will always be left behind. It's not enough to go to meetings and pontificate about how we ought to be

doing geothermal, we need to mount a serious and organized approach and get this off the ground.

I personally agreed with the person who said our number one priority should be going after some of the stimulus money for geothermal power generation. Perhaps if we got the right heads together, we could identify the top choice in the state and go after just one with that money.

If the state is serious about this, you should set up a committee or sub-team and give them the task of getting this thing rolling. Otherwise, I'm afraid folks will just go back and publish more papers and not much of anything will really happen.

Conclusion: Stephen Lucero thanked the group for their attendance and contributions during the day. He said he looks forward to continuing to work in support of geothermal development in the state and in deepening the relationships within the group, as well as expanding to include others.

Summary prepared by Lucy Moore. Please contact her with comments or questions: 505-820-2166 or lucymoore@nets.com

Chavez, Carl J, EMNRD

From: Lucero, Stephen A., EMNRD
Sent: Thursday, March 04, 2010 3:44 PM
To: Sarracino, Robert
Cc: Chavez, Carl J, EMNRD; Katharine Chartrand
Subject: Ideas for Proposed NM Oil and Gas Geothermal Coproduction Meeting

Hello – Here are some thoughts and ideas for the Geothermal Oil and Gas Coproduction working group meeting

Administrative Lead: NM Consortium

Technical Lead : Dr. Richard Erdlac (Erdlac Consulting)

University Lead: Ron Broadhead (Principal Senior Petroleum Geologist, NM Tech)

Regulatory Lead: Carl Chavez NM OCD

Meeting Location: Albuquerque

Meeting Timeframe: Late Summer/Fall 2010

Action Items:

S. Lucero to provide general meeting synopsis and goals to Ron Broadhead. Ron can then submit a proposal to the NM Consortium.

Contacts need to be made at NMOGA and industry in the state

Email Distribution list to be made - S. Lucero will start sending contacts to NMC via email

Steve Lucero
State of New Mexico
Energy Conservation and Management Division
1220 South Saint Francis Drive
Santa Fe, NM 87505

(505) 476-3324
stephen.lucero@state.nm.us
www.cleanenergynm.org

Chavez, Carl J, EMNRD

Subject:	Geothermal Regulations Stakeholder Meeting
Location:	OCD 3rd Floor Conference Room
Start:	Tue 3/30/2010 10:30 AM
End:	Tue 3/30/2010 12:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Chavez, Carl J, EMNRD
Required Attendees:	Hall, John, NMENV; Johnson, Mike S., OSE; Heber, David, OSE; Rappuhn, Doug H., OSE; Brooks, David K., EMNRD; Altomare, Mikal, EMNRD; VonGonten, Glenn, EMNRD; Lucero, Stephen A., EMNRD; Olson, Bill, NMENV; Sanchez, Daniel J., EMNRD; Fesmire, Mark, EMNRD

Note: The meeting date is tentative until confirmed by all attendees. Also, the OCD can teleconference in the event physical attendance is not possible.

Please send me your agenda items in advance of the meeting. Thank you.

Draft Agenda:

1) Does NMED and OSE agree with OCD's Geothermal Regulatory Interpretation
2) If so, the stakeholders will brainstorm under the various geothermal applications to determine "Who Does What?"
3) Innovative ways for OCD to handle the magnitude of the permitting process. Seems like NMED has been thinking outside the box to avoid permitting and OCD may need to adopt a similar strategy where the situation is deemed incidental heat unpermitted, aquifers with greater than 10,000 ppm that may be exempt from a WQCC Discharge Permit, but still regulated under Geothermal Regulations; EGSs where there is no aquifer in the bedrock, fractures are artificially created, and a generally fixed volume is injected to create a closed-loop ground recirculating system (again, WQCC Permitting may not apply, or may apply for Class V Geothermal injection wells, and any production/development wells; etc.).
4) NMED Issues
5) OSE Issues
6) OCD Issues
7) Miscellaneous
8) Path Forward

(OCD Santa Fe Conf. Rm.) Geothermal Communication Meeting
2/24/2010 Stakeholders (UIC-999)

Name	Agency	phone	E-mail
Carl Chavez	NM-OCD Env. Bureau	505 476-3490	Carl j.chavez@state.nm.us
Mikal Altomare	NM-OCD legal	505-476-3480	mikal.altomare@state.nm.us
Daniel Sanchez	NM OCD Compliance	476-3493	daniel.sanchez@state.nm.us
Mike Johnson	NMOSE Hydrology	505 827-3867	mike.johnson@state.nm.us
David Heber	NMOSE Water Rights	505-827-6102	david.heber@state.nm.us
Steve Lucero	NM ECMD C EMNRD	505 476-3324	stephen.lucero
John Hall	NMED - GWQB	505-827-1049	john.hall
David Brooks	NM-OCD-legal	505-476-3450	david.brooks

NM Energy, Minerals & Natural Resources Division
Geothermal Stakeholder Communication Meeting
Wednesday, February 24, 2010 (1:00 – 2:00 p.m.)

Draft Agenda

1) Introductions: Carl Chavez, OCD (505) 476-3490 (Geothermal Power) Meeting Notice & Steve Lucero, ECMD (505) 476-3324 (Renewable Energy Stimulus Funding & Geothermal Working Group) (Note: OCD Online "UIC-999" for complete info. & OCD Geothermal Resource Page with Geothermal Regulations at http://www.emnrd.state.nm.us/ocd/documents/OilConservationDivisionGeothermalApplicationProcess8-18-2009.pdf).

2) Governor's Executive Order: DB to ID deep source geothermal resources; Technical and Policy Recommendations for streamlining the renewable power generation process in New Mexico.

3) This meeting partly stems from No. 2 and present experience with permitting issues (i.e., correlative rights, UIC Class V Injection Wells vs. Production/Development Wells under Geothermal Regulations) for the first OCD permitted power generation project (Lightning Dock) near Animas, New Mexico.

4) OCD Attorneys: David Brooks and Mikal Altomore discuss interpretation of OCD Geothermal Regulations and Perceived Jurisdiction.

5) Stakeholder Discussion

6) Miscellaneous

7) Path Forward

Chavez, Carl J, EMNRD

Subject:	OCD Geothermal Regulations Communication Meeting & OCD Perceived Authority for Low-Temp. Geothermal Resource(s) in New Mexico to Extract the Heat
Location:	Telephone Conference Call from OCD Conference Room
Start:	Wed 2/24/2010 1:00 PM
End:	Wed 2/24/2010 2:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Chavez, Carl J, EMNRD
Required Attendees:	Hall, John, NMENV; Olson, Bill, NMENV; Rappuhn, Doug H., OSE; Phillips, Haddy L., OSE; Jackson, Charles L., OSE; Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Altomare, Mikal, EMNRD; Fesmire, Mark, EMNRD
Optional Attendees:	Lucero, Stephen A., EMNRD

Ladies and Gentlemen:

Please call into 1-(213)-289-0500 and enter the Participant Access Code of "4509670" to enter the conference call at 1:00 p.m. tomorrow Mountain Standard Time.

You may review the OCD's Geothermal Regulations at
http://www.emnrd.state.nm.us/ocd/documents/OilConservationDivisionGeothermalApplicationProcess8-18-2009.pdf

Please share the above information with anyone else who would like to participate. Thank you.

Hi Carl –

Thanks for contacting us at the OSE on this matter. A counterpart or I will link up for your telephonic conference, and I expect our Water Rights Division to also call in. As you note, there are matters of appropriation of thermal waters that the OSE would likely maintain (?) a role in... that'll be a water rights issue.

Your timing on the matter is good. Over the next year, the OSE expects to review our involvement in all manners of boreholes that do not appropriate/divert groundwater, and closed loop/heat exchange wells would be one example. Will you guys be exerting jurisdiction over these wells? As it stands, we have been issuing exploratory permits for the closed loop wells, but they are a square peg in a round hole as far as our regs go. Processing the multi-well applications is time-intensive, and other than stressing adherence to good well construction principles, we don't walk away with much other than an eventual smattering of Well Records filed reflecting an abstracted overview of drilling conditions. We do have well construction concerns regarding the loop wells where artesian conditions exist or where more than one aquifer is penetrated during drilling.

OSE issues on closed loop/heat exchange wells have also included that drilling services are conducted by a licensed well driller, and appropriate abandonment of boreholes was conducted as necessary. We have also thus far monitored the grout mix being used in these wells, as there is an industry tendency to enhance thermal conductivity of the annular grout by adding heady amounts of sand to a high solids bentonite grout. Spec sheets thus far provided by ground loop contractors indicate the low permeability of the sand-bentonite grouts used is acceptable, but we worry additional sand may be used to the point of limiting the sealing effect of the bentonite matrix... an issue if multiple aquifers must be kept separated.

Douglas H. Rappuhn
Hydrology Bureau / New Mexico Office of the State Engineer

5550 San Antonio Drive NE
Albuquerque, NM 87109-4127
Phone: 505-383-4018; Fax: 505-383-4030
e-mail: doug.rappuhn@state.nm.us

OCD Message from 2/22/2010

Ladies and Gentlemen:

I have contacted most of you today on the mail list above to convey OCD's preliminary interpretation of its Geothermal Regulations by OCD Attorneys in a meeting this morning. OCD has preliminarily determined that it also has jurisdiction over low-temperature geothermal resources in New Mexico, where the intent is to extract and use the heat (not incidental use).

Therefore, the OCD would like to arrange a telephone conference call between all geothermal stakeholders: Office of the State Engineer, New Mexico Environment Department (NMED) and Oil Conservation Division (OCD) to preliminarily discuss the OCD's findings and to communicate on an agreeable path forward between the stakeholder agencies. This may change the currently perceived, "Who Does What" for permitting geothermal operations in New Mexico.

The OCD findings come at an opportune time when the Geothermal Working Group headed by the Energy, Minerals, and Natural Resources Department, Energy Conservation and Management Division (ECMD) is working under an Executive Order to develop a statewide database for deep source geothermal resources for power generation, technical and policy recommendations for streamlining the commercial geothermal power generation process, etc. It would seem one permitting agency may help to streamline the process. However, NMED and OCD are aware of OSE's involvement in all adjudicatory water rights issues at all geothermal project locations......, which likely will not change.

I will be sending out a meeting notice for a telephone conference call this coming Wednesday afternoon at 1:30 p.m. for a 1 hour meeting and will provide a phone number to call into along with a participant code to enter the telephone conference call.

NMED's calendar is open Wednesday only, and then on March 9 or 10, 2010 would be the soonest it could participate.

Please contact me at (505) 476-3490 if you have questions. Thank you.

STATE OF NEW MEXICO
GOVERNOR BILL RICHARDSON

For Immediate Release
January 12, 2010

Contact: Alarie Ray-Garcia
(505) 231-7350

Governor Bill Richardson Sets Bold Agenda for Future of New Mexico's Green Economy

SANTA FE-Governor Bill Richardson today signed an executive order that outlines the state's course to building a comprehensive green economy. The executive order carries out recommendations and goals detailed in the report developed by the Governor's Green Jobs Cabinet.

Governor Richardson signed the executive order at SCHOTT Solar's Albuquerque manufacturing plant.

"A comprehensive green economy is critical to the future of New Mexico and will lead our state into a new era of economic vitality and stability," Governor Richardson said.
"Today I am outlining a clear path to ensure our state capitalizes economically and environmentally on our abundant renewable resources and assets."

The Green Jobs Cabinet identified five immediate goals for the state to realize its full green economy potential, including:

1. To become a leader in renewable energy export.
2. To become the center of the North American solar industry. This includes everything from research and development to manufacturing to the installation of solar elements in our buildings.
3. To lead the nation in Green Grid innovation.
4. To continue being a leader in green building and energy efficiency.
5. To have an educational system that prepares New Mexico students for jobs in green technologies.

Governor Richardson's executive order lays out a wide scope of directives to reach these goals, and involves several state agencies, including the Economic Development Department, the Energy, Minerals, and Natural Resources Department, the New Mexico Environmental

State Government;

4. Executive Order 2006-01; State of New Mexico Energy Efficient Green Building Standards
for State Buildings;

5. Executive Order 2006-69; New Mexico Climate Change Action;

6. Executive Order 2007-053; Increasing Energy Efficiency in State Government by 2015 and
Statewide by 2012 and 2020;

7. Executive Order 2008-028; Establishing a Strong Telework and Flexible Work Hours Program to Help Reduce Fuel Use and Taxpayer Costs;

8. Executive Order 2009-002; Expanding New Mexico's Clean Energy Economy;

9. Executive Order 2009-047; Establishing New Mexico As A Leader In Addressing Climate
Change;

WHEREAS, Executive Order 2009-002 established the Green Jobs Cabinet ("GJC") with the purpose of preparing a statewide strategic plan for clean energy and clean technology economic development and job creation;

WHEREAS, in developing its report to the Governor, the GJC interviewed over 100 clean energy economy leaders, organized town hall dialogues in over a dozen cities in every region of the State, and solicited citizen recommendations via a formal Call for Comments;

WHEREAS, the GJC recommended five strategies for expanding New Mexico's clean energy economy, consisting of:

1. Be the Leader in Renewable Energy Export
2. Be the Center of the North American Solar Industry
3. Lead the Nation in Green Grid Innovation
4. Be a Center of Excellence for Green Building and Energy Efficiency
5. Have a Highly-Skilled and Ready-to-Work Workforce

WHEREAS, green jobs, defined by the GJC as "family-supporting, career-track jobs that directly contribute to preserving or enhancing environmental quality," are generally well-paid, place-based, difficult to lose to foreign competition, and critical to a sustainable future;

WHEREAS, between 1998 and 2007, green jobs grew by 50% overall in New Mexico, which is 25 times the rate of overall job growth in the State according to The Pew Charitable Trusts;

WHEREAS, according to the New Mexico Department of Workforce Solutions, New Mexico's clean energy economy has created green jobs in both rural and urban areas; the Clean Energy Sector grew in New Mexico during the last 10 years by 118%, Energy Efficiency by 184%, Environmentally Friendly Production by 99%, and Conservation and Pollution Mitigation by 35%;

c. EDD shall convene a working group that includes the Los Alamos and Sandia National Laboratories, New Mexico's research universities, venture capital community, entrepreneurs and other relevant stakeholders no later than June 30, 2010 to determine best practices for standardized, streamlined and incentivized market transfer mechanisms for clean energy technologies. EDD shall provide a report with its findings and proposed commercialization strategies to the GJC and the Governor no later than September 30, 2010.

d. EDD shall, in collaboration with the New Mexico Partnership ("Partnership"), develop annual recommendations for improving the State's competitive position in attracting renewable energy companies to New Mexico no later than September 1 of each year. Such recommendations shall be created per the requirements of any agreements in existence between EDD and the Partnership.

2. Energy, Minerals, and Natural Resources Department ("EMNRD"): EMNRD shall implement and abide by the following directives:

   a. EMNRD shall continue to support the efforts of the New Mexico Association of Counties to establish a special property tax assessment district for renewable energy in each interested county of the State. EMNRD shall report on implementation progress to the Clean Energy Development Council ("CEDC") and the GJC and no later than March 1, 2010 and July 1, 2010, respectively.

   b. EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010.

   c. EMNRD shall participate in Public Regulation Commission ("PRC") rule-making and Investor-Owned Utility and rural electric cooperatives program filings related to the implementation of the Efficient Use of Energy Act and the Renewable Energy Act. EMNRD shall document its participation, recommendations and the PRC outcomes and submit a summary to the GJC and the Governor no later than December 1 of each year.

3. New Mexico Environment Department ("NMED"): NMED shall implement and abide by the following directive:

6. Department of Workforce Solutions ("DWS"): DWS shall implement and abide by the following directives:

   a. DWS shall convene the Green Industry Council ("Council"), as constituted in New Mexico's State Energy Sector Partnership and Training Grant proposal and with any additional Council Members deemed necessary by the Chair of the Council, two or more times by December 1, 2010. The Council shall assist in identifying: demand for particular green occupations; recognized industry-wide green standards for worker knowledge, skills and abilities; potential educational partnerships with industry; and other programs, opportunities and incentives available to advance green workforce development in New Mexico. EDD, Public Education Department ("PED") and Higher Education Department ("HED") shall participate in the Council with PED and HED working to ensure alignment of K-12 and higher education with industry requirements to prepare an educated green workforce. DWS shall submit a report to the GJC and the Governor on the Council's findings no later than December 15, 2010.

   b. DWS shall, with the support of EDD, convene a stakeholder meeting to discuss New Mexico Entrepreneurship in the Green Economy. DWS shall ensure that the stakeholders include PED and HED, university and college officials, K-12 educators, entrepreneurs, scientists, venture capitalists and interested businesses. DWS shall subsequently prepare a coordinated Statewide action plan for submission to the GJC and the Governor no later than December 15, 2010. The plan shall address the role of entrepreneurial workforce and technology maturation skills development, opportunities for incorporating entrepreneurial education into the state career technical standards and curriculum frameworks and college coursework, and strategies for developing, supporting and retaining entrepreneurial talent in New Mexico as a driver of job creation and economic development.

IV. Agency Support: All state agencies shall assist, as appropriate, in implementing this Order and fulfilling its purpose. The actions mandated as a result of this Executive Order shall be accomplished within the bounds of, and consistent with, the relevant agency's statutory and regulatory authority.

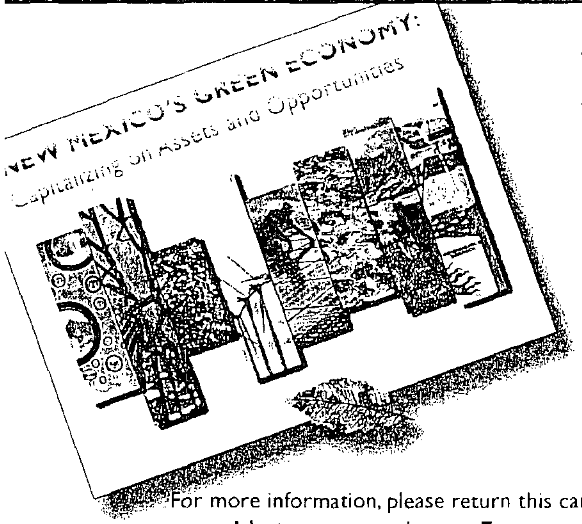
V. Lead Coordinator: The Governor's Energy & Environmental Policy Advisor shall be the Lead Coordinator and in this capacity shall serve as the central point of contact for implementation of this Order, shall be authorized to obtain periodic progress reports from agencies regarding their compliance with this Order, and shall be authorized to give directives to agencies to ensure implementation of this Order.

VI. Role of Committees and Working Groups: The committees and working groups established by this Executive Order shall be advisory bodies that make recommendations to the Green Jobs Cabinet and Governor and in no event shall make final decisions regarding policy.

VII. Public Support: Public members of the committees and working groups established by this Executive Order shall serve voluntarily and shall receive no pay for their services, nor shall they be reimbursed for travel or subsistence expenses, unless otherwise provided by law.

VIII. Disclaimer: Nothing in this Executive Order is intended to create a private right of action to enforce any provision of this Order or to mandate the undertaking of any particular action pursuant to this Order; nor is this Order intended to diminish or expand any existing legal rights or remedies.

JUST RELEASED: GOVERNOR RICHARDSON'S GREEN JOBS CABINET REPORT



This report outlines **five** economic development goals:

GOAL #1: Be the Leader in Renewable Energy Export

GOAL #2: Be the Center of the North American Solar Industry

GOAL #3: Lead the Nation in Green Grid Innovation

GOAL #4: Be a Center of Excellence for Green Building and Energy Efficiency

GOAL #5: Have a Highly Skilled and Ready-to-Work Workforce

For more information, please return this card **or** visit our website at
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Brendan Miller
Green Economy Manager
New Mexico Economic Development Department
1100 St. Francis Drive
Santa Fe, NM 87505

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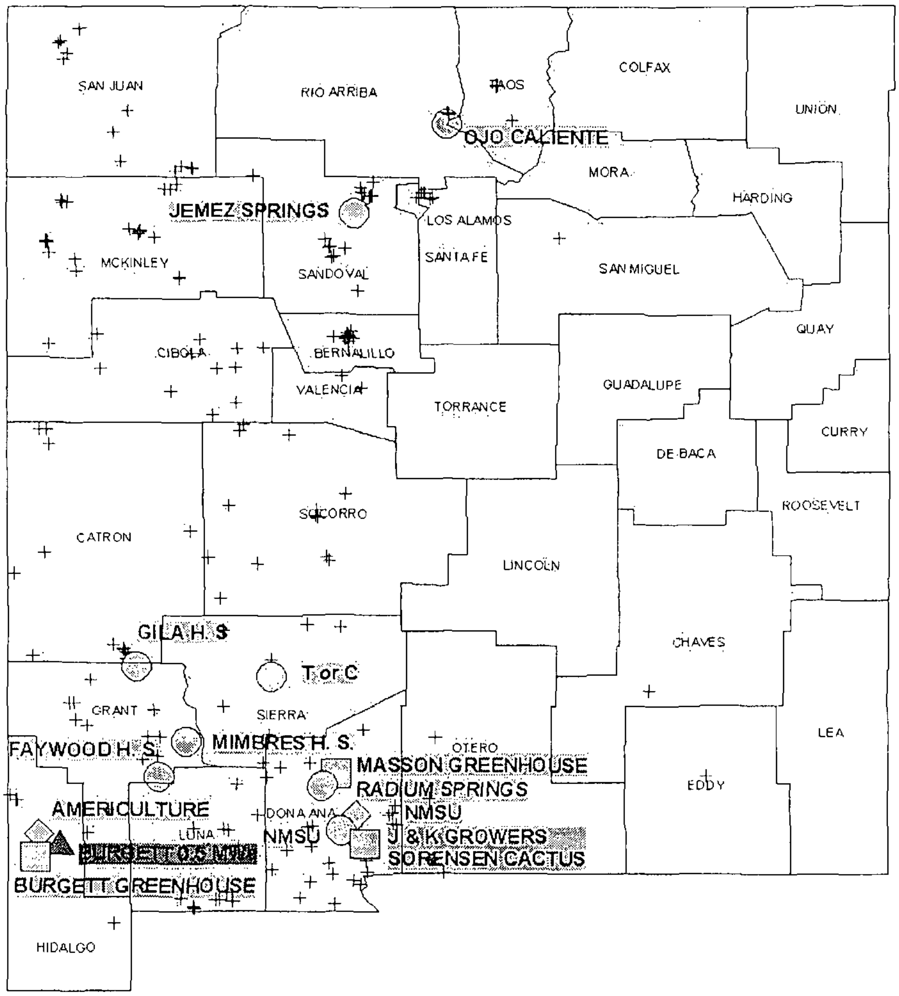


Figure 5. Geothermal use in New Mexico. Yellow circles -space and district heating; green squares - greenhousing; blue diamonds – aquaculture; red triangle – binary electrical power; black crosses – thermal wells and springs (Witcher, 2002).

6.3 Aquaculture

The AmeriCulture Fish Farm at Cotton City in southwest New Mexico (Figure 5) raises tilapia from eggs produced on site. AmeriCulture markets and sells a disease free tilapia fry to growers and researchers nation wide for grow out to full size. Tilapia is a fish that is growing in popularity for its taste and in recent years, local Red Lobster seafood restaurants have added tilapia to the menu.

Geothermal offers several advantages for fish culture. For instance, AmeriCulture is heated with a downhole heat exchanger installed in a 400-foot depth well at much

THE POWER OF WASTE WATER

RMOTC PROJECT TO USE PRODUCED WATER FOR GEOTHERMAL APPLICATION

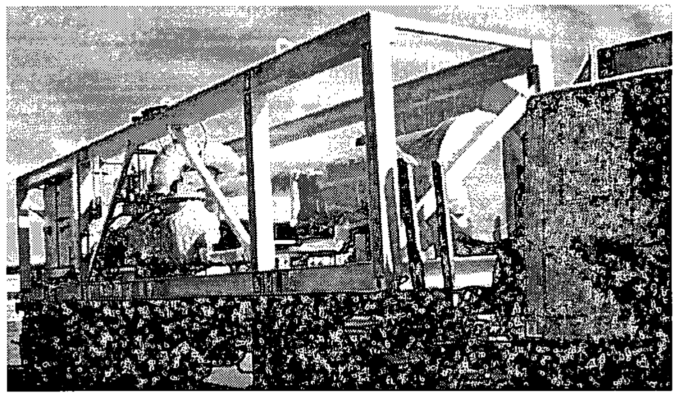
There are a large number of oil and gas wells in the United States that produce hot water as well as hydrocarbon products. These wells, which generally produce fluids at temperatures below 220°F, have been estimated as being capable of generating upwards of 5,000 MW of power. To test the concept of using oil-field waste water to power field production equipment, RMOTC recently partnered with Ormat Nevada Inc. Equipment for the test will be installed this summer at NPR-3.

The purpose of the project is to validate the premise that a binary geothermal power generation system that uses hot water produced by an oil field can reliably generate commercial electricity. The unit to be used is similar to the 250 kW Ormat Energy Converter (OEC) unit that has been producing electricity from 210°F geothermal water at an Austrian resort for more than six years. Similar units have also been in continuous commercial operation since the 1980s in Nevada and Thailand.

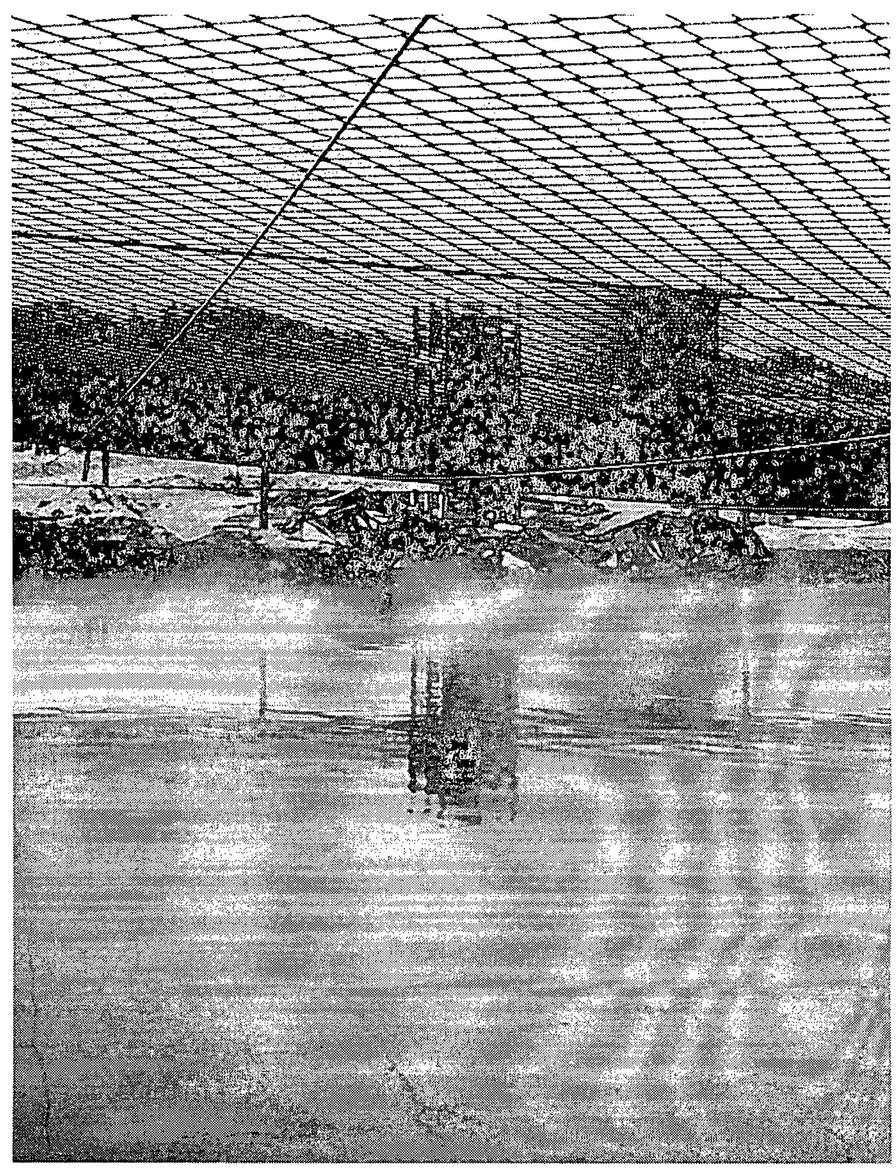
The power system is a commercial, air-cooled, skid-mounted standard design Ormat Organic Rankine Cycle (ORC) power plant. Ormat will supply the unit that RMOTC will install and subsequently operate for a 12-month test period – together about a $1 million investment. The binary power unit brings produced hot water through pipelines to a heat exchanger in the OEC. In the heat exchanger, the geothermal fluid heats and vaporizes a secondary working fluid, which is typically an organic fluid with a low boiling point. **The vapors drive a turbine which powers a generator and then are condensed for recycle into the heat exchanger, completing the cycle within a closed system.** The cooled geothermal fluid is reinjected into the reservoir or discharged.

Geothermal Potential at NPR-3

Two formations at NPR-3 produce sufficient hot water for the generation of low-temperature geothermal energy. The average production temperature for the Tensleep is 190°F and 200°F for the Madison. Early projections indicate that with minor work on



Left: The equipment to be installed at NPR-3 is set to arrive in mid-June. Below: Waste water at NPR-3 is currently treated before being discharged into an adjacent stream.

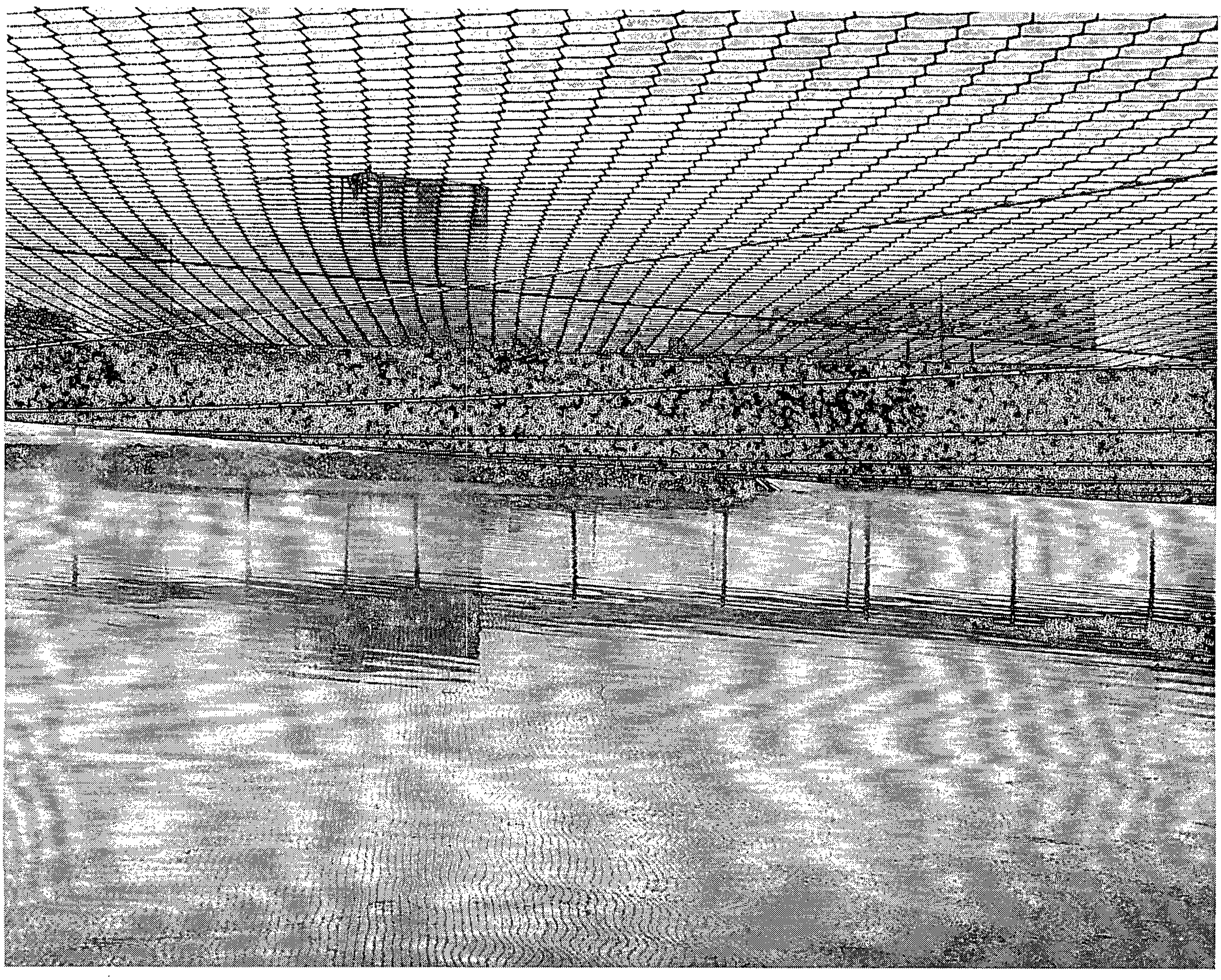


present wells, the rate for the combined Tensleep and Madison produced water would be between 126 and 210 MBWPD. There is also the potential to drill additional Tensleep and Madison wells.

The present produced water from the Tensleep formation is projected to produce 180 kW of gross power. When the Madison produced water is included with potential increases in Tensleep production, the gross power potential would be in the 540 kW to 900 kW range. Currently, the hot water is a waste stream and is treated through a series of treatment ponds and then discharged into an adjacent stream. The OEC will allow the water's heat to be harnessed before it reaches the ponds. The electricity generated from the Tensleep wells' produced water will be used to power field production equipment. The ORC power unit will be interconnected into the field electrical system and the produced energy will be metered and monitored for reliability and quality.

The aquifer in both the Tensleep and Madison formations are continuously recharged from the mountains to the west. The Tensleep and Madison are interconnected by a series of fractures to the underlying formations and the basement rock. **The unit that will be used at RMOTC has been field proven in other situations, but has never been used in an oil field.**

Harnessing the available hot water produced during oil production to power the oil field could potentially lead to more economical access to reserves, especially in stripper fields such as NPR-3. The use of field-proven and time-tested technologies to test geothermal application in the oil field builds confidence that this clean, renewable source could become commonplace in the oil fields of the future.



Chavez, Carl J, EMNRD

Subject:	OCD Geothermal Regulations Communication Meeting & OCD Perceived Authority for Low-Temp. Geothermal Resource(s) in New Mexico to Extract the Heat
Location:	Telephone Conference Call from OCD Conference Room
Start:	Wed 2/24/2010 1:00 PM
End:	Wed 2/24/2010 2:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Chavez, Carl J, EMNRD
Required Attendees:	Hall, John, NMENV; Olson, Bill, NMENV; Rappuhn, Doug H., OSE; Phillips, Haddy L., OSE; Jackson, Charles L., OSE; Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Altomare, Mikal, EMNRD; Fesmire, Mark, EMNRD

Ladies and Gentlemen:

Please call into 1-(213)-289-0500 and enter the Participant Access Code of "4509670" to enter the conference call at 1:00 p.m. tomorrow Mountain Standard Time.

You may review the OCD's Geothermal Regulations at
http://www.emnrd.state.nm.us/ocd/documents/OilConservationDivisionGeothermalApplicationProcess8-18-2009.pdf

Please share the above information with anyone else who would like to participate. Thank you.

OCD Message from 2/22/2010

Ladies and Gentlemen:

I have contacted most of you today on the mail list above to convey OCD's preliminary interpretation of its Geothermal Regulations by OCD Attorneys in a meeting this morning. OCD has preliminarily determined that it also has jurisdiction over low-temperature geothermal resources in New Mexico, where the intent is to extract and use the heat (not incidental use).

Therefore, the OCD would like to arrange a telephone conference call between all geothermal stakeholders: Office of the State Engineer, New Mexico Environment Department (NMED) and Oil Conservation Division (OCD) to preliminarily discuss the OCD's findings and to communicate on an agreeable path forward between the stakeholder agencies. This may change the currently perceived, "Who Does What" for permitting geothermal operations in New Mexico.

The OCD findings come at an opportune time when the Geothermal Working Group headed by the Energy, Minerals, and Natural Resources Department, Energy Conservation and Management Division (ECMD) is working under an Executive Order to develop a statewide database for deep source geothermal resources for power generation, technical and policy recommendations for streamlining the commercial geothermal power generation process, etc. It would seem one permitting agency may help to streamline the process. However, NMED and OCD are aware of OSE's involvement in all adjudicatory water rights issues at all geothermal project locations……, which likely will not change.

I will be sending out a meeting notice for a telephone conference call this coming Wednesday afternoon at 1:30 p.m. for a 1 hour meeting and will provide a phone number to call into along with a participant code to enter the telephone conference call.

NMED's calendar is open Wednesday only, and then on March 9 or 10, 2010 would be the soonest it could participate.

Please contact me at (505) 476-3490 if you have questions. Thank you.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Monday, February 22, 2010 4:58 PM
To: Hall, John, NMENV; Olson, Bill, NMENV; Rappuhn, Doug H., OSE; Phillips, Haddy L., OSE; Jackson, Charles L., OSE; Smith, Mark A, EMNRD; Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Altomare, Mikal, EMNRD
Cc: Lucero, Stephen A., EMNRD
Subject: OCD Geothermal Regulations Communication Meeting & OCD Perceived Authority for Low-Temp. Geothermal Resource(s) in New Mexico to Extract the Heat

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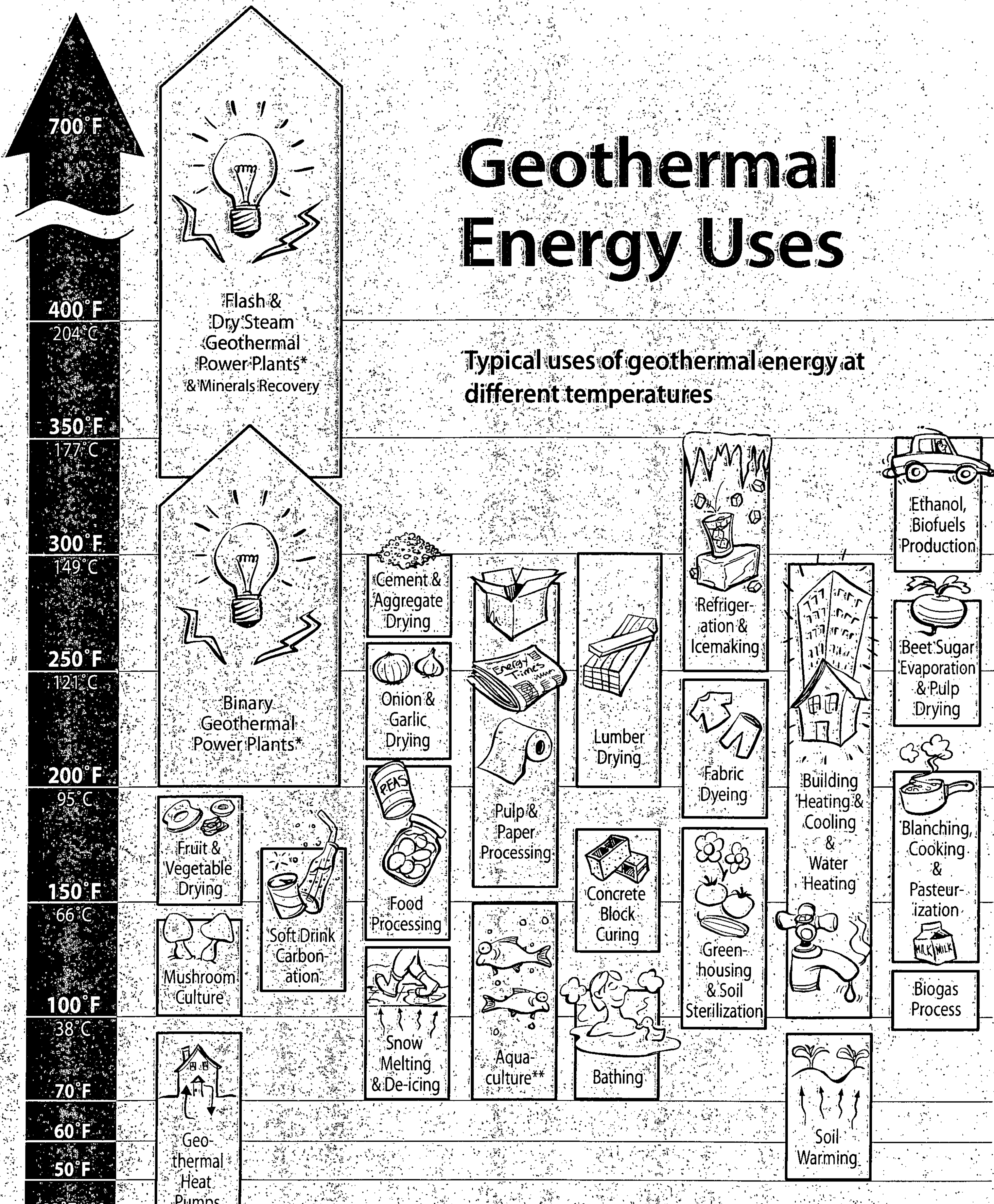
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Geothermal Energy Uses

Typical uses of geothermal energy at different temperatures



*Geothermal electricity can be used to produce renewable Hydrogen.
**Cool water is added to make the temperature just right for the fish.

Chavez, Carl J, EMNRD

From: Lucero, Stephen A., EMNRD
Sent: Tuesday, February 16, 2010 1:28 PM
To: Chavez, Carl J, EMNRD
Subject: RE: Geothermal Working Group OCD Database, Technical & Policy Recommendations/Comments Requested by April 9, 2010
Attachments: 2010 NM Geothermal Database Technical Group

Hi Carl

Please find the attached v-card. Note that this email list also includes people that did not attend the meeting, but still are stakeholders. NM Consortium ended up with the sign-in sheet and I am waiting to get a copy of it from them.

Thanks for the telephone conference information. NM Consortium has offered to hose the meeting again, on May 16th at the Hotel Santa Fe. I think we should take them up on it – a face to face meeting tends to be more productive. If we need an interim discussion prior to May 16th – we could use the teleconference line.

Thanks for your participation, comments and the extensive write-up on the meeting.

Steve

Stephen Lucero
Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

From: Chavez, Carl J, EMNRD
Sent: Tuesday, February 16, 2010 10:55 AM
To: Lucero, Stephen A., EMNRD
Subject: FW: Geothermal Working Group OCD Database, Technical & Policy Recommendations/Comments Requested by April 9, 2010

Steve:

Good morning.

FYI. Can you send the work group members e-mail addresses out? Also, the free telephone conference phone number for call to obtain code for telephone communication meetings is:(712) 580-7700 (you have to call in to setup a conference call and get the code, once you have it, you distribute it with a date time for callers to phone in to a meeting). Thanks.

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Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Tuesday, February 16, 2010 10:48 AM
To: Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Ezeanyim, Richard, EMNRD; Brooks, David K., EMNRD; Jones, William V., EMNRD
Subject: Geothermal Working Group OCD Database, Technical & Policy Recommendations/Comments Requested by April 9, 2010

Hey guys.

I have posted a "brainstorm" file at L:\ENVIRONM\WORD\COMMON\OCD Training\OCD PROGRAMS\UIC PROGRAM\UIC WELLS\UIC Class V Geothermal Well Application Process\Geothermal Work Group 2010 for you to enter your recommendations directly. Please use this file so everyone can view it and get ideas based on comments received from difference offices, people, etc.

I will be compiling and working on a final draft to present to Daniel Sanchez for approval before sending it to Steve Lucero of EMNRD before the May 2010 meeting.

For more background on the issues, please read the "Geothermal Meeting Highlights 2/11/2010 at the same file location.

Please contact me if you have questions. Thank you in advance.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
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Witcher, Jim	Jimwitcher@zianet.com

Chavez, Carl J, EMNRD

Distribution List Name: 2010 NM Geothermal Database Technical Group

Categories: Geothermal

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Daniel, et al.:

Next official meeting is scheduled for the week of May 16, 2010 to discuss the NM Tech data base, technical and policy recommendations proposed by members in draft were requested to be sent to Steve Lucero (EMNRD) as the group moves toward the May meeting. Data base recommendations are to be submitted to the NM Consortium (NM Tech, NMSU & UNM) who organized the meeting and has developed a website to post geothermal information at geothermal@newmexicoconsortium.org. Communication calls (teleconference) are expected between scheduled major meetings with the e-mail distribution list to be sent out soon to members to establish an electronic communications network within the group.

A copy of "New Mexico's Green Economy: Capitalizing on Assets and Opportunities" publication was passed around with a website link (www.edd.state.nm.us/greenEconomy/overview/index.html) along with the Governor's Executive Order. Presentations from the meeting will also be posted at the website (http://newmexicoconsortium.org/working-with-nmc/nmc-network).

Please find below the highlights w/ emphasis on OCD issues from yesterday's first Deep Source Geothermal Commercialization Working Group Meeting to develop a statewide geothermal resource assessment and database. The purpose of the resource assessment and database is to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that will promote commercial-scale development of the geothermal resource. The grouOp will develop technical and policy recommendations to accelerate full-scale development of NM's deep-source geothermal resource.

Major Highlights:

Based on Jim Witcher's deep source presentation, and observations thereof from group interaction, it appears that commercial geothermal companies would prefer to identify shallow high-termperature (>250 F) geothermal resources of significant size with prolific fresh water resources and transmission lines nearby in NM. From the meeting discussion, isolated areas were preferred to populated areas due to water rights issues that can occur between multiple water rights owners in populated areas. Also, aesthetics (pits, well test noise, seismicity, etc.) or siting is important. In Europe, geothermal companies that installed controlled EGS possessed full capital to finance their projects with ownership of land and water rights at the start of their projects, which avoided the permit delays experienced in the U.S. Consequently, it was inferred based on the US financial infrastructure that commercial geothermal power companies possessing full capital and owning all resource rights have the best chance of receiving a geothermal permit for power generation in a timely fashion in NM, unless it can find a way to off-set land, mineral and water rights issues in a timely fashion. A discussion of oil and gas power generation projects are attractive in that transmission infrastructure is in place along with an OCD permitting process (re-entry into existing deep seated oil and gas wells with appropriate casing diameter); however, once a large high-temperature resource is identified and power generation is desired, there are numerous mineral rights issues that will need to be resolved to protect existing oil and gas resources, potash, and water adjudicatory rights issues between adjacent water rights owners to address draw down, fresh cooling tower makeup water that OCD will be responsible for permitting. Multiple land owners, lease owners, water rights owners, etc. seems to end up in the public hearing process that may take years to resolve before an OCD geothermal permit could be issued. At Lightning Dock for example, it took OCD ~ 1.5 years to permit the facility, and the geothermal company is still attempting to get through the water rights adjudicatory issues from the OSE. Other renewable energy power generation companies (wind, solar, etc.) need to be working together with Geothermal Power Companies to consider installing all applicable forms of renewable power technology to boost power generation and make better use of the transmission lines. Steve Lucero (EMNRD) will attend RETA meetings to make them aware of renewable power plant issues out 5 to 10 years, to make RETA more aware of the renewable energy vision. Lastly, it was also noted that modern day binary cycle power generation systems can produce power at temperatures less than 250F; therefore, NMED does not appear to be responsible for these power generation projects.

EGS where there are faults, i.e., Socorro Rio Grande Rift, geothermal companies should not be injecting over fault planes, as seismicity will definitely increase there. Need to back off of fault systems, and with EGS, the operator is creating the fractures for a closed and controlled geothermal system. In this way, seismicity may be reduced so as not to threaten population centers. Also, where geothermal temperatures are at 700F, EGS operators must designed controlled systems in order to use binary cycle systems to produce power. Uncontrolled EGS could result in flash steam systems that will evaporate and deplete the hydrologic resources, i.e., Cobo, NV. Still using flash steam after depleting hydrogeologic and hydrologic resources, pumping in water from another aquifer miles away to sustain flash stem system. No good! Not for NM...Earthquake in Basil 3.9 on Richter Scale shut down EGS project. Socorro has experienced a 5.9 Magnitude earthquake on the Richter Scale before. If Alta Rock were to implement EGS in Socorro, would need to back away from fault system to create isolated and controlled closed loop fracture systems in order to generate power with minimal seismicity affects.

It is thought that EGS is still decades away, but shallow low and high temperature binary cycle power generation may be only 2 – 5 years away if we can locate the right areas.

Introduction:

Nevada is 10 years into their geothermal projects, which appear to be largely economic due to the nature of their resource. Some states with geothermal programs to look at are Southern Methodist (SMU), University of Michigan, and University of Colorado (Geothermal Academy). NM Tech wants to rival the University of Colorado and perhaps the database is a first step in their long-term planning to become a university in NM offering degree programs in geothermal studies?

Database:

EMNRD has awarded NM Tech a $200,000 Grant to develop a Deep-Source Geothermal Commercialization Working Group database. The majority of the meeting was devoted to fleshing out The data base will become a work in progress as new information gets entered from hot springs, geothermal well work, various resources, etc. Several case-studies have been developed by Jim Witcher who presented some more high temperature geothermal locations of possible interest in NM. A web-based one portal GIS system that would draw from multiple databases (BLM, USGS, etc.) was suggested with a recommendation for specific GIS package (not ArcGIS). In addition, a reference link in the database where raw geothermal data could be found was highlighted as key to making raw data accessible to prospective geothermal power developers to solicit the interest of shareholders, etc. for projects in NM.

- NM Tech plans to staff 3 graduate students and 1 GIS student for project.
- Key DB parameters for column header with pertinent geothermal resource information (i.e., geochemistry, geologic, hydrogeologic, geophysics-seismcity, etc.) was discussed that would allow a ranking system with references to access geothermal raw data.
- OSE Representatives (Sylvia Lucero & Rick Semonias?) indicated that all they have in their website water resource information is related to spas using hot water (i.e., T or C Mineral Springs) and it had been categorized in their system as "Exploratory Well", but was recently changed going forward a "Geothermal" designation. No geothermal information is reported in their process. Can only include well owner, construction, and depth to water table (this is helpful in identifying shallow ground water influenced by deeper heat sources).
- Currrently evaluating GIS (i.e., Geomap, ArcView, GMT- spherical vs. Cartesian coordinate systems) to use for project. One portal at NM Tech extracting database info. from multiple sources, QA/QC issues to deal with, but this is the only way to access massive data most efficiently. University of North Dakota has Excel comma delimited file with geothermal info. SMU has heat flow database.

Presentations:

Jim Witcher (Witcher & Associates):

- Rincon, NM highly fractured rhyolite dike is hydrogeologic window for heat flow upward (>250F @ 1300 ft. bgl). This looks very promising based on a temperature gradient (transient system graph) indicates that curve will spread out with depth and increase in temperature over time as in 50,000 years with heat conduction the geothermal termperature are increasing with time... Paleozoic carbonate and Tertiary Thurman Fm. provide for permeability while the Tent Palm Park Fm. forms the confining cap rock low permeability that allows upflow into shallow ground water..
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you leave wells with pumps in place for aqua-culture, nurseries, etc. Could create 2000 jobs between power plant and direct heat applications.

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- Local utility companies like PNM may be interested in purchasing electricity from the geothermal plants too, and not just exporting power out of state...
- Cost of a 7,000 ft. geothermal well was estimated to be about $2M that is why shallow high-temp resources are preferred to deep basin projects.
- Can get a lot of information from hot spings. Can cut cost by estimating geothermal temp. with depth and have laboratory work done to assess geochemistry. I do thermometry myself and develop a simple spreadsheet.
- Need to include any hot spring raw data into database or provide references to raw data. Good to have. Saves time and helps to drive decisions on some projects...
- During exploration, sometimes have to go deeper into bedrock for more heat and/or water.
- Need ranking system for resources identified in db. Include: bot. hole temp., geochem., thermal gradient, .. Could rank by sum of all numbers... Have to start somewhere, may want to focus on geology only...? Raw geochemistry data preferred. Can estimate MW of power to make a decision to proceed.
- Should have community acceptance of EGS Projects.
- No more obstacles on Fed. lands as there are on Private lands, but on Fed. lands require Env. Impact Statement. BLM in NM has been compiling an EIS that will help streamline the geothermal projects on Fed. lands.
- Better to own all resources going into geothermal projects.
- EGS should not drill into fault zones due to earthquake risks. Install EGS away from fault zones. Use controlled EGS so that more efficient binary cycle systems may be used to generate power and not flash steam that will evaporate and deplete the hydrogeologic and hydrologic resources in the area.
- Lightning Dock Geothermal and McGregor geothermal info. can be placed on the NM Tech db. Identify volcanic (young volc.), structure (permeability, fractures), any reference to bibliographies to track down data.
- Location of transmission lines? Can place this on the web, but there are maps. EMNRD needs to be in communication with RETA. They may not be looking out 5 to 10 years and you need to make them aware of your plans. Jeremy Turner is the Director.

Conclusions:

Steve Lucero (EMNRD)

- Jim Witcher will focus on heat source map (heat flow map integrated into database).
- Geothermal wells
- Conductivity info.
- Deep basin databases that have already been developed, find them
- Use SMU website and other data to make preliminary map and heat flow db w/ NMT can put together.
- Tertiary subcrop map
- Jim Witcher has db from hot springs developed since 1995
- USGS has links to all young faults and seismic data
- Start with spreadsheet where we have data
- Next step vizio diagrams with data fields for each db and then combine for plan document for final NM Tech product.
- Info. in db will post in Microsoft Excel Spreadsheet and Mark Person, et al. will organize it..
- Not interested in volcanic sheets that cool in termperature in a couple of week or months.
- Send DB comments to NM Consortium website at geothermal@newmexicoconsortium.org.
- Send draft technical recommendations and policy recommendations at your earliest convenience to Steve Lucero (e-mail address: stephen.lucero@state.nm.us) for compilation to discuss at future meetings going forward. Next major meeting is the week of May 16, 2010.

Note: Communication conference calls may occur between major meetings. EMNRD will setup these calls and has provided the free teleconference phone number ((712) 580-7700)) that you are to call and enter the code number at the date and time provided by the EMNRD to access the conference call from your office.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, February 12, 2010 1:51 PM
To: Lucero, Stephen A., EMNRD
Subject: FW: NM Geothermal Working Group Meeting (2/11/10) Highlights & Path Forward

FYI.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Friday, February 12, 2010 1:37 PM
To: Sanchez, Daniel J., EMNRD
Cc: Jones, William V., EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Brooks, David K., EMNRD; Ezeanyim, Richard, EMNRD
Subject: NM Geothermal Working Group Meeting (2/11/10) Highlights & Path Forward

Daniel, et al.:

FYI, Geothermal Meeting Highlights info. provided below. If anyone would like to provide recommendations, etc. on this, please feel free to do so. I have saved this information under the OCD Training Folder at L:\ENVIRONM\WORD\COMMON\OCD Training\OCD PROGRAMS\UIC PROGRAM\UIC WELLS\UIC Class V Geothermal Well Application Process (see "geothermal work group 2010" folder)..

Next official meeting is scheduled for the week of May 16, 2010 to discuss the NM Tech data base, technical and policy recommendations proposed by members in draft were requested to be sent to Steve Lucero (EMNRD) as the group moves toward the May meeting. Data base recommendations are to be submitted to the NM Consortium (NM Tech, NMSU & UNM) who organized the meeting and has developed a website to post geothermal information at geothermal@newmexicoconsortium.org. Communication calls (teleconference) are expected between scheduled major meetings with the e-mail distribution list to be sent out soon to members to establish an electronic communications network within the group.

A copy of "New Mexico's Green Economy: Capitalizing on Assets and Opportunities" publication was passed around with a website link (www.edd.state.nm.us/greenEconomy/overview/index.html) along with the Governor's Executive Order. Presentations from the meeting will also be posted at the website.

Please find below the highlights w/ emphasis on OCD issues from yesterday's first Deep Source Geothermal Commercialization Working Group Meeting to develop a statewide geothermal resource assessment and database. The purpose of the resource assessment and database is to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that will promote commercial-scale development of the geothermal resource. The grou0p will develop technical and policy recommendations to accelerate full-scale development of NM's deep-source geothermal resource.

Major Highlights:

Based on Jim Witcher's deep source presentation, and observations thereof from group interaction, it appears that commercial geothermal companies would prefer to identify shallow high-termperature (>250 F) geothermal resources of significant size with prolific fresh water resources and transmission lines nearby in NM. From the meeting discussion, isolated areas were preferred to populated areas due to water rights issues that can occur between multiple water rights owners in populated areas. Also, aesthetics (pits, well test noise, seismicity, etc.) or siting is important. In Europe, geothermal companies that installed controlled EGS possessed full capital to finance their projects with ownership of land and water rights at the start of their projects, which avoided the permit delays experienced in the U.S. Consequently, it was inferred based on the US financial infrastructure that commercial geothermal power companies possessing full capital and owning all resource rights have the best chance of receiving a geothermal permit for power generation in a timely fashion in NM, unless it can find a way to off-set land, mineral and water rights issues in a timely fashion. A discussion of oil and gas power generation projects are attractive in that transmission infrastructure is in place along with an OCD permitting process (re-entry into existing deep seated oil and gas wells with appropriate casing diameter); however, once a large high-temperature resource is identified and power generation is desired, there are numerous mineral rights issues that will need to be resolved to protect existing oil and gas resources, potash, and water adjudicatory rights issues between adjacent water rights owners to address draw down, fresh cooling tower makeup water that OCD will be responsible for permitting. Multiple land owners, lease owners, water rights owners, etc. seems to end up in the public hearing process that may take years to resolve before an OCD geothermal permit could be issued. At Lightning Dock for example, it took OCD ~ 1.5 years to permit the facility, and the geothermal company is still attempting to get through the water rights adjudicatory issues from the OSE. Other renewable energy power generation companies (wind, solar, etc.) need to be working together with Geothermal Power Companies to consider installing all applicable forms of renewable power technology to boost power generation and make better use of the transmission lines. Steve Lucero (EMNRD) will attend RETA meetings to make them aware of renewable power plant issues out 5 to 10 years, to make RETA more aware of the renewable energy vision. Lastly, it was also noted that modern day binary cycle power generation systems can produce power at temperatures less than 250F; therefore, NMED appears to be responsible for these power generation projects.

EGS where there are faulits, i.e., Socorro Rio Grande Rift, geothermal companies should not be injecting over fault planes, as seismicity will definitely increase there. Need to back off of fault systems, and with EGS, the operator is creating the fractures for a closed and controlled geothermal system. In this way, seismicity may be reduced so as not to threaten population centers. Also, where geothermal temperatures are at 700F, EGS operators must designed controlled systems in order to use binary cycle systems to produce power. Uncontrolled EGS could result in flash steam systems that will evaporate and deplete the hydrologic resources, i.e., Cobo, NV. Still using flash steam after depleting hydrogeologic and hydrologic resources, pumping in water from another aquifer miles away to sustain flash stem system. No good!!!!! No!!! Not for NM...Earthquake in Basil 30.9 on Richter Scale shut down EGS project. Socorro has experienced a 5.9 Magnitude earthquake on the Richter Scale before. If Alta Rock were to implement EGS in Socorro, would need to back away from fault system to create isolated and controlled closed loop fracture systems in order to generate power with minimal seismicity affects.

It is thought that EGS is still decades away from NMSU Rep., but shallow low and high temperature binary cycle power generation may be only 2 – 5 years away if we can locate the right areas..

Introduction:

Nevada is 10 years into their geothermal projects, which appear to be largely economic due to the nature of their resource. Some states with geothermal programs to look at are Southern Methodist (SMU), University of Michigan, and University of Colorado (Geothermal Academy). NM Tech wants to rival the University of Colorado and perhaps the database is a first step in their long-term planning to become a university in NM offering degree programs in geothermal studies?

Database:

EMNRD has awarded NM Tech a $200,000 Grant to develop a Deep-Source Geothermal Commercialization Working Group database. The majority of the meeting was devoted to fleshing out The data base will become a work in progress as new information gets entered from hot springs, geothermal well work, various resources, etc. Several case-studies have been developed by Jim Witcher who presented some more high temperature geothermal locations of possible interest in NM. A web-based one portal GIS system that would draw from multiple databases (BLM, USGS, etc.) was suggested with a recommendation for specific GIS package (not ArcGIS). In addition, a reference link in the database where raw geothermal data could be found was highlighted as key to making raw data accessible to prospective geothermal power developers to solicit the interest of shareholders, etc. for projects in NM.

- NM Tech plans to staff 3 graduate students and 1 GIS student for project.
- Key DB parameters for column header with pertinent geothermal resource information (i.e., geochemistry, geologic, hydrogeologic, geophysics-seismcity, etc.) was discussed that would allow a ranking system with references to access geothermal raw data.

- OSE Representatives (Sylvia Lucero & Rick Semonias?) indicated that all they have in their website water resource information is related to spas using hot water (i.e., T or C Mineral Springs) and it had been categorized in their system as "Exploratory Well", but was recently changed going forward a "Geothermal" designation. No geothermal information is reported in their process. Can only include well owner, construction, and depth to water table (this is helpful in identifying shallow ground water influenced by deeper heat sources).
- Currrently evaluating GIS (i.e., Geomap, ArcView, GMT- spherical vs. Cartesian coordinate systems) to use for project. If one portal at NM Tech extracting database info. from multiple sources, QA/QC issues to deal with, but this is the only way to access massive data most efficiently. University of North Dakota has Excel comma delimited file geothermal info. SMU has heat flow database.

Presentations:

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- Lightning Dock Geothermal and McGregor geothermal info. can be placed on the NM Tech db. Identify volcanic (young volc.), structure (permeability, fractures), any reference to bibliographies to track down data.
- Location of transmission lines? Can place this on the web, but there are maps. EMNRD needs to be in communication with RETA. They may not be looking out 5 to 10 years and you need to make them aware of your plans. Jeremy Turner is the Director.

Conclusion of Meeting:

Steve Lucero (EMNRD)

- Jim Witcher will focus on heat source map (heat flow map integrated into database).
- Geothermal wells
- Conductivity info.
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- Use SMU website and other data to make preliminary map and heat flow db w/ NMT can put together.
- Tertiary subcrop map
- Jim Witcher has db from hot springs developed since 1995
- USGS has links to all young faults and seismic data
- Start with spreadsheet where we have data
- Next step vizio diagrams with data fields for each db and then combine for plan document for final NM Tech product.
- Info. in db will post in Microsoft Excel Spreadsheet and Mark Person, et al. will organize it..
- Not interested in volcanic sheets that cool in termperature in a couple of week or months.
- Send DB comments to NM Consortium website at geothermal@newmexicoconsortium.org.
- Send draft technical recommendations and policy recommendations at your earliest convenience to Steve Lucero (e-mail address: stephen.lucero@state.nm.us
-) for compilation to discuss at future meetings going forward. Next major meeting is the week of May 16, 2010.

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Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
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(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Katharine Chartrand [info@newmexicoconsortium.org]
Sent: Friday, February 12, 2010 2:05 PM
To: Chavez, Carl J, EMNRD
Subject: Geothermal Working Group Meeting Follow Up

Thank you for your participation in the EMNRD 's Geothermal Working Group meeting Thursday February 11. The NM Consortium has established a website to facilitate communication among this group. If you were unable to attend, workshops presentations and notes will be posted on this website within a week.

Please send information that you would like posted on the website to geothermal@newmexicoconsoritum.org. We'd like information that would be useful to the group for discussion or to someone trying to evaluate geothermal resources in the state. This information includes

1. presentations from the workshop
2. web links to data sources that we should be aware of
3. web links to web-based databases that provide examples of useful functionality
4. data files
5. bibliographical information - both useful web based bibliographies and individual papers
6. links to information about the regulatory process and timeline
7. anything else that would support the process or its objectives.

It is always useful to explain specifically why the information you are providing is useful to the group. That will be included as a note with the information on the website.

Katharine Chartrand
Executive Director
New Mexico Consortium

This inbound email has been scanned for malicious software and transmitted safely to you using Webroot Email Security.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, February 12, 2010 1:37 PM
To: Sanchez, Daniel J., EMNRD
Cc: Jones, William V., EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Brooks, David K., EMNRD; Ezeanyim, Richard, EMNRD
Subject: NM Geothermal Working Group Meeting (2/11/10) Highlights & Path Forward

Daniel, et al.:

FYI, Geothermal Meeting Highlights info. provided below. If anyone would like to provide recommendations, etc. on this, please feel free to do so. I have saved this information under the OCD Training Folder at L:\ENVIRONM\WORD\COMMON\OCD Training\OCD PROGRAMS\UIC PROGRAM\UIC WELLS\UIC Class V Geothermal Well Application Process (see "geothermal work group 2010" folder)..

Next official meeting is scheduled for the week of May 16, 2010 to discuss the NM Tech data base, technical and policy recommendations proposed by members in draft were requested to be sent to Steve Lucero (EMNRD) as the group moves toward the May meeting. Data base recommendations are to be submitted to the NM Consortium (NM Tech, NMSU & UNM) who organized the meeting and has developed a website to post geothermal information at geothermal@newmexicoconsortium.org. Communication calls (teleconference) are expected between scheduled major meetings with the e-mail distribution list to be sent out soon to members to establish an electronic communications network within the group.

A copy of "New Mexico's Green Economy: Capitalizing on Assets and Opportunities" publication was passed around with a website link (www.edd.state.nm.us/greenEconomy/overview/index.html) along with the Governor's Executive Order. Presentations from the meeting will also be posted at the website.

Please find below the highlights w/ emphasis on OCD issues from yesterday's first Deep Source Geothermal Commercialization Working Group Meeting to develop a statewide geothermal resource assessment and database. The purpose of the resource assessment and database is to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that will promote commercial-scale development of the geothermal resource. The grou0p will develop technical and policy recommendations to accelerate full-scale development of NM's deep-source geothermal resource.

Major Highlights:

Based on Jim Witcher's deep source presentation, and observations thereof from group interaction, it appears that commercial geothermal companies would prefer to identify shallow high-termperature (>250 F) geothermal resources of significant size with prolific fresh water resources and transmission lines nearby in NM. From the meeting discussion, isolated areas were preferred to populated areas due to water rights issues that can occur between multiple water rights owners in populated areas. Also, aesthetics (pits, well test noise, seismicity, etc.) or siting is important. In Europe, geothermal companies that installed controlled EGS possessed full capital to finance their projects with ownership of land and water rights at the start of their projects, which avoided the permit delays experienced in the U.S. Consequently, it was inferred based on the US financial infrastructure that commercial geothermal power companies possessing full capital and owning all resource rights have the best chance of receiving a geothermal permit for power generation in a timely fashion in NM, unless it can find a way to off-set land, mineral and water rights issues in a timely fashion. A discussion of oil and gas power generation projects are attractive in that transmission infrastructure is in place along with an OCD permitting process (re-entry into existing deep seated oil and gas wells with appropriate casing diameter); however, once a large high-temperature resource is identified and power generation is desired, there are numerous mineral rights issues that will need to be resolved to protect existing oil and gas resources, potash, and water adjudicatory rights issues between adjacent water rights owners to address draw down, fresh cooling tower makeup water that OCD will be responsible for permitting. Multiple land owners, lease owners, water rights owners, etc. seems to end up in the public hearing process that may take years to resolve before an OCD geothermal permit could be issued. At Lightning Dock for example, it took OCD ~ 1.5 years to permit the facility, and the geothermal company is still attempting to get through the water rights adjudicatory issues from the OSE. Other renewable energy power generation companies (wind, solar, etc.) need to be working together with Geothermal Power Companies to consider installing all applicable forms of renewable power technology to boost power generation and make better use of the transmission lines. Steve Lucero (EMNRD) will attend RETA meetings to make them aware of renewable power plant issues out 5 to 10 years, to make RETA more aware of the renewable energy vision. Lastly, it was also noted that modern day binary cycle power generation systems can produce power at temperatures less than 250F; therefore, NMED appears to be responsible for these power generation projects.

EGS where there are faulits, i.e., Socorro Rio Grande Rift, geothermal companies should not be injecting over fault planes, as seismicity will definitely increase there. Need to back off of fault systems, and with EGS, the operator is creating the fractures for a closed and controlled geothermal system. In this way, seismicity may be reduced so as not to threaten population centers. Also, where geothermal temperatures are at 700F, EGS operators must designed controlled systems in order to use binary cycle systems to produce power. Uncontrolled EGS could result in flash steam systems that will evaporate and deplete the hydrologic resources, i.e., Cobo, NV. Still using flash steam after depleting hydrogeologic and hydrologic resources, pumping in water from another aquifer miles away to sustain flash stem system. No good!!!!! No!!! Not for NM...Earthquake in Basil 30.9 on Richter Scale shut down EGS project. Socorro has experienced a 5.9 Magnitude earthquake on the Richter Scale before. If Alta Rock were to implement EGS in Socorro, would need to back away from fault system to create isolated and controlled closed loop fracture systems in order to generate power with minimal seismicity affects.

It is thought that EGS is still decades away from NMSU Rep., but shallow low and high temperature binary cycle power generation may be only 2 – 5 years away if we can locate the right areas..

Introduction:

Nevada is 10 years into their geothermal projects, which appear to be largely economic due to the nature of their resource. Some states with geothermal programs to look at are Southern Methodist (SMU), University of Michigan, and University of Colorado (Geothermal Academy). NM Tech wants to rival the University of Colorado and perhaps the database is a first step in their long-term planning to become a university in NM offering degree programs in geothermal studies?

Database:

EMNRD has awarded NM Tech a $200,000 Grant to develop a Deep-Source Geothermal Commercialization Working Group database. The majority of the meeting was devoted to fleshing out The data base will become a work in progress as new information gets entered from hot springs, geothermal well work, various resources, etc. Several case-studies have been developed by Jim Witcher who presented some more high temperature geothermal locations of possible interest in NM. A web-based one portal GIS system that would draw from multiple databases (BLM, USGS, etc.) was suggested with a recommendation for specific GIS package (not ArcGIS). In addition, a reference link in the database where raw geothermal data could be found was highlighted as key to making raw data accessible to prospective geothermal power developers to solicit the interest of shareholders, etc. for projects in NM.

- NM Tech plans to staff 3 graduate students and 1 GIS student for project.
- Key DB parameters for column header with pertinent geothermal resource information (i.e., geochemistry, geologic, hydrogeologic, geophysics-seismcity, etc.) was discussed that would allow a ranking system with references to access geothermal raw data.
- OSE Representatives (Sylvia Lucero & Rick Semonias?) indicated that all they have in their website water resource information is related to spas using hot water (i.e., T or C Mineral Springs) and it had been categorized in their system as "Exploratory Well", but was recently changed going forward a "Geothermal" designation. No geothermal information is reported in their process. Can only include well owner, construction, and depth to water table (this is helpful in identifying shallow ground water influenced by deeper heat sources).
- Currrently evaluating GIS (i.e., Geomap, ArcView, GMT- spherical vs. Cartesian coordinate systems) to use for project. If one portal at NM Tech extracting database info. from multiple sources, QA/QC issues to deal with, but this is the only way to access massive data most efficiently. University of North Dakota has Excel comma delimited file geothermal info. SMU has heat flow database.

Presentations:

Jim Witcher (Witcher & Associates):

- Rincon, NM highly fractured rhyolite dike is hydrogeologic window for heat flow upward (>250F @ 1300 ft. bgl). This looks very promising based on a temperature gradient (transient system graph) indicates that curve will spread out with depth and increase in temperature over time as in 50,000 years with heat conduction the geothermal termperature are increasing with time... Paleozoic carbonate and Tertiary Thurman Fm. provide for permeability while the Tent Palm Park Fm. forms the confining cap rock low permeability that allows upflow into shallow ground water..

- Las Cruces, Tortuga Mtn. area: hydrogeologic window allows for 140 – 180F at ground water (2000 – 3000 mg/L high TDS upward flow) at greater than 1000 ft. A geothermal power plant could actually cleanup the salinity of the ground water there. Manco Sh., Chinle are low permeability cap rock and where stripped awy, hydrogeologic window exists. Mid-Tertiary fill out crops and sits on Paleozoic and pre-cambrian rocks. In the mountain areas the shales are stripped away and you find hot springs, and geothermal resources. Similar to low elevation hydrogeologic discharge concept.
- Rio Grande Uplift south of T or C, NM. Laramide uplift caused ring fractures (highly shattered rx) associated with ring caldera. There is a similar ring fracture within 1000 ft. of Socorro with highly shattered rx. and high hydraulic conductivity and conduction of heat through fractures, Pleistocene faults, etc.
- Radium Springs (Sandiego Mtn. (TONUCO MTN): similar to Rio Grande Uplift item above..
- Look for hydrogeologic windows where heat flows upward through higher permeability strata (i.e., SS, fractured granite (w/ high concentrations of Uranium and Thorium) fractured carbonates, karst breccias features, etc.) that allow hot water to flow into shallow ground water, which is most economic to drill wells and generate power. The Fusselman Dolo. Fm. has solution caverns with breccias in the McGregor Range area.
- Graben geologic complexes with convective heat flow to surface are economic.
- Deep basins (i.e., Albuquerque and Tularosa Basins) are filled with 10K – 20K ft. of sediments and if sediments are permeable may provide geothermal power source? It is most economic when high heat is present in shallow ground water.
- Recent exploration well at McGregor Range indicated a geothermal temperature range of 140 to 190F @ 4,500 ft. bgl.
- Valles Caldera only large magma driven geothermal heat source in NM (Mt. Taylor also has one, but it is small & takes millions of years for heat to propagate upwards to shallower ground water depths)
- San Juan Basin Oil and gas fields: Deep gradient system- Dakota SS Fm. is a high permeability prolific ground water and geothermal reservoir (geothermal gradient: 2.5F/100ft. versus background 1 – 1.5F/100 ft) at depth that may be worth exploring.
- Albuquerque Basin Mesa Del Sol Project: basin is 20,000 ft. deep (could find 340F @ 12,650 to 13,000 ft. bgl.) Not as economic due to depth, but if natural gas prices rise, could be attractive? Chinle (500 ft. thick), San Andres (150 ft. thick) & Glorietta Fms (150 ft. thick) may be good?
- SE NM, the Santa Rosa Fm. may be good? Paleozoic Fms.? Deep basins (Permean & San Juan)? You don't drill down to basin, but look for shallow heat conducted upward through hydrogeologic windows.
- Is the geothermal resource sustainable? 10 MW power system at LDG may be sustainable for 10 years? Have to look at dimensions of resource to estimate power production life.
- In Arkansas (Cottonwood area): high fault and fracture density and shattered rock allows upwelling of hydrothermal ground water.
- Need the following info. for NM Tech database: geothemometry; reservoir geology (structure & stratigraphy); geophysics (direct-heat flow, proxy methods-resistivity; & structural methd-gravity, seismic; geochemistry (geothermometry, soil gas studies (Radon, Hg, He).
- Other parameters that are good to know include: depth to water table, well locations and owners- OSE In Nevada, record water temperature on water well logs to indicate heat source is present, but OSE doesn't require that in water well logs and drillers typically do not comment on water termperature. OSE now using "Geothermal" well code instead of "Exploratory Well" code for mineral bath, spa areas of the state.

Mark Person (NM Tech):

- Provided handout. Can prevent 12,000 tons of CO2 from enteing atmosphere and save $ 0.5M per yr. by not burning natural gas and using geothermal instead....
- Use hydrothermal modeling and stress locations of shear to locate hydrogeologic window areas. If rock shear deformation exists, positive thing for EGS and geothermal drilling.
- T or C Hot Springs show promise for further high-temperature geothermal power generation projects. Can estimate geothermal temperature gradients wrt depth based on hot spring data and they indicate the heat source has already propagated heat into shallower ground water depths. OSE "Exploratory Well" database may have well owner and location info.
- EGS where there are faulits, i.e., Socorro Rio Grande Rift, geothermal companies should not be injecting over fault planes, as seismicity will definitely increase there. Need to back off of fault systems, and with EGS, the operator is creating the fractures for a closed and controlled geothermal system. In this way, seismicity may be reduced so as not to threaten population centers. Also, where geothermal temperatures are at 700F, EGS operators must designed controlled systems in order to use binary cycle systems to produce power. Uncontrolled EGS could result in flash steam systems that will evaporate and deplete the hydrologic resources, i.e., Cobo, NV.

Still using flash steam after depleting hydrogeologic and hydrologic resources, pumping in water from another aquifer miles away to sustain flash stem system. No good!!!!! No!!! Not for NM...Earthquake in Basil 30.9 on Richter Scale shut down EGS project. Socorro has experienced a 5.9 Magnitude earthquake on the Richter Scale before. If Alta Rock were to implement EGS in Socorro, would need to back away from fault system to create isolated and controlled closed loop fracture systems in order to generate power with minimal seismicity affects.

- What can NM do for $200K in this database? Need more than this. Several $M? Could focus on 5 best scenario case-study areas proposed by Jim Witcher to start off. DB will be a work in progress that would be updated over time with new info. too National DB covers all states (see www.Geocommunicator.gov).
- Currently using ArcGIS at NM Tech. NM Tech wants to create web based portal where web users can pull in data from multiple databases, but how? Can be done.....
- There are economics and land rights issues to contend with on these geothermal projects.
- Need streamlined permit process for drilling, permits, etc. Seismicity protocol shen hydrofracing or injection process. Water rights? Geothermal rights?
- OCD cares about siting of geothermal projects. For example, what would happen if an EGS 50 MW power plant were constructed near the university within city limits. There will be noise from well testing, large evaporation ponds for well testing and for drilling geothermal wells, there will likely be water table draw down as many hundreds of millions of gallons of fresh water would need to go into the fractures, and if drilling in high density fault and fracture zones in the vicinity of Rio Grande Rift, could be loosing a high percent of water that will need to be made up...... Siting aesthetics does matter.
- Database driven more by private sector than national db. Reno, NV has a good model to look at geothermal map, layers of data, different GIS layers.
- Focus on description of geothermal resources and deep well information? Lots of stratigraphic information in San Juan and Permian Basins with lots of tops, easy, but outliers away from basins harder. Requires more time to get information.NM Tech also has some well cuttings and core samples to look at.

Mike Albright (TBA Power, UT):

- Involved with Jemez Pueblo EGS Project.
- Basic geothermal economics: 14.8 MW net capacity over 10 yers= profit of $30M. Over 30 years= profit $354M (debt ~ 98M).. BIG MOTIVATOR! 30-yr calculations are used for investors. Even at 20 years can make good profit. When you close a geothermal power plant, I recommend that you leave wells with pumps in place for aqua-culture, nurseries, etc. Could create 2000 jobs between power plant and direct heat applications.
- USGS: 600 GW of power estimated from US geothermal more than 6x the power of all existing power plants. Currently, the US is utilizing 1% of that resource.
- NM has greater potential geothermal resources than UT. NM has 70% of the potential of Hawaii for generating power! Think NM is ranked 5/13 states for geothermal potential.
- If geothermal exploration reveals groundwater with temperatures from 200 to 250F, will back off of project. If greater than 250, may choose to stay with project?
- Lightning Dock Geothermal is a blind resource (just following hot springs).
- Think of EGS as an artificial heat exchanger with artificial permeability, heat exchange, through cracks...In addition to the heat source, all you need is 10 – 15 microdarcy and a 900 ft x 1500 ft block size to install controlled EGS. It's that simple. What NM needs is EGS under control and not research projects!!! Europe has done it for 25 years! Can use low injection pressures and move away from fault/fracture systems to minimize seismicity.
- Must have financing in place in the beginning or else can't do it in Europe.
- NM should make renewable energy operators get together with geothermal operators to install different types of renewable energy power production applications to increase power production and receive max. efficiency by sending down transmission lines. Need to work out deals with each other. Solar just needs the land space to set up their power grid and there are no waste products! Wind maybe similar?
- Transmission lines are too far away? Motivate to install lines where needed. Steve Lucero should be involved with RETA to make sure they are aware of the geothermal and renewable power grids planned 5 to 10 years out, as RETA may not even be planning for them?
- Local utility companies like PNM may be interested in purchasing electricity from the geothermal plants too, and not just exporting power out of state...
- Cost of a 7,000 ft. geothermal well was estimated to be about $2M that is why shallow high-temp resources are preferred to deep basin projects.
- Can get a lot of information from hot spings. Can cut cost by estimating geothermal temp. with depth and have laboratory work done to assess geochemistry. I do thermometry myself and develop a simple spreadsheet.

- Need to include any hot spring raw data into database or provide references to raw data. Good to have. Saves time and helps to drive decisions on some projects...
- During exploration, sometimes have to go deeper into bedrock for more heat and/or water.
- Need ranking system for resources identified in db. Include: bot. hole temp., geochem., thermal gradient, .. Could rank by sum of all numbers... Have to start somewhere, may want to focus on geology only...? Raw geochemistry data preferred. Can estimate MW of power to make a decision to proceed.
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February 11, 2010
Deep Source Geothermal Commercialization
Working Group Meeting
Santa Fe, NM

Time	Lead Group	Topic
0900-0915	NM ECMD	Welcome, Introductions, Executive Order 2010-001
0915-0930	NM ECMD/NM Tech	Working Group Goals, Scope of Work
0930-1000	Jim Witcher	Previous Work, Existing Data
1000-1045	All	Group Discussion - Goals, Previous Work, Existing Data
1045-1100	*Break*	
1100-1130	NM Tech	Database and Data Presentation: Maps, GIS, Web-based Software
1130-1145	NM ECMD/All	Morning Session Wrap-Up, Discussion
1145-1300	*Lunch*	
1300-1330	Michael Albrecht	Project Development Resource Assessment Needs
1330-1400	All	Group Discussion - Industry needs
1400-1500	NM ECMD/NM Tech	Policy Recommendations, Action Items, Next Meeting
1500		Meeting Adjourn

ECMD Geothermal Program Goals

- Resource Identification, Assessment, Development and Use
- Public Outreach
- Promote Geothermal Industry in NM
- 10% of NM electricity needs are to be met with renewable energy by 2011, 20% by 2020

STATE OF NEW MEXICO
GOVERNOR BILL RICHARDSON

For Immediate Release
January 12, 2010

Contact: Alarie Ray-Garcia
(505) 231-
7350

Governor Bill Richardson Sets Bold Agenda for Future of New Mexico's Green Economy

SANTA FE-Governor Bill Richardson today signed an executive order that outlines the state's course to building a comprehensive green economy. The executive order carries out recommendations and goals detailed in the report developed by the Governor's Green Jobs Cabinet.

Governor Richardson signed the executive order at SCHOTT Solar's Albuquerque manufacturing plant.

"A comprehensive green economy is critical to the future of New Mexico and will lead our state into a new era of economic vitality and stability," Governor Richardson said.
"Today I am outlining a clear path to ensure our state capitalizes economically and environmentally on our abundant renewable resources and assets."

The Green Jobs Cabinet identified five immediate goals for the state to realize its full green economy potential, including:

1. To become a leader in renewable energy export.

2. To become the center of the North American solar industry. This includes everything from research and development to manufacturing to the installation of solar elements in our buildings.

3. To lead the nation in Green Grid innovation.

4. To continue being a leader in green building and energy efficiency.

5. To have an educational system that prepares New Mexico students for jobs in green technologies.

Governor Richardson's executive order lays out a wide scope of directives to reach these goals, and involves several state agencies, including the Economic Development Department, the Energy, Minerals, and Natural Resources Department, the New Mexico Environmental

State Government;

4. Executive Order 2006-01; State of New Mexico Energy Efficient Green Building Standards
for State Buildings;

5. Executive Order 2006-69; New Mexico Climate Change Action;

6. Executive Order 2007-053; Increasing Energy Efficiency in State Government by 2015 and
Statewide by 2012 and 2020;

7. Executive Order 2008-028; Establishing a Strong Telework and Flexible Work Hours Program to Help Reduce Fuel Use and Taxpayer Costs;

8. Executive Order 2009-002; Expanding New Mexico's Clean Energy Economy;

9. Executive Order 2009-047; Establishing New Mexico As A Leader In Addressing Climate
Change;

WHEREAS, Executive Order 2009-002 established the Green Jobs Cabinet ("GJC") with the purpose of preparing a statewide strategic plan for clean energy and clean technology economic development and job creation;

WHEREAS, in developing its report to the Governor, the GJC interviewed over 100 clean energy economy leaders, organized town hall dialogues in over a dozen cities in every region of the State, and solicited citizen recommendations via a formal Call for Comments;

WHEREAS, the GJC recommended five strategies for expanding New Mexico's clean energy economy, consisting of:

1. Be the Leader in Renewable Energy Export
2. Be the Center of the North American Solar Industry
3. Lead the Nation in Green Grid Innovation
4. Be a Center of Excellence for Green Building and Energy Efficiency
5. Have a Highly-Skilled and Ready-to-Work Workforce

WHEREAS, green jobs, defined by the GJC as "family-supporting, career-track jobs that directly contribute to preserving or enhancing environmental quality," are generally well-paid, place-based, difficult to lose to foreign competition, and critical to a sustainable future;

WHEREAS, between 1998 and 2007, green jobs grew by 50% overall in New Mexico, which is 25 times the rate of overall job growth in the State according to The Pew Charitable Trusts;

WHEREAS, according to the New Mexico Department of Workforce Solutions, New Mexico's clean energy economy has created green jobs in both rural and urban areas; the Clean Energy Sector grew in New Mexico during the last 10 years by 118%, Energy Efficiency by 184%, Environmentally Friendly Production by 99%, and Conservation and Pollution Mitigation by 35%;

c. EDD shall convene a working group that includes the Los Alamos and Sandia National Laboratories, New Mexico's research universities, venture capital community, entrepreneurs and other relevant stakeholders no later than June 30, 2010 to determine best practices for standardized, streamlined and incentivized market transfer mechanisms for clean energy technologies. EDD shall provide a report with its findings and proposed commercialization strategies to the GJC and the Governor no later than September 30, 2010.

d. EDD shall, in collaboration with the New Mexico Partnership ("Partnership"), develop annual recommendations for improving the State's competitive position in attracting renewable energy companies to New Mexico no later than September 1 of each year. Such recommendations shall be created per the requirements of any agreements in existence between EDD and the Partnership.

2. Energy, Minerals, and Natural Resources Department ("EMNRD"): EMNRD shall implement and abide by the following directives:

   a. EMNRD shall continue to support the efforts of the New Mexico Association of Counties to establish a special property tax assessment district for renewable energy in each interested county of the State. EMNRD shall report on implementation progress to the Clean Energy Development Council ("CEDC") and the GJC and no later than March 1, 2010 and July 1, 2010, respectively.

   b. EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010.

   c. EMNRD shall participate in Public Regulation Commission ("PRC") rule-making and Investor-Owned Utility and rural electric cooperatives program filings related to the implementation of the Efficient Use of Energy Act and the Renewable Energy Act. EMNRD shall document its participation, recommendations and the PRC outcomes and submit a summary to the GJC and the Governor no later than December 1 of each year.

3. New Mexico Environment Department ("NMED"): NMED shall implement and abide by the following directive:

6. Department of Workforce Solutions ("DWS"): DWS shall implement and abide by the following directives:

   a. DWS shall convene the Green Industry Council ("Council"), as constituted in New Mexico's State Energy Sector Partnership and Training Grant proposal and with any additional Council Members deemed necessary by the Chair of the Council, two or more times by December 1, 2010. The Council shall assist in identifying: demand for particular green occupations; recognized industry-wide green standards for worker knowledge, skills and abilities; potential educational partnerships with industry; and other programs, opportunities and incentives available to advance green workforce development in New Mexico. EDD, Public Education Department ("PED") and Higher Education Department ("HED") shall participate in the Council with PED and HED working to ensure alignment of K-12 and higher education with industry requirements to prepare an educated green workforce. DWS shall submit a report to the GJC and the Governor on the Council's findings no later than December 15, 2010.

   b. DWS shall, with the support of EDD, convene a stakeholder meeting to discuss New Mexico Entrepreneurship in the Green Economy. DWS shall ensure that the stakeholders include PED and HED, university and college officials, K-12 educators, entrepreneurs, scientists, venture capitalists and interested businesses. DWS shall subsequently prepare a coordinated Statewide action plan for submission to the GJC and the Governor no later than December 15, 2010. The plan shall address the role of entrepreneurial workforce and technology maturation skills development, opportunities for incorporating entrepreneurial education into the state career technical standards and curriculum frameworks and college coursework, and strategies for developing, supporting and retaining entrepreneurial talent in New Mexico as a driver of job creation and economic development.

IV. Agency Support: All state agencies shall assist, as appropriate, in implementing this Order and fulfilling its purpose. The actions mandated as a result of this Executive Order shall be accomplished within the bounds of, and consistent with, the relevant agency's statutory and regulatory authority.

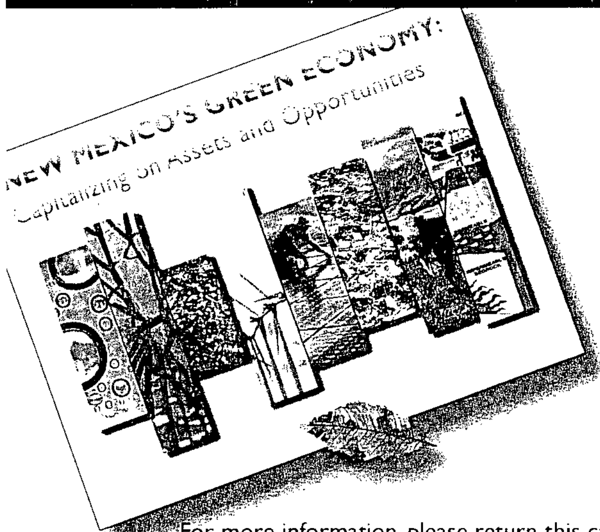
V. Lead Coordinator: The Governor's Energy & Environmental Policy Advisor shall be the Lead Coordinator and in this capacity shall serve as the central point of contact for implementation of this Order, shall be authorized to obtain periodic progress reports from agencies regarding their compliance with this Order, and shall be authorized to give directives to agencies to ensure implementation of this Order.

VI. Role of Committees and Working Groups: The committees and working groups established by this Executive Order shall be advisory bodies that make recommendations to the Green Jobs Cabinet and Governor and in no event shall make final decisions regarding policy.

VII. Public Support: Public members of the committees and working groups established by this Executive Order shall serve voluntarily and shall receive no pay for their services, nor shall they be reimbursed for travel or subsistence expenses, unless otherwise provided by law.

VIII. Disclaimer: Nothing in this Executive Order is intended to create a private right of action to enforce any provision of this Order or to mandate the undertaking of any particular action pursuant to this Order; nor is this Order intended to diminish or expand any existing legal rights or remedies.

JUST RELEASED: GOVERNOR RICHARDSON'S GREEN JOBS CABINET REPORT



This report outlines **five** economic development goals:

GOAL #1: Be the Leader in Renewable Energy Export
GOAL #2: Be the Center of the North American Solar Industry
GOAL #3: Lead the Nation in Green Grid Innovation
GOAL #4: Be a Center of Excellence for Green Building and Energy Efficiency
GOAL #5: Have a Highly Skilled and Ready-to-Work Workforce

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Brendan Miller
Green Economy Manager
New Mexico Economic Development
Department
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Santa Fe, NM 87505

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1892. Since then, the use of the Boise Front geothermal aquifer has expanded to include four separate systems that heat hundreds of buildings, including the State Capitol. Besides Boise, geothermal activity has been identified throughout Idaho; however, to date no commercial geothermal power plants have been developed in the state. The first commercial geothermal power plant is currently under construction at Raft River, and several other areas are under consideration. Past exploration and development efforts have been limited because power rates in Idaho were among the lowest in the country for many years and the state's small population did not necessitate new sources of electric power. Therefore, there is a great need for exploration and resource characterization to better define resource potential. Currently the best guess by even the most knowledgeable researchers in the state is that Idaho could sustain anywhere from a handful of geothermal power plants to rivaling Nevada or even Southern California in recoverable resource. A number of promising geothermal prospects are on BLM and USFS land which further complicates development. Further, both geothermal direct use and electric power projects may conflict with water allocation issues that can also limit development. For these reasons, federal and state support is needed to mitigate barriers and to help researchers understand the resource potential so that they may plan accordingly for future development.

Montana

Industry stakeholders assert that Montana's geothermal resource has been overlooked due to the state's low fossil fuel energy prices, low population and lack of transmission access to remote locations. Also, some past geothermal projects were proposed for areas just outside Yellowstone National Park, which created local controversy and concerns. There are several direct use facilities currently in operation in Montana, mostly in western parts of the state, where geothermal heating is used for aquaculture, greenhouses, and spas and resorts. The USDOE and the Montana state government have joined together to organize a database of locations where geothermal resources have been identified. According to their records, Montana has at least 15 high-temperature sites, a few of them with estimated deep-reservoir temperatures exceeding 350°F (176.7°C). Among these 15 sites are locations in the vicinity of Helena, Bozeman, Ennis, Butte, Boulder and White Sulphur Springs. There is also interest in oil and gas fields in Eastern Montana, including Poplar Dome, where oil wells co-produce hot fluid at boiling temperatures that may be sufficient to support a small geothermal power plant for use at the site. In the near term, oil and gas co-production and geothermal space heating is considered the greatest potential for using geothermal resources in Montana. State and federal support would help these projects come to fruition and encourage further investment in geothermal projects.

Nevada

From 1984 through 1992, 14 geothermal power plants were developed in Nevada. 15 years later, Nevada is seeing a resurgence in development: 24 new plants under development have a combined capacity of up to 751 MW; nine projects with power contracts already secure have a combined capacity of up to 204 MW. Nevada is the one state that has put together federal and state efforts to develop geothermal in an effective way. While some of the recent success in Nevada is owed to prior exploration and research, progress could not have been accomplished without the coordinated effort of state and federal agencies, the state RPS, the federal Production Tax Credit (PTC), the BLM efforts to reduce leasing backlogs, the USDOE's support for cost-shared drilling and technical assistance, and the work of the Great Basin Center for Geothermal Energy at the University of Nevada Reno. These efforts can serve as a model for other states, but they must continue to maintain industry momentum.

New Mexico

Geothermal resources have an opportunity to be a large contributor to the energy needs of New Mexico. To date, however, New Mexico only uses its geothermal resources for thermal heating applications in about a dozen locations. The greatest use of geothermal resources in New Mexico has been its greenhouses, which provide a few hundred jobs and $30 million in annual revenues. During the 1970s and 1980s a large geothermal power project was under development in the Valles Caldera in north-central New Mexico. Resource and regulatory issues led to the cancellation of the project. At the time, it was believed that Valles Caldera was the only geothermal resource area in the state capable of producing a large electric power plant. However, when traveling throughout the state, it became clear that there are a number of attractive resource prospects outside of this conflict area. Unfortunately, limited work has been done in these areas, and most of them are blind (i.e. without apparent surface manifestations). These areas are high-risk and developers in the state need federal or state funding to aid with early exploration and to reduce the high investment risk associated with their development. There is also a need to explore the Rio Grande Rift area in greater detail for both geothermal power prospects and for large-scale geothermal heating potential specifically in Las Cruces and its surrounding areas. In the near term, development is likely for direct use and small-scale power. Drilling has occurred at two locations where small geothermal power units will be installed for an aquaculture facility to produce 10 million pounds of fish annually and a greenhouse that would expand to 40 acres. The resource has been proven at these sites and these projects need continued financial support to ensure project completion.

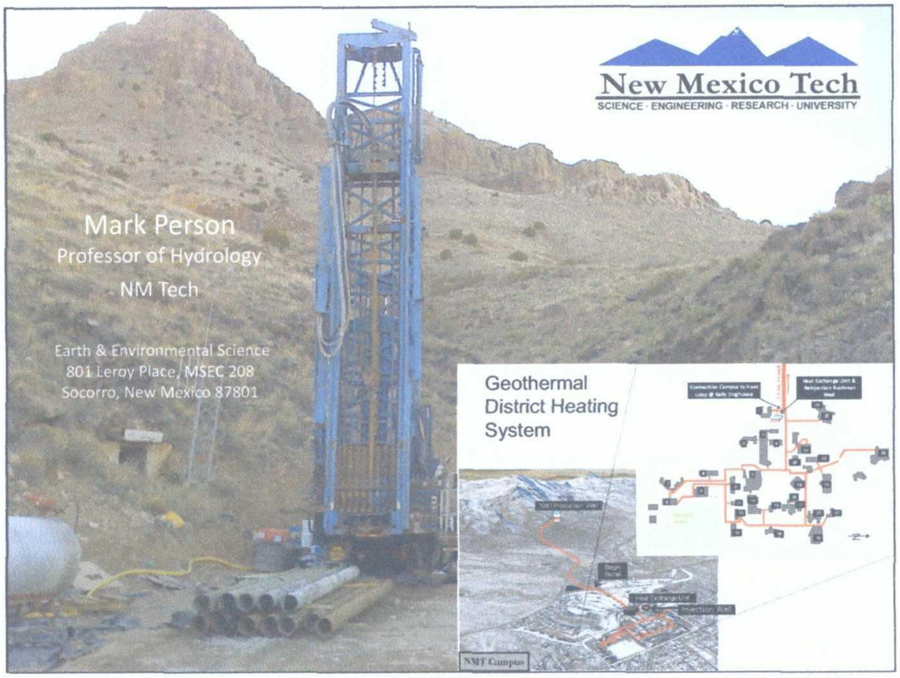
Oregon

Oregon's geothermal resource base has been well-documented. Numerous geothermal direct use projects have been constructed and a small-scale geothermal power project ran in south-central Oregon in the mid-1980s. Conventional wisdom had been that Oregon's geothermal resources sufficient for power production were only available near the Cascade volcanoes and in remote regions in the eastern part of the state. The problems with these projects have been a lack of transmission access and regulatory hurdles (similar to those experienced in California) associated with development on federal land, USFS land in particular. While several large-scale geothermal power projects are currently under development in the state, their success is contingent upon coordinated efforts by federal and state land agencies to conduct environmental impact statements. In the near-term, however, it is clear that small power and direct use projects can be developed without much conflict. Researchers in Oregon are currently experimenting with geothermal heat and power technologies for alternative fuel production and expansions are planned for several direct use facilities in the state. Most agree that these projects can succeed as long as they continue to receive federal and state support.

Texas

In 1990, Texas became the first and only U.S. state east of the Rocky Mountains with an operating geothermal power plant. The demonstration plant was built in Pleasant Bayou and used a geopressured reservoir of high-temperature fluid and natural gas to produce 982 kW of electric energy. The power produced was not cost-competitive at the time with conventional fossil-fuel sources and the plant was shut down five months later. 16 years later, there is a strong consensus that both the geopressured resource as well as hot wastewater co-produced from oil and gas wells can be used to build several hundred plants statewide just like the one built in Pleasant Bayou.

Developers can do this in Texas because of the abundance of oil and gas wells in the state. The effort to revive these types of plants has been largely encouraged by research efforts at Southern Methodist University and the University of Texas-Permian Basin. As a result of their efforts, Texas has become a major area of interest for geothermal development. Researchers have estimated that electric power production potential from Texas oil and gas wells range from 400 MW in the near term to over 2,000 MW. While a small grant has been provided by USDOE to examine potential areas where these projects can be successful, most agree there is a need to fund demonstration projects using the geopressured and oil and gas co-production resources. Further,



Working Group Goals & Scope of Work

- Promote geothermal energy exploration and development (both low- and high temperature)
- Working with our Partners, Develop a NM *Geothermal Resource* Web Site which will display Various maps of geothermal potential
- Web Site will Provide Public access to all relevant data from the site in a variety of formats
- Web site Interactivity? Allow user to query data points on maps (e.g. well names, locations, temperatures, depths) interactively
- Secondary Objective: Development of a 'Geothermal Academy' at NM Tech tailored after the Colorado School of Mines. Community outreach....Visit potential towns that have known geothermal resources and help assess and develop them.

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Proposed NM Geothermal Data Base Categories

- Geochemistry (^{18}O, ^{2}H, $^{3}He/^{4}He$, cation- & silica-based geothermeters
- Shallow Heat Flow Map
- Water table depth Map
- Temperature Maps at 2, 4 km depths
- Stress State - seismicity
- GPS-Geodesy
- Geology (esp. pluton locations), Hydrologic window locations?
- Petrophysical information (permeability, porosity, thermal conductivity)
- Ownership-land use information

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Ranking Methodologies: Navy GPO Ranking Methodology

Genetic Occurrence Models for Geothermal Prospecting, Combs, J.; Monastero, F., Sabin, A., Unruh, J., and D. Walker, 008, Navy GPO Report N68936-04-C-0054

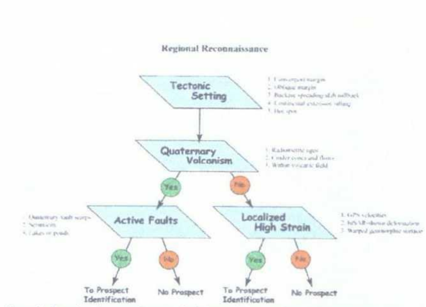

Figure 1. A regional reconnaissance decision path is part of the initial screening tool used to identify regional features potentially associated with geothermal occurrences. Significant geologic features that should be assessed or examined are listed next to each level.

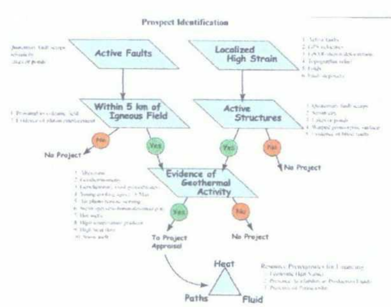

Figure 2. A district level decision path follows regional reconnaissance with a goal of identifying potential prospects. In parts of the Basin and Range where no apparent surface geothermal manifestations exist, localized high strain rates and subtle, active structures may be the only guides to geothermal targets.

1. Qualitative
2. Decision Tree: Go/No Go Approach

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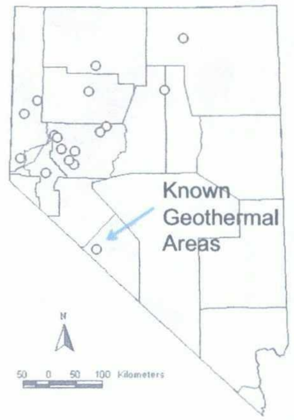
Ranking Methodologies: Nevada

A Method for Estimating Indiscovered Geothermal Resources in Nevada and the Great Basin, 2004, Coolbaugh, M. and L. A. Shevenell, Geothermal Resources Council Transactions, v. 28, p. 13-18.



Ranking Parameters:

1. Occurrence of young volcanic rocks
2. Seismicity
3. Presence/absence of NE trending faults
4. Regional gravity anomalies
5. Statistically Based: Use known geothermal resources to calibrate model

Degree of Explortivity

1. Presence of a deep water table (< 60 ft)
2. Proximity to a nearby geothermal or oil/gas
3. borehole (Blackwell, SMU data base)
4. Proximity to a water well
5. Presences/absence of hot springs

Fig. 1. Distribution of favorable and unfavorable geothermal areas, based on a 5-layer logistic regression model. Economic and sub-economic geothermal systems (Table 1) are shown with circles.

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Ranking Methodologies: USGS

A review of methods applied by the US Geological Survey in the Assessment of Geothermal Resources, Williams, C. F, Reed, M. J., and R. H. Mariner, 2008, USGS Open File Report 2008-1296

1. Volume/Enthalpy Estimation
2. Energy Recovery Factor (5-20%)
3. Monte Carlo Analysis

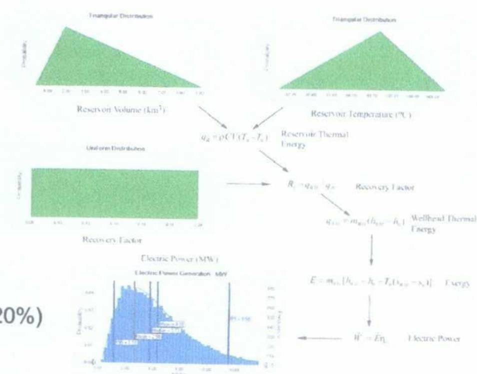

Figure 3. Schematic of the Monte Carlo uncertainty analysis applied in the calculation of reservoir thermal energy, wellhead thermal energy, and electric power generation potential for liquid-dominated geothermal systems in the national resource assessment.

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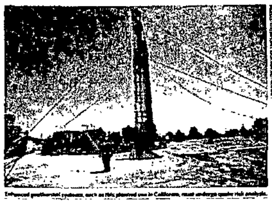
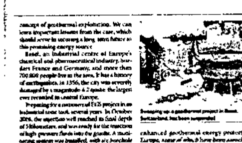
Geothermal quake risks must be faced

Discussion needs to be open about how exploitation of Earth's internal heat can produce ear[illegible]akes, says **Domenico Giardini**, so that the alternative-energy technology can be properly utilized.





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GIS Map Making Tools

GeoMapApp - Is a program that a group at Lamont-Doherty Earth Observatory have developed. It started as a nice tool for visualizing topography and bathymetry -- and it is very good at going across the shoreline (example image below). But it has some other cool features that even the most landlocked earth scientist can appreciate:

- very easy to make profiles
- import data to display on maps
- it is linked to a lot of databases from which you can overlay data on maps (e.g., heat flow, earthquakes, magnetic anomalies, geochemistry, many marine databases (that's where they started)
- easy to save maps that can be imported to Google Earth

The soon to be released new version has many more databases included and a very slick interface that allows you to change opacity of layers so you can overlay topography, geology, and other datasets.

ArcView ($1,500/license) is the most basic solution, offering mapping, support for data imports and analysis. ArcEditor adds on sophisticated features to update and manage datasets within the package (rather than having to update the data outside the package and re-upload it), including allowing multiple administrators access to these features. ArcInfo is the most comprehensive package, adding on additional graphical rendering, workflow management, and more — all costing several thousand dollars a license. All three packages include expansive features for map rendering, data management, and analysis.

ArcGIS - The free ArcReader tool makes it easy for anyone to view and query maps created in the various ArcGIS tools

GMT is an open source collection of ~60 tools for manipulating geographic and Cartesian data sets (including filtering, trend fitting, gridding, projecting, etc.) and producing Encapsulated PostScript File (EPS) illustrations ranging from simple x-y plots via contour maps to artificially illuminated surfaces and 3-D perspective views. GMT supports ~30 map projections and transformations and comes with support data such as GSHHS coastlines, rivers, and political boundaries. GMT is developed and maintained by Paul Wessel and Walter H. F. Smith with help from a global set of volunteers and is supported by the National Science Foundation. It is released under the GNU General Public License.

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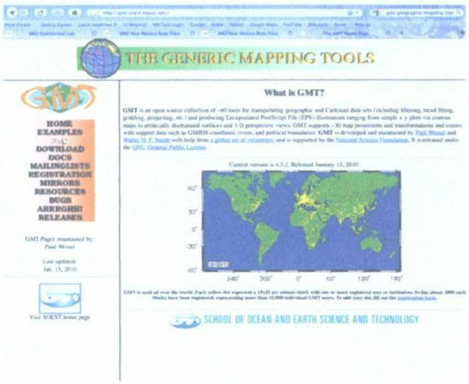
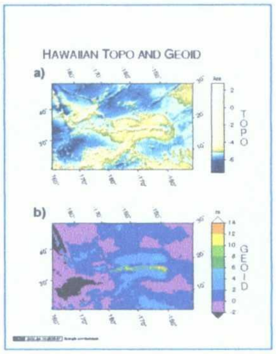
Generic Mapping Tool (GMT)

- University of Hawaii with NSF support
- Runs on PCs, Mac, and Linux platforms
- Free





http://gmt.soest.hawaii.edu/

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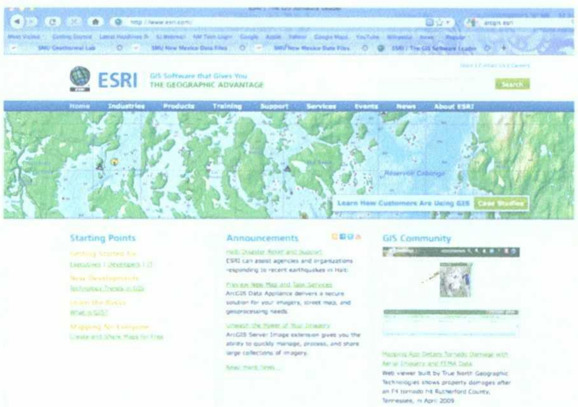
ArcView

Industry Standard
$1500/liscence
File formats (e.g. shapefiles) not easily read into other GIS environments
But there are tools to do so (ogr2ogr software; http://www.qgis.org/wiki/Ogr2ogr)



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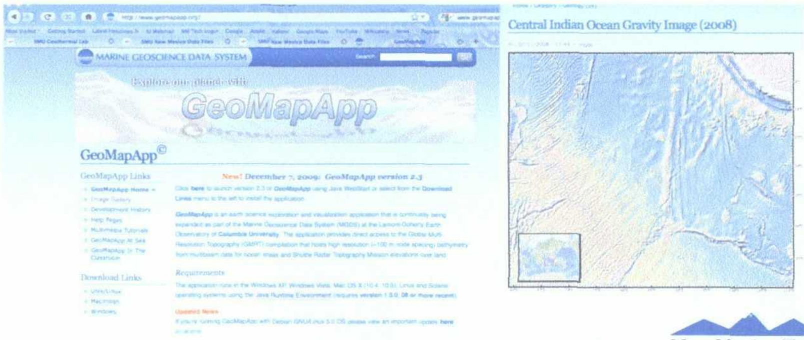
GeoMapApp.org

- Written in Java so is platform independent
- Columbia University



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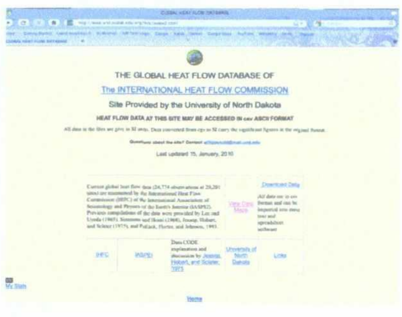
Existing Heatflow Data Bases

- SMU
- University of North Dakota



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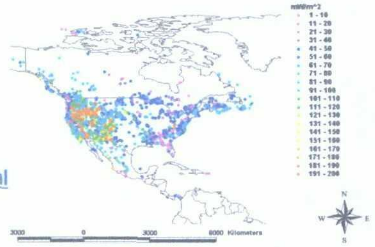
University of North Dakota Global Heat Flow data base

Data	Number	Codes	Site	Name	Latitude	Longitude	Elevation	Min.	Depth	Max	Depth	No.	Temperatures	Temp.	Gradient
A	B	B	A-B-F	70.3336	-148.8522	7	16	12	3.39	54	79	82 AK			
A	B	B	D-G-M	70.2689	-148.6522	8	17	24	3.51	61	79	82 AK			
A	B	GC	58.0681	-134.6169	505	44	102	11	3	4.02	46	138	85 AK		
A	B	B	ASC	56.8342	-133.3022	21	91	129	37	11	1.88	71	138	85 AK	
A	B	B	BC	54.9019	-132.1333	305	77	108	17	2	3.89	69	138	85 AK	
A	B	A	IGO	40.5014	-122.6014	470	7	145	13	3.05	41	90	82 CA		
A	B	A	DMB	EQ	37.5017	-122.1189	1	171	84	78	80 CA				
A	B	CBHF-4	36.6017	-117.8839	1055	15	40	79	4	3.05	242	39	80 CA		
A	B	CBHF-3	35.9681	-117.8683	1079	15	40	69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
A	B	CBHF-2	35.9358	-117.8675	1123	15	65	48							
A	B	CBHF-11	36.0339	-117.8347	1254	30	45	525							
A	B	CBHF-13	36.0172	-117.8167	1266	15	30	821							
A	B	CUTD-6	36.0011	-117.785	1268	15	35	338							
A	B	CBHF-8	35.9678	-117.7681	977	20	50	76							
A	B	A	HI	VISTA	34.7342	-117.7678	130	175							
A	B	CBHF-9	36.0342	-117.7508	1084	15	40	156							
A	B	A	BLK	BTTE	34.55	-117.7167	122	244							
A	B	B	CBHF-17	35.8683	-117.585	899	15	45							
A	B	A	ERQU	VL	33.0842	-116.485	807	38							
A	B	BO	7	42.7344	-116.3022	1479	12	20							
A	B	B	WW	42.9344	-116.2858	929	10	45							
A	B	WW	LNDRT	43.2333	-116.285	962	160	230							
A	B	BO	6	42.8672	-116.2678	1091	7	15							
A	B	WW	43.0519	-116.2353	762	25	63	63							
A	B	RDH-104	42.885	-116.2347	1021	40	455	87							
A	B	RDH-8	42.8517	-116.2011	1044	50	454	102							
A	B	WW	BLACK	42.8167	-116.1525	995	30	60							
A	B	WW	42.9017	-116.0681	795	10	30	143							
A	B	WW	43.4672	-116.0675	1044	20	210	43							
A	B	RDH-128	42.8172	-116.0186	914	30	305	59							
A	B	A	PINKHAM	33.7686	-115.9192	975	73	113							



http://www.und.nodak.edu/org/ihfc/index2.html

Downloadable in csv (excel) data format

Organized by continent

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Sothern Methodist University Heatflow Database

DATABASE	AREA OR AMS MAP	HOLE NAME	PUB REF	TWN/RNG-SEC	STATE	TECT PROV	W LONG (Deg)(nad27)	N LAT (Deg) (nad27)	MEAS DATE (m/d/y)	DRILL DATE (m/d/y)	COL ELEV (m)	DRILL DEPTH (m)	WAT TABLE (m)
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	ALBUQ	REIT754		NM	BASIN AND RANGE	-106.5167	35.9500			1650		
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	BCKMAN	REIT754		NM	SOUTHERN ROCKY MTNS	-106.1500	35.8667			1810		
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	BIBON	REIT754		NM	COLORADO PLATEAU	-107.3167	35.2167			1870		
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	BIBOS	REIT754		NM	COLORADO PLATEAU	-107.3167	35.2000			1910		
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	CHACSL	REIT754		NM	COLORADO PLATEAU	-107.4000	35.8500			----		
SMURegionalHeatFlow	ALBUQUERQUE AMS NM	CHACWS	REIT754		NM	COLORADO PLATEAU	-107.8000	35.9333					

Sym	SURF TEMP (C)	MIN TEMP (C)	MAX TEMP (C)	BOT TEMP (C)	LITH INFO
					-
					-

DEPTH START (m)	DEPTH END (m)	AVG TCU (W/m/K)	Sym	<SE>	BULK COND.	# TCU	UN GRAD (C/km)	Sym	<SE>	CO GRAD (C/km)	Sym	<SE>	UN HF (mW/m2)	Sym	<SE>
140.0	180.0	2.3		0.0		10	20			20			46		
30.0	90.0														
90.0	340.0														
90.0	140.0	3.2		0.3		5	28			28			90		
380.0	830.0														
40.0	100.0	1.8		0.1		5	37			37			68		
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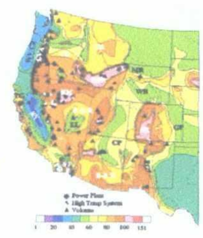

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A Review of Methods Applied by the U.S. Geological Survey in the Assessment of Identified Geothermal Resources

By Colin F. Williams, Marshall J. Reed, and Robert H. Mariner

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Abstract

The U. S. Geological Survey (USGS) is conducting an updated assessment of geothermal resources in the United States. The primary method applied in assessments of identified geothermal systems by the USGS and other organizations is the volume method, in which the recoverable heat is estimated from the thermal energy available in a reservoir. An important focus in the assessment project is on the development of geothermal resource models consistent with the production histories and observed characteristics of exploited geothermal fields. The new assessment will incorporate some changes in the models for temperature and depth ranges for electric power production, preferred chemical geothermometers for estimates of reservoir temperatures, estimates of reservoir volumes, and geothermal energy recovery factors. Monte Carlo simulations are used to characterize uncertainties in the estimates of electric power generation. These new models for the recovery of heat from heterogeneous, fractured reservoirs provide a physically realistic basis for evaluating the production potential of natural geothermal reservoirs.

Introduction

Under the mandate of the Energy Policy Act of 2005, the United States Geological Survey (USGS) is conducting a new assessment of the moderate-temperature (90 to 150°C) and high-temperature (>150°C) geothermal resources of the United States. The assessment is focused on the western United States, including Alaska and Hawaii, and is highlighting geothermal energy resources located on public lands. It will be the first comprehensive national geothermal resource assessment since 1979 (USGS Circular 790; Muffler, 1979). In the new assessment the USGS will provide estimates of the geothermal electrical power generation potential from identified and undiscovered resources, and evaluate the potential impact of evolving geothermal production technology. An important component will be a provisional estimate of the power production potential of Enhanced Geothermal Systems (EGS) techniques, which involve the creation of producing geothermal reservoirs in low permeability rock units.

As described by Williams and Reed (2005), Williams and others (2007), and Reed and Mariner (2007), a number of changes are being incorporated in the new resource assessment. Changes to the evaluation of identified hydrothermal systems include: (1) a minimum temperature for electric power production of approximately 90°C (75°C in Alaska), (2) a maximum depth extent for selected geothermal reservoirs of as much as 6 km, (3) a change in the preferred geothermometers used for estimating reservoir temperatures, (4) a revised method for determining recovery factors, and (5) independent evaluations of reservoir permeability using reservoir models, production histories, and chemical tracer tests. This report provides a summary of USGS techniques used to evaluate the electric power production potential of identified geothermal resources.

Background

Comprehensive efforts to assess the geothermal resources of the United States began after passage of The Geothermal Energy Research, Development and Demonstration Act of 1974, which assigned responsibility for the evaluation and assessment of geothermal resources to the USGS through the U.S. Department of the Interior (DOI). The USGS produced three national geothermal resource assessments in the eight years following, USGS Circular 726, *Assessment of Geothermal Resources of the United States-1975* (White and Williams, 1975), USGS Circular 790, *Assessment of Geothermal Resources of the United States–1978* (Muffler, 1979) and USGS Circular 892, *Assessment of Low-temperature Geothermal Resources of the United States–1982* (Reed, 1983). These reports evaluated various methodologies for geothermal resource assessments and provided estimates of potential electric power generation that continue to guide long-term geothermal planning (for example, Green and Nix, 2006).

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The last national assessment of moderate (90 to 150°C) and high-temperature (greater than 150°C) geothermal resources, USGS Circular 790 (Muffler, 1979), estimated the potential for approximately 23,000 Megawatts-electric (MWe) of electrical power generation from identified high-temperature (>150°C) 302F geothermal systems at depths less than 3 km in the western United States. Estimates of potential power production from undiscovered resources ranged from 72,000 to 127,000 MWe. Circular 790 listed nine western states (Alaska, Arizona, California, Hawaii, Idaho, Nevada, New Mexico, Oregon and Utah) with the potential for at least 100 MWe of electrical power generation per state from identified geothermal systems.

Geothermal Resource Terminology

This report follows other USGS geothermal resource studies in using the terminology adopted by Muffler and Cataldi (1978) for the subdivision of the geothermal resource base. These subdivisions are easily illustrated through a modified McKelvey diagram (fig. 1), in which the degree of geologic assurance regarding resources is set along the horizontal axis and the economic feasibility (effectively equivalent to depth) is set along the vertical axis (Muffler and Cataldi, 1978). USGS geothermal assessments consider both identified and undiscovered systems and define the "resource" as that portion of the accessible resource base that can be recovered as useful heat under current and potential economic and technological conditions. Similarly, the "reserve" is the identified portion of the resource that can be recovered economically using existing technology.

Within this framework, identified hydrothermal systems are divided into three temperature classes: low-temperature (<90°C), moderate-temperature (90 to 150°C), and high-temperature (>150°C). High-temperature systems include both liquid- and vapor-dominated resources. Moderate-temperature systems are almost exclusively liquid-dominated, and all low-temperature systems are liquid-dominated. All three temperature classes are suitable for direct use applications, but in general only moderate- and high-temperature systems are viable for electric power generation. Systems at the upper end of the low-temperature range can be exploited for electric power generation if sufficiently low temperatures are available for cooling the working fluid in a binary power plant. These conditions are found at Chena Hot Springs in Alaska (Holdman, 2006).

In the new USGS geothermal assessment, identified geothermal systems are also categorized as producing (the reservoir is currently generating electric power), confirmed (the reservoir has been evaluated with a successful commercial flow test of a production well), and potential (there are reliable estimates of temperature and volume for the reservoir but no successful well tests to date). Reservoir thermal energy and electric power production potential are estimated for all producing, confirmed, and potential geothermal systems above 90°C in the contiguous United States and Hawaii, and above 75°C in Alaska.

The Volume Method

An important component of geothermal resource assessment methodology is the development of geothermal resource models consistent with the production histories of exploited geothermal fields. The primary method applied in past USGS assessments for evaluating the production potential of identified geothermal systems was the volume method (Nathenson, 1975; White and Williams, 1975; Muffler and Cataldi, 1978; Muffler, 1979), in which the recoverable heat is estimated from the thermal energy available in a reservoir of uniformly porous and permeable rock using a thermal recovery factor, R_g, for the producible fraction of a reservoir's thermal energy. These studies established the volume method as the standard approach, and recent assessments of geothermal resources in parts of the United States rely on modified versions of the USGS volume method (for example, Lovekin, 2004). The basics of the volume method have been discussed in detail (Nathenson, 1975; Muffler and Cataldi, 1978; Muffler, 1979;

Lovekin, 2004; Williams, 2004), so only a brief summary of the relevant aspects is presented here.

The electric power generation potential from an identified geothermal system depends on the thermal energy, q_R, present in the reservoir, the amount of thermal energy that can be extracted from the reservoir at the wellhead, q_{WH}, and the efficiency with which that wellhead thermal energy can be converted to electric power. Once the reservoir fluid is available at the wellhead, the thermodynamic and economic constraints on conversion to electric power are well known (for example, DiPippo, 2005). The challenge in the resource assessment lies in quantifying the size and thermal energy of a reservoir as well as the constraints on extracting that thermal energy. In the volume method, the reservoir thermal energy is calculated as

$$q_R = \rho C V (T_R - T_0), \tag{1}$$

where ρC is the volumetric specific heat of the reservoir rock, V is the volume of the reservoir, T_R is the characteristic reservoir temperature, and T_0 is a reference, or dead-state, temperature. The thermal energy that can be extracted at the wellhead is given by

$$q_{WH} = m_{WH}(h_{WH} - h_0), \tag{2}$$

where m_{WH} is the extractable mass, h_{WH} is the enthalpy of the produced fluid, and h_0 is the enthalpy at some reference temperature (15°C in Circular 790). The wellhead thermal energy is then related to the reservoir thermal energy by the recovery factor, R_g, which was defined in Circular 790 as

$$R_g = q_{WH} / q_R \tag{3}$$

Inherent in equations (1) and (2) is a geometrical concept of the reservoir that allows calculation of a volume and an estimate of the ability to extract hot fluid from the volume. In general it is possible to produce many times the original volume of fluid from the reservoir in order to recover the thermal energy from the reservoir rock. Because The Geysers vapor-dominated field in northern California was the only producing geothermal reservoir in the United States at the time, the mean value for R_g of 0.25 used in Circular 790 was derived from an analysis by Nathenson (1975) of the factors influencing the extraction of heat from a geothermal reservoir through a "cold sweep" process, in which the hot reservoir fluid is gradually replaced by colder water through natural or artificial injection. Analyses of production data from fractured reservoirs at The Geysers, Coso in California, and Dixie Valley in Nevada, indicate that R_g in those fields is closer to 0.1 and varies depending upon the assumed reservoir size and geometry (Williams, 2004). The recent GeothermEx evaluation of identified geothermal resources in California and Nevada incorporates a range for R_g from 0.05 to 0.2, which yields most likely values closer to observed values but also leaves a large uncertainty regarding potential geothermal power production (Lovekin, 2004).

From estimates of R_g and measurements of reservoir volume and properties, the exergy, E, (DiPippo, 2005), referred to as the available work, W_A, in Circular 790, for a geothermal reservoir can be determined as

$$E = m_{WH}[h_{WH} - h_0 - T_0(s_{WH} - s_0)], \qquad (4)$$

where s_{WH} is the entropy of the produced fluid and s_0 is the entropy at the reference temperature. In the actual implementation of this approach the mean values for the input variables are replaced with a range of values corresponding to estimated uncertainties, and these values are then used in Monte Carlo simulations to define the reservoir properties and productivity, along with the associated uncertainties (for example, Muffler, 1979; Lovekin, 2004; Williams and Reed, 2007). The electric energy, $\dot{W}_e$, for a given period of time (typically 30 years) is then determined through multiplying the exergy over the same period of time by a utilization efficiency, η_u, which is generally well-constrained for a reservoir of a specified fluid state and temperature (Muffler and others, 1979).

$$\dot{W}_e = \dot{E}\eta_u \qquad (5)$$

For power generation above 150°C, Muffler and others (1979) used a constant value for η_u of 0.4 down to the minimum reservoir temperature for electric power production of 150°C. Lovekin (2004) increased this to 0.45. A compilation of η_u for existing geothermal power plants producing from liquid-dominated systems over a wide range of temperatures confirms η_u equal to approximately 0.4 above 175°C (fig. 2). There is a linear decline in η_u below 175°C as reservoir temperatures approach the reference state in binary power plant operations. In the new assessment the 150°C lower limit is revised downward to include binary power production from moderate-temperature systems. Developments in binary power plant technology have led to electric power generation from systems with temperatures as low as 94°C in the lower 48 states (Amedee, California) and 75°C in Alaska (Chena Hot Springs), and production from lower temperatures is possible, if not always economically viable at the present time. For geothermal systems in the contiguous United States and Hawaii, the lower limit for electric power generation is set at 90°C, but for Alaska the assessment includes potential power generation from systems with temperatures as low as 75°C, due to the availability of near-freezing cooling water at many sites.

Temperature and Chemical Geothermometers

Geothermal reservoir temperatures can be determined from in situ measurements in exploration and production wells where available. In order to characterize the thermal state of a geothermal reservoir when in situ temperature measurements are not available, chemical geothermometers can be applied as proxies. The calculation of chemical geothermometers rests on the assumption that some relationship between chemical or isotopic constituents in the water was established at higher temperatures and this relationship has persisted when the water cools as it flows to the surface. The calculation of subsurface temperatures from chemical analyses of water and steam collected at hot springs, fumaroles, geysers, and shallow water wells is a standard tool of geothermal exploration and fills the need to estimate the subsurface temperature of a geothermal prospect area before any deep wells are drilled.

The first temperature calculations were based on experimental laboratory studies of mineral solubility at elevated temperature (Kennedy, 1950; Fournier and Rowe, 1966). As geothermal exploration progressed, observed relationships among dissolved chemical constituents at known temperatures in wells were used to calibrate geothermometers from the aqueous species produced at the surface. Experimental and field data from sodium-chloride solutions were used to develop the mathematical equations for several geothermometers, and most of the calculations are suggested only for use with analyses of dilute, sodium-chloride type waters at near-neutral pH. In some geothermal prospect areas, for example the Basin and Range, sodium-bicarbonate type waters predominate, and few systems have sodium-chloride type water. The differences in the types of water chemistry encountered in geothermal systems require extra caution in the application of geothermometers.

Interpretation of the calculated temperatures requires knowledge of the most likely reactions to have occurred between the water and the surrounding rocks. In addition, the charge balance is calculated for every water analysis as a check for the completeness of the analysis and its accuracy. For the USGS geothermal resource assessment, some simple calculations are used to determine the reliability of the chemical analyses of geothermal waters (Reed and Mariner, 1991). Each ion in the analysis is converted to its equivalent concentration, and the charge balance error (CBE) is calculated as 100 times the absolute value of the difference between the summation of equivalent concentrations of cations (Na^+, K^+, Ca^{++}, Mg^{++}) and the summation of equivalent concentrations of anions (Cl^-, F^-, HCO_3^-, SO_4^{--}) divided by the average of the summation of equivalent concentrations of cations and the summation of equivalent concentrations of anions. An error greater than 10 percent in the charge balance is indicative of a problem with the analysis, and analyses that fall into this category are only be used for geothermal calculations in the assessment if no other analyses are available and the associated uncertainties in the calculated temperatures can be quantified.

Most geothermal systems never reach chemical equilibrium because most of the reaction rates are dependent on the concentrations of components in solution (Barton, 1984). The flow of hydrothermal fluids through a geothermal reservoir is constantly changing the concentrations of components in solution, and the geothermometers reflect a steady-state condition that exists at high temperature between the circulating water and enclosing rocks. The reaction rates for mineral solubility are dependent on temperature as well as several other variables in a hydrothermal system. For example, the approximate times to reach equilibrium between the feldspar minerals and fluid for the Na-K-Ca geothermometer varies from tens of hours at 500°C to on the order of 100 years at 150°C, and the solution-mineral equilibrium for quartz takes from tens of hours at

250°C to tens of years at 100°C (Barton, 1984). As the geothermal water cools on its way to the surface, the reaction rates become more sluggish. A secondary assumption is that the flow of hydrothermal water to the surface is rapid with respect to the rates of reactions at near-surface temperatures.

Geothermometer-based temperature estimates in the new geothermal resource assessment rely primarily on silica and cation geothermometers. In natural environments, it is often difficult to choose the correct silica geothermometer because it is not clear which mineral is controlling the dissolved silica concentration. Below 180°C, there is a choice between geothermometers for chalcedony and quartz, since each of these minerals may control the dissolved silica in different rock environments. Giggenbach (1992) developed an equation to approximate the calculated temperature in the transition zone between the chalcedony solubility control at low temperatures and the quartz solubility control at high temperatures (fig. 3). This smoothed curve eliminates the ambiguity of the calculations between 20°C and 210°C. Above 210°C, the quartz geothermometer is representative of the silica solubility in geothermal systems up to about 250°C. Temperatures for waters with dissolved silica concentrations of more than 462 mg/L (250°C) and for silica concentrations in condensed steam are estimated by comparing the analyzed silica concentrations with the quartz solubility determinations in Fournier and Potter (1982).

Silica geothermometers rely on the fact that each of the silica (SiO_2) minerals has its own solubility in water as a function of temperature and pressure, and silica hydrolizes in water to form the neutral silicic acid complex, $H_4SiO_4^\circ$. The silica minerals precipitate from the aqueous solution by the reverse reaction when the silicic acid complex becomes supersaturated, polymerizes, and precipitates as a solid. The rates of dissolution and precipitation are relatively rapid at high temperatures and are rather sluggish at low temperatures. The individual silica mineral that precipitates depends on the temperature and pressure conditions and on the degree of supersaturation.

Fournier (1992) warns that the geothermometers are changed significantly by high concentrations of ions in solution, especially at high temperature (over 300°C). The equations for silica geothermometers work best at pH values between 5 and 7 (Fournier, 1992). In acidic solutions (less than pH = 3) or in alkaline solutions (greater than pH = 8) part of the silicic acid complex ionizes and the precipitation reaction is changed (Busey and Mesmer, 1977). Silica mineral saturation temperatures for high-pH waters are determined using SOLMINEQ88, a solution-mineral equilibrium computer model (Kharaka, 1988). There are few systems encountered with low pH, and the corrections are not considered here.

The cation geothermometers use ratios of cation concentrations to represent the hydrothermal, steady-state reactions that take place within mineral groups such as the feldspars, micas, zeolites, or clays. The use of concentration ratios rather than the actual concentrations makes these geothermometers less sensitive to changes in strength of the solution due either to boiling or to dilution. The cation geothermometers normally use sodium, potassium, calcium, magnesium, and lithium in various relationships that are temperature dependent. For the Na-K-Ca-Mg geothermometer, these relationships are based on several different mineral equilibria, and these different reactions result in a discontinuous function for this geothermometer.

The most commonly used cation geothermometer is the Na-K-Ca-Mg formulations of Fournier and Truesdell (1973) and Fournier and Potter (1979). The Na-K-Ca-Mg geothermometer has two formulations, one for lower (<100°C) temperature waters and one for higher (>100°C) temperature waters. This geothermometer was used extensively in the previous USGS geothermal resource assessment (Brook and others, 1979). However, in the western United States (Brook and others, 1979), these two different formulations result in a major discontinuity and an underreporting in the number of systems in the range between 100°C and 130°C (fig. 4). There should be a larger number of lower temperature geothermal systems, with a systematic decrease in the number of systems as aquifer temperatures increase (see for example, Reed, 1983, fig. 16).

Although control from calibration well samples is limited, it appears that the K-Mg geothermometer provides estimated temperatures reasonably close to temperatures measured in drilled geothermal systems within the 90°C to 130°C range. The potassium-magnesium geothermometer relates temperature to the logarithm of the ratio of potassium concentration squared to magnesium concentration, $c_{(K)}^2/c_{(Mg)}$ (Giggenbach, 1988). Temperatures were calculated for the geothermal systems (with reported Mg concentrations) in the western United States (Brook and others, 1979), using the K-Mg geothermometer (fig. 5), and these K-Mg geothermometer temperatures exhibit a continuous decrease in the number of geothermal systems as higher temperatures are evaluated, regardless of the type of water chemistry. Because the potassium to magnesium ratio is consistently representative of the subsurface temperature, the K-Mg geothermometer is generally the preferred cation geothermometer in this assessment. The Na-K-Ca geothermometer is preferred in Cl-rich waters and used where Mg data are unavailable. The magnesium ion concentration is below the detection limit in many analyses of geothermal waters, and the K-Mg geothermometer cannot be calculated for these waters.

Reservoir Volume

The difficulty of developing accurate estimates for the volumes of unexploited geothermal reservoirs varies depending on the geologic setting and the availability of data from exploration and development drilling. Many geothermal reservoirs are dominated by fracture porosity, which can be characterized by high permeabilities but relatively low fluid volumes. In addition, fracture permeability is sensitive to relatively rapid (in geologic time) temporal variations in the state of stress and fluid chemistry, and this can lead to heterogeneous permeability distributions within the fracture-dominated reservoirs (for example, Melosh and others, 2008). Estimates of reservoir volumes in the new assessment are derived from production histories, drilling results, chemical tracer tests, and exploratory geological and geophysical investigations.

In some cases information on a geothermal system is limited to the temperature, flow rate and chemical composition of a thermal spring. Under these circumstances, reservoir volumes are estimated by applying constraints from well-characterized geothermal reservoirs in analogous geologic settings. For example, for hot springs emerging from range-front faults in the Great Basin, the width of the fault damage zone (typically 100 to 500 m) constrains one horizontal dimension of the geothermal reservoir, and the temperature of the reservoir fluid relative to the background geothermal gradient defines the maximum depth of circulation. The greatest uncertainty in the estimated reservoir volume for a range front fault system lies in the lateral extent of the reservoir along strike. In the absence of geophysical or structural constraints, the upper end of possible along-strike extents is defined by the examples of producing geothermal reservoirs and other well-explored geothermal systems. Based on these examples, the default along-strike extent of a fault-hosted geothermal reservoir ranges from 1 to 5 km, with a most likely extent of 2 km. The largest volumes determined from this range of reservoir dimensions are consistent with larger, producing fault-hosted reservoirs such as Dixie Valley and Beowawe. The smallest volumes are consistent with simple vertical conduits of limited spatial extent and doubtful viability for commercial power production.

In Circular 790 the maximum depth extent for geothermal reservoirs was set to 3 km, as a representative limit of the economic and technological constraints of drilling and exploitation (Muffler and others, 1979). Although the maximum depth of geothermal drilling in the United States is approximately 3.5 km, geothermal wells deeper than 4 km have been completed in Italy, and a number of wells for Enhanced Geothermal Systems development have been drilled to depths of approximately 5 km (Kobayashi, 2000; Bertani, 2005). In the case of geothermal systems for which the base of the reservoir has not been defined by drilling, thermal constraints on the vertical extent of fluid circulation or the depth of the brittle-ductile transition are applied, but in no case is the base of the reservoir allowed to extend beyond 6 km.

Studies relating the rate of natural heat loss (both advective and conductive) and the dimensions and rate of fluid flow through a hydrothermal system can also provide a basis for estimating the volume of a geothermal reservoir (Wisian and others, 2001; Williams, 2005). In the new resource assessment, estimates of total heat loss from a geothermal reservoir are determined from heat flow or temperature-gradient measurements, when available, and used as an additional check against the predictions of the estimated reservoir temperatures and volumes.

Geothermal Recovery Factor

Hydrothermal systems capable of generating electrical power require the presence of both high temperatures and locally high permeabilities (for example, Bjornsson and Bodvarsson, 1990). Although the volume method provides a means of estimating the heat content of a geothermal reservoir, it does not explicitly predict the reservoir permeability. The presence of permeability adequate for production is based on the existence of a geothermal anomaly (for example, hot springs, flowing wells, anomalously high heat flow) and the assumed recovery factor, which incorporates an estimate of the effective reservoir permeability and porosity. Reservoir models and production histories are generally consistent with the predictions of the volume method when the reservoir volume and the spatial distribution of permeability are well-constrained (for example, Parini and Riedel, 2000; Williams, 2004). Potential problems arise when both the volume of a reservoir and its flow properties must be estimated. Many geothermal reservoirs are dominated by fracture porosity, which can be characterized by high permeabilities but relatively low fluid volumes. In addition, fracture permeability is sensitive to relatively rapid (in geologic time) temporal variations in the state of stress and fluid chemistry.

In the USGS national assessment of low-temperature geothermal resources, Reed (1983) applied models for the recovery of heat and fluid from low-temperature sedimentary reservoirs using constraints on drawdown at production wells. Production-related pressure declines have posed significant problems in geothermal reservoirs, and, despite the risk of thermal breakthrough, injection has become a common procedure for sustaining production (Axelsson, 2003). Consequently, any estimate of reservoir production potential should evaluate longevity from the perspective of injection and eventual thermal breakthrough. Models for the recovery of heat from uniformly porous, homogeneous, and liquid-phase reservoirs using injection indicate that R_g can reach values of 0.5 or higher (for example, Nathenson, 1975; Garg and Pritchett, 1990; Sanyal and Butler, 2005).

To allow for uncertainties in the distribution of permeability in a producing geothermal reservoir, the resource estimates in Circular 790 were based on a Monte Carlo uncertainty model with a triangular distribution for R_g with a most-likely value of 0.25 and a range from 0 to 0.5 (Muffler et al, 1979). More recent analyses of data from the fractured reservoirs commonly exploited for geothermal energy indicate that R_g is closer to 0.1, with a range of approximately 0.05 to 0.2 (Lovekin, 2004; Williams, 2004, 2007). In general this apparent discrepancy in R_g reflects the contrast in thermal energy recovery from complex, fracture-dominated reservoirs compared to the uniform, high-porosity reservoirs considered in the early models. The original values for R_g were derived from models of the effects cooling in a geothermal reservoir due to reinjection or natural inflow of water colder than pre-existing reservoir temperatures (for example, Nathenson, 1975; Bodvarsson and Tsang, 1982; Garg and Pritchett, 1990; Sanyal and Butler, 2005). This is consistent with the optimal extraction of thermal energy from a reservoir, as in general it is possible to produce many times the original volume of fluid from the reservoir in order to recover the thermal energy from the reservoir rock. The challenge is to extend these results to evaluate the thermal effects of injection and production in reservoirs ranging from those containing a few isolated fracture zones to those that are so pervasively fractured as to approach the idealized behavior of uniformly porous reservoirs.

The first step in the transition from these uniform reservoirs to fractured reservoirs is managed through implementation of the fracture flow model of Bodvarsson and Tsang (1982). This model provides a means of predicting the propagation of a thermal front for liquid-dominated reservoirs with different rates of production and fracture spacing and highlights the sensitivity of thermal energy recovery to average fracture spacing. For representative geothermal reservoir rock and fluid properties, the Bodvarsson and Tsang model predicts that fractured reservoirs approach the uniform energy sweep possible in porous reservoirs when the average fracture spacing is approximately 50 m. As the average fracture spacing grows, a progressively larger fraction of thermal energy in the formation is bypassed by cooler water moving along fracture paths, and the geothermal recovery factor drops (Williams, 2007; Williams and others, 2007).

Although these results are suggestive of the factors that determine why less heat may be recoverable from naturally-fractured reservoirs, the Bodvarsson and Tsang model fails to replicate other important features of geothermal production from fractured reservoirs. In particular, analyses of tracer tests in active geothermal fields, as well as variations in recorded flow rates from producing fractures, clearly indicate significant variation in permeability and path length among fractures connecting injection and production wells (Shook, 2005; Reed, 2007). The chemical tracer tests yield information on the variability of flow in a reservoir that can be plotted as a curve relating flow capacity to storage capacity, or the productivity of each portion of the reservoir. Examples for the Beowawe and Dixie Valley geothermal fields are shown in figure 6. In the Beowawe field approximately 50 percent of the flow comes from the most productive 10 percent of the permeable fractures, and in the Dixie Valley field approximately 35 percent of the flow comes from the most productive 10 percent of the permeable fractures. By contrast, the uniform fracture model requires an equal distribution of flow across the entire permeable fracture network (fig. 6). The spatial distributions and hydraulic properties of real fracture networks are highly heterogeneous, and the heterogeneity manifests itself in the fundamental production characteristics yielded by the moment analysis of tracer tests. Any accurate characterization of injection and production from fractured reservoirs must be able to account for this heterogeneity.

Williams (2007) investigated the use of self-similar fracture distributions in a modification of the Bodvarsson and Tsang (1982) model as a means of better representing the actual fracture flow characteristics and variations in R_g observed in producing reservoirs. One simple and effective way of characterizing this heterogeneity has been through the use of models that characterize fracture properties such as permeability through a self-similar distribution (for example, Watanabe and Takahashi, 1995). If, for example, the productivity of fractures intersecting a production well follows a self-similar distribution, this distribution is described by

$$N_k = C_k k^{-d_k}, \qquad (6)$$

where k is a reference permeability, N_k represents the number of fractures intersecting the well with permeability greater than or equal to k, C_k is a constant, and d_k is the fractal dimension.

Although there is some direct evidence for fractal dimensions of properties that are relevant to permeability, such as fracture aperture, fracture length, and fracture density, the fractal dimensions for permeability may vary over a wide range (for example, Watanabe and Takahashi, 1995; Dreuzy and others, 2001). For the purpose of this analysis, the fractures of interest are those that contribute significant volume to flow in the well and thus span a permeability range of approximately two orders of magnitude (Bjornsson and Bodvarsson, 1990). These will be a relatively small subset of the total population of fractures with measureable permeability. This analysis also equates the productivity of individual fracture sets with their permeability, an approach consistent with observations in producing geothermal fields (for example, James and others, 1987). Records of flow from producing fractures in geothermal wells confirm the varying contribution of individual fractures or fracture sets to geothermal production (fig. 7), and also demonstrate large the range of fractal dimensions necessary to characterize the observed variations in flow.

Figure 8 compares flow capacity/storage capacity curves from self-similar models for three different fractal dimensions with the Beowawe, Dixie Valley and uniform fracture model curves from figure 6. (For details see Williams, 2007.) The distribution of flow for the Dixie Valley field is consistent with the modeled distribution for d=1, and the distribution for the Beowawe field is consistent with the modeled distribution for d=0.667. The smaller value for d in the Beowawe field reflects the dominance of a single fracture or fracture system in the permeability tapped by the chemical tracer test. Like the uniform fracture model, the self-similar fracture flow models yield a range of values for R_g that depends both on average fracture spacing and on the dimensionality of the spatial distribution of fractures (fig. 9).

These results indicate that the self-similar models for fracture permeability reproduce the behavior of producing geothermal reservoirs and provide a physically-based justification for the observed variation in R_g. Given the observed variability in fracture flow properties, the likelihood that most natural fractures will match these varied flow properties with diverse fracture spacings and orientations, and the range of recovery factors determined from production histories of geothermal reservoirs, it is not possible to assign a single value, or even a narrow range, for R_g for unexploited geothermal systems. Taking the above analysis as a guide, in the new resource assessment R_g for fracture-dominated reservoirs is estimated to range from 0.08 to 0.2, with a uniform probability over the entire range. For sediment-hosted reservoirs this range is increased from 0.1 to 0.25.

Electric Power Estimates and Monte Carlo Uncertainty Analyses

Equations 1 through 5 cover the basic relationships used to estimate electric power generation potential for a given geothermal system. Uncertainties in the estimates are accommodated through a Monte Carlo simulation approach, which is shown schematically in figure 10. For each system, USGS investigators determine most likely, minimum and maximum values for reservoir temperature and volume. These values are used to generate triangular probability distributions for temperature and volume, and the resulting distributions are combined for an estimate of reservoir thermal energy. A uniform distribution for the geothermal recovery factor is introduced in the next step of the Monte Carlo analysis, and the resulting values for wellhead exergy are transformed to electric power estimates using the utilization efficiency relationship shown in figure 2. The final result is a distribution of electric power generation estimates for each geothermal system (fig. 10), which includes values for the most likely, mean, median, 5 percent and 95 percent electric power generation potential.

Summary

The USGS is conducting a new assessment of the moderate- and high-temperature geothermal resources of the United States. This new assessment will present a detailed estimate of electrical power generation potential and an evaluation of the major technological challenges for increased geothermal development. The assessment effort involves partnerships with the Department of Energy, Bureau of Land Management, national laboratories, universities, state agencies and the geothermal industry. The new assessment will introduce significant changes in the models for geothermal energy recovery factors, estimates of reservoir permeability, limits to temperatures and depths for electric power production, and include the potential impact of evolving EGS technology.

Improvements incorporated in the new resource assessment include (1) a minimum temperature for electric power production of approximately 90°C (75°C in Alaska), (2) a maximum depth extent for selected geothermal reservoirs of as much as 6 km, (3) a change in the preferred geothermometers used for estimating reservoir temperatures, (4) a revised method for determining recovery factors, and (5) independent evaluations of reservoir permeability using reservoir models, production histories, and chemical tracer tests.

The adjustment in expected recovery factors account for the behavior of heterogeneous fracture-dominated reservoirs. Models for the effects of injection within reservoirs of self-similar distributions of fracture permeability reproduce both the observed range of R_g and the flow capacity/volume capacity characteristics of producing fractured geothermal reservoirs. Although these analytical models are not intended as replacements for detailed numerical reservoir models, they do provide a physically realistic justification for applying a range of potential recovery factors to an unexploited reservoir in order to reflect the heterogeneous character of fracture permeability.

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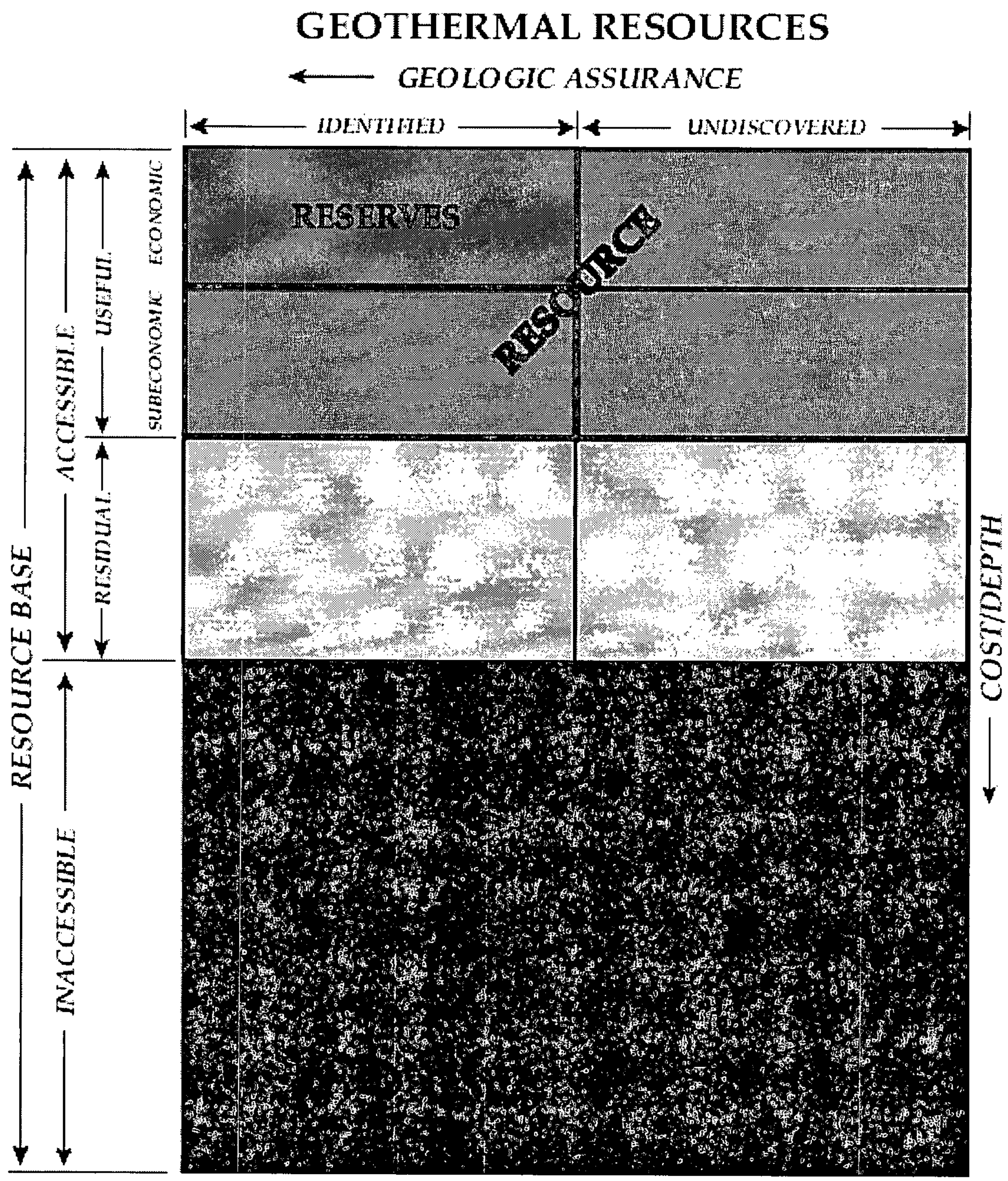

Figure 1. McKelvey diagram representing geothermal resource and reserve terminology in the context of geologic assurance and economic viability.

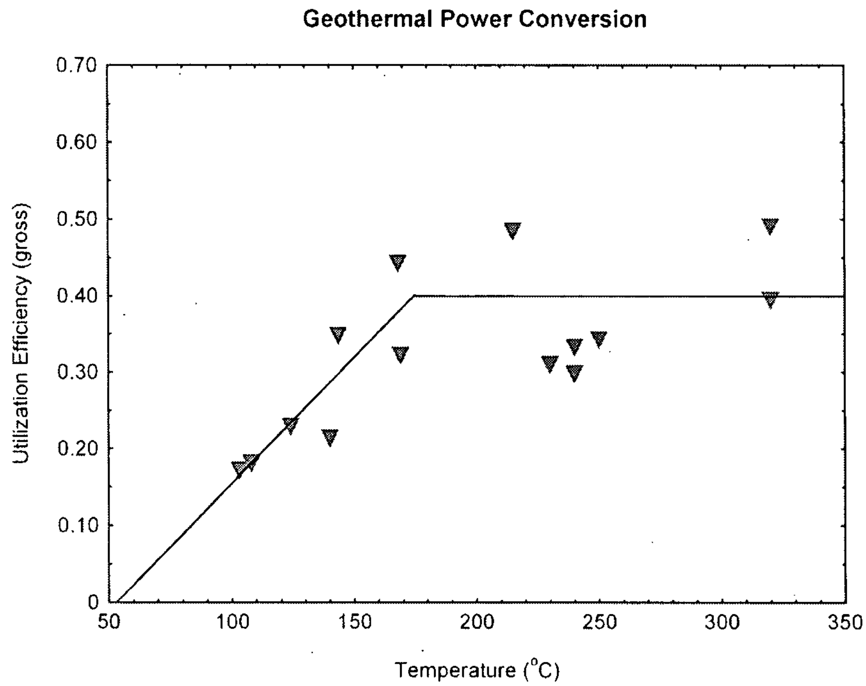

Figure 2. Utilization efficiency as a function of temperature for existing geothermal power plants studied by DiPippo (2005) (green triangles), along with the conversion relationship used in the new assessment (black line).

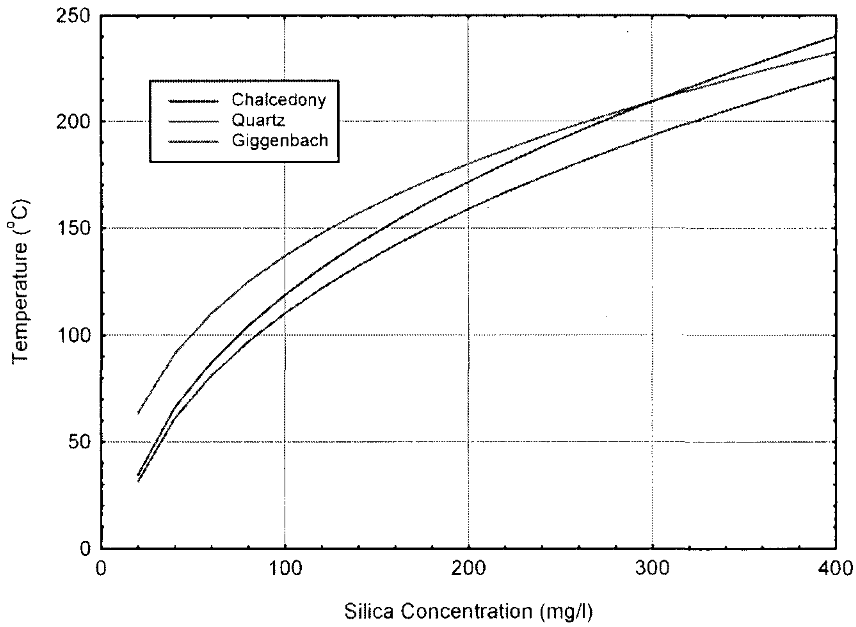

Figure 3. Graph of the solubility curves for quartz (green line) and chalcedony (red line) showing the curve (blue line) of Giggenbach (1992) to approximate the transition from chalcedony to quartz.

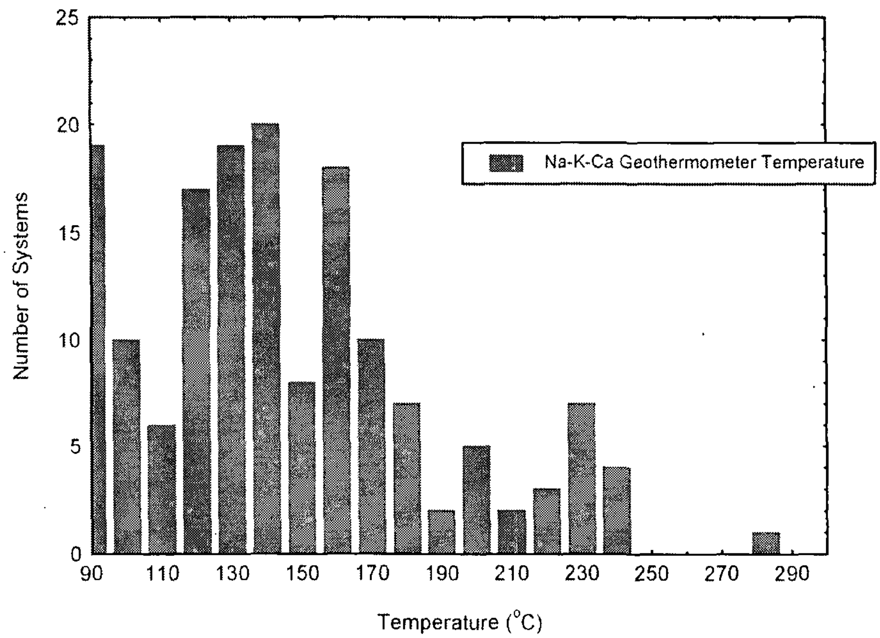

Figure 4. Histogram for 10°C increments of temperatures calculated with the Na-K-Ca-Mg geothermometer for the geothermal systems identified in USGS Circular 790 (Brook and others, 1979). There are anomalously few systems with calculated temperatures in the range between 100° and 130°C. This is interpreted as an underreporting of systems between 100° and 130°C.

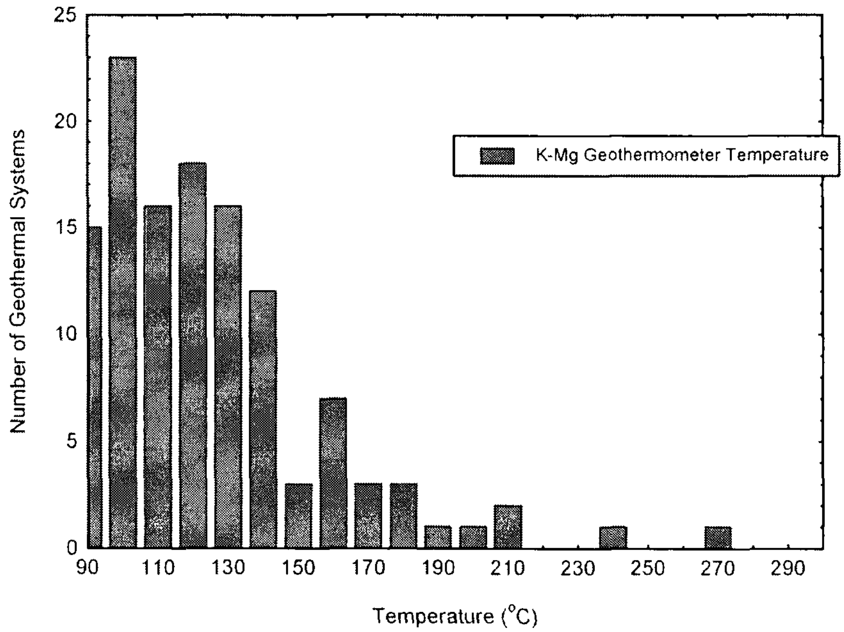

Figure 5. Histogram for 10°C increments of temperatures calculated with the K-Mg geothermometer for the geothermal systems (with reported Mg concentrations) identified in USGS Circular 790 (Brook and others, 1979). These calculated temperatures exhibit a continuous decrease in the number of geothermal systems as higher temperatures are evaluated, regardless of the type of water chemistry.

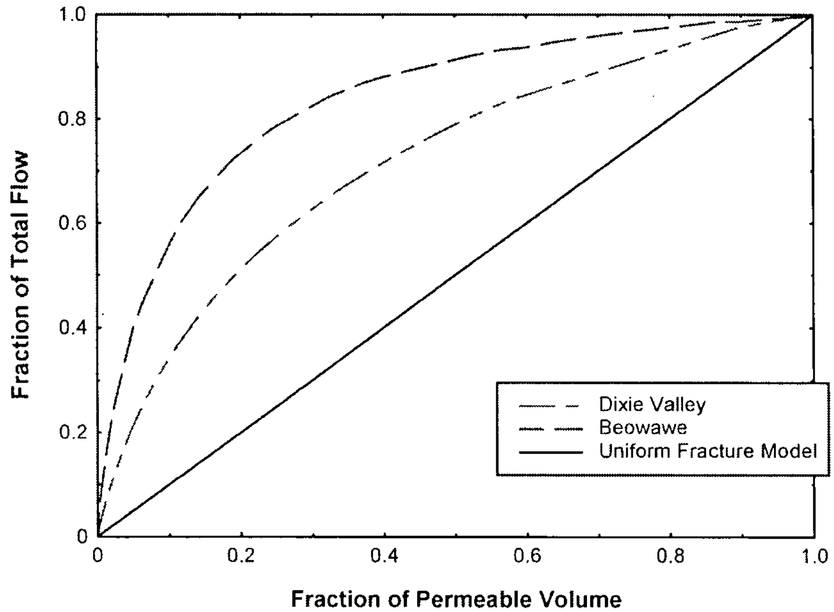

Figure 6. Distribution of flow capacity across the reservoir permeable volume for the fractured reservoir model of Bodvarsson and Tsang (black) and the Beowawe (Shook, 2005) and Dixie Valley (Reed, 2007) geothermal fields.

Self-similar Fracture Populations for Non-dimensional Well Flowrate = 100

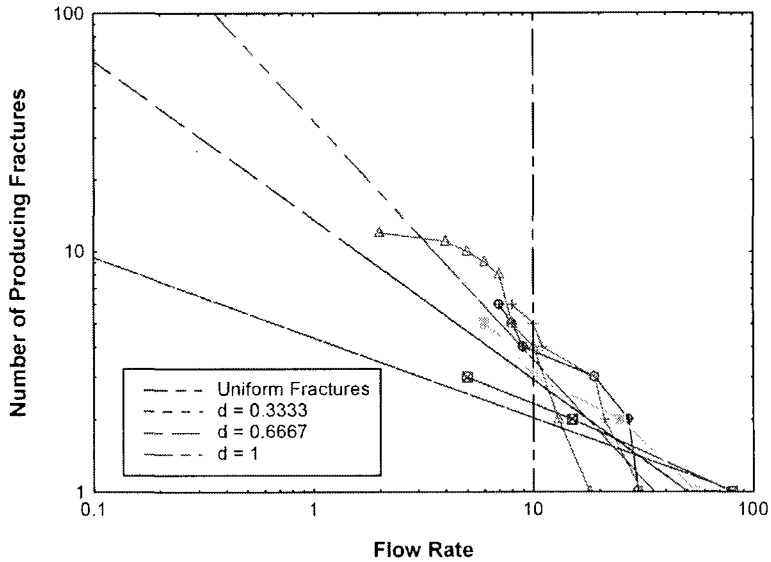

Figure 7. Fracture flow distributions for the uniform fracture model and self-similar models with fractal dimensions of *d*=0.333, 0.667, and 1.0, along with observations derived from pressure-temperature-spinner (PTS) logs in producing geothermal wells reported by Drenick (1986) (orange triangles), Enedy (1988) (blue squares), Garg and others (1997) (red squares and blue circles), and Hardeman and others (2000) (grey crosses).

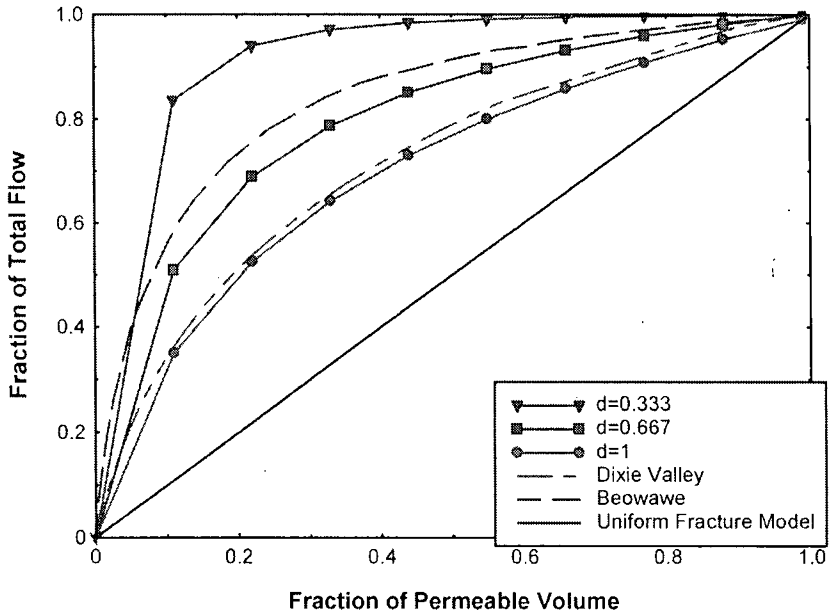

Figure 8. Distribution of flow capacity from figure 6 with the predictions of self-similar models with three different fractal dimensions (after Williams, 2007).

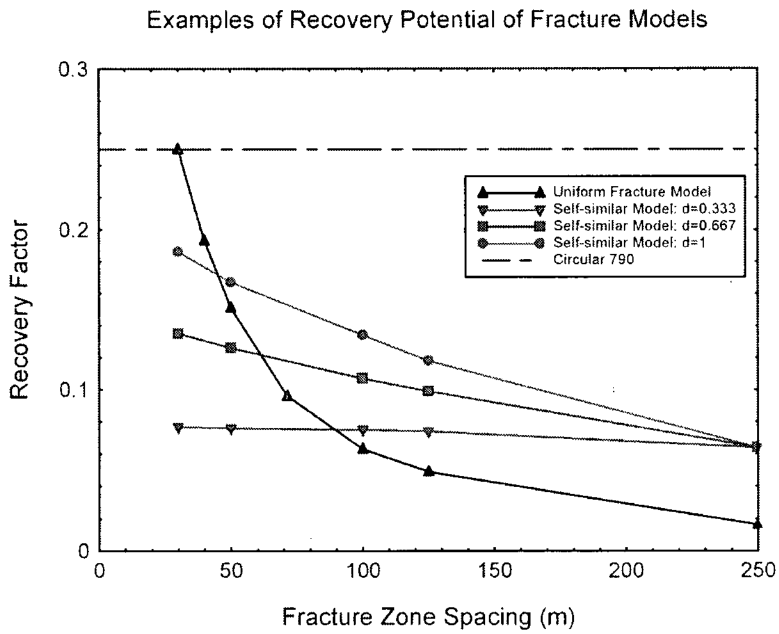

Figure 9. Variations in recovery factor with fracture spacing for example models incorporating planar fractures with uniform flow properties (black) and fractal distributions of flow properties among the producing fractures (green, blue and red).

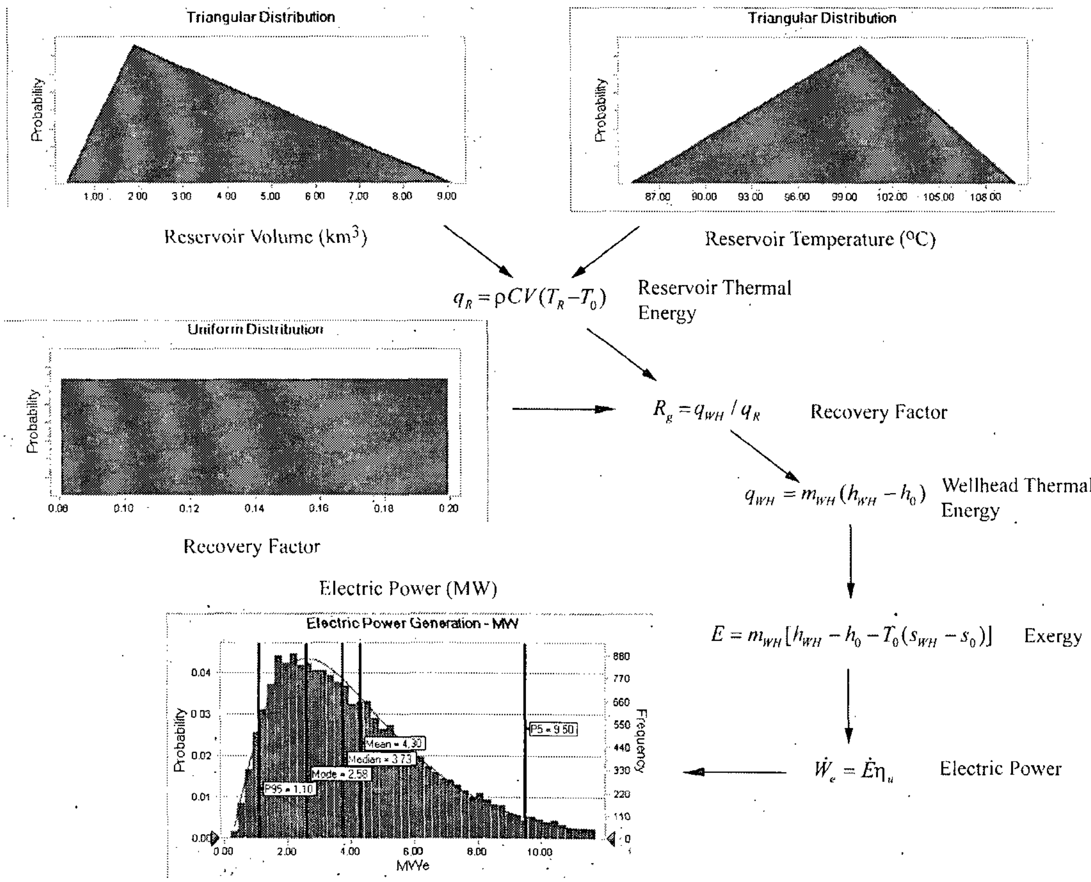

Figure 10. Schematic of the Monte Carlo uncertainty analysis applied in the calculation of reservoir thermal energy, wellhead thermal energy, and electric power generation potential for liquid-dominated geothermal systems in the national resource assessment.

An Assessment of Geothermal Resource Development Needs in the Western United States

Raft River Groundbreaking. Photo by Daniel J. Fleischmann

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A Review of Methods Applied by the U.S. Geological Survey in the Assessment of Identified Geothermal Resources

By Colin F. Williams, Marshall J. Reed, and Robert H. Mariner

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A Review of Methods Applied by the U.S. Geological Survey in the Assessment of Identified Geothermal Resources

By Colin F. Williams, Marshall J. Reed, Robert H. Mariner

Abstract

The U. S. Geological Survey (USGS) is conducting an updated assessment of geothermal resources in the United States. The primary method applied in assessments of identified geothermal systems by the USGS and other organizations is the volume method, in which the recoverable heat is estimated from the thermal energy available in a reservoir. An important focus in the assessment project is on the development of geothermal resource models consistent with the production histories and observed characteristics of exploited geothermal fields. The new assessment will incorporate some changes in the models for temperature and depth ranges for electric power production, preferred chemical geothermometers for estimates of reservoir temperatures, estimates of reservoir volumes, and geothermal energy recovery factors. Monte Carlo simulations are used to characterize uncertainties in the estimates of electric power generation. These new models for the recovery of heat from heterogeneous, fractured reservoirs provide a physically realistic basis for evaluating the production potential of natural geothermal reservoirs.

Introduction

Under the mandate of the Energy Policy Act of 2005, the United States Geological Survey (USGS) is conducting a new assessment of the moderate-temperature (90 to 150°C) and high-temperature (>150°C) geothermal resources of the United States. The assessment is focused on the western United States, including Alaska and Hawaii, and is highlighting geothermal energy resources located on public lands. It will be the first comprehensive national geothermal resource assessment since 1979 (USGS Circular 790; Muffler, 1979). In the new assessment the USGS will provide estimates of the geothermal electrical power generation potential from identified and undiscovered resources, and evaluate the potential impact of evolving geothermal production technology. An important component will be a provisional estimate of the power production potential of Enhanced Geothermal Systems (EGS) techniques, which involve the creation of producing geothermal reservoirs in low permeability rock units.

As described by Williams and Reed (2005), Williams and others (2007), and Reed and Mariner (2007), a number of changes are being incorporated in the new resource assessment. Changes to the evaluation of identified hydrothermal systems include: (1) a minimum temperature for electric power production of approximately 90°C (75°C in Alaska), (2) a maximum depth extent for selected geothermal reservoirs of as much as 6 km, (3) a change in the preferred geothermometers used for estimating reservoir temperatures, (4) a revised method for determining recovery factors, and (5) independent evaluations of reservoir permeability using reservoir models, production histories, and chemical tracer tests. This report provides a summary of USGS techniques used to evaluate the electric power production potential of identified geothermal resources.

Background

Comprehensive efforts to assess the geothermal resources of the United States began after passage of The Geothermal Energy Research, Development and Demonstration Act of 1974, which assigned responsibility for the evaluation and assessment of geothermal resources to the USGS through the U.S. Department of the Interior (DOI). The USGS produced three national geothermal resource assessments in the eight years following, USGS Circular 726, *Assessment of Geothermal Resources of the United States-1975* (White and Williams, 1975), USGS Circular 790, *Assessment of Geothermal Resources of the United States–1978* (Muffler, 1979) and USGS Circular 892, *Assessment of Low-temperature Geothermal Resources of the United States–1982* (Reed, 1983). These reports evaluated various methodologies for geothermal resource assessments and provided estimates of potential electric power generation that continue to guide long-term geothermal planning (for example, Green and Nix, 2006).

The last national assessment of moderate (90 to 150°C) and high-temperature (greater than 150°C) geothermal resources, USGS Circular 790 (Muffler, 1979), estimated the potential for approximately 23,000 Megawatts-electric (MWe) of electrical power generation from identified high-temperature (>150°C) geothermal systems at depths less than 3 km in the western United States. Estimates of potential power production from undiscovered resources ranged from 72,000 to 127,000 MWe. Circular 790 listed nine western states (Alaska, Arizona, California, Hawaii, Idaho, Nevada, New Mexico, Oregon and Utah) with the potential for at least 100 MWe of electrical power generation per state from identified geothermal systems.

Geothermal Resource Terminology

This report follows other USGS geothermal resource studies in using the terminology adopted by Muffler and Cataldi (1978) for the subdivision of the geothermal resource base. These subdivisions are easily illustrated through a modified McKelvey diagram (fig. 1), in which the degree of geologic assurance regarding resources is set along the horizontal axis and the economic feasibility (effectively equivalent to depth) is set along the vertical axis (Muffler and Cataldi, 1978). USGS geothermal assessments consider both identified and undiscovered systems and define the "resource" as that portion of the accessible resource base that can be recovered as useful heat under current and potential economic and technological conditions. Similarly, the "reserve" is the identified portion of the resource that can be recovered economically using existing technology.

Within this framework, identified hydrothermal systems are divided into three temperature classes: low-temperature (<90°C), moderate-temperature (90 to 150°C), and high-temperature (>150°C). High-temperature systems include both liquid- and vapor-dominated resources. Moderate-temperature systems are almost exclusively liquid-dominated, and all low-temperature systems are liquid-dominated. All three temperature classes are suitable for direct use applications, but in general only moderate- and high-temperature systems are viable for electric power generation. Systems at the upper end of the low-temperature range can be exploited for electric power generation if sufficiently low temperatures are available for cooling the working fluid in a binary power plant. These conditions are found at Chena Hot Springs in Alaska (Holdman, 2006).

In the new USGS geothermal assessment, identified geothermal systems are also categorized as producing (the reservoir is currently generating electric power), confirmed (the reservoir has been evaluated with a successful commercial flow test of a production well), and potential (there are reliable estimates of temperature and volume for the reservoir but no successful well tests to date). Reservoir thermal energy and electric power production potential are estimated for all producing, confirmed, and potential geothermal systems above 90°C in the contiguous United States and Hawaii, and above 75°C in Alaska.

The Volume Method

An important component of geothermal resource assessment methodology is the development of geothermal resource models consistent with the production histories of exploited geothermal fields. The primary method applied in past USGS assessments for evaluating the production potential of identified geothermal systems was the volume method (Nathenson, 1975; White and Williams, 1975; Muffler and Cataldi, 1978; Muffler, 1979), in which the recoverable heat is estimated from the thermal energy available in a reservoir of uniformly porous and permeable rock using a thermal recovery factor, R_g, for the producible fraction of a reservoir's thermal energy. These studies established the volume method as the standard approach, and recent assessments of geothermal resources in parts of the United States rely on modified versions of the USGS volume method (for example, Lovekin, 2004). The basics of the volume method have been discussed in detail (Nathenson, 1975; Muffler and Cataldi, 1978; Muffler, 1979;

Lovekin, 2004; Williams, 2004), so only a brief summary of the relevant aspects is presented here.

The electric power generation potential from an identified geothermal system depends on the thermal energy, q_R, present in the reservoir, the amount of thermal energy that can be extracted from the reservoir at the wellhead, q_{WH}, and the efficiency with which that wellhead thermal energy can be converted to electric power. Once the reservoir fluid is available at the wellhead, the thermodynamic and economic constraints on conversion to electric power are well known (for example, DiPippo, 2005). The challenge in the resource assessment lies in quantifying the size and thermal energy of a reservoir as well as the constraints on extracting that thermal energy. In the volume method, the reservoir thermal energy is calculated as

$$q_R = \rho C V (T_R - T_0), \qquad (1)$$

where ρC is the volumetric specific heat of the reservoir rock, V is the volume of the reservoir, T_R is the characteristic reservoir temperature, and T_0 is a reference, or dead-state, temperature. The thermal energy that can be extracted at the wellhead is given by

$$q_{WH} = m_{WH}(h_{WH} - h_0), \qquad (2)$$

where m_{WH} is the extractable mass, h_{WH} is the enthalpy of the produced fluid, and h_0 is the enthalpy at some reference temperature (15°C in Circular 790). The wellhead thermal energy is then related to the reservoir thermal energy by the recovery factor, R_g, which was defined in Circular 790 as

$$R_g = q_{WH} / q_R \qquad (3)$$

Inherent in equations (1) and (2) is a geometrical concept of the reservoir that allows calculation of a volume and an estimate of the ability to extract hot fluid from the volume. In general it is possible to produce many times the original volume of fluid from the reservoir in order to recover the thermal energy from the reservoir rock. Because The Geysers vapor-dominated field in northern California was the only producing geothermal reservoir in the United States at the time, the mean value for R_g of 0.25 used in Circular 790 was derived from an analysis by Nathenson (1975) of the factors influencing the extraction of heat from a geothermal reservoir through a "cold sweep" process, in which the hot reservoir fluid is gradually replaced by colder water through natural or artificial injection. Analyses of production data from fractured reservoirs at The Geysers, Coso in California, and Dixie Valley in Nevada, indicate that R_g in those fields is closer to 0.1 and varies depending upon the assumed reservoir size and geometry (Williams, 2004). The recent GeothermEx evaluation of identified geothermal resources in California and Nevada incorporates a range for R_g from 0.05 to 0.2, which yields most likely values closer to observed values but also leaves a large uncertainty regarding potential geothermal power production (Lovekin, 2004).

From estimates of R_g and measurements of reservoir volume and properties, the exergy, E, (DiPippo, 2005), referred to as the available work, W_A, in Circular 790, for a geothermal reservoir can be determined as

$$E = m_{WH}[h_{WH} - h_0 - T_0(s_{WH} - s_0)], \qquad (4)$$

where s_{WH} is the entropy of the produced fluid and s_0 is the entropy at the reference temperature. In the actual implementation of this approach the mean values for the input variables are replaced with a range of values corresponding to estimated uncertainties, and these values are then used in Monte Carlo simulations to define the reservoir properties and productivity, along with the associated uncertainties (for example, Muffler, 1979; Lovekin, 2004; Williams and Reed, 2007). The electric energy, $\dot{W}_e$, for a given period of time (typically 30 years) is then determined through multiplying the exergy over the same period of time by a utilization efficiency, η_u, which is generally well-constrained for a reservoir of a specified fluid state and temperature (Muffler and others, 1979).

$$\dot{W}_e = \dot{E}\eta_u \qquad (5)$$

For power generation above 150°C, Muffler and others (1979) used a constant value for η_u of 0.4 down to the minimum reservoir temperature for electric power production of 150°C. Lovekin (2004) increased this to 0.45. A compilation of η_u for existing geothermal power plants producing from liquid-dominated systems over a wide range of temperatures confirms η_u equal to approximately 0.4 above 175°C (fig. 2). There is a linear decline in η_u below 175°C as reservoir temperatures approach the reference state in binary power plant operations. In the new assessment the 150°C lower limit is revised downward to include binary power production from moderate-temperature systems. Developments in binary power plant technology have led to electric power generation from systems with temperatures as low as 94°C in the lower 48 states (Amedee, California) and 75°C in Alaska (Chena Hot Springs), and production from lower temperatures is possible, if not always economically viable at the present time. For geothermal systems in the contiguous United States and Hawaii, the lower limit for electric power generation is set at 90°C, but for Alaska the assessment includes potential power generation from systems with temperatures as low as 75°C, due to the availability of near-freezing cooling water at many sites.

Temperature and Chemical Geothermometers

Geothermal reservoir temperatures can be determined from in situ measurements in exploration and production wells where available. In order to characterize the thermal state of a geothermal reservoir when in situ temperature measurements are not available, chemical geothermometers can be applied as proxies. The calculation of chemical geothermometers rests on the assumption that some relationship between chemical or isotopic constituents in the water was established at higher temperatures and this relationship has persisted when the water cools as it flows to the surface. The calculation of subsurface temperatures from chemical analyses of water and steam collected at hot springs, fumaroles, geysers, and shallow water wells is a standard tool of geothermal exploration and fills the need to estimate the subsurface temperature of a geothermal prospect area before any deep wells are drilled.

The first temperature calculations were based on experimental laboratory studies of mineral solubility at elevated temperature (Kennedy, 1950; Fournier and Rowe, 1966). As geothermal exploration progressed, observed relationships among dissolved chemical constituents at known temperatures in wells were used to calibrate geothermometers from the aqueous species produced at the surface. Experimental and field data from sodium-chloride solutions were used to develop the mathematical equations for several geothermometers, and most of the calculations are suggested only for use with analyses of dilute, sodium-chloride type waters at near-neutral pH. In some geothermal prospect areas, for example the Basin and Range, sodium-bicarbonate type waters predominate, and few systems have sodium-chloride type water. The differences in the types of water chemistry encountered in geothermal systems require extra caution in the application of geothermometers.

Interpretation of the calculated temperatures requires knowledge of the most likely reactions to have occurred between the water and the surrounding rocks. In addition, the charge balance is calculated for every water analysis as a check for the completeness of the analysis and its accuracy. For the USGS geothermal resource assessment, some simple calculations are used to determine the reliability of the chemical analyses of geothermal waters (Reed and Mariner, 1991). Each ion in the analysis is converted to its equivalent concentration, and the charge balance error (CBE) is calculated as 100 times the absolute value of the difference between the summation of equivalent concentrations of cations (Na^{+}, K^{+}, Ca^{++}, Mg^{++}) and the summation of equivalent concentrations of anions (Cl^{-}, F^{-}, HCO_3^{-}, SO_4^{--}) divided by the average of the summation of equivalent concentrations of cations and the summation of equivalent concentrations of anions. An error greater than 10 percent in the charge balance is indicative of a problem with the analysis, and analyses that fall into this category are only be used for geothermal calculations in the assessment if no other analyses are available and the associated uncertainties in the calculated temperatures can be quantified.

Most geothermal systems never reach chemical equilibrium because most of the reaction rates are dependent on the concentrations of components in solution (Barton, 1984). The flow of hydrothermal fluids through a geothermal reservoir is constantly changing the concentrations of components in solution, and the geothermometers reflect a steady-state condition that exists at high temperature between the circulating water and enclosing rocks. The reaction rates for mineral solubility are dependent on temperature as well as several other variables in a hydrothermal system. For example, the approximate times to reach equilibrium between the feldspar minerals and fluid for the Na-K-Ca geothermometer varies from tens of hours at 500°C to on the order of 100 years at 150°C, and the solution-mineral equilibrium for quartz takes from tens of hours at

250°C to tens of years at 100°C (Barton, 1984). As the geothermal water cools on its way to the surface, the reaction rates become more sluggish. A secondary assumption is that the flow of hydrothermal water to the surface is rapid with respect to the rates of reactions at near-surface temperatures.

Geothermometer-based temperature estimates in the new geothermal resource assessment rely primarily on silica and cation geothermometers. In natural environments, it is often difficult to choose the correct silica geothermometer because it is not clear which mineral is controlling the dissolved silica concentration. Below 180°C, there is a choice between geothermometers for chalcedony and quartz, since each of these minerals may control the dissolved silica in different rock environments. Giggenbach (1992) developed an equation to approximate the calculated temperature in the transition zone between the chalcedony solubility control at low temperatures and the quartz solubility control at high temperatures (fig. 3). This smoothed curve eliminates the ambiguity of the calculations between 20°C and 210°C. Above 210°C, the quartz geothermometer is representative of the silica solubility in geothermal systems up to about 250°C. Temperatures for waters with dissolved silica concentrations of more than 462 mg/L (250°C) and for silica concentrations in condensed steam are estimated by comparing the analyzed silica concentrations with the quartz solubility determinations in Fournier and Potter (1982).

Silica geothermometers rely on the fact that each of the silica (SiO_2) minerals has its own solubility in water as a function of temperature and pressure, and silica hydrolizes in water to form the neutral silicic acid complex, $H_4SiO_4^{\circ}$. The silica minerals precipitate from the aqueous solution by the reverse reaction when the silicic acid complex becomes supersaturated, polymerizes, and precipitates as a solid. The rates of dissolution and precipitation are relatively rapid at high temperatures and are rather sluggish at low temperatures. The individual silica mineral that precipitates depends on the temperature and pressure conditions and on the degree of supersaturation.

Fournier (1992) warns that the geothermometers are changed significantly by high concentrations of ions in solution, especially at high temperature (over 300°C). The equations for silica geothermometers work best at pH values between 5 and 7 (Fournier, 1992). In acidic solutions (less than pH = 3) or in alkaline solutions (greater than pH = 8) part of the silicic acid complex ionizes and the precipitation reaction is changed (Busey and Mesmer, 1977). Silica mineral saturation temperatures for high-pH waters are determined using SOLMINEQ88, a solution-mineral equilibrium computer model (Kharaka, 1988). There are few systems encountered with low pH, and the corrections are not considered here.

The cation geothermometers use ratios of cation concentrations to represent the hydrothermal, steady-state reactions that take place within mineral groups such as the feldspars, micas, zeolites, or clays. The use of concentration ratios rather than the actual concentrations makes these geothermometers less sensitive to changes in strength of the solution due either to boiling or to dilution. The cation geothermometers normally use sodium, potassium, calcium, magnesium, and lithium in various relationships that are temperature dependent. For the Na-K-Ca-Mg geothermometer, these relationships are based on several different mineral equilibria, and these different reactions result in a discontinuous function for this geothermometer.

The most commonly used cation geothermometer is the Na-K-Ca-Mg formulations of Fournier and Truesdell (1973) and Fournier and Potter (1979). The Na-K-Ca-Mg geothermometer has two formulations, one for lower (<100°C) temperature waters and one for higher (>100°C) temperature waters. This geothermometer was used extensively in the previous USGS geothermal resource assessment (Brook and others, 1979). However, in the western United States (Brook and others, 1979), these two different formulations result in a major discontinuity and an underreporting in the number of systems in the range between 100°C and 130°C (fig. 4). There should be a larger number of lower temperature geothermal systems, with a systematic decrease in the number of systems as aquifer temperatures increase (see for example, Reed, 1983, fig. 16).

Although control from calibration well samples is limited, it appears that the K-Mg geothermometer provides estimated temperatures reasonably close to temperatures measured in drilled geothermal systems within the 90°C to 130°C range. The potassium-magnesium geothermometer relates temperature to the logarithm of the ratio of potassium concentration squared to magnesium concentration, $c_{(K)}^2/c_{(Mg)}$ (Giggenbach, 1988). Temperatures were calculated for the geothermal systems (with reported Mg concentrations) in the western United States (Brook and others, 1979), using the K-Mg geothermometer (fig. 5), and these K-Mg geothermometer temperatures exhibit a continuous decrease in the number of geothermal systems as higher temperatures are evaluated, regardless of the type of water chemistry. Because the potassium to magnesium ratio is consistently representative of the subsurface temperature, the K-Mg geothermometer is generally the preferred cation geothermometer in this assessment. The Na-K-Ca geothermometer is preferred in Cl-rich waters and used where Mg data are unavailable. The magnesium ion concentration is below the detection limit in many analyses of geothermal waters, and the K-Mg geothermometer cannot be calculated for these waters.

Reservoir Volume

The difficulty of developing accurate estimates for the volumes of unexploited geothermal reservoirs varies depending on the geologic setting and the availability of data from exploration and development drilling. Many geothermal reservoirs are dominated by fracture porosity, which can be characterized by high permeabilities but relatively low fluid volumes. In addition, fracture permeability is sensitive to relatively rapid (in geologic time) temporal variations in the state of stress and fluid chemistry, and this can lead to heterogeneous permeability distributions within the fracture-dominated reservoirs (for example, Melosh and others, 2008). Estimates of reservoir volumes in the new assessment are derived from production histories, drilling results, chemical tracer tests, and exploratory geological and geophysical investigations.

In some cases information on a geothermal system is limited to the temperature, flow rate and chemical composition of a thermal spring. Under these circumstances, reservoir volumes are estimated by applying constraints from well-characterized geothermal reservoirs in analogous geologic settings. For example, for hot springs emerging from range-front faults in the Great Basin, the width of the fault damage zone (typically 100 to 500 m) constrains one horizontal dimension of the geothermal reservoir, and the temperature of the reservoir fluid relative to the background geothermal gradient defines the maximum depth of circulation. The greatest uncertainty in the estimated reservoir volume for a range front fault system lies in the lateral extent of the reservoir along strike. In the absence of geophysical or structural constraints, the upper end of possible along-strike extents is defined by the examples of producing geothermal reservoirs and other well-explored geothermal systems. Based on these examples, the default along-strike extent of a fault-hosted geothermal reservoir ranges from 1 to 5 km, with a most likely extent of 2 km. The largest volumes determined from this range of reservoir dimensions are consistent with larger, producing fault-hosted reservoirs such as Dixie Valley and Beowawe. The smallest volumes are consistent with simple vertical conduits of limited spatial extent and doubtful viability for commercial power production.

In Circular 790 the maximum depth extent for geothermal reservoirs was set to 3 km, as a representative limit of the economic and technological constraints of drilling and exploitation (Muffler and others, 1979). Although the maximum depth of geothermal drilling in the United States is approximately 3.5 km, geothermal wells deeper than 4 km have been completed in Italy, and a number of wells for Enhanced Geothermal Systems development have been drilled to depths of approximately 5 km (Kobayashi, 2000; Bertani, 2005). In the case of geothermal systems for which the base of the reservoir has not been defined by drilling, thermal constraints on the vertical extent of fluid circulation or the depth of the brittle-ductile transition are applied, but in no case is the base of the reservoir allowed to extend beyond 6 km.

Studies relating the rate of natural heat loss (both advective and conductive) and the dimensions and rate of fluid flow through a hydrothermal system can also provide a basis for estimating the volume of a geothermal reservoir (Wisian and others, 2001; Williams, 2005). In the new resource assessment, estimates of total heat loss from a geothermal reservoir are determined from heat flow or temperature-gradient measurements, when available, and used as an additional check against the predictions of the estimated reservoir temperatures and volumes.

Geothermal Recovery Factor

Hydrothermal systems capable of generating electrical power require the presence of both high temperatures and locally high permeabilities (for example, Bjornsson and Bodvarsson, 1990). Although the volume method provides a means of estimating the heat content of a geothermal reservoir, it does not explicitly predict the reservoir permeability. The presence of permeability adequate for production is based on the existence of a geothermal anomaly (for example, hot springs, flowing wells, anomalously high heat flow) and the assumed recovery factor, which incorporates an estimate of the effective reservoir permeability and porosity. Reservoir models and production histories are generally consistent with the predictions of the volume method when the reservoir volume and the spatial distribution of permeability are well-constrained (for example, Parini and Riedel, 2000; Williams, 2004). Potential problems arise when both the volume of a reservoir and its flow properties must be estimated. Many geothermal reservoirs are dominated by fracture porosity, which can be characterized by high permeabilities but relatively low fluid volumes. In addition, fracture permeability is sensitive to relatively rapid (in geologic time) temporal variations in the state of stress and fluid chemistry.

In the USGS national assessment of low-temperature geothermal resources, Reed (1983) applied models for the recovery of heat and fluid from low-temperature sedimentary reservoirs using constraints on drawdown at production wells. Production-related pressure declines have posed significant problems in geothermal reservoirs, and, despite the risk of thermal breakthrough, injection has become a common procedure for sustaining production (Axelsson, 2003). Consequently, any estimate of reservoir production potential should evaluate longevity from the perspective of injection and eventual thermal breakthrough. Models for the recovery of heat from uniformly porous, homogeneous, and liquid-phase reservoirs using injection indicate that R_g can reach values of 0.5 or higher (for example, Nathenson, 1975; Garg and Pritchett, 1990; Sanyal and Butler, 2005).

To allow for uncertainties in the distribution of permeability in a producing geothermal reservoir, the resource estimates in Circular 790 were based on a Monte Carlo uncertainty model with a triangular distribution for R_g with a most-likely value of 0.25 and a range from 0 to 0.5 (Muffler et al, 1979). More recent analyses of data from the fractured reservoirs commonly exploited for geothermal energy indicate that R_g is closer to 0.1, with a range of approximately 0.05 to 0.2 (Lovekin, 2004; Williams, 2004, 2007). In general this apparent discrepancy in R_g reflects the contrast in thermal energy recovery from complex, fracture-dominated reservoirs compared to the uniform, high-porosity reservoirs considered in the early models. The original values for R_g were derived from models of the effects cooling in a geothermal reservoir due to reinjection or natural inflow of water colder than pre-existing reservoir temperatures (for example, Nathenson, 1975; Bodvarsson and Tsang, 1982; Garg and Pritchett, 1990; Sanyal and Butler, 2005). This is consistent with the optimal extraction of thermal energy from a reservoir, as in general it is possible to produce many times the original volume of fluid from the reservoir in order to recover the thermal energy from the reservoir rock. The challenge is to extend these results to evaluate the thermal effects of injection and production in reservoirs ranging from those containing a few isolated fracture zones to those that are so pervasively fractured as to approach the idealized behavior of uniformly porous reservoirs.

The first step in the transition from these uniform reservoirs to fractured reservoirs is managed through implementation of the fracture flow model of Bodvarsson and Tsang (1982). This model provides a means of predicting the propagation of a thermal front for liquid-dominated reservoirs with different rates of production and fracture spacing and highlights the sensitivity of thermal energy recovery to average fracture spacing. For representative geothermal reservoir rock and fluid properties, the Bodvarsson and Tsang model predicts that fractured reservoirs approach the uniform energy sweep possible in porous reservoirs when the average fracture spacing is approximately 50 m. As the average fracture spacing grows, a progressively larger fraction of thermal energy in the formation is bypassed by cooler water moving along fracture paths, and the geothermal recovery factor drops (Williams, 2007; Williams and others, 2007).

Although these results are suggestive of the factors that determine why less heat may be recoverable from naturally-fractured reservoirs, the Bodvarsson and Tsang model fails to replicate other important features of geothermal production from fractured reservoirs. In particular, analyses of tracer tests in active geothermal fields, as well as variations in recorded flow rates from producing fractures, clearly indicate significant variation in permeability and path length among fractures connecting injection and production wells (Shook, 2005; Reed, 2007). The chemical tracer tests yield information on the variability of flow in a reservoir that can be plotted as a curve relating flow capacity to storage capacity, or the productivity of each portion of the reservoir. Examples for the Beowawe and Dixie Valley geothermal fields are shown in figure 6. In the Beowawe field approximately 50 percent of the flow comes from the most productive 10 percent of the permeable fractures, and in the Dixie Valley field approximately 35 percent of the flow comes from the most productive 10 percent of the permeable fractures. By contrast, the uniform fracture model requires an equal distribution of flow across the entire permeable fracture network (fig. 6). The spatial distributions and hydraulic properties of real fracture networks are highly heterogeneous, and the heterogeneity manifests itself in the fundamental production characteristics yielded by the moment analysis of tracer tests. Any accurate characterization of injection and production from fractured reservoirs must be able to account for this heterogeneity.

Williams (2007) investigated the use of self-similar fracture distributions in a modification of the Bodvarsson and Tsang (1982) model as a means of better representing the actual fracture flow characteristics and variations in R_g observed in producing reservoirs. One simple and effective way of characterizing this heterogeneity has been through the use of models that characterize fracture properties such as permeability through a self-similar distribution (for example, Watanabe and Takahashi, 1995). If, for example, the productivity of fractures intersecting a production well follows a self-similar distribution, this distribution is described by

$$N_k = C_k k^{-d_k}, \qquad (6)$$

where k is a reference permeability, N_k represents the number of fractures intersecting the well with permeability greater than or equal to k, C_k is a constant, and d_k is the fractal dimension.

Although there is some direct evidence for fractal dimensions of properties that are relevant to permeability, such as fracture aperture, fracture length, and fracture density, the fractal dimensions for permeability may vary over a wide range (for example, Watanabe and Takahashi, 1995; Dreuzy and others, 2001). For the purpose of this analysis, the fractures of interest are those that contribute significant volume to flow in the well and thus span a permeability range of approximately two orders of magnitude (Bjornsson and Bodvarsson, 1990). These will be a relatively small subset of the total population of fractures with measureable permeability. This analysis also equates the productivity of individual fracture sets with their permeability, an approach consistent with observations in producing geothermal fields (for example, James and others, 1987). Records of flow from producing fractures in geothermal wells confirm the varying contribution of individual fractures or fracture sets to geothermal production (fig. 7), and also demonstrate large the range of fractal dimensions necessary to characterize the observed variations in flow.

Figure 8 compares flow capacity/storage capacity curves from self-similar models for three different fractal dimensions with the Beowawe, Dixie Valley and uniform fracture model curves from figure 6. (For details see Williams, 2007.) The distribution of flow for the Dixie Valley field is consistent with the modeled distribution for d=1, and the distribution for the Beowawe field is consistent with the modeled distribution for d=0.667. The smaller value for d in the Beowawe field reflects the dominance of a single fracture or fracture system in the permeability tapped by the chemical tracer test. Like the uniform fracture model, the self-similar fracture flow models yield a range of values for R_g that depends both on average fracture spacing and on the dimensionality of the spatial distribution of fractures (fig. 9).

These results indicate that the self-similar models for fracture permeability reproduce the behavior of producing geothermal reservoirs and provide a physically-based justification for the observed variation in R_g. Given the observed variability in fracture flow properties, the likelihood that most natural fractures will match these varied flow properties with diverse fracture spacings and orientations, and the range of recovery factors determined from production histories of geothermal reservoirs, it is not possible to assign a single value, or even a narrow range, for R_g for unexploited geothermal systems. Taking the above analysis as a guide, in the new resource assessment R_g for fracture-dominated reservoirs is estimated to range from 0.08 to 0.2, with a uniform probability over the entire range. For sediment-hosted reservoirs this range is increased from 0.1 to 0.25.

Electric Power Estimates and Monte Carlo Uncertainty Analyses

Equations 1 through 5 cover the basic relationships used to estimate electric power generation potential for a given geothermal system. Uncertainties in the estimates are accommodated through a Monte Carlo simulation approach, which is shown schematically in figure 10. For each system, USGS investigators determine most likely, minimum and maximum values for reservoir temperature and volume. These values are used to generate triangular probability distributions for temperature and volume, and the resulting distributions are combined for an estimate of reservoir thermal energy. A uniform distribution for the geothermal recovery factor is introduced in the next step of the Monte Carlo analysis, and the resulting values for wellhead exergy are transformed to electric power estimates using the utilization efficiency relationship shown in figure 2. The final result is a distribution of electric power generation estimates for each geothermal system (fig. 10), which includes values for the most likely, mean, median, 5 percent and 95 percent electric power generation potential.

Summary

The USGS is conducting a new assessment of the moderate- and high-temperature geothermal resources of the United States. This new assessment will present a detailed estimate of electrical power generation potential and an evaluation of the major technological challenges for increased geothermal development. The assessment effort involves partnerships with the Department of Energy, Bureau of Land Management, national laboratories, universities, state agencies and the geothermal industry. The new assessment will introduce significant changes in the models for geothermal energy recovery factors, estimates of reservoir permeability, limits to temperatures and depths for electric power production, and include the potential impact of evolving EGS technology.

Improvements incorporated in the new resource assessment include (1) a minimum temperature for electric power production of approximately 90°C (75°C in Alaska), (2) a maximum depth extent for selected geothermal reservoirs of as much as 6 km, (3) a change in the preferred geothermometers used for estimating reservoir temperatures, (4) a revised method for determining recovery factors, and (5) independent evaluations of reservoir permeability using reservoir models, production histories, and chemical tracer tests.

The adjustment in expected recovery factors account for the behavior of heterogeneous fracture-dominated reservoirs. Models for the effects of injection within reservoirs of self-similar distributions of fracture permeability reproduce both the observed range of R_g and the flow capacity/volume capacity characteristics of producing fractured geothermal reservoirs. Although these analytical models are not intended as replacements for detailed numerical reservoir models, they do provide a physically realistic justification for applying a range of potential recovery factors to an unexploited reservoir in order to reflect the heterogeneous character of fracture permeability.

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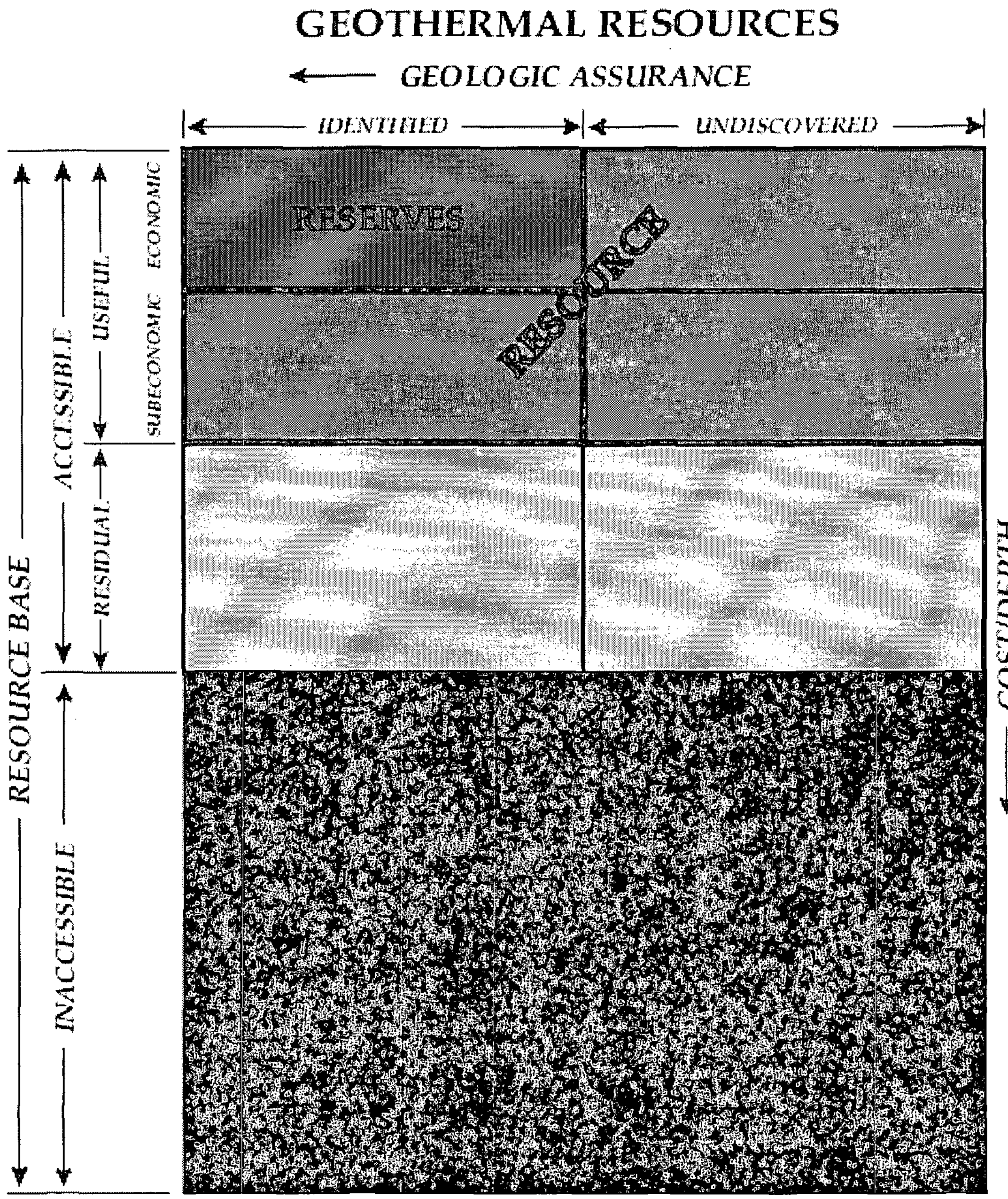


Figure 1. McKelvey diagram representing geothermal resource and reserve terminology in the context of geologic assurance and economic viability.

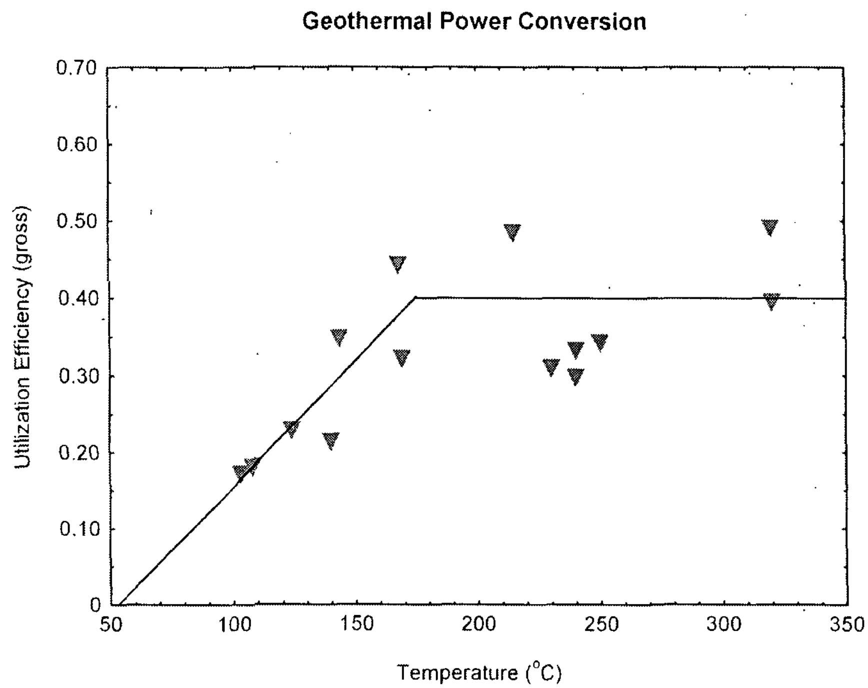


Figure 2. Utilization efficiency as a function of temperature for existing geothermal power plants studied by DiPippo (2005) (green triangles), along with the conversion relationship used in the new assessment (black line).

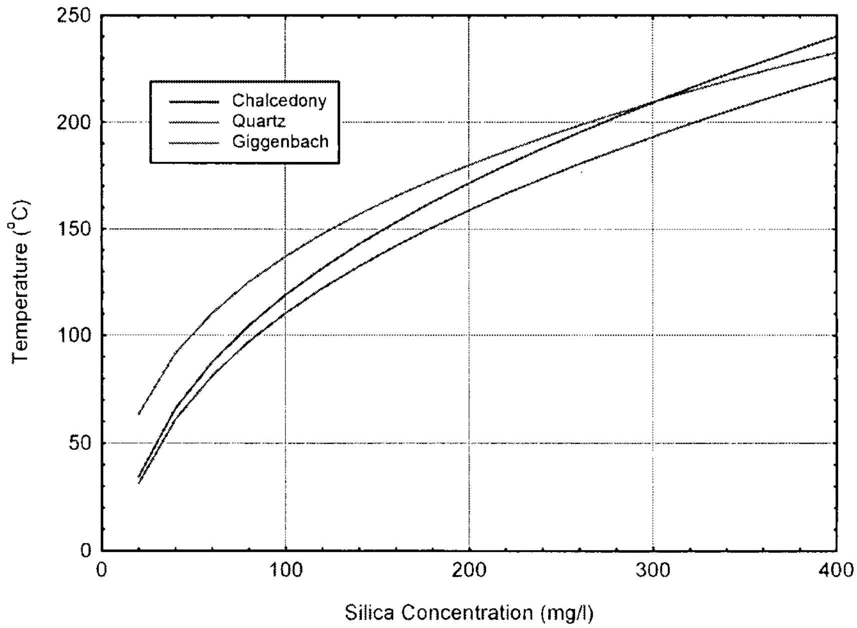


Figure 3. Graph of the solubility curves for quartz (green line) and chalcedony (red line) showing the curve (blue line) of Giggenbach (1992) to approximate the transition from chalcedony to quartz.

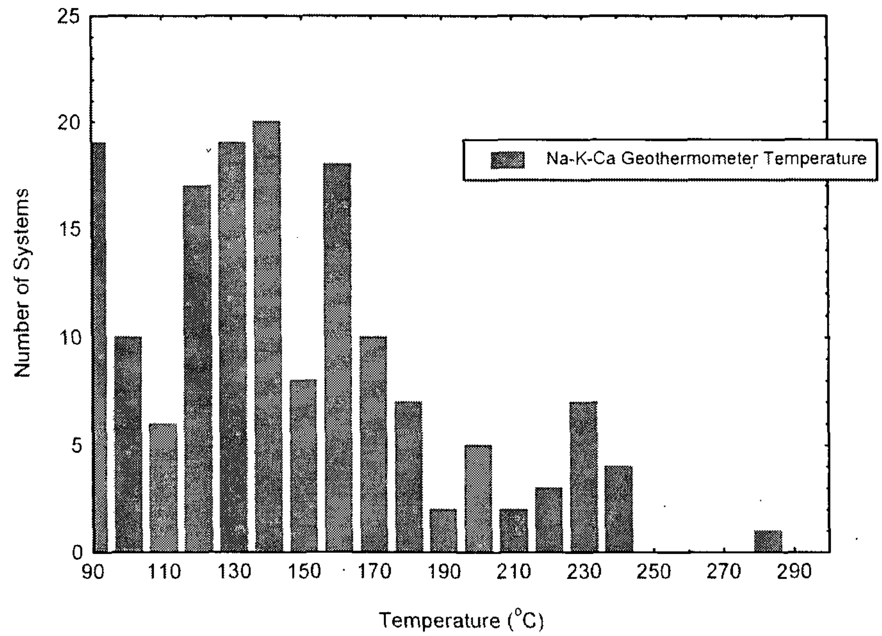


Figure 4. Histogram for 10°C increments of temperatures calculated with the Na-K-Ca-Mg geothermometer for the geothermal systems identified in USGS Circular 790 (Brook and others, 1979). There are anomalously few systems with calculated temperatures in the range between 100° and 130°C. This is interpreted as an underreporting of systems between 100° and 130°C.

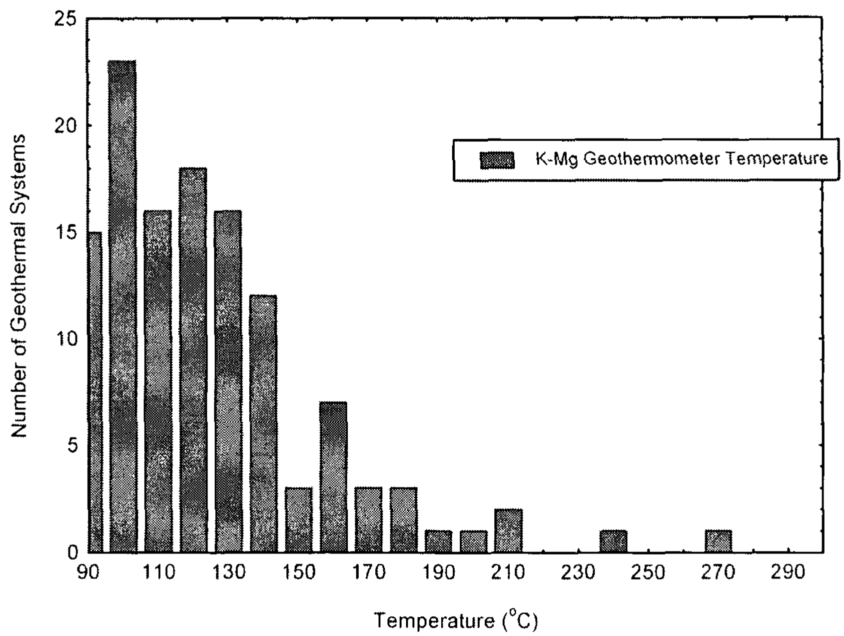


Figure 5. Histogram for 10°C increments of temperatures calculated with the K-Mg geothermometer for the geothermal systems (with reported Mg concentrations) identified in USGS Circular 790 (Brook and others, 1979). These calculated temperatures exhibit a continuous decrease in the number of geothermal systems as higher temperatures are evaluated, regardless of the type of water chemistry.

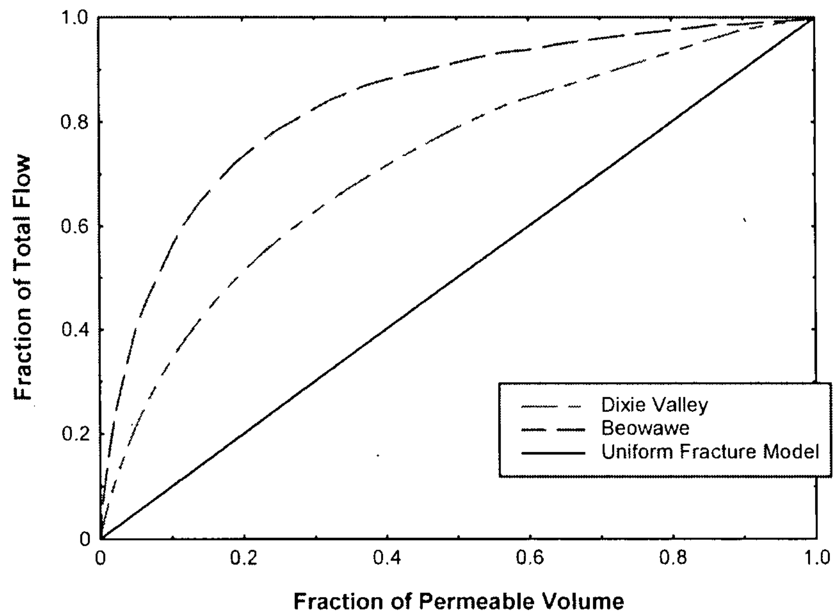


Figure 6. Distribution of flow capacity across the reservoir permeable volume for the fractured reservoir model of Bodvarsson and Tsang (black) and the Beowawe (Shook, 2005) and Dixie Valley (Reed, 2007) geothermal fields.

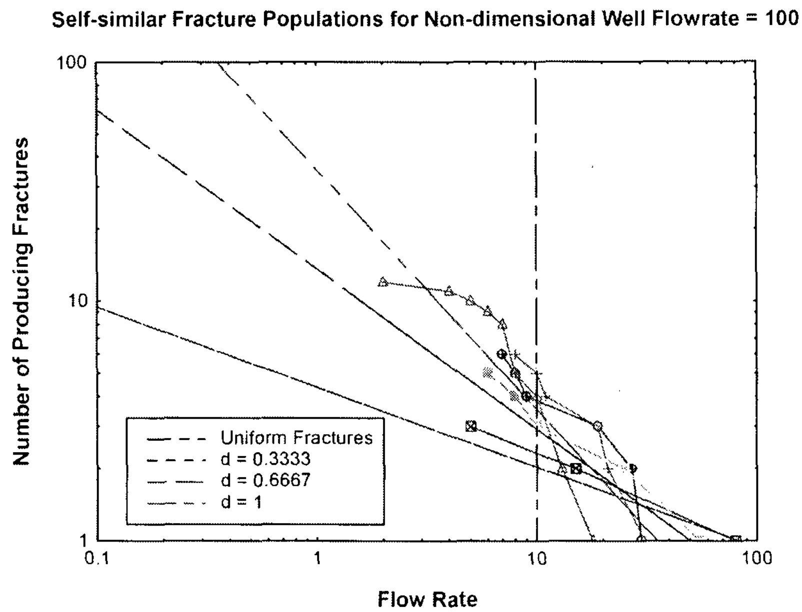


Figure 7. Fracture flow distributions for the uniform fracture model and self-similar models with fractal dimensions of *d*=0.333, 0.667, and 1.0, along with observations derived from pressure-temperature-spinner (PTS) logs in producing geothermal wells reported by Drenick (1986) (orange triangles), Enedy (1988) (blue squares), Garg and others (1997) (red squares and blue circles), and Hardeman and others (2000) (grey crosses).

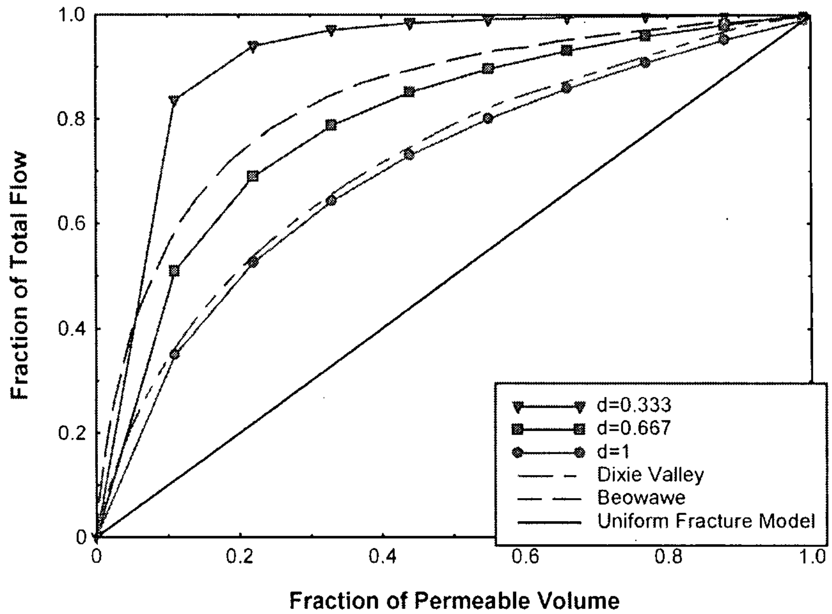


Figure 8. Distribution of flow capacity from figure 6 with the predictions of self-similar models with three different fractal dimensions (after Williams, 2007).

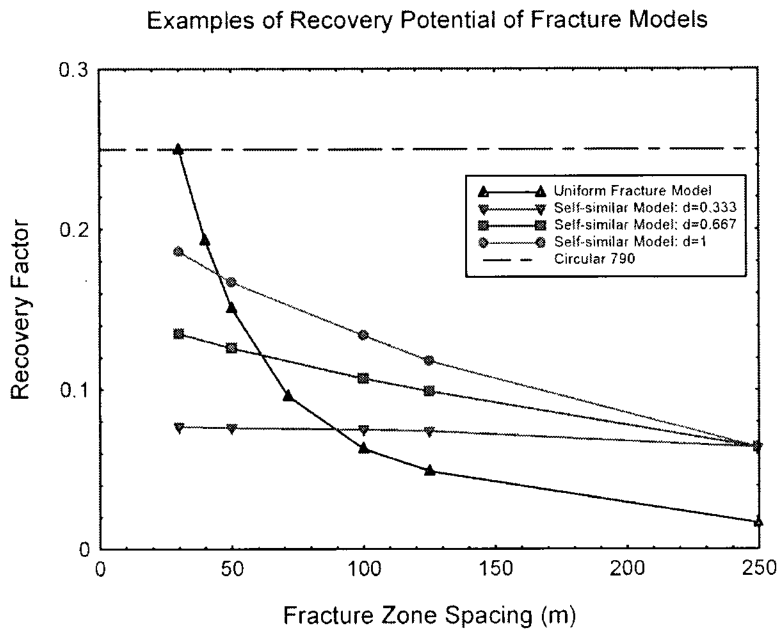


Figure 9. Variations in recovery factor with fracture spacing for example models incorporating planar fractures with uniform flow properties (black) and fractal distributions of flow properties among the producing fractures (green, blue and red).

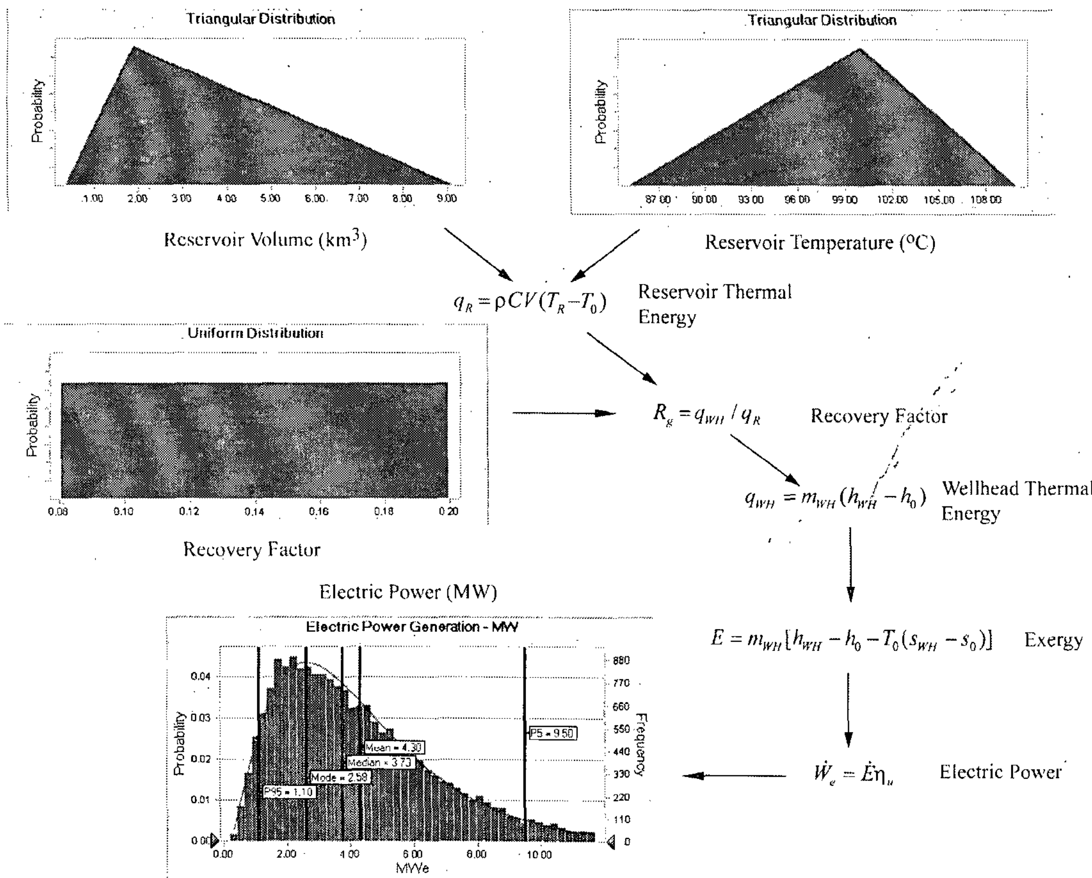


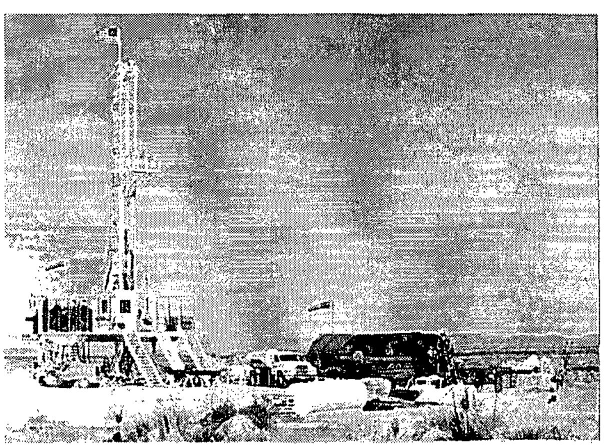
Figure 10. Schematic of the Monte Carlo uncertainty analysis applied in the calculation of reservoir thermal energy, wellhead thermal energy, and electric power generation potential for liquid-dominated geothermal systems in the national resource assessment.

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary
Tom Mills
Deputy Cabinet Secretary

A STRATEGIC PLAN FOR NEW MEXICO GEOTHERMAL RESOURCES DEVELOPMENT

Prepared
by
James C. Witcher
Southwest Technology Development Institute
New Mexico State University



Prepared for
U. S. Department of Energy

Submitted to
New Mexico Energy, Minerals
and Natural Resources Department
Santa Fe, New Mexico

AUGUST 31, 2004

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary
Tom Mills
Deputy Cabinet Secretary

May 6, 2005

Jeff Baker, Acting Director
Central Regional Office
U.S. Department of Energy
1617 Cole Blvd.
Golden, CO 80401

Subject: **New Mexico Geothermal Energy Strategic Plan,**
DOE Cooperative Agreement No. DE-FC48-02R820603

Dear Mr. Baker:

New Mexico now has a Geothermal Energy Strategic Plan and the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) wishes to thank the U.S. Department of Energy (DOE) for funding this important work. Enclosed is a copy of "A Strategic Plan for New Mexico Geothermal Resources Development" prepared by James C. Witcher at New Mexico State University (NMSU).

Funded by DOE in 2003, EMNRD partnered with NMSU, the New Mexico Geothermal Energy Working Group (NMGEWG), and the Geothermal Heat Pump Consortium to produce the document. There was a kick-off to the work at the Spring 2004 Working Group annual meeting, followed by a series of working meetings of NMGEWG during June through November, with technical support provided by NMSU. The November 2004 meeting also addressed implementation of the Geothermal Energy Strategic Plan. Starting with the Spring 2005 NMGEWG annual meeting, May 10-11 at NMSU, the Geothermal Energy Strategic Plan is available for general distribution. The document can also be found at http://www.emnrd.state.nm.us/ecmd/html/geothermal.htm.

If there are any questions, please contact Brian Johnson, Geothermal Energy Program Manager, at 505/476-3313 or bkjohnson@state.nm.us.

Sincerely,

Joanna Prukop

Joanna Prukop
Cabinet Secretary

cc: Chris Wentz, Director, EMNRD Energy Conservation and Management Division
Sandy Glatt, Senior Energy Project Officer, DOE Central Regional Office

Enclosure: "A Strategic Plan for New Mexico Geothermal Resources Development"

A STRATEGIC PLAN FOR NEW MEXICO GEOTHERMAL RESOURCES DEVELOPMENT

Prepared
by
James C. Witcher
Southwest Technology Development Institute
New Mexico State University

Prepared
for
U. S. Department of Energy

Submitted to
New Mexico Energy, Minerals
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AUGUST 31, 2004

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Late Cretaceous compressional uplifts that are broken by north-trending Late Cenozoic extensional faulting (Witcher, 1991a). Maximum temperatures of these geothermal systems at depths less than 3,000 to 4,000 feet are probably limited to 300 and 350°F. Water quality of the systems is generally between 1,000 and 3,500 mg/L total dissolved solids (TDS) and usually represents a sodium chloride to chloride-sulfate-bicarbonate chemistry, depending upon the bedrock host rocks (Witcher, 1995). Hydrogen sulfide is mostly absent except in trace amounts at a very few sites and carbonate scaling potential varies from site to site.

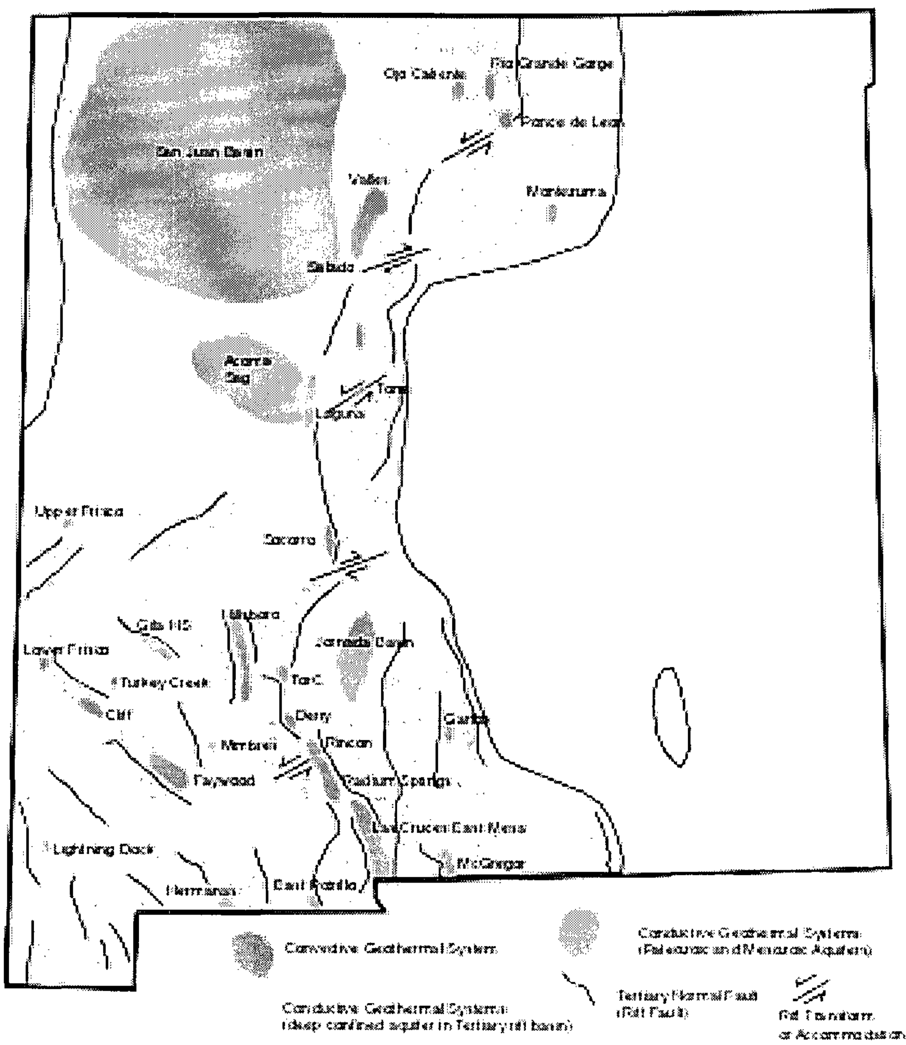

Figure 4. New Mexico geothermal resources. Yellow indicates region with inferred geothermal resource potential based on heat flow information and well bottom hole temperatures.

6.0 Current Geothermal Utilization in New Mexico

6.1 Introduction

Important economic growth in New Mexico has occurred during the last decade and a half with direct-use of geothermal energy. New Mexico has taken the nation's lead in geothermal greenhouse acreage with more than half of the state's acreage now heated by geothermal (Witcher, 2002). Geothermal greenhouse gross receipts rank in the top ten of all agriculture sectors. New Mexico is appealing to the greenhouse industry for several reasons, including a good climate, inexpensive land, a good agricultural labor force, and the availability of low cost geothermal heat. More than half of this geothermal development is directly tied to the geothermal program at the Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU) in Las Cruces.

6.2 Electric Power

Geothermal electrical power generation equipment is currently installed in conjunction with the large 30-acre Burgett Geothermal Greenhouse in the Animas Valley near Cotton City (Figure 5). The Burgett power plant provides a model for combined geothermal electrical power and geothermal direct-use. The Burgett facility has evolved into a cascaded system where 230°F well production is fed into the power plant heat exchangers at a rate of 1,200 gallons per minute (gpm) and the 185°F outflow from the power plant is used for space heating of the greenhouses (Witcher and others, 2002a). The Burgett power plant applies binary power technology. A heat exchanger allows the geothermal water to heat a low boiling point working fluid that is isolated in a closed loop across the turbine, condenser, and heat exchanger. The Burgett power plant consists of three modular 0.3 MWe units that use isopentane, a hydrocarbon working fluid.

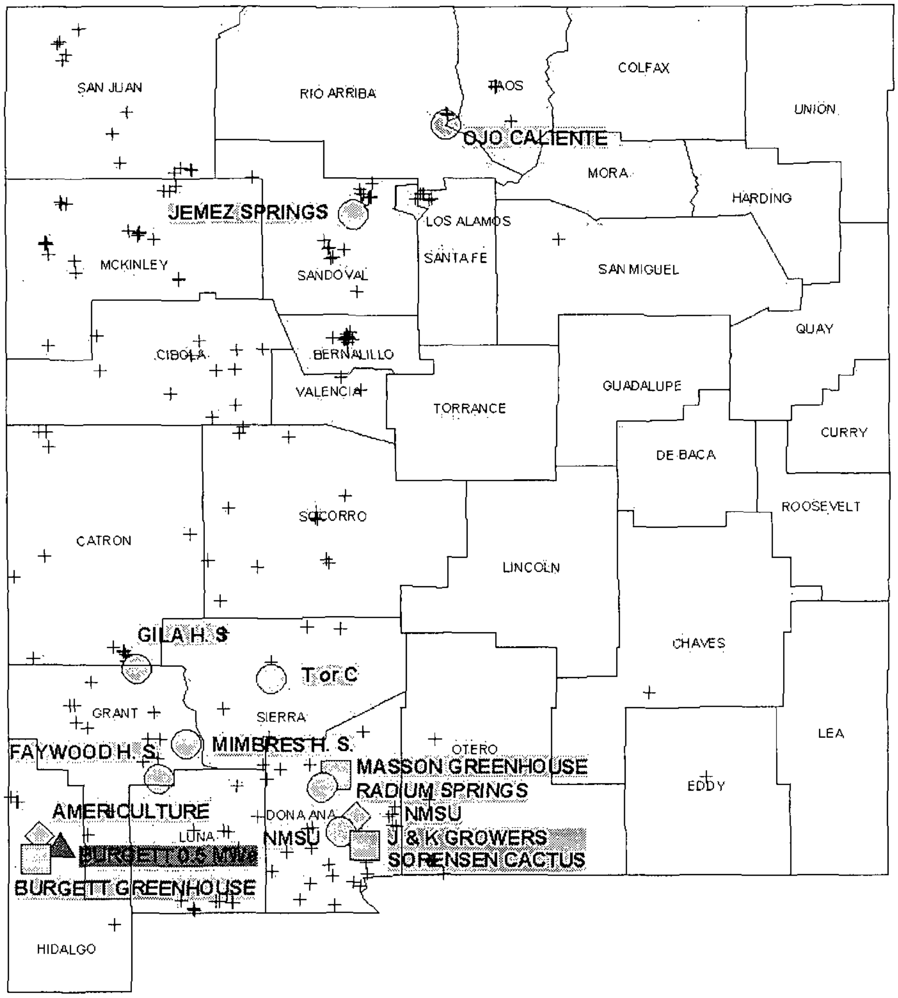

Figure 5. Geothermal use in New Mexico. Yellow circles -space and district heating; green squares - greenhousing; blue diamonds – aquaculture; red triangle – binary electrical power; black crosses – thermal wells and springs (Witcher, 2002).

6.3 Aquaculture

The AmeriCulture Fish Farm at Cotton City in southwest New Mexico (Figure 5) raises tilapia from eggs produced on site. AmeriCulture markets and sells a disease free tilapia fry to growers and researchers nation wide for grow out to full size. Tilapia is a fish that is growing in popularity for its taste and in recent years, local Red Lobster seafood restaurants have added tilapia to the menu.

Geothermal offers several advantages for fish culture. For instance, AmeriCulture is heated with a downhole heat exchanger installed in a 400-foot depth well at much lower costs than fossil fuels (Witcher and others, 2002a). Many species have accelerated growth rates in warm water. In addition, the geothermal water can be used as a growth medium; thereby, adding to the agriculture receipts in the State without additional consumptive use of valuable fresh water supply.

6.4 Space and District Heating

The aridity and high elevation of New Mexico creates significant heating loads on winter nights. Where shallow geothermal resources are co-located with large heating demands, space and district heating is favorable and can compete with fossil fuel costs. Many of these sites are also favorable for spas.

In operation since 1982, a district geothermal heating system on the NMSU campus in Las Cruces uses up to 260 gpm of 143°F water that is produced from less than 980 ft depth (Cunniff and others, 1983; and Witcher and others, 2002b). Geothermal water is passed through a heat exchanger to heat fresh water that is fed as needed into space and domestic hot water loops on campus. The geothermal water with heat removed is injected into the reservoir margin beneath the NMSU golf course. Geothermal heating is done in the dorms, academic buildings, and athletic facilities on the eastern third of the campus. Geothermal heat also provides domestic hot water for showers in the dorms and athletic facilities.

At Gila Hot Springs, geothermal space and district heating is applied to a trailer court, rental cabins, a store, and several homes. A 300-foot depth flowing well provides 165°F water for heating (Witcher and Lund, 2002).

6.5 Greenhousing

The most important geothermal use in New Mexico is for greenhouses (Figure 5). Geothermal greenhousing accounts for more than half of the greenhouse acreage in the State and New Mexico leads the nation in geothermal greenhouse acreage. Current geothermal greenhouses use wells at less than 1,000 feet depth with resource temperatures ranging from 143 to 240°F (Witcher, 2002). A view of the importance of geothermal greenhouses for rural economic development is found below in **7.0 Economic Impact.**

Table 2. New Mexico geothermal greenhouse economic benefits and energy savings.

Site	Location	Product	Size	Jobs	Payroll	Est Capital Investment	Energy Use	Energy Savings
			acres	persons	$/yr	$	MMBtu/yr	$/yr
Burgett Geothermal Greenhouse	Animas/ Cotton City	cut roses	30	90	1,315,440	10,500,000	126,000	819,000
Masson Radium Springs	Radium Springs	potted plants and flowers	20	140	2,046,240	7,000,000	84,000	546,000
J & K Growers	Las Cruces	potted plants and flowers	2	16	116,928	700,000	8,400	54,600
Sorensen Cactus	Las Cruces	decorative cactus	1	8	58,000	350,000	4,200	27,300
		TOTALS	53	254	3,536,608	18,550,000	222,600	1,446,900

Table 3. Energy and economic assumptions.

Assumption	Category	Amount	Units
1	average hourly wage w/benefits	$7.00	$/hr
2	annual work hours	2088	hrs/yr
3	capital investment per acre ~$8 per square foot	$350,000.00	$
4	energy use per acre per year southern NM	4,200	MMBtu/yr
5	energy cost MMBtu		
	geothermal	$1.50	$/MMBtu
	natural gas with boiler losses	$8.00	$/MMBtu

11.0 New Mexico Geothermal Resources Strategic Development Plan

11.1 Mission Statement

"To foster industry sectors active in the development of ground-coupled heat pump installations, direct use applications and electricity production from geothermal resources;

To encourage innovative development and effective utilization of geothermal resources;

To promote the use and awareness of geothermal resources as clean and sustainable non-carbon energy;

To use geothermal resources for economic development in NM"

11.2 WORK GROUP: Establish an effective New Mexico Geothermal Energy Working Group (NMGEWG) to provide useful networking, problem solving, and strategic direction for resource development and outreach.

<u>Purpose</u> Provide networking for organizations and individuals interested in geothermal energy in NM in order to identify the needs, barriers, and opportunities for geothermal development and assist in the development and public awareness of geothermal resources and ground-coupled (geothermal) heat pump technology.

<u>Membership</u> Encourage and seek a broad and active membership to include energy companies, utilities, direct-heat geothermal users, drilling contractors and drillers, engineering firms, geothermal spa owners, educational institutions, national labs, Native American organizations, Local, State, Federal, and Tribal government.

<u>Structure</u> Establish committees where appropriate and needed to advance and accomplish strategic plans.

<u>Meetings</u> Hold NMGEWG meetings on an annual basis or as the group determines.

11.3 EDUCATION: Increase public awareness of New Mexico geothermal energy resources, rules, laws, benefits, and cost-effective applications through education and outreach.

Workshops	Sponsor, initiate, and coordinate educational programs such as workshops and symposiums to promote the uses of geothermal energy to various groups, including businesses, developers, New Mexico and local government departments, lawmakers, financial organizations, regulators, planners, engineers, geologists, utilities, city and county economic development organizations and forums.
Website	Develop a "geothermal clearinghouse" website which provides accessible news, tutorials, maps, geoscience and engineering data, regulations, and development information on geothermal in NM.
Speakers Bureau	Form a speakers bureau so that NMGEWG members are available to give presentations to civic organizations and others on the nature, opportunities, and advantages of geothermal energy and develop effective outreach presentations in the form of brochures, fact sheets, and computer slide presentations.
Factsheets	Develop a set of factsheets that are available to all NMGEWG members and the public so that geothermal information can be disseminated concisely and conveniently.
Other	Assist electric and gas utilities' energy education programs with geothermal. Develop educational curriculum for K-12 and university level on geothermal energy, resources, and development. Develop a portable geothermal booth for use by NMGEWG members at meetings, fairs, and other public events.

11.4 POLICY: **Encourage adoption of laws, regulations, and policies that encourage, support, and spur the development of New Mexico's geothermal resources and use of ground-coupled (geothermal) heat pump technology.**

Impacts — Review applicable laws and regulations on geothermal leasing, drilling, and utilization for unnecessary impediments to New Mexico geothermal development and use. Determine the most effective and suitable incentives to development that may include production tax credits, streamlined leasing and royalty assessment, cost-share, and low-cost loans.

Advocate — Provide information to policy makers and advocate inclusion of geothermal energy in policies of the executive branch of New Mexico government, the Public Regulation Commission, and other agencies that regulate or promulgate renewable energy, land use, natural resources, and water utilization rules so that incentives for wise development are maximized and barriers are minimized.

Legislation — Identify appropriate New Mexico and Federal legislative committees and others influencing energy policies and make them aware of New Mexico geothermal benefits and potential. Assist or promote the drafting of legislation beneficial to geothermal development and sustainability with ground-coupled (geothermal) heat pumps, geothermal direct-use and electrical power generation. Priority issues may include:

- New Mexico thermal (Btu) utilization incentive for renewables that includes direct-use geothermal.
- Federal royalty rates and assessment methods for direct-use geothermal.
- Federal streamlining and speedup of lease application evaluation and approval process.
- Federal and State elimination or reduction of minimum lease acreage for direct-use geothermal.

Utilization — Promote and encourage use of geothermal in State buildings where appropriate.

Financing — Explore and develop innovative mechanisms that encourage geothermal development such as enterprise zones and municipal financing or bonds.

11.5 RESOURCES: Increase geotechnical knowledge and understanding of New Mexico geothermal resources.

Exploration

Promote and encourage geothermal utilization with site-specific resource assessments, exploration, and slim-hole drilling in promising areas. Priority areas may include:

- Socorro
  (New Mexico Institute of Mining and Technology)
- Rincon
- Las Cruces East Mesa
- Albuquerque Basin
- Lightning Dock
- Valles caldera
- Hillsboro
- Radium Springs
- Truth or Consequences.

Resource

Assist the SWTDI/NMSU geothermal extension program to acquire funding to continue basic resource data collection and characterization activities.

- Identify the resources known to be potentially suitable for geothermal power generation.
- Identify geographical locations and communities where geothermal production and use are most promising.
- Update geothermal databases and resource maps.
- Develop exploration and development case studies of key geothermal sites in New Mexico.
- Investigate and develop additional low-cost exploration and drilling strategies and methods for direct-use geothermal.

11.6 FINANCIAL: Promote financial assistance for geothermal energy projects.

Identify

Compile and disseminate information on available government and private sector financial assistance and incentives for geothermal development in New Mexico.

Risk Perception

Investigate the perception of lending organizations to the risks of financing geothermal applications.

Innovation

Research and investigate innovative methods that could be applied to geothermal energy projects.

11.7 UTILIZATION: **Promote innovative and broader use of geothermal energy to include new projects for direct-use geothermal applications, electricity production, and ground-coupled heat pumps.**

Promote

Coordinate with the New Mexico Economic Development Department; regional, county, and city economic development organizations; and others in promoting the economic benefits of geothermal energy resources for direct-use sectors potential most favorable in New Mexico and power generation. Specific direct-uses include:

- greenhousing
- crop drying
  - chile
  - onions
- dairy processing
  - cheese
  - milk
- aquaculture
- district heating
- spas
- ground-coupled (geothermal) heat pumps

Data Collection

Encourage and assist in collection and evaluation of economic and engineering data at existing geothermal use sites in NM.

Other

Explore opportunities in geothermal power with rural electric cooperatives in areas with a suitable geothermal resource base. Address potential of ground-coupled heat pump applications. Inventory large energy users in the proximity to geothermal resources in New Mexico.

11.8 SUSTAINABILITY: Promote sustainable and clean geothermal development that provides sound economic development and enhanced quality of life in New Mexico.

Reservoir — Encourage and assist with water level, geochemical, and downhole thermal monitoring of current and future geothermal use areas and reservoirs. A properly managed reservoir conserves water and ensures resource sustainability.

Cascade — Promote applications that use cascaded heat from geothermal power production and hotter upstream direct-use geothermal applications. Combined heat and power provides maximum economic return from the resource.

Environment — Seek advisement on environmental concerns for geothermal development and formulate educational or suitable mitigating strategies and approaches.

12.0 Conclusion

The New Mexico Geothermal Strategic Development Plan recognizes that geothermal is more than energy. Geothermal is a potentially powerful vehicle for important rural economic development. The future of direct-use geothermal may include chile and onion drying, cheese and milk processing, additional aquaculture, greenhouses, and district heating. Binary electric power generation provides opportunities for cascaded direct-use development or combined heat and power. Changes in Federal royalty and Federal and State leasing rules will encourage the use of the State and Federal geothermal resource for direct-use applications and help spur much needed economic development in rural areas. A thermal (Btu) utilization incentive for renewables that includes direct-use geothermal is highly desirable and should probably include solar and biomass energy also. Because much needs to be learned about the resource base, increased exploration and characterization activities are encouraged and recommended in order to ensure geothermal use and sustainability. The high upfront capital costs of geothermal development require innovative financing and an awareness of the lower backend costs and advantages. Education of the nature and advantages of geothermal to the public, potential users, regulators, legislators, government policy makers, and financial institutions and advisors is crucial to advance geothermal use in New Mexico. Previous successes in geothermal direct-use in the State and the New Mexico Geothermal Resources Strategic Development Plan provide a basis to expand the State geothermal resume and accelerate geothermal development.

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2. Identify industries involved in geoexchange with New Mexico through a Request For Qualifications (RFQ) process.

An important task will be to compile a list of qualified geoexchange service providers to serve New Mexico. This may necessitate investigating their listed qualifications, certifications or accreditations to determine what is their level of expertise. If it is determined that the industry is not yet at the level which is needed to be of any value, the committee may have to visit the need for infrastructure training. A list of qualified individuals or companies could then be distributed to potential end users interested in geoexchange. This document should serve as a valuable resource to stimulate business opportunities. This RFQ would be directed to qualified individuals and companies that comprise the geoexchange industry. This would include professionals involved in the design and installation of geoexchange systems—drillers, loopers, geoexchange system designers, architects, and engineers—as well as system and component retailers and distributors and energy service companies. Applicants need not be located in New Mexico; they need only demonstrate that they are qualified to serve the state's customers by demonstrating past experience and qualifications to perform the services they list in the application form.

Individuals and organizations that wish to be added to the providers list would need to complete an application. It would include information on services offered, qualifications, training, experience, references, and any conflicts of interest. This list would be updated continuously as new individuals and companies are identified that want to work in the New Mexico geoexchange industry. Although there is no end date, it will be important to produce a reasonably comprehensive list in a short period of time.

3. Establish state webpage co-sponsored by the New Mexico Geothermal Energy Working Group (NMGEWG) and the Geothermal Heat Pump Consortium (GHPC).

A critical task will be to set up a tailored webpage with information focusing specifically on NMGEWG activities, geoexchange technology, and related industry resources. This can be hosted on the GHPC's web site, which has proven to be a continually growing source of information about geoexchange technology, providing a wealth of educational information to the public at large. Visitors can easily navigate around the site and access information on how geoexchange works, case studies of geoexchange installations, industry news, and technical reports.

4. Strengthen New Mexico contacts with Oklahoma, GHPC and the International Ground Source Heat Pump Association (IGSHPA).

An important task will be to strengthen relationships. Oklahoma has adopted language that can be carried over to New Mexico. The GHPC has worked with many key IGSHPA staff and members, including Lisa McArthur, Assistant Director of IGSHPA. New Mexico should seriously consider adopting the mechanical licensing language adopted by Oklahoma. For example:

Ground source piping means piping buried below the earth's surface or submerged in a water well, lake, or pond and used in conjunction with a heat pump to provide heating, ventilation, and/or air conditioning to a structure.

Process piping means lay out, assembly, installation, and maintenance of pipe systems, pipe supports, and related hydraulic and pneumatic controls; equipment for steam, hot water, heating, cooling, lubricating, and fire sprinklers, not subject to regulation pursuant to the Alarm Industry Act; and industrial production and processing systems.

The qualifications for mechanical licensure are contingent on examination. This means that a license cannot be issued until the applicant has passed the appropriate examination for the license type and category. Examinations and the passing score for each examination are approved by committee. Applicants for the Ground Source Piping category must provide proof of being certified in the proper installation of ground source piping by an organization approved by said committee.

New Mexico Geothermal Energy Working Group
Spring 2004 Meeting

Camel Rock Suites Hotel
3007 S. St. Francis Drive
Santa Fe, NM

AGENDA

Wednesday, May 12, 8:00–1:00

GEOTHERMAL DIRECT USE & POWER GENERATION SESSION

8:00 am	Arrive, refreshments, pickup handouts, signup for 5-minute presentations
8:15	Welcome *Brian Johnson, Coordinator, NM Geothermal Energy Working Group, New Mexico Energy, Minerals and Natural Resources Department (EMNRD)* • Meeting purpose • Introductions • Review/Approval of Agenda
8:30	Governor Richardson's Clean Energy Initiatives *Craig O'Hare, Special Assistant to the Secretary for Renewables, EMNRD*
8:45	US Department of Energy ***Geopowering the West*** Program Update *Roger Hill, Sandia National Laboratories*
9:00	NM Geothermal Resources 101 *Jim Witcher, New Mexico State University (NMSU), Southwest Technology Development Institute*
9:30	Proposed Geothermal Development on the Valles Caldera Preserve *Ken Boren, Owner, GeoProducts of New Mexico*
10:00	DOE Geothermal Grants: Agricultural (Non-Greenhouse) Direct-Use Development, Information Clearinghouse, Strategic Planning, District Heating & Cooling Proposal, and GRED-III Proposal Opportunity *Brian Johnson, EMNRD*
10:15	BREAK: refreshments, networking
10:30	YOU HAVE THE FLOOR! (5-minute presentations) *Brian Johnson, EMNRD, Facilitator*
	Issues Discussion—all participants
11:00	Geothermal Strategic Planning for New Mexico *Brian Johnson, EMNRD, Co-Facilitator* *Jim Witcher, NMSU Southwest Technology Development Institute, Co-Facilitator*
12:45	Action Items
1:00	Adjourn

New Mexico Geothermal Energy Working Group
May 12, 2004
Santa Fe, NM

Strategic Planning Meeting Summary

Geothermal Direct Use & Power Generation Session

The New Mexico Geothermal Energy Working Group held a meeting to initiate a strategic planning process for geothermal resource development in New Mexico. The following questions were posed to the Working Group by the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) to kick-off the discussion. The discussion was co-facilitated by Brian Johnson, EMNRD's Geothermal Program Manager, and Jim Witcher, Geothermal Project Manager, Southwest Technology Development Institute at New Mexico State University.

1. What geothermal technologies should be included?
As a first step, the Facilitators listed technology subdivisions and the Working Group identified specific technologies and related issues that should be included when we refer to geothermal.

POWER GENERATION
- Hybrid: solar/wood
- Steam transmission
- Cascading

DIRECT-USE
- Milk drying
- Mineral processing
- DHE
- Aquaculture
- Greenhouse technology
- Agricultural processing
- Spas

EXTRACTION TECHNOLOGIES
- Corrosion resistance/materials
- Mineral recovery
- Drilling
- Reinjection

RESOURCE
- Match with users & transmission
- Exploration methods (economic development potential in nanotechnology)
- Water use

RELATED POINTS
- Stakeholder collaboration
- CFR Process
- Institutional/legal: taxes, etc.
- Long-term potential
- Basic data & research
- Public education
- Fossil fuel replacement (security)
- Future technology adaptation with NM assets

2. What is impeding geothermal development?

As an initial attempt to identify barriers, the Facilitators identified broad topic areas and the Working Group noted important components of those topics.

TECHNOLOGY
- Drilling is too expensive
- Closely linked to R&D issues

RESOURCE
- Water adjudication
- Water rights
- Closely linked to R&D issues (exploration)
- Closely linked to LAND issues

INSTITUTIONAL
- Leadership
- No fast-tracking for approval processes
- Difficulty of doing exploration under current state laws and regs. Also development. Difficulties compounded by backlog in state agencies, etc.
- Bureaucracy (transactional costs)
- Legislative requirements on agencies
- Government priorities

AWARENESS
- Public perception
- Need to educate public
- Negative impression
- Local support

LAND
- Lack of water at good heat sources
- Land ownership
- Land access
- Closely linked to RESOURCE issues

ENVIRONMENT
- Public opposition, valid or invalid, due to asthetic, environment, or other social reasons
- Environmental perceptions

FINANCING
- Investment risk
- Money
  - Capitalization
  - Production tax credit

ECONOMICS
- Tax structure
- Energy bill
- Royalties
- No return on PPA by utility
- Drilling costs too expensive, leading to high costs
- Upfront costs and lack of, or perverse, incentives
- Need incentives tailored to geothermal resources

RESEARCH & DEVELOPMENT (R&D)
- Lack of funding (research)
- Lack of knowledge about state geothermal resources
- Lost knowledge from past exploration
- Lack of exploration
- Closely linked to RESOURCE issues (exploration)
- Closely linked to TECHNOLOGY issues

INFRASTRUCTURE
- Transmission upgrades

3. What organizations affect geothermal development?
The Working Group identified agencies, utilities, and companies important to geothermal in New Mexico.

- Public Regulation Commission
- Office of the State Engineer
- Geothermal developers:
  - Vulcan
  - Calpine
  - Ormat
- Federal Minerals Management Service
- Public Service Company of New Mexico
- Geothermal Resource Council
- Texas-New Mexico Power
- New Mexico Congressional Delegation
- Local communities that can benefit
  - Example: Eastern Plains Council of Governments (EPCOG) supports wind
  - Example (geothermal): T or C Chamber of Commerce to support spas

4. What innovations should be used?
As a first step towards removing barriers to geothermal development, the Working Group stated actions that should be taken.

- Lobbying to legislature
- Expedite permitting process
- Geothermal Information Clearinghouse
- Collaboration with all stakeholders involved
  - Example: USDA Forest Service program, Region 3 (unique)
  - Example: PNM "Project Power"
- Involvement with Clean Energy Development Council
  - Reference: Governor's Executive Order
  - Green tariff recommended
- Hold decision-makers event
  - Example: Leadership conference, NM Institute of Mining and Technology

Reported by:
Brian K. Johnson, PE, CEM
EMNRD
6/2/04

New Mexico Geothermal Energy Working Group
Geothermal Strategic Planning
June 2004 Meeting

Mesilla Valley Inn
Best Western
901 Avenida de Mesilla
Las Cruces, NM

MEETING AGENDA

Tuesday, June 15, 1:00–4:45 pm

1:00 pm Arrive, pickup handouts, sign in

1:15 pm Welcome
Brian Johnson, Coordinator, NM Geothermal Energy Working Group,
New Mexico Energy, Minerals and Natural Resources Department (EMNRD)
- Meeting Purpose
- Introductions
- Review of Meeting Agenda

1:30 pm US Department of Energy ***Geopowering the West*** Program Update
Roger Hill, Sandia National Laboratories

1:45 pm Overview and Summary of May 2004 Strategic Planning
Brian Johnson (EMNRD) and Jim Witcher, New Mexico State University
(NMSU),
Southwest Technology Development Institute

2:30 pm Discussion - Initial Definition of Strategic Goals and Objectives
Brian Johnson (EMNRD), Co-Facilitator
Jim Witcher (NMSU), Co-Facilitator

3:15 pm BREAK

3:30 pm Discussion - Preliminary Action Plans for Strategic Objectives
Brian Johnson (EMNRD), Co-Facilitator
Jim Witcher (NMSU), Co-Facilitator

4:30 pm Action Items

4:45 pm Adjourn

FIELD TRIP SCHEDULE

Wednesday, June 16, 8:30–11:45

8:15 am	Gather in parking lot of Mesilla Valley Inn Best Western
8:30 am	Travel over to the NMSU Geothermal Greenhouse Business Incubator off University Ave across from NM Farm and Ranch Museum *Jim Witcher (NMSU) and Ron Polka (NMSU)*
9:45 am	Leave NMSU and travel to Radium Springs (15 miles north of Las Cruces on I-25). Take Radium Springs Exit and then take first paved road to the right to travel to greenhouse. Stay on frontage road until it turns west into a County Road.
10:30 am	Tour Masson Radium Springs Geothermal Greenhouse *Jim Witcher (NMSU), Doug Andrews (Masson), and Rick Pierce (Masson)*
12:00 am	End of Tour, Lunch, and Travel

New Mexico Geothermal Energy Working Group
15 June, 2004
Las Cruces, NM

Strategic Planning Meeting Summary 6/15/2004

The New Mexico Geothermal Energy Working Group (NMGWG) held a meeting on the afternoon of 15 June 2004 at the Mesilla Best Western in Las Cruces, NM to discuss strategic goals and objectives for geothermal resource development. Discussion was co-facilitated by Brian Johnson, ENMNRD and Jim Witcher, Southwest Technology Development Institute at New Mexico State University (SWTDI/NMSU) (See attached meeting agenda).

The next morning, 16 June 2004, a field trip tour of the SWTDI/NMSU Geothermal Business Incubator Greenhouse and Aquaculture facility was led by SWTDI/NMSU staff, Ron Polka and Jim Witcher. Afterwards, the group toured the Masson Radium Springs Farm geothermal greenhouse at Radium Springs. Jim Witcher, Doug Andrews (Masson) and Rick Pierce (Masson) led the tour of the Masson facility, the second largest geothermal heated greenhouse in the nation at 20 acres. In addition, Bob Donohue, FishiNewMexico, kindly conducted an unscheduled and impromptu tour for the group through his catfish farm along the Rio Grande about 5 miles north of Radium Springs. On the way back to Las Cruces, Jim Witcher led the group into the Rincon Hills to observe opal samples at some Quaternary fossil hot springs deposits (siliceous sinter/opal beds) at Rincon, a major intermediate-temperature geothermal system in the Rio Grande rift.

A key goal of the strategic planning meeting was to provide initial definition of strategic goals and objectives for the NM strategic plan for geothermal development. A follow on goal was to formulate preliminary action plans for strategic objectives.

After a short review of the 12 May 2004 NM Geothermal Working Group (NMGWG) meeting, Roger Hill of Sandia National Labs (SNL) gave an overview of current activities and news for the USDOE Geopowering the West (GPW). A national program review of the GPW program was conducted in Washington earlier in the month. One result of the review will include recommendations for GPW in the near future. One significant highlight of geothermal development in the western U. S. is the expansion of geothermal electric output by Ormat on the order of about 200 MWe, primarily in California and Nevada. Also, a large number of proposals were submitted under the last USDOE State Energy Program (SEP) funding cycle, indicating widespread interest in geothermal. USDOE tentatively plans to announce awards for the SEP projects in September 2004.

Several keys areas dominated discussion during the meeting. Many topics, such as development barriers, business opportunities, and economic development, have also had prominence in previous NMGWG meeting discussions. Geothermal education and outreach was a theme that had not been dwelled upon to any great extent in previous meetings. Geothermal education was broken out into public outreach and curriculum development for K-12 and university degree programs. While initiatives and efforts for public outreach do exist in the GPW program in states with active working groups, there is a noticeable lack of formal organized curriculum for education about geothermal (and other renewables) in the schools and universities (at least in NM). It was decided that education should be included in the NM strategic plan and could include an action item to develop geothermal curriculum. At the university level, such a curriculum could be multi-discipline and include the geosciences, engineering, agriculture, legal, and economic and business fields of study.

Geothermal exchange (geothermal heat pumps) were also discussed with emphasis for inclusion in the NM geothermal strategic plan. A section should probably be included and a best way to accomplish the task may be to have a subcommittee comprised of geothermal heat pump stakeholders formulate specific goals and action for a NM geothermal heat pump development strategy.

To date, the following major areas of geothermal development are tentatively selected for inclusion in NM strategic goals and action plans:

- Education
- Direct-use
- Power Generation
- Geothermal Heat Pumps
- Resource Characterization
- Geothermal Technology
  - Materials
  - Exploration
  - Drilling
- Monitoring Existing Systems Performance and Impact
- Rural Economic Development
- Barriers to Development
  - Land Availability and Leasing Timeframes
  - Royalties and Taxation
- Linkage to Water Resources
  - Brackish Water
  - Sustainability Issues
- Infrastructure Needs
- Economics
  - Labor
  - Taxes
  - Incentives
  - Financing Resources
- Environment

The next meeting for the New Mexico Geothermal Energy Working Group (NMGWG) will be held in Santa Fe on the 20th of July, 2004. A preliminary working draft of a NM geothermal strategic plan will be presented for discussion, markup, addition, and modification.

Reported by:
James C. Witcher
NMSU
7/8/04

New Mexico Geothermal Energy Working Group
Geothermal Strategic Planning
July 2004 Meeting

Energy, Minerals and Natural Resources Department
3rd floor Conference Room
Chino Building
1220 S. St Francis Drive
Santa Fe, NM

MEETING AGENDA

Tuesday, July 20, 9:00 AM–1:00 PM

9:00 am	Arrive, pickup handouts, sign in
9:15 am	Welcome *Brian Johnson, Coordinator, NM Geothermal Energy Working Group, New Mexico Energy, Minerals and Natural Resources Department (EMNRD)* • Meeting Purpose • Introductions • Review of Meeting Agenda
9:30 am	Announcements and News *Attendees*
9:45 am	Overview and Summary of June 04 Strategic Planning *Brian Johnson (EMNRD) and Jim Witcher, New Mexico State University*
(NMSU),	*Southwest Technology Development Institute*
10:00 am	Discussion and Overview of Draft Strategic Plan *Brian Johnson (EMNRD), Co-Facilitator* *Jim Witcher (NMSU), Co-Facilitator*
11:15 pm	BREAK
11:30 am	Discussion and Overview of Draft Strategic Plan *Brian Johnson (EMNRD), Co-Facilitator* *Jim Witcher (NMSU), Co-Facilitator*
12:45 pm	Action Items/New Business
1:00 pm	Adjourn

New Mexico Geothermal Energy Working Group
20 July, 2004
Santa Fe, NM

Strategic Planning Meeting Summary 7/20/2004

The New Mexico Geothermal Energy Working Group (NMGWG) held a meeting on 20 July 2004 at the Energy, Minerals and Natural Resources Department (EMNRD) in Santa Fe, NM to discuss strategic goals and objectives for geothermal resource development (AGENDA_7_20_04; and ATTENDEES_7_20_04). Discussion was co-facilitated by Brian Johnson, EMNRD and Jim Witcher, Southwest Technology Development Institute at New Mexico State University (SWTDI/NMSU).

The main goal of the strategic planning meeting in July was to review a working draft of the NM Geothermal Strategic Plan and discuss overall content and language and make additions and deletions as necessary. Results of the July review will be incorporated into a draft final NM geothermal strategic plan to be presented for final review and comment at the 17 August, 2004 meeting.

Roger Hill of Sandia National Labs (SNL) gave an overview of current activities and news for the USDOE Geopowering the West (GPW). A national program review of the GPW program was conducted in Washington, DC earlier in the summer. A large number of proposals were submitted under the last USDOE State Energy Program (SEP) funding cycle, indicating increasing interest in geothermal. A GPW State Summit meeting will be held after the Geothermal Resources Council (GRC) Annual Conference in Palm Springs, CA to discuss results and highlights of activities over the last year, share information and discuss direction for the coming year in the GPW program.

After a short review of the 15 June 2004 NM Geothermal Working Group (NMGWG) meeting, the group began a review and discussion of the draft NM Geothermal Strategic Plan. The draft plan was organized into Strategic Objectives with a series of Action Plans. The Strategic Objectives are preceded by a brief Mission Statement. The final draft plan to be presented on 17 August will include an Executive Summary and Introduction sections as additions to the Mission Statement, Strategic Objectives, and Action Plans.

The seven Strategic Objectives were organized according to the following areas:

1) Education; 2) Policy; 3) Resource Base and Technology; 4) Financial; 5) Use; 6) Sustainability and Environment; and 7) Working Group. An additional Strategic Objective may be added on geothermal heat pumps for the draft Final Strategic Plan. Brian Johnson (EMNRD) has solicited e-mail comments from the geoexchange community for incorporation into the Final Strategic Plan.

As presented at the meeting, the Action Plans formed a "laundry list" that was largely derived from previous Working Group meetings. In order to create enhanced document utility, the group decided that the top 2 or 3 Action Plans under each major Strategic Objective will be highlighted for priority. The prioritized Action Plans will have a completion timeframe during the next 1 to 4 years. However, the Final Strategic Plan will retain mention of other Action Plan items as lower priorities. This provides an overall memory or retention of items for any future discussion, efforts or modifications to the Strategic Plan. In addition to prioritizing the Action Plans, the Working Group consolidated some of the Action Plans. As presented most of the

Action Plans used general or generic language. The Working Group decided that specific deliverables or processes will be identified, especially for the priority Action Plans.

The next meeting for the New Mexico Geothermal Energy Working Group (NMGWG) will be held in Santa Fe at the EMNRD offices in the Wendell Chino Building, 1220 St Francis on the 17 August, 2004. A final draft of a NM geothermal strategic plan will be presented for additional discussion and modifications.

Reported by:
James C. Witcher
NMSU
8/2/04

New Mexico Geothermal Energy Working Group
Geothermal Strategic Planning
August 2004 Meeting

Energy, Minerals and Natural Resources Department
Portal Hall
(1st floor conference room off entrance lobby)
Chino Building
1220 S. St Francis Drive
Santa Fe, NM

MEETING AGENDA

Tuesday, August 17, 9:00 AM–1:00 PM

9:00 am	Arrive, pickup handouts, sign in
9:15 am	Welcome *Brian Johnson, Coordinator, NM Geothermal Energy Working Group,* *New Mexico Energy, Minerals and Natural Resources Department (EMNRD)* • Meeting Purpose • Introductions • Review of Meeting Agenda
9:30 am	Announcements and News *Attendees*
9:45 am	Discussion and Overview of Final Draft Strategic Plan *Brian Johnson (EMNRD), Co-Facilitator* *Jim Witcher (NMSU), Co-Facilitator*
11:15 pm	BREAK
11:30 am	Discussion and Overview of Draft Strategic Plan *Brian Johnson (EMNRD), Co-Facilitator* *Jim Witcher (NMSU), Co-Facilitator*
12:45 pm	Action Items/New Business
1:00 pm	Adjourn

New Mexico Geothermal Energy Working Group

17 August, 2004
Santa Fe, NM

Strategic Planning Meeting Summary 8/17/2004

The New Mexico Geothermal Energy Working Group (NMGWG) held a meeting on 17 August 2004 at the Energy, Minerals and Natural Resources Department (EMNRD) in Santa Fe, NM to make final changes and review of a NM strategic plan for geothermal resource development (AGENDA_8_17_04; and ATTENDEES_8_17_04). Discussion was co-facilitated by Brian Johnson, EMNRD and Jim Witcher, Southwest Technology Development Institute at New Mexico State University (SWTDI/NMSU).

The main goal of the strategic planning meeting in August was to review and make changes to a final draft of the NM Geothermal Strategic Plan and discuss overall content and language. Results of the August review will be incorporated into a final NM geothermal strategic plan by 31 August, 2004.

Several items were identified for addition and clarification in the plan. A geothermal heat pump discussion will be added. Also, it was determined that drivers and responsibilities for the implementation of the plan were not clarified. An action plan and narrative implementation will be added. Tribal participation will be brought out more in the plan scope.

While the plan outlines the objectives and actions well, a discussion of barriers and incentives will clarify the needs and scope of the plan. A narrative(s) on barriers and incentives will be added to the plan.

A Btu thermal energy utilization incentive should be given high priority. In order to gain wide support, the incentive should be coordinated so that it applies to solar and biomass as well.

In addition to more aggressive promotion and advertising of geothermal district heating, State facilities and buildings should be given encouragement or incentives to use geothermal. Large energy users near known geothermal resources should be identified and alerted to potential advantages of geothermal.

Finally, it is clear that several geothermal fact sheets should be compiled and published to augment the working group activities and action plans.

Reported by:
James C. Witcher
NMSU
8/31/04

New Mexico Geothermal Strategic Planning Participants

New Mexico Geothermal Energy Working Group
May – August 2004

Name	Organization	Address	Telephone	E-Mail
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Name	Organization	Address	Telephone	E-Mail
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Geothermal Resources Conservation Act – Sections 71-5-1 to -24 NMSA 1978

71-5-1. Short title.

Chapter 71, Article 5 NMSA 1978 may be cited as the "Geothermal Resources Conservation Act".

71-5-2. Purpose of act.

A. It is hereby found and determined that the people of the state of New Mexico have a direct and primary interest in the development of geothermal resources, and that this state should exercise its power and jurisdiction through its oil conservation commission and division to require that wells drilled in search of, development of, or incident to the production of geothermal resources be drilled, operated, maintained and abandoned in such a manner as to safeguard life, health, property, natural resources and the public welfare, and to encourage maximum economic recovery.

B. To these ends, it is the intent of the legislature that the power and jurisdiction of the commission and the division as given by the Geothermal Resource [Resources] Conservation Act [71-5-1 NMSA 1978] shall be supplemental to the other powers and jurisdiction given the commission and the division by the statutes of this state.

71-5-2.1. Exclusion; incidental loss or extraction of heat.

When the application of potable water to a beneficial use involves the incidental loss or extraction of heat, and the water is 250 degrees Fahrenheit or less, then that heat is not a geothermal resource for which a royalty is due. In such a case, the use is not governed by laws related to geothermal resources but is simply governed by Chapter 72 NMSA 1978.

71-5-3. Definitions.

As used in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978]:

A. "geothermal resources" means the natural heat of the earth or the energy, in whatever form, below the surface of the earth present in, resulting from, created by or which may be extracted from this natural heat and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances;

B. "commission" means the oil conservation commission;

C. "correlative rights" means the opportunity afforded, insofar as is practicable to do so, to the owner of each property in a geothermal reservoir to produce his just and equitable share of the geothermal resources within such reservoir, being an amount, so far as can be practicably determined and so far as can be practicably obtained without waste, substantially in the proportion that the recoverable geothermal resources under such property bear to the total recoverable geothermal resources in the reservoir and, for such purpose, to use his just and equitable share of the natural heat or energy in the reservoir;

D. "division" means the oil conservation division of the energy, minerals and natural resources department;

E. "geothermal reservoir" means an underground reservoir containing geothermal resources, whether the fluids in the reservoir are native to the reservoir or flow into or are injected into the reservoir;

F. "geothermal field" means the general area which is underlaid or reasonably appears to be underlaid by at least one geothermal reservoir;

G. "low-temperature thermal reservoir" means a geothermal reservoir containing low-temperature thermal water, which is defined as naturally heated water, the temperature of which is less than boiling at the altitude of occurrence, which has additional value by virtue of the heat contained therein and is found below the surface of the earth or in warm springs at the surface;

H. "person" means:

(1) any individual, estate, trust, receiver, cooperative association, club, corporation, company, firm, partnership, joint venture, syndicate or other entity; or

(2) the United States or any agency or instrumentality thereof or the state of New Mexico or any political subdivision thereof;

I. "well" means any well dug or drilled for the discovery or development of geothermal resources or incident to the discovery or development of geothermal resources or for the purpose of injecting or reinjecting geothermal resources or the residue thereof or other fluids into a geothermal reservoir or any well dug or drilled for any other purpose and reactivated or converted to any of the aforesaid uses; and

J. "potash" means the naturally occurring bedded deposits of the salts of the element potassium.

71-5-4. Waste prohibited.

The production or handling of geothermal resources of any type or in any form, or the handling of products thereof, in such manner or under such conditions or in such amounts as to constitute waste is each hereby prohibited.

71-5-5. Waste definitions.

As used in this act, the term "waste," in addition to its ordinary meaning, shall include:

A. "underground waste" as those words are generally understood in the geothermal business, and in any event to embrace the inefficient, excessive or improper use or dissipation of the reservoir fluids or energy, including the natural energy of the heated fluids or the natural heat of the earth, and the locating, spacing, drilling, equipping, operating or producing of any well or wells in a manner that would reduce or tend to reduce the total quantity of geothermal resources ultimately recovered from any geothermal reservoir;

B. "surface waste" as those words are generally understood in the geothermal business, and in any event to embrace the unnecessary or excessive surface loss or destruction without beneficial use, however caused, of geothermal resources of any type or in any form, or any product thereof, and including the loss or destruction of geothermal resources resulting from leakage, evaporation or seepage, especially incident to or resulting from the manner of spacing, equipping, operating or producing of any well or wells, or incident to or resulting from the inefficient transportation, use or storage of geothermal resources;

C. the production from any well or wells in this state of geothermal resources in excess of the reasonable market demand therefor, in excess of the capacity of the geothermal transportation facility connected thereto to efficiently receive and transport such geothermal resources, or in excess of the capacity of a geothermal utilization facility to efficiently receive and utilize such geothermal resources;

D. the nonratable purchase or taking of geothermal resources within a geothermal reservoir in this state. Such nonratable taking or purchasing causes or results in excessive or improper dissipation of reservoir energy and results in waste, as defined in Subsection A of this section, and is in violation of Section 14 [71-5-14 NMSA 1978] of the Geothermal Resources Conservation Act; and

E. drilling or producing operations for geothermal resources within any area containing commercial deposits of potash where such operations would have the effect unduly to reduce the total quantity of such commercial deposits of potash which may reasonably be recovered in commercial quantities or where such operations would interfere unduly with the orderly development of such potash deposits.

71-5-6. Commission's and division's powers and duties.

A. In addition to its other powers and duties, the division shall have, and is hereby given, jurisdiction over all matters relating to the conservation of geothermal resources and the prevention of waste of potash as a result of geothermal operations in this state. It shall have jurisdiction, authority and control of and over all persons, matters or things necessary or proper to enforce effectively the provisions of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] or any other law of this state relating to the conservation of geothermal resources and the prevention of waste of potash as a result of geothermal operations. Provided, however, nothing in this section shall be construed to supersede the authority which any state department or agency has with respect to the management, protection and utilization of the state lands or resources and its jurisdiction.

B. The commission shall have concurrent jurisdiction and authority with the division to the extent necessary for the commission to perform its duties as required by the Geothermal Resources Conservation Act. In addition, any hearing on any matter may be held before the commission if the division director, in his discretion, determines that the commission shall hear the matter.

71-5-7. Power of commission and division to prevent waste and protect correlative rights.

The commission and division are hereby empowered, and it is their duty, to prevent the waste prohibited by the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] and to protect correlative rights, as in that act provided. To that end, the commission and division may make and enforce rules, regulations and orders relating to geothermal resources, and to do whatever may be reasonably necessary to carry out the purposes of that act whether or not indicated or specified in any section thereof.

71-5-8. Enumeration of powers.

Included in the power given to the division is the authority to collect data; to make investigations and inspections; to examine properties, leases, papers, books and records; to examine, check, test and gauge geothermal resources wells and geothermal resources transportation, storage and utilization facilities; to limit and allocate production of geothermal resources as provided in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978]; and to require certificates of clearance for the production or transportation of geothermal resources.

Apart from any authority, express or implied, elsewhere given to or existing in the division by virtue of the Geothermal Resources Conservation Act [Chapter 71, Article 5 NMSA 1978] or the statutes of this state, the division may make rules, regulations and orders for the purposes and with respect to the subject matter stated herein, viz.:

A. to require noncommercial or abandoned wells to be plugged in such a way as to confine all fluids in the strata in which they are found, and to prevent them from escaping into other strata; the division may require a bond of not to exceed ten thousand dollars ($10,000) conditioned for the performance of such regulations;

B. to prevent geothermal resources, water or other fluids from escaping from the strata in which they are found into other strata;

C. to require reports showing locations of all geothermal resources wells, and to require the filing of logs and drilling records or reports and production reports;

D. to prevent the premature cooling of any geothermal stratum or strata by water encroachment, or otherwise, which reduces or tends to reduce the total ultimate recovery of geothermal resources from any geothermal reservoir;

E. to prevent "blowouts" and "caving" in the sense that such terms are generally understood in the geothermal drilling business;

F. to require wells to be drilled, operated and produced in such a manner as to prevent injury to neighboring leases or properties and to afford reasonable protection to human life and health and to the environment;

G. to identify the ownership of geothermal producing leases, properties, plans, structures, and transportation and utilization facilities;

H. to require the operation of wells efficiently;

I. to fix the spacing of wells;

J. to classify and from time to time as is necessary reclassify geothermal reservoirs and low-temperature thermal reservoirs;

K. to define and from time to time as is necessary redefine the horizontal and vertical limits of geothermal reservoirs and low-temperature thermal reservoirs;

L. to permit and regulate the injection of fluids into geothermal reservoirs and low-temperature thermal reservoirs;

M. to regulate the disposition of geothermal resources or the residue thereof, and to direct the surface or subsurface disposal of such in a manner that will afford reasonable protection against contamination of all fresh waters and waters of present or probable future value for domestic, commercial, agricultural or stock purposes, and will afford reasonable protection to human life and health and to the environment; and

N. to define and from time to time as is necessary redefine the limits of any area containing commercial deposits of potash, and to regulate and where necessary prohibit geothermal drilling or producing operations where such operations would have the effect unduly to reduce the total quantity of such commercial deposits of potash which may reasonably be recovered in commercial quantities.

71-5-9. Regulation of geothermal resources production.

Upon determination by the division that geothermal resources production from a particular geothermal resources reservoir is causing waste or is about to result in waste, the division shall limit, allocate and distribute the total amount of geothermal resources which may be produced from that reservoir.

71-5-10. Allocation of production.

A. Whenever, to prevent waste, the total amount of geothermal resources which may be produced from a geothermal reservoir is limited, the division shall allocate and distribute the allowable production among the geothermal wells in the reservoir on a reasonable basis and recognizing correlative rights, including in the allocation schedule any well which it finds is being unreasonably discriminated against through denial of access to a geothermal resources transportation or utilization facility which is reasonably capable of handling the geothermal product of the well. In protecting correlative rights, the division may give equitable consideration to acreage, to the pressure, temperature, quantity and quality of the geothermal resources producible from the wells in the reservoir, and to such other pertinent factors as may from time to time exist, and, insofar as is practicable, shall prevent drainage between producing tracts in the reservoir which is not equalized by counterdrainage.

B. No order limiting, allocating and distributing production from any geothermal reservoir shall be issued except after notice and hearing. In entering such an order the division must find that waste is resulting or is about to result from the unratable taking of geothermal resources or from the production of geothermal resources from a reservoir in excess of the market demand therefor, in excess of the capacity of the available geothermal transportation facilities to efficiently receive and transport such geothermal resources, or in excess of the capacity of the available geothermal utilization facility to efficiently receive and utilize such geothermal resources. When limiting, allocating and distributing production from a geothermal reservoir, the division shall do so on the basis of three-month allocation periods and shall promulgate reasonable rules regarding production tolerances and overproduction and underproduction.

C. After the effective date of any rule, regulation or order fixing the allowable production and establishing permitted tolerances for overproduction, no person shall produce more than the allowable production and permitted tolerance applicable to him, his wells, leases or properties determined as provided in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], and the allowable production shall be produced in accordance with the applicable rules, regulations and orders.

71-5-11. Equitable allocation of production spacing; pooling.

A. The rules, regulations or orders of the division shall, so far as it is practicable to do so, afford to the owner of each property in a geothermal reservoir the opportunity to produce his just and equitable share of the geothermal resources in the reservoir, being an amount, so far as can be practically determined, and so far as such can be practicably obtained without waste, substantially in the proportion that the quantity of the recoverable geothermal resources under such property bears to the total recoverable geothermal resources in the reservoir, and for this purpose to use his just and equitable share of the reservoir energy.

B. The division may establish a spacing unit for each geothermal reservoir, such being the area that can be efficiently and economically drained and developed by one well, and in so doing the division shall consider the economic loss caused by the drilling of unnecessary wells, the protection of correlative rights, including those of royalty owners, the prevention of waste, the avoidance of the augmentation of risks arising from the drilling of an excessive number of wells and the prevention of reduced recovery which might result from the drilling of too few wells.

C. When two or more separately owned tracts of land are embraced within a spacing unit, or where there are owners of royalty interests or undivided interests in geothermal resources which are separately owned, or any combination thereof, embraced within such spacing unit, the owner or owners thereof may validly pool their interests and develop their lands as a unit. Where, however, such owner or owners have not agreed to pool their interests, and where one such separate owner, or owners, who has the right to drill has drilled or proposes to drill a well on said unit to a geothermal reservoir, the division, to avoid the drilling of unnecessary wells or to protect correlative rights, or prevent waste, shall pool all or any part of such lands or interest or both in the spacing unit as a unit.

All orders effecting such pooling shall be made after notice and hearing, and shall be upon such terms and conditions as are just and reasonable and will afford to the owner or owners of each tract or interest in the unit the opportunity to recover or receive without unnecessary expense his just and fair share of the geothermal resources. Each order shall describe the lands included in the unit designated thereby, identify the reservoir or reservoirs to which it applies and designate an operator for the unit. All operations for the pooled geothermal resources which are conducted on any portion of the unit shall be deemed for all purposes to have been conducted upon each tract within the unit by the owner or owners of such tract. For the purpose of determining the portions of production owned by the persons owning interests in the pooled geothermal resources, such production shall be allocated to the respective tracts within the unit in the proportion that the number of surface acres included within each tract bears to the number of surface acres included in the entire unit. The portion of the production allocated to the owner or owners of each tract or interest included in a well spacing unit formed by a pooling order shall, when produced, be considered as if produced from the separately owned tract or interest by a well drilled thereon. Such pooling order of the division shall make definite provision as to any owner, or owners, who elects not to pay his proportionate share in advance for the pro rata reimbursement solely out of production to the parties advancing the costs of development and operation which shall be limited to the actual expenditures required for such purpose not in excess of what are reasonable, but which shall include a reasonable charge for supervision and may include a charge for the risk involved in the drilling of such well, which charge for risk shall not exceed two hundred percent of the nonconsenting working interest owner's or owners' pro rata share of the cost of drilling and completing the well.

In the event of any dispute relative to such costs, the division shall determine the proper costs after due notice to interested parties and a hearing thereon. The division is specifically authorized to provide that the owner or owners drilling or paying for the drilling, or for the operation of a well for the benefit of all shall be entitled to all production from such well which would be received by the owner, or owners, for whose benefit the well was drilled or operated, after payment of royalty as provided in the lease, if any, applicable to each tract or interest, and obligations payable out of production, until the owner or owners drilling or operating the well or both have been paid the amount due under the terms of the pooling order or order settling such dispute. No part of the production or proceeds accruing to any owner or owners of a separate interest in such unit shall be applied toward the payment of any cost properly chargeable to any other interest in said unit.

If the interest of any owner or owners of any unleased mineral interest is pooled by virtue of the Geothermal Resources Conservation Act [Chapter 71, Article 5 NMSA 1978], seven-eighths of such interest shall be considered as a working interest and one-eighth shall be considered a royalty interest, and he shall in all events be paid one-eighth of all production from the unit and creditable to his interest.

D. Whenever it appears that the owners in any geothermal reservoir have agreed upon a plan for the spacing of wells, or upon a plan or method of distribution of production from the reservoir, or upon any other plan for the development or operation of such reservoir, which plan, in the judgment of the division, has the effect of preventing waste as prohibited by the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] and is fair to the royalty owners in such reservoir, then such plan shall be adopted by the division with respect to the reservoir; however, the division, upon hearing and after notice, may subsequently modify any such plan to the extent necessary to prevent waste as prohibited by the Geothermal Resources Conservation Act.

71-5-12. Court may authorize pooling or unitization by fiduciaries.

A. When an existing geothermal resources lease upon property owned by a decedent at the time of his death, by a minor or by an incompetent, does not authorize pooling or unitization thereof with other lands in the vicinity, the district court for the county in which any portion of the lands subject to said lease is situated can authorize the executor or administrator of the estate of the decedent, or the guardian of the minor or incompetent, to execute appropriate instruments authorizing or effectuating such pooling or unitization, or both, if the court finds it to be in the interest of the owners of such property.

B. An executor, administrator or guardian desiring authorization to execute such instruments shall file a verified petition to the appropriate district court setting forth a description of the lease, the lands subject thereto and the reason that the proposed action is in the interest of the owners of the affected real estate. A copy of the instrument by which such pooling or unitization is proposed to be authorized or effectuated shall be attached to the petition.

C. No notice of the hearing upon the petition shall be required; provided, however, that the court in its discretion may require such notice as it may direct to be given to affected parties.

D. Upon entry of an order of the court authorizing execution of the proposed instrument in the form attached to the petition, or with such modification as the court may direct, and execution thereof by the executor, administrator or guardian, the interest in the property owned by the decedent at the time of death, or by the ward, shall be subject in all respects to the terms of said instrument and the executor, administrator or guardian, without further order of the court, shall be authorized to execute division orders, transfer orders, correction instruments, receipts and other instruments made necessary or desirable by the pooling or unitization so effected.

71-5-13. Spacing unit with divided mineral ownership.

A. Whenever the operator of any geothermal resources well shall dedicate lands comprising a standard spacing unit to a geothermal resources well, it shall be the obligation of the operator, if two or more separately owned tracts of land are embraced within the spacing unit, or where there are owners or royalty interests or undivided interests in the geothermal resources which are separately owned or any combination thereof, embraced within such spacing unit, to obtain voluntary agreements pooling of said lands or interests or an order of the division pooling said lands, which agreement or order shall be effective from the first production. Any division order that increases the size of a standard spacing unit for a geothermal reservoir, or extends the boundaries of such a reservoir, shall require dedication of acreage to existing wells in the reservoir in accordance with the acreage dedication requirements for said reservoir, and all interests in the spacing units that are dedicated to the affected wells shall share in production from the effective date of the said order.

B. Any operator failing to obtain voluntary pooling agreements, or failing to apply for an order of the division pooling the lands dedicated to the spacing unit as required by this section, shall nevertheless be liable to account to and pay each owner of geothermal interests, including owners of overriding royalty interests and other payments out of production, either the amount to which each interest would be entitled if pooling had occurred or the amount to which each interest is entitled in the absence of pooling, whichever is greater.

C. Nonstandard spacing units may be established by the division and all geothermal interests in any such nonstandard unit shall share in production from that unit from the date of the order establishing the said nonstandard unit.

71-5-14. Common purchasers; discrimination in purchasing prohibited.

Any person now or hereafter engaged in the taking or purchasing of geothermal resources from one or more producers within a single geothermal reservoir shall be a common purchaser within that geothermal reservoir, and shall purchase geothermal resources of like quality, quantity and pressure lawfully produced from that geothermal reservoir and tendered to such common purchaser at a reasonable point. Such purchase shall be made without unreasonable discrimination in favor of one producer against another in the price paid, quantities taken, the bases of measurement or the facilities offered.

In the event such purchaser is also a producer, he is prohibited to the same extent from discriminating in favor of himself with respect to geothermal resources wells in which he has an interest, direct or indirect, as against other geothermal resources wells in the same geothermal reservoir.

For the purposes of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], reasonable differences in prices paid or facilities afforded, or both, shall not constitute unreasonable discrimination if such differences bear a fair relationship to difference in quality, quantity or pressure of the geothermal resources available or to the relative lengths of time during which such geothermal resources will be available to the purchaser.

Any common purchaser taking geothermal resources produced from wells within a geothermal reservoir shall take ratably under such rules, regulations and orders, concerning quantity, as may be promulgated by the division after due notice and public hearing. The division, in promulgating such rules, regulations and orders may consider the quality and the quantity of the geothermal resources available, the pressure and temperature of the product at the point of delivery, acreage attributable to the well, market requirements and other pertinent factors.

Nothing in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] shall be construed or applied to require, directly or indirectly, any person to purchase geothermal resources of a quality or under a pressure or under any other condition by reason of which such geothermal resource cannot be economically and satisfactorily used by such purchaser by means of his geothermal utilization facilities then in service.

71-5-15. Purchase, sale or handling of excess geothermal resources or products prohibited.

A. The sale or purchase or acquisition, or the transportation, utilization or processing, or handling in any other way, of geothermal resources in whole or in part produced in excess of the amount allowed by any statute of this state, or by any provision of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], or by any rule, regulation or order of the commission or division made hereunder, is hereby prohibited, and such geothermal resources are hereby referred to as "illegal geothermal resources."

B. The sale or purchase or acquisition, or the transportation, utilization or processing, or the handling in any other way, of any product of geothermal resources, which product is derived in whole or in part from geothermal resources produced in whole or in part in excess of the amount allowed by any statute of this state, or by any provision of the Geothermal Resources Conservation Act, or by any rule, regulation or order of the commission or division made thereunder, is hereby prohibited, and each such commodity or product is herein referred to as "illegal geothermal resources product."

71-5-16. Rules and regulations to effectuate prohibitions against purchase or handling of illegal geothermal resources or illegal geothermal resources product.

A. The division is specifically authorized and directed to make such rules, regulations and orders, and may provide for such certificates of clearance or tenders, as may be necessary to make effective the prohibitions contained in Section 71-5-15 NMSA 1978.

B. Unless and until the division provides for certificates of clearance or tenders, or some other method, so that any person may have an opportunity to determine whether any contemplated transaction of sale or purchase or acquisition, or of transportation, refining, processing or handling in any other way, involves illegal geothermal resources, or illegal geothermal resources product, no penalty shall be imposed for the sale or purchase or acquisition, or the transportation, refining, processing or handling in any other way, of illegal geothermal resources or illegal geothermal resources product, except under circumstances stated in the succeeding provisions of this subsection. Penalties shall be imposed for the division of each transaction prohibited in Section 71-5-15 NMSA 1978 when the person committing the same knows that illegal geothermal resources, or illegal geothermal resources product, are involved in such transaction, or when such person could have known or determined such fact by the exercise of reasonable diligence or from facts within his knowledge. However, regardless of lack of actual notice or knowledge, penalties as provided in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] shall apply to any sale or purchase or acquisition, and to the transportation, refining, processing or handling in any other way, of illegal geothermal resources, or illegal geothermal resources product where administrative provision is made for identifying the character of the commodity as to its legality. It shall likewise be a violation for which penalties shall be imposed for any person to sell or purchase or acquire, or to transport, refine, process or handle in any way, any geothermal resources or any product thereof without complying with the rule, regulation or order of the commission or division relating thereto.

71-5-17. Hearings on rules, regulations and orders; notice; emergency rules.

A. Except as provided for herein, before any rule, regulation or order, including revocation, change, renewal or extension thereof, shall be made under the provisions of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], a public hearing shall be held at such time, place and manner as may be prescribed by the division. The division shall first give reasonable notice of such hearing (in no case less than ten days, except in an emergency) and at any such hearing any person having an interest in the subject matter of the hearing shall be entitled to be heard. Any member of the commission or division, or any employee of the commission or division, shall have power to administer oaths to any witness in any hearing, investigation or proceeding contemplated by the Geothermal Resources Conservation Act.

B. In case an emergency is found to exist by the division which in its judgment requires the making of a rule, regulation or order without first having a hearing, such emergency rule, regulation or order shall have the same validity as if a hearing with respect to the same had been held after due notice. The emergency rule, regulation or order permitted by this section shall remain in force no longer than fifteen days from its effective date, and, in any event, it shall expire when the rule, regulation or order made after due notice and hearing with respect to the subject matter of such emergency rule, regulation or order becomes effective.

71-5-17.1. Rules of procedure in hearings; manner of giving notice; record of rules, regulations and orders.

The division shall prescribe its rules of order or procedure in hearings or other proceedings before it under the Geothermal Resources Conservation Act [71-5-1 NMSA 1978]. Any notice required to be given under that act or under any rule, regulation or order prescribed by the commission or division shall be by personal service on the person affected, or by publication once in a newspaper of general circulation published at Santa Fe and once in a newspaper of general circulation published in the county, or each of the counties if there is more than one, in which any land, geothermal resources or other property which may be affected shall be situated. The notice shall issue in the name of "the state of New Mexico" and shall be signed by the director of the division, and the seal of the commission shall be impressed thereon, and it shall specify the number and style of the case, and the time and place of hearing, shall briefly state the general nature of the order or regulation contemplated by the division on its own motion or sought in a proceeding brought before the commission or division, the name of the petitioner or applicant and, unless the order, rule or regulation is intended to apply to and affect the entire state, it shall specify or generally describe the common source or sources of supply that may be affected by such order, rule or regulation. Personal service thereof may be made by any agent of the division or by any person over the age of eighteen years in the same manner as is provided by law for the service of summons in civil actions in the district courts of this state. Such service shall be complete at the time of such personal service or on the date of such publication, as the case may be. Proof of service shall be the affidavit of the person making personal service or of the publisher of the newspaper in which publication is had, as the case may be. All rules, regulations and orders made by the commission or division shall be entered in full by the director thereof in a book to be kept for such purpose by the division, which shall be a public record and open to inspection at all times during reasonable office hours. A copy of any rule, regulation or order, certified by the director of the division under the seal of the commission, shall be received in evidence in all courts of the state with the same effect as the original.

71-5-17.2. Subpoena power; immunity of natural persons required to testify.

The commission or any member thereof, or the director of the division or his authorized representative, may subpoena witnesses, require their attendance and giving of testimony before it and require the production of books, papers and records in any proceeding before the commission or the division. No person shall be excused from attending and testifying or from producing books, papers and records before the commission or the division, or from complying with a subpoena, in any hearing, investigation or proceeding held by or before the commission or division or in any cause or proceeding in any court by or against the commission or division, relative to matters within the jurisdiction of the commission or division, on the ground or for the reason that the testimony or evidence, documentary or otherwise, required of him may tend to incriminate him or subject him to a penalty or forfeiture; provided that nothing herein contained shall be construed as requiring any person to produce any books, papers or records, or to testify in response to any inquiry, not pertinent to some question lawfully before the commission or division or court for determination. No natural person shall be subjected to criminal prosecution or to any penalty or forfeiture for any transaction, matter or thing concerning which he may be required to testify or produce evidence, documentary or otherwise, before the commission or division, or in compliance with a subpoena or in any cause or proceeding; provided, that no person testifying shall be exempted from prosecution and punishment for perjury committed in so testifying.

71-5-17.3. Failure or refusal to comply with subpoena; refusal to testify; contempt.

In case of failure or refusal on the part of any person to comply with any subpoena issued by the commission or any member thereof, or the director of the division or his authorized representative, or on the refusal of any witness to testify or answer as to any matters regarding which he may be lawfully interrogated, any district court, on the application of the commission or division, may issue an order and compel the person to comply with the subpoena and to attend before the commission or division and produce such documents and give his testimony upon such matters as may be lawfully required.

71-5-17.4. Perjury; punishment.

If any person of whom an oath shall be required under the provisions of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], or by any rule, regulation or order of the commission or division, shall willfully swear falsely in regard to any matter or thing respecting which such oath is required, or shall willfully make any false report or affidavit required or authorized by the provisions of the Geothermal Resources Conservation Act or by any rule, regulation or order of the commission or division, such person shall be guilty of a felony and, upon conviction, shall be imprisoned for not more than five years nor less than six months.

71-5-17.5. Additional powers of commission or division; hearings before examiner; hearings de novo.

In addition to the powers and authority, either express or implied, granted to the oil conservation commission or division, the division may, in prescribing its rules of order or procedure in connection with hearings or other proceedings before the division, provide for the appointment of one or more examiners to be members of the staff of the division to conduct hearings with respect to matters properly coming before the division and to make reports and recommendations to the director of the division with respect thereto. Any member of the commission or the director of the division or his authorized representative may serve as an examiner. The division shall promulgate rules and regulations with regard to hearings to be conducted before examiners, and the powers and duties of the examiners in any particular case may be limited by order of the division to particular issues or to the performance of particular acts. In the absence of any limiting order, an examiner appointed to hear any particular case may regulate all proceedings before him and perform all acts and take all measures necessary or proper for the efficient and orderly conduct of the hearing, including the swearing of witnesses, [and] receiving of testimony and exhibits offered in evidence subject to objections as may be imposed, and shall cause a complete record of the proceeding to be made and transcribed and shall certify the same to the director of the division for consideration together with the report of the examiner and his recommendations in connection therewith. The director of the division shall base the decision rendered in any matter or proceeding heard by an examiner upon the transcript of testimony and record made by or under the supervision of the examiner in connection with the proceeding, and the decision shall have the same force and effect as if the hearing had been conducted before the director of the division. When any matter or proceeding is referred to an examiner and a decision is rendered thereon, any party of record adversely affected may have the matter heard de novo before the commission upon application filed with the division within thirty days from the time the decision is rendered.

71-5-18. Rehearings; appeals.

A. Within twenty days after entry of an order or decision of the division, a party of record adversely affected may file with the commission an application for rehearing in respect of any matter determined by the order or decision, setting forth the respect in which the order or decision is believed to be erroneous. The commission shall grant or refuse the application in whole or in part within ten days after it is filed, and failure to act within the ten-day period shall be deemed a refusal of the application and a final disposition of the application. In the event the rehearing is granted, the commission may enter a new order or decision after rehearing as may be required under the circumstances.

B. A party of record to the rehearing proceeding dissatisfied with the disposition of the application for rehearing may appeal to the district court pursuant to the provisions of Section 39-3-1.1 NMSA 1978.

C. The pendency of proceedings to review shall not of itself stay or suspend operation of the order or decision being reviewed, but during the pendency of the proceedings, the district court in its discretion may, upon its own motion or upon proper application of any party to the proceedings, stay or suspend in whole or in part operation of the order or decision pending review on terms as the court deems just and proper and in accordance with the practice of courts exercising equity jurisdiction; provided that the court, as a condition to any staying or suspension of operation of any order or decision, may require that one or more parties secure, in a form and amount as the court may deem just and proper, one or more other parties against loss or damage due to the staying or suspension of the commission's or division's order or decision in the event that the action of the commission or division is affirmed.

71-5-19. Temporary restraining order or injunction; grounds; hearing; bond.

A. No temporary restraining order or injunction of any kind shall be granted against the commission or the members thereof, or against the attorney general, or against any agent, employee or representative of the division restraining the commission, or any of its members, or the division or any of its agents, employees or representatives, or the attorney general, from enforcing any statute of this state relating to conservation of geothermal resources, or any of the provisions of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], or any rule, regulation or order made thereunder, except after due notice to the director of the division, and to all other defendants, and after a hearing at which it shall be clearly shown to the court that the act done or threatened is without sanction of law, or that the provision of the Geothermal Resources Conservation Act, or the rule, regulation or order complained of, is invalid, and that, if enforced against the complaining party, will cause an irreparable injury. With respect to an order or decree granting temporary injunctive relief, the nature and extent of the probable invalidity of the statute, or of any provision of Geothermal Resources Conservation Act, or of any rule, regulation or order hereunder involved in such suit, must be recited in the order or decree granting the temporary relief, as well as a clear statement of the probable damage relied upon by the court as justifying temporary injunctive relief.

B. No temporary injunction of any kind, including a temporary restraining order against the commission or the members thereof, or the division or its agents, employees or representatives, or the attorney general, shall become effective until the plaintiff shall execute a bond to the state with sufficient surety in an amount to be fixed by the court reasonably sufficient to indemnify all persons who may suffer damage by reason of the violation pendente lite by the complaining party of the statute or the provisions of the Geothermal Resources Conservation Act or of any rule, regulation or order complained of. Any person so suffering damage may bring suit thereon before the expiration of six months after the statute, provision, rule, regulation or order complained of shall be finally held to be valid, in whole or in part, or such suit against the commission, or the members thereof, or the division, shall be finally dismissed. Such bond shall be approved by the judge of the court in which the suit is pending, and shall be for the use and benefit of all persons who may suffer damage by reason of the violation pendente lite of the statute, provision, rule, regulation or order complained of in such suit, and who may bring suit within the time prescribed by this section; and such bond shall be so conditioned. From time to time, on motion and with notice to the parties, the court may increase or decrease the amount of the bond and may require new or additional sureties, as the facts may warrant.

71-5-20. Actions for violations.

Whenever it shall appear that any person is violating, or threatening to violate, any statute of this state with respect to the conservation of geothermal resources, or any provision of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], or any rule, regulation or order made thereunder, the division through the attorney general, shall bring suit against such person in the county of the residence of the defendant, or in the county of the residence of any defendant if there be more than one defendant, or in the county where the violation is alleged to have occurred, for penalties, if any are applicable, and to restrain such person from continuing such violation or from carrying out the threat of violation. In such suit the division may obtain injunction, prohibitory and mandatory, including temporary restraining orders and temporary injunctions, as the facts may warrant, including, when appropriate, an injunction restraining any person from moving or disposing of illegal geothermal resources, or illegal geothermal resources product, and any or all such commodities, or funds derived from the sale thereof, may be ordered to be impounded or placed under the control of an agent appointed by the court if, in the judgment of the court, such action is advisable.

71-5-21. Actions for damages; institution of actions for injunctions by private parties.

Nothing in the Geothermal Resources Conservation Act [71-5-1 NMSA 1978], contained or authorized, and no suit by or against the division, and no penalties imposed or claimed against any person for violating any statute of this state with respect to conservation of geothermal resources, or any provision of that act, or any rule, regulation or order issued hereunder, shall impair or abridge or delay any cause of action for damages which any person may have or assert against any person violating any statute of this state with respect to conservation of geothermal resources, or any provision of the Geothermal Resources Conservation Act, or any rule, regulation or order issued hereunder. Any person so damaged by the violation may sue for and recover such damages as he may be entitled to receive. In the event the division should fail to bring suit to enjoin any actual or threatened violation of any statute of this state with respect to the conservation of geothermal resources, or of any provision of this act [71-5-1 to 71-5-17, 71-5-18 to 71-5-22, 71-5-24 NMSA 1978], or of any rule, regulation or order made hereunder, then any person or party in interest adversely affected by such violation, and who has notified the division in writing of such violation or threat thereof and has requested the division to sue, may, to prevent any or further violation, bring suit for that purpose in the district court of any county in which the division could have brought suit. If, in such suit, the court holds that injunctive relief should be granted, then the division shall be made a party and shall be substituted for the person who brought the suit, and the injunction shall be issued as if the division had at all times been the complaining party.

71-5-22. Violation of court order grounds for appointment of receiver.

The violation by any person of an order of the court relating to the operation of any geothermal resources well or wells, or of any geothermal transportation, storage or utilization facility, shall be sufficient ground for the appointment of a receiver with power to conduct operations in accordance with the order of the court.

71-5-23. Violations of the Geothermal Resources Conservation Act; penalties.

A. Any person who knowingly and willfully violates any provision of the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] or any provision of any rule or order issued pursuant to that act shall be subject to a civil penalty of not more than two thousand five hundred dollars ($2,500) for each violation. For purposes of this subsection, in the case of a continuing violation, each day of violation shall constitute a separate violation. The penalties provided in this subsection shall be recoverable by a civil suit filed by the attorney general in the name and on behalf of the commission or the division in the district court of the county in which the defendant resides or in which any defendant resides if there be more than one defendant or in the district court of any county in which the violation occurred. The payment to [of] such penalty shall not operate to legalize any illegal geothermal resources or illegal product involved in the violation for which the penalty is imposed or relieve a person on whom the penalty is imposed from liability to any other person for damages arising out of such violation.

B. It is unlawful, subject to a criminal penalty of a fine of not more than five thousand dollars ($5,000) or imprisonment for a term not exceeding three years or both such fine and imprisonment, for any person to knowingly and willfully:

(1) violate any provisions of the Geothermal Resources Conservation Act or any rule, regulation or order of the commission or the division issued pursuant to that act; or

(2) do any of the following for the purpose of evading or violating the Geothermal Resources Conservation Act or any rule, regulation or order of the commission or division issued pursuant to that act;

(a) make any false entry or statement in a report required by the Geothermal Resources Conservation Act or by any rule, regulation or order of the commission or division issued pursuant to that act;

(b) make or cause to be made any false entry in any record, account or memorandum required by the Geothermal Resources Conservation Act or by any rule, regulation or order of the commission or division issued pursuant to that act;

(c) omit or cause to be omitted from any such record, account or memorandum full, true and correct entries; or

(d) remove from this state or destroy, mutilate, alter or falsify any such record, account or memorandum.

C. For the purposes of Subsection B of this section, each day of violation shall constitute a separate offense.

D. Any person who knowingly and willfully procures, counsels, aids or abets the commission of any act described in Subsection A or B of this section shall be subject to the same penalties as are prescribed therein.

71-5-24. Seizure and sale of illegal geothermal resources or illegal geothermal resources product; procedure.

A. Apart from, and in addition to, any other remedy or procedure which may be available to the division, or any penalty which may be sought against or imposed upon any person, with respect to violations relating to illegal geothermal resources or illegal geothermal resources product, [such resources] shall, exept [except] under such circumstances as are stated herein, be contraband and shall be seized and sold, and the proceeds applied as herein provided. Such sale shall not take place unless the court shall find in the proceeding provided in this section that the owner of such illegal geothermal resources or illegal geothermal resources product is liable, or in some proceeding authorized by the Geothermal Resources Conservation Act [71-5-1 NMSA 1978] such owner has already been held to be liable, for penalty for having produced such illegal geothermal resources, or for having purchased or acquired such illegal geothermal resources or illegal geothermal resources product. Whenever the division believes that illegal geothermal resources or illegal geothermal resources product is subject to seizure and sale, as provided herein, it shall, through the attorney general, bring a civil action in rem for that purpose in the district court of the county where the commodity is found, or the action may be maintained in connection with any suit or cross-action for injunction or for penalty relating to any prohibited transaction involving such illegal geothermal resources or illegal geothermal resources product. Notice of the action in rem shall be given in conformity with the law or rule applicable to such proceeding. Any person or party in interest who may show himself to be adversely affected by any such seizure and sale shall have the right to intervene in said suit to protect his rights.

B. Whenever the pleading with respect to the forfeiture of illegal geothermal resourc es or illegal geothermal resources product shows ground for seizure and sale, and such pleading is verified or is supported by affidavit or affidavits, or by testimony under oath, the court shall order such commodity to be impounded or placed under the control, actual or constructive, of the court through an agent appointed by the court.

C. The judgment effecting the forfeiture shall provide that the commodity be seized, if not already under the control of the court, and that a sale be had in similar manner and with similar notice as provided by law or rule with respect to the sale of personal property under execution; provided, however, the court may order that the commodity be sold in specified lots or portions, and at specified intervals, instead of being sold at one time. Title to the amount sold shall pass as of the date of the seizure. The judgment shall provide for payment of the proceeds of the sale into the common school fund, after first deducting the costs in connection with the proceedings and the sale. The amount sold shall be treated as legal geothermal resources or legal geothermal resources product, as the case may be, in the hands of the purchaser, but the purchaser and the commodity shall be subject to all applicable laws and rules, regulations and orders with respect to further sale or purchase or acquisition, and with respect to the transportation, refining, processing or handling in any other way, of the commodity purchased.

D. Nothing in this section shall deny or abridge any cause of action a royalty owner, or any lien holder, or any other claimant, may have, because of the forfeiture of the illegal geothermal resources or illegal geothermal resources product, against the person whose act resulted in such forfeiture.

TITLE 19 - NATURAL RESOURCES AND WILDLIFE

CHAPTER 14

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This rule was filed as Rule G-0.1, Rule G-1, Rule G-2, Rule G-3, Rule G-4, Rule G-5, Rule G-6, Rule G-7, Rule G-8, Rule G-9, Rule G-10 and Rule G-100.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 1 GENERAL PROVISIONS

19.14.1.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.1.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.1.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.1.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.1.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.1.6 OBJECTIVE:

A. The following geothermal rules and regulations are of statewide application and have been adopted by the oil conservation division of the New Mexico energy and minerals department to conserve the natural geothermal resources of the state of New Mexico, to prevent waste, and to protect the correlative rights of all owners of geothermal resources. Special rules, regulations, and order may be adopted from time to time when required for a particular geothermal resources area, and shall prevail over the geothermal rules and regulations if in conflict therewith. However, when these geothermal rules and regulations do not conflict with special rules hereafter adopted, these geothermal rules and regulations will apply.

B. The Division may grant exceptions to these rules and regulations after notice and hearing, when the granting of such exceptions will not result in waste but will protect correlative rights or prevent waste.
[Rule G-1; Recompiled 12/31/01]

19.14.1.7 DEFINITIONS:

A. “Commission” shall mean the oil conservation commission.

B. “Condensate” shall mean the liquid recovered from the condensation of gases or steam produced from a geothermal reservoir.

C. “Correlative rights” shall mean the opportunity afforded, insofar as is practicable to do so, the owner of each property in a geothermal reservoir to produce his just and equitable share of the geothermal resources within such reservoir, being an amount, so far as can be practicably determined, and so far as can be practicably obtained without waste, substantially in the proportion that the quantity of recoverable geothermal resources under such property bears to the total recoverable geothermal resources in the reservoir, and for such purpose to use his just and equitable share of the natural heat or energy in the reservoir.

D. “Designated agent” shall mean that person designated by the owner or operator of any geothermal resources well to be his agent in all matters concerning the keeping of records within the state.

E. “Development well” shall mean a well drilled within the established limits of a designated geothermal field or within one mile thereof, for the commercial production of geothermal resources.

F. “Disposal well” shall mean a well drilled or converted for the purpose of disposing of fluids into a formation other than a geothermal reservoir.

G. “Division” shall mean the oil conservation division of the New Mexico energy and minerals department.

H. “Drilling operations” shall mean the actual drilling, redrilling, completion or recompletion of a well for geothermal production or injection, including the running and cementing of casing, the performance of such operations as logging and perforating, and the installation of wellhead equipment.

I. “Exploratory well” shall mean a well drilled for the discovery or evaluation of geothermal resources one mile or more beyond the established limits of a designated geothermal field.

J. “Geothermal section” shall mean that section of the oil conservation division charged with the authority and duty of regulating the drilling, development and production of geothermal resources, and with conserving and preventing waste of geothermal resources within this state pursuant to the provisions of the Geothermal Resources Conservation Act.

K. “Geothermal field” shall mean an area defined by the division which contains a well, or wells, capable of commercial geothermal production. "Geothermal field" includes "low-temperature thermal field."

L. "Geothermal gradient well" (see thermal gradient well)

M. "Geothermal observation well" shall mean any well which is to be utilized for the express purpose of evaluating or monitoring a geothermal reservoir by pressure observation or limited production.

N. "Geothermal reservoir" shall mean any common source of geothermal resources, whether the fluids produced from the reservoir are native to the reservoir, or flow into or are injected into said reservoir.

O. "Geothermal resources" shall mean the natural heat of the earth or the energy, in whatever form, below the surface of the earth present in, resulting from, created by, or which may be extracted from, this natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas and other hydrocarbon substances.

P. "Geothermal resources area" shall mean the same general surface area which is underlain, or appears to be underlain, by one or more formations containing geothermal resources.

Q. "Geothermal resources well" (see well)

R. "Geothermal waters" shall mean the water or brine produced from a geothermal reservoir.

S. "Injection" shall mean the placing of fluids in an underground stratum through a wellbore, whether by pressure at the surface or by gravity flow, and whether for disposal or other purpose.

T. "Injection well" shall mean a well drilled or converted for the purpose of injecting fluids into a geothermal reservoir.

U. "Log or well log" shall mean a systematic detailed and correct recorded description of the lithologic sequence encountered while drilling a geothermal well.

V. "Low-temperature thermal field" shall mean an area defined by the commission which contains a well, or wells, capable of production of low-temperature thermal waters.

W. "Low-temperature thermal water" shall mean naturally heated water the temperature of which is less than boiling at the altitude of occurrence, which has value by virtue of the heat contained therein and is found below the surface of the earth, or in warm springs on the surface.

X. "Low-temperature thermal well" shall mean a well drilled to produce low-temperature thermal water for the purpose of extracting heat for agricultural, commercial, industrial, municipal or domestic uses.

Y. "Multiple completion" shall mean the completion of a well in such a manner as to produce from more than one geothermal reservoir.

Z. "Operator" shall mean any person drilling, maintaining, operating, producing or in control of any well, and shall include "owner" when any well is operated or has been operated or is about to be operated by or under the direction of the owner.

AA. "Owner" shall mean the person who has the right to drill into and to produce from any geothermal resources area, and to appropriate the geothermal resources thereof for himself or for himself and another.

BB. "Person" shall mean any individual, firm, association or corporation or any other group or combination acting as a unit.

CC. "Potential" shall mean the properly determined ability of a well to produce geothermal resources under conditions prescribed by the division.

DD. "Temporary abandonment" shall mean a state or period of suspended operations during which essentially continuous drilling, production, injection, storage or work-over procedures have not taken place. Such period shall be 60 days for drilling wells and six months for all other classes of wells.

EE. "Thermal gradient well" shall mean a well drilled or used solely for temperature observation purposes, and which shall not be completed as a geothermal producing well or as an injection or disposal well.

FF. "Unorthodox well location" shall mean a location which does not conform to the well location requirements established by the geothermal rules and regulations of the division.

GG. "Waste" shall mean any physical waste including, but not limited to, underground waste resulting from the inefficient, excessive or improper use or dissipation of reservoir heat or energy or resulting from the location, spacing, drilling, equipping, operation or production of a geothermal resources well in such a manner as to reduce or tend to reduce the ultimate economic recovery of the geothermal resources within a reservoir and surface waste resulting from the inefficient production, gathering, transportation, storage or utilization of geothermal resources and the handling of geothermal resources in such a manner that causes or tends to cause the unnecessary or excessive loss or destruction of geothermal resources obtained or released from a geothermal reservoir.

HH. "Well" shall mean any exploratory well, development well, injection well, disposal well, thermal gradient well, geothermal observation well, or low-temperature thermal well, as defined herein.

[Rule G-01; Recompiled 12/31/01]

19.14.1.8 ENFORCEMENT OF LAWS, RULES, AND REGULATIONS DEALING WITH CONSERVATION OF GEOTHERMAL RESOURCES: The division, its agents, representatives, and employees are charged with the duty and obligation of enforcing all statutes, rules and regulations of the state of New Mexico relating to the conservation of geothermal resources. However, it shall be the responsibility of all geothermal resource owners or operators to obtain information pertaining to the regulation of geothermal resources before operations have begun. Minor deviations from the requirements of these rules as to field practices may be permitted by the division or its duly authorized

representatives where such can be safely done without waste and burdensome delay or expense to the operator avoided.
[Rule G-2; Recompiled 12/31/01]

19.14.1.9 WASTE PROHIBITED:

A. The production or handling of geothermal resources of any type or in any form, or the handling of products thereof, in such a manner or under such conditions or in such an amount as to constitute or result in waste is hereby prohibited.

B. All owners, operators, contractors, drillers, transporters, service companies, pipe pulling and salvage contractors and other persons shall at all times conduct their operations in the drilling, equipping, operating, producing, and plugging and abandoning of geothermal resource wells in a manner that will prevent waste of geothermal resources, and shall not wastefully utilize geothermal resources or allow leakage of such resources from a geothermal reservoir, or from wells, tanks, containers, or pipe, or other storage, conduit or operating equipment.
[Rule G-3; Recompiled 12/31/01]

19.14.1.10 PROTECTION OF LIFE, HEALTH AND THE ENVIRONMENT: All geothermal operations, exploratory, drilling and producing, shall be conducted in a manner that will afford maximum reasonable protection to human life and health and to the environment.
[Rule G-4; Recompiled 12/31/01]

19.14.1.11 OTHER DEPARTMENTS AND AGENCIES: Nothing in these rules shall be construed to supersede the authority which any state department or agency has with respect to the management, protection and utilization of the state lands and resources under its jurisdiction.
[Rule G-5; Recompiled 12/31/01]

19.14.1.12 UNITED STATES GOVERNMENT LEASES: It is recognized by the division that all persons conducting geothermal operations on United States government land shall comply with the United States government regulations. Such persons shall also comply with all applicable state rules and regulations which are not in conflict therewith.
[Rule G-6; Recompiled 12/31/01]

19.14.1.13 UNITIZED AREAS: After notice and hearing, the division may grant approval for the combining of two or more contiguous leases into a unitized area for purposes of exploration for and production of geothermal resources.
[Rule G-7; Recompiled 12/31/01]

19.14.1.14 CLASSIFYING AND DEFINING POOLS: The division will determine whether a particular well or field is a high-temperature geothermal well or field or a low-temperature thermal well or field, as the case may be, and will, from time to time, classify and reclassify wells and name pools accordingly, and will determine the limits of any field so designated and from time to time redetermine such limits.
[Rule G-8; Recompiled 12/31/01]

19.14.1.15 FORMS UPON REQUEST: Forms for written notices, requests and reports required by the division will be furnished upon request.
[Rule G-9; Recompiled 12/31/01]

19.14.1.16 AUTHORITY TO COOPERATE WITH OTHER AGENCIES: The division may from time to time enter into arrangements with state and federal governmental agencies, industrial committees and other persons, with respect to special projects, services and studies relating to conservation of geothermal resources.
[Rule G-10; Recompiled 12/31/01]

19.14.1.17 DESIGNATION OF AGENT: Any person who had drilled or is drilling or proposes to drill any geothermal well shall file a "designation of agent" (on a form approved by the division) with the division. The designated agent shall be a resident of this state and shall be the repository for all well records of wells drilled by the owner or operator for whom he is agent (Rule G-200 B) [now 19.14.51.9 NMAC]. All changes of address of the agent shall be immediately reported to the division in writing. Upon termination of any agent's authority, a new designation of agent shall be filed with the division within ten days.
[Rule G-100; Recompiled 12/31/01]

HISTORY OF 19.14.1 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-0.1, Definitions, 11/1/83.
Rule G-1, Scope of Rules and Regulations, 11/1/83.

Rule G-2, Enforcement of Laws, Rules, and Regulations Dealing with Conservation of Geothermal Resources, 11/1/83.
Rule G-3, Waste Prohibited, 11/1/83.
Rule G-4, Protection of Life, Health, and the Environment, 11/1/83.
Rule G-5, Other Departments and Agencies, 11/1/83.
Rule G-6, United States Government Leases, 11/1/83.
Rule G-7, Unitized Areas, 11/1/83.
Rule G-8, Classifying and Defining Pools, 11/1/83.
Rule G-9, Forms Upon Request, 11/1/83.
Rule G-10, Authority to Cooperate with Other Agencies, 11/1/83.
Rule G-100, Designation of Agent, 11/1/83

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-101.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 20 PLUGGING BOND

19.14.20.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.20.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.20.3 STATUTORY AUTHORITY: [RESERVED]
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19.14.20.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.20.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.20.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.20.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.20.8 PLUGGING BOND:

A. Any person who has drilled or is drilling or proposes to drill any geothermal resources well shall post with the division, and obtain approval thereof, a bond, in a form approved by the division, conditioned to plug such well, if non-productive or when abandoned, in such a way as to confine all fluids in their native strata. Each such bond shall be executed by a responsible surety company authorized to transact business in the state of New Mexico and shall describe, or by subsequent rider describe, the name and exact location of the well, or wells, covered by the bond. Bonds may be either one-well bonds or multi-well bonds, in the amounts stated below in accordance with type of bond and depth of well(s):

(1) One-well bonds:

Projected depth of proposed well or Actual depth of existing well	Amount of bond
Less than 500 feet deep ("shallow")	$2,000
500 feet to 2,000 feet deep ("intermediate")	$3,000
More than 2,000 feet deep ("deep")	$5,000.

Revised plans for an actively drilling shallow or intermediate well being drilled under a one-well bond may be approved by the division for drilling as much as 15 percent deeper than the maximum depth on the well's bond, provided, however, any well drilled more than 15 percent deeper than the maximum allowed depth on the bond must be covered by a new bond in the amount prescribed for the deeper depth bracket, in which case the old bond will be released.

(2) Multi-well bonds:

Projected depth of proposed wells or Actual depth of existing wells	Amount of bond
Less than 500 feet deep ("shallow")	$10,000
500 feet to 2,000 feet deep ("intermediate")	$10,000
More than 2,000 feet deep ("deep")	$10,000

(a) Not more than ten shallow wells may be drilled under a $10,000 multi-well bond. A $2,000 one-well bond shall be posed for each additional shallow well drilled or an additional $10,000 multi-well bond must be posted for each additional ten (or portion thereof) shallow wells drilled.

(b) Not more than six intermediate wells may be drilled under a $10,000 multi-well bond. A $3,000 one-well bond shall be posted for each additional intermediate well drilled or an additional $10,000 multi-well bond must be posted for each additional six (or portion thereof) intermediate wells drilled.

(c) Not more than four deep wells may be drilled under a $10,000 multi-well bond. A $5,000 one-well bond shall be posted for each additional deep well drilled or an additional $10,000 multi-well bond must be posted for each additional four (or portion thereof) deep wells drilled.

(d) The $10,000 multi-well bond may be used to cover the drilling of a combination of wells, i.e., shallow and intermediate, shallow and deep, intermediate and deep, or shallow, intermediate and deep, provided however, that the $10,000 capacity of the bond shall be charged in an amount equal to the one-well bond requirement for each such combination well according to its depth.

(e) Revised plans for an actively drilling shallow or intermediate well being drilled under a multi-well bond may be approved for drilling as much as 15 percent deeper than the well's maximum depth bracket without affecting the bond. Any well drilled more than 15 percent deeper than its depth bracket, however, shall be placed in the next deeper depth bracket, and the $10,000 capacity of the multi-well bond charged accordingly. Additional bonding will be required in the event the capacity of the bond to cover the well in its new depth bracket is inadequate.

B. For the purposes of the division, the bond required is a plugging bond, not a drilling bond, and shall endure until the well has been plugged and abandoned, and such plugging and abandonment approved by the division. Transfer of the well or property does not release the bond. In case of transfer and the principal desires to be released from the bond, he shall proceed as follows:

(1) The principal on the bond shall notify the division in writing that the well, or wells, covered by the bond are being or have been transferred to a certain transferee. The notice shall name the wells and shall give their exact location.

(2) On the same instrument the transferee shall recite that he accepts such transfer and accepts the responsibility for such well, or wells, under his bond which shall be tendered therewith.

(3) When the division has approved the transfer, the transferor is immediately released of the plugging responsibility of the well, or wells, constitute all of the wells covered by the bond, such bond will be released by written notice from the division to the principal and to the surety company.

C. The division director is vested with power to act for the division in all matters relating to this rule.
[Recompiled 12/31/01]

HISTORY OF 19.14.20 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-101, Plugging Bonds, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-101.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 20 PLUGGING BOND

19.14.20.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.20.2 SCOPE: [RESERVED]
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19.14.20.3 STATUTORY AUTHORITY: [RESERVED]
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19.14.20.4 DURATION: [RESERVED]
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19.14.20.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.20.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.20.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.20.8 PLUGGING BOND:

A. Any person who has drilled or is drilling or proposes to drill any geothermal resources well shall post with the division, and obtain approval thereof, a bond, in a form approved by the division, conditioned to plug such well, if non-productive or when abandoned, in such a way as to confine all fluids in their native strata. Each such bond shall be executed by a responsible surety company authorized to transact business in the state of New Mexico and shall describe, or by subsequent rider describe, the name and exact location of the well, or wells, covered by the bond. Bonds may be either one-well bonds or multi-well bonds, in the amounts stated below in accordance with type of bond and depth of well(s):

(1) One-well bonds:

Projected depth of proposed well or Actual depth of existing well	Amount of bond
Less than 500 feet deep ("shallow")	$2,000
500 feet to 2,000 feet deep ("intermediate")	$3,000
More than 2,000 feet deep ("deep")	$5,000.

Revised plans for an actively drilling shallow or intermediate well being drilled under a one-well bond may be approved by the division for drilling as much as 15 percent deeper than the maximum depth on the well's bond, provided, however, any well drilled more than 15 percent deeper than the maximum allowed depth on the bond must be covered by a new bond in the amount prescribed for the deeper depth bracket, in which case the old bond will be released.

(2) Multi-well bonds:

Projected depth of proposed wells or Actual depth of existing wells	Amount of bond
Less than 500 feet deep ("shallow")	$10,000
500 feet to 2,000 feet deep ("intermediate")	$10,000
More than 2,000 feet deep ("deep")	$10,000

(a) Not more than ten shallow wells may be drilled under a $10,000 multi-well bond. A $2,000 one-well bond shall be posed for each additional shallow well drilled or an additional $10,000 multi-well bond must be posted for each additional ten (or portion thereof) shallow wells drilled.

(b) Not more than six intermediate wells may be drilled under a $10,000 multi-well bond. A $3,000 one-well bond shall be posted for each additional intermediate well drilled or an additional $10,000 multi-well bond must be posted for each additional six (or portion thereof) intermediate wells drilled.

(c) Not more than four deep wells may be drilled under a $10,000 multi-well bond. A $5,000 one-well bond shall be posted for each additional deep well drilled or an additional $10,000 multi-well bond must be posted for each additional four (or portion thereof) deep wells drilled.

(d) The $10,000 multi-well bond may be used to cover the drilling of a combination of wells, i.e., shallow and intermediate, shallow and deep, intermediate and deep, or shallow, intermediate and deep, provided however, that the $10,000 capacity of the bond shall be charged in an amount equal to the one-well bond requirement for each such combination well according to its depth.

(e) Revised plans for an actively drilling shallow or intermediate well being drilled under a multi-well bond may be approved for drilling as much as 15 percent deeper than the well's maximum depth bracket without affecting the bond. Any well drilled more than 15 percent deeper than its depth bracket, however, shall be placed in the next deeper depth bracket, and the $10,000 capacity of the multi-well bond charged accordingly. Additional bonding will be required in the event the capacity of the bond to cover the well in its new depth bracket is inadequate.

B. For the purposes of the division, the bond required is a plugging bond, not a drilling bond, and shall endure until the well has been plugged and abandoned, and such plugging and abandonment approved by the division. Transfer of the well or property does not release the bond. In case of transfer and the principal desires to be released from the bond, he shall proceed as follows:

(1) The principal on the bond shall notify the division in writing that the well, or wells, covered by the bond are being or have been transferred to a certain transferee. The notice shall name the wells and shall give their exact location.

(2) On the same instrument the transferee shall recite that he accepts such transfer and accepts the responsibility for such well, or wells, under his bond which shall be tendered therewith.

(3) When the division has approved the transfer, the transferor is immediately released of the plugging responsibility of the well, or wells, constitute all of the wells covered by the bond, such bond will be released by written notice from the division to the principal and to the surety company.

C. The division director is vested with power to act for the division in all matters relating to this rule.
[Recompiled 12/31/01]

HISTORY OF 19.14.20 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-101, Plugging Bonds, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-102.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 21 DRILLING PERMIT

19.14.21.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.21.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.21.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.21.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.21.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.21.6 OBJECTIVE: [RESERVED]

19.14.21.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.21.8 DRILLING PERMIT:

A. Prior to the commencement of operations, the owner or operator of any proposed well to be drilled for geothermal exploration, production, observation, or thermal gradient, or for injection or disposal purposes, shall file division form G-101, application for permit to drill, deepen or plug back-geothermal resources well, and obtain approval thereof from the division. form G-101 shall be accompanied by form G-102, geothermal resources well location and acreage dedication plat.

B. No permit shall be approved for the drilling of any well within the corporate limits of any city, town or village of this state unless notice of intention to drill such well has been given to the duly constituted governing body of such city, town or village or its duly authorized agent. Evidence of such notification shall accompany the application for a permit to drill (form G-101).
[Recompiled 12/31/01]

HISTORY OF 19.14.21 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-102, Drilling Permit, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-103.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 22 SIGN ON WELLS

19.14.22.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.22.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.22.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.22.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.22.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.22.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.22.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.22.8 SIGN ON WELLS: Each well, other than a thermal gradient well, shall be identified by a sign, posted on the drilling rig or not more than 20 feet from the well. Such sign shall be of durable construction and the lettering thereon kept in legible condition. Lettering shall be such that under normal conditions it shall be legible at a distance of 50 feet. Each sign shall show the name of the owner or operator of the well, the name of the lease, the number of the well, and the location of the well by quarter-quarter section, township and range. Each lease shall have a different and distinctive name, and the wells thereon shall be numbered in non-repetitive, logical sequence.
[Recompiled 12/31/01]

HISTORY OF 19.14.22 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-103, Sign on Wells, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-104.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 23 WELL SPACING

19.14.23.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.23.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.23.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.23.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.23.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.23.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.23.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.23.8 CLASSIFICATION OF WELLS:

A. Any well, other than a thermal gradient well, a geothermal observation well or a low-temperature thermal well, which is drilled a distance of one mile or more outside the boundary of any defined geothermal field and a distance of one mile or more beyond any well which is within one mile of such field, shall be classified as an exploratory well, and as such shall be spaced, drilled, operated and produced in accordance with these Geothermal Rules and Regulations.

B. Any well, other than a thermal gradient well, a geothermal observation well or a low-temperature thermal well, which is not an exploratory well as defined above shall be classified as a development well, unless such well is being drilled for injection or disposal purposes, in which case it will be appropriately classified.

C. Any well classified as a development well or injection or disposal well within a given geothermal field shall be drilled, operated and produced in accordance with these Geothermal Rules and Regulations unless special rules in conflict therewith have been promulgated for such field, said special rules then being applicable.
[Recompiled 12/31/01]

19.14.23.9 ACREAGE AND WELL LOCATION REQUIREMENTS:

A. Exploration wells. A well classified as an exploratory well shall be located on a designated drilling tract comprising at least 40 surface acres (being a quarter-quarter section of the U. S. public land surveys, or a projection thereof if on unsurveyed land) , and shall be located at least 330 feet from the outer boundary of the quarter-quarter section, at least 660 feet from the nearest such other well drilling to or capable of producing from or injection into the same formation to which it is projected, and at least 100 feet from any public road, street or highway dedicated prior to commencement of drilling.

B. Development wells. A well classified as a development well shall be located on a designated drilling tract comprising at least 10 surface acres (being a quarter-quarter-quarter section of the U.S. public land surveys or a projection thereof if on unsurveyed land), and shall be located at least 165 feet from the outer boundary of the quarter-quarter-quarter section, at least 330 feet from the nearest well drilling to or capable of production from or injection into the same geothermal reservoir to which it is projected, and at least 100 feet from any public road, street or highway dedicated prior to commencement of drilling.

C. Injection wells. Injection wells drilled for the purpose of injecting into a geothermal reservoir shall be located at least 330 feet from the outer boundary of the lease or drilling parcel and at least 100 feet from any public road, street or highway dedicated prior to commencement of drilling.

D. Disposal wells. There shall be no restriction as to the placement of geothermal disposal wells.

E. Thermal gradient wells and low-temperature thermal wells. There shall be no restriction as to the placement of thermal gradient wells or low-temperature thermal wells.
[Recompiled 12/31/01]

19.14.23.10 NON-STANDARD LOCATIONS:

A. The division director shall have the authority to grant an exception to the well location requirements of Rules B (1) , (2) , and (3) [now Subsections A, B and C of 19.14.23.9 NMAC] above without notice and hearing when such application is based upon topographical or geologic or engineering considerations.

B. Applications for such administrative approval shall be filed in duplicate and shall be accompanied by a plat showing the ownership of surrounding lands (within a 990-foot radius of the proposed location if application is for exception to Rule G-104 B (1) [now Subsection A of 19.14.23.9 NMAC] exploration wells; within a 495-foot radius of the proposed location if application is for exception to Rule G-104 B (2) [now Subsection B of 19.14.23.9 NMAC] development wells; within a 990-foot radius of the proposed location if application is for exception to Rule G-104 B (3) [now Subsection C of 19.14.23.9 NMAC] injection wells; and all drilling or completed wells thereon. If the proposed non-standard location is based upon topography, the plat shall also show the existent topographical conditions. If it is based upon geologic or engineering considerations, the application shall be accompanied by a geologic or engineering analysis, explaining the necessity for the non-standard location.

C. A copy of the application and accompanying plats and documents shall also be sent to the other owners, if any there be, within the above prescribed radii of the proposed non-standard location and the application shall state that such required copies have been so furnished. The division director may approve the non-standard location upon receipt of waivers from the above other owners or if no such other owner has entered an objection to the non-standard location within 20 days after receipt of the application by the division. If such objection is received, the matter will be set for hearing if the applicant so desires. If the director is not convinced of the necessity or desirability of such exception, he may require supplemental information to justify the exception, or set the matter for hearing if the applicant so desires.
[Recompiled 12/31/01]

19.14.23.11 OFFSETTING ACTION: Whenever an exception to the well location requirements is granted, the division after hearing may take such action as may be necessary to offset any advantage the person securing the exception may gain over other owners within the same geothermal reservoir.
[Recompiled 12/31/01]

19.14.23.12 SPECIAL ACREAGE AND WELL LOCATION REQUIREMENTS: In order to prevent waste and protect correlative rights, the division may, after notice and hearing, adopt different well location requirements and greater or lesser acreage dedication requirements than those contained in Rules G-104 B (1), (2), and (3) [now Subsections A, B and C of 19.14.23.9 NMAC] above for a particular geothermal reservoir and may adopt special well location and acreage dedication requirements for a particular low-temperature thermal field.
[Recompiled 12/31/01]

HISTORY OF 19.14.23 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-104, Well Spacing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-105.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 24 ROTARY DRILLING AND CABLE TOOL DRILLING

19.14.24.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
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19.14.24.2 SCOPE: [RESERVED]
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19.14.24.3 STATUTORY AUTHORITY: [RESERVED]
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19.14.24.4 DURATION: [RESERVED]
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19.14.24.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.24.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.24.8 ROTARY DRILLING AND CABLE TOOL DRILLING: Rotary drilling equipment, adequately equipped to contain underground pressures and prevent or control blowouts, shall be used for the drilling of all geothermal resources wells except thermal gradient wells, low-temperature thermal wells and disposal wells, none of which will penetrate any high pressure zone or formation, in which case cable tools may be used.
[Recompiled 12/31/01]

HISTORY OF 19.14.24 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-105, Rotary Drilling and Cable Tool Drilling, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-106.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 25 DRILLING MUD AND MUD PITS

19.14.25.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
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19.14.25.2 SCOPE: [RESERVED]
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19.14.25.3 STATUTORY AUTHORITY: [RESERVED]
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[Recompiled 12/31/01]

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19.14.25.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.25.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.25.8 DRILLING MUD AND MUD PITS:

A. In order to assure an adequate supply of drilling fluid to confine all natural fluids to their respective native strata and to prevent blowouts, each operator shall, prior to commencing drilling operations, provide a pit of adequate size to hold such drilling fluid and to receive drill cuttings, and such pit shall be so constructed and maintained to prevent contaminants from overflowing on the surface of the ground and/or entering any water course.

B. The temperature of the return mud shall be monitored continuously during the drilling of the surface casing hole, and in the case of a thermal gradient well, shall be monitored to total depth. Either a continuous temperature recording device shall be installed and maintained in good working condition, or the temperature shall be measured manually and recorded at least one time each hour.
[Recompiled 12/31/01]

HISTORY OF 19.14.25 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-106, Drilling Mud and Mud Pits, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-107.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 26 SEALING OFF STRATA

19.14.26.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.26.2 SCOPE: [RESERVED]
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19.14.26.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.26.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.26.5 EFFECTIVE DATE: [November 15, 1983]
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19.14.26.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.26.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.26.8 SEALING OFF STRATA:

A. During the drilling of any well, all fresh water strata and salt water strata overlying the geothermal resources strata shall be sealed or separated to prevent the migration of fluids from one stratum to the other.

B. All waters of present or probable future value for domestic, commercial, agricultural or stock purposes shall be confined to their respective strata and shall be adequately protected by methods approved by the division. Special precautions by methods satisfactory to the division shall be taken to guard against loss of artesian water from the strata in which it occurs, and to prevent the contamination of such artesian water strata by any objectional geothermal fluids. Sealing off of strata, and migration prevention shall ordinarily be accomplished by cementing casing.
[Recompiled 12/31/01]

HISTORY OF 19.14.26 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-107, Sealing Off Strata, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-108.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 27 CASING AND CEMENTING REQUIREMENTS

19.14.27.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.27.2 SCOPE: [RESERVED]
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19.14.27.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.27.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.27.8 CASING AND CEMENTING REQUIREMENTS:

A. All wells drilled for the production of geothermal resources, including low-temperature thermal wells, and all specialty wells, including injection and disposal wells, shall be cased and cemented in such manner as to protect surface waters, if any, useable ground waters, geothermal resources, and life, health and property. Thermal gradient wells shall be drilled, completed and plugged in such a manner as to protect surface waters, in any, and useable ground waters. The division may require casing and cementing as is deemed necessary for such wells.

B. All casing strings reaching the surface shall provide adequate anchorage for blowout prevention equipment, hole pressure control, and protection for all natural resources. Although specifications for casing programs shall be determined on a well-to-well basis, the following general casing requirements should be used as guidelines in submitting form G-101, application for permit to drill, deepen, or plug back-geothermal resources well.

(1) Conductor Pipe: A minimum of 90 feet and a maximum of 200 feet. In special cases the division may allow conductor pipe to be run and cemented at deeper depths. Annular space is to be cemented solid to the surface. An annular blowout-preventer or equivalent approved by the division shall be installed on conductor pipe on exploratory wells and on development wells when deemed necessary by the division. Note: For thermal gradient wells and low-temperature thermal wells the conductor pipe requirement may be reduced or waived by the division. The above conductor pipe requirements are not meant to be applicable to the single or double joint of large diameter pipe often run to keep mud out of the cellar.

(2) Surface Casing: Except in the case of thermal gradient wells and low-temperature thermal wells, the surface casing hole shall be logged with an electrical or radioactivity log, or equivalent, before running casing. Note: This requirement may vary from area to area, depending upon the amount of subsurface data available, and may be waived under certain conditions. Requests for exceptions to the logging requirement should be noted on form G-101 when applying for a drilling permit. Surface casing shall provide for control of formation fluids, for protection of useable ground water and for adequate anchorage for blowout-prevention equipment. All surface casing shall be, if possible, cemented solid to the surface.

(a) Length of Surface Casing:

(i) In areas where subsurface geological conditions are variable or unknown, surface casing in general shall be set at a depth equalling or exceeding 10 percent of the proposed total depth of the well. A minimum of 200 feet and a maximum of 1,500 feet of surface casing shall be set.

(ii) In areas of known high formation pressure, surface casing shall be set at a depth determined by the division after a careful study of geological conditions. The division will make such a determination within 30 days. Drilling shall not commence until such determination has been made.

(iii) Within the confines of designated geothermal fields, the depth at which surface casing shall be set shall be determined by the division on the basis of known field conditions. Requirements (a)(1) and (a)(2) [now (i) and (ii) of Subparagraph (a) and (b)of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above may be waived for low-temperature thermal wells.

(b) Cementing Point for Surface Casing:

(i) In areas where subsurface geological conditions are variable or unknown, surface casing shall be set in accordance with (a) (1) [now (i) Subparagraph (a) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above and through a sufficient series of low permeability, competent lithologic units (such as claystone or siltstone) to ensure a solid anchor for blowout-prevention equipment and to protect useable ground water and surface water from contamination. A second string of surface casing may be required if the first string has not been cemented through a sufficient series of low permeability, competent lithologic units and either a rapidly increasing thermal gradient or rapidly increasing formation pressures are encounted.

(ii) In areas of known high formation pressure, surface casing shall be set in accordance with (a) (2) [now (ii) Subparagraph (a) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above and through a sufficient series of low permeability, competent lithologic units (such as claystone, siltstone or basalt) to ensure a solid anchor for blowout-prevention equipment and to protect useable ground water and surface water from contamination. A second string of surface casing may be required, before drilling into the known high pressure zone is permitted, if the first string of surface casing has not been cemented through a sufficient series of low-permeability, competent lithologic units.

(iii) Within the confines of designated geothermal fields, cementing point shall be determined by the division on the basis of known field conditions. Requirements (b)(1) and (b)(2) [now (i) and (ii) of Subparagraph (b) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above may be waived for low-temperature thermal wells.

(c) Return mud temperatures: Return mud temperatures shall be entered into the log book after each joint of pipe has been drilled down. See Rule G-106(b) [now Subsection B of 19.14.25.8 NMAC].

(d) Blowout-prevention equipment (BOPE): BOPE capable of shutting in the well during any operation shall be installed on the surface casing and maintained ready for use at all time (see Section H) [see compiler's note].

(3) Intermediate casing: Intermediate casing shall be required for protection against anomalous pressure zones, caveins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings shall be, if possible, cemented solid to the surface. This requirement (to circulate cement) may be waived if the production casing will be cemented to the surface.

(4) Production casing: Production casing may be set above or through the producing or injection zone and cemented above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the zone, to segregate zones and to prevent movement of fluids behind the casing into zones that contain useable ground water. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if run. If the production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet, the lap shall be cemented solid, and it shall be pressure tested to ensure its integrity. In order to reduce casing corrosion, production casing used to produce corrosive brine reservoirs shall be of the same nominal inside diameter from the shoe of the casing to the ground surface.

(5) Casing and Cement Tests: All casing strings shall be tested after cementing and before commencing any other operations on the well. Form G-103 shall be filed for each casing string reporting the grade and weight of pipe used. In the case of combination strings utilizing pipe of varied grades or weights, the footage of each grade and weight used shall be reported. The results of the casing test, including actual pressure held on the pipe and the pressure drop observed, shall also be reported on the form G-103. See Rule G-203C(2) [now Paragraph (2) of Subsection C of 19.14.54.8 NMAC].

(a) Casing strings in wells drilled with rotary tools shall be pressure-tested. Minimum casing test pressure shall be approximately one-third of the manufacturer's rated internal yield pressure except that the test pressure shall not be less than 600 pounds per square inch and need not be greater than 1,500 pounds per square inch. In cases where combination strings are involved, the above test pressures shall apply to the lowest pressure-rated casing used. Test pressures shall be applied for a period of 30 minutes. If a drop of more than ten percent of the test pressure should occur, the casing or cement job shall be considered defective and corrective measures shall be taken before commencing any further operations on the well.

(b) Casing strings in wells drilled with cable tools may be tested as outlined in Rule 5(a) [now Subparagraph (a) of Paragraph (5) of Subsection B of 19.14.27.8 NMAC] above, or by bailing the well dry, in which case the well must remain satisfactorily dry for a period of at least one hour before commencing any further operations on the well.

(6) Defective casing or cementing: If the cementing of any casing appears to be defective, or if the casing in any well appears to be defective or corroded or parted, or if there appears to be any underground leakage for whatever other reason, which may cause or permit underground waste, the operator shall proceed with diligence to use the appropriate method or methods to eliminate such hazard. If such hazard of waste cannot be eliminated, the well shall be plugged and abandoned in accordance with a division approved plugging program.

(7) Logging: All wells, except thermal gradient wells and low-temperature thermal wells, shall be logged with an electrical or radioactivity log, or equivalent, from total depth to the surface casing shoe. This requirement may be waived by the division depending upon geological or engineering conditions.

[Recompiled 12/31/01]

HISTORY OF 19.14.27 NMAC:

Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:

Rule G-108, Casing and Cementing Requirements, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-109.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 28 DEVIATION TESTS AND DIRECTIONAL DRILLING

19.14.28.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.28.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.28.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.28.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.28.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.28.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.28.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.28.8 DEVIATION TESTS AND DIRECTIONAL DRILLING:

A. Any well which is deepened or drilled with rotary tools shall be tested at reasonably frequent intervals to determine the deviation from the vertical. Such tests shall be made at least each 500 feet or at the first bit change succeeding 500 feet. A tabulation of all deviation tests, sworn to and notarized, shall be filed with form G-105, geothermal resources well log. When the deviation averages more than five degrees in any 500-foot interval, the division director may require that a directional survey be run to establish the location of the producing interval(s).

B. The division director, at the request of an offset operator, may require any operator to make a directional survey of any well. Said directional survey and all associated costs shall be at the expense of the requesting party and shall be secured in advance by a $5,000.00 indemnity bond posted with and approved by the division. The requesting party may designate the well survey company, and said survey shall be witnessed by a representative of the division.

C. No well shall be intentionally deviated except toward the vertical without prior permission from the division. Permission to deviate a well other than toward the vertical shall be obtained on division form G-103 with copies of said form G-103 being furnished to all other operators owning leases offsetting the drilling tract, if any there be. Upon request of the division director any well which was intentionally deviated shall be directionally surveyed. The division may at its option witness such survey and the Santa Fe office shall be notified of the date and hour all directional surveys are to be conducted. All directional surveys run on any well which was intentionally deviated in any manner for any reason must be filed with the division upon completion of the well. Form G-104, certificate of compliance and authorization to produce geothermal resources, will not be approved until the operator has submitted an affidavit that all such directional surveys have been filed.
[Recompiled 12/31/01]

HISTORY OF 19.14.28 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-109, Deviation Tests and Directional Drilling, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-110.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 29 SHOOTING AND CHEMICAL TREATMENT OF WELLS

19.14.29.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.

[Recompiled 12/31/01]

19.14.29.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.29.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.29.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.29.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.29.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.29.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.29.8 SHOOTING AND CHEMICAL TREATMENT OF WELLS: If injury results to the producing formation, casing or casing seat from shooting or treating a well, the operator thereof shall proceed with diligence to use the appropriate method and means for rectifying such damage. If shooting or chemical treating results in irreparable injury to the well, the division may require the operator to properly plug and abandon the well.
[Recompiled 12/31/01]

HISTORY OF 19.14.29 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-110, Shooting and Chemical Treatment of Wells, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-111.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 30 RIGHT OF ENTRY

19.14.30.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.30.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.30.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.30.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.30.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.30.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.30.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.30.8 RIGHT OF ENTRY: The division or its duly authorized representatives shall have the right of entry onto any geothermal resources site for the purpose of inspecting wells and equipment and for the purpose of determining whether compliance with or violation of these rules is occurring.
[Recompiled 12/31/01]

HISTORY OF 19.14.30 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-111, Right of Entry, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-112.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 31 NOISE ABATEMENT

19.14.31.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.31.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.31.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.31.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.31.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.31.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.31.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.31.8 NOISE ABATEMENT: Adequate noise abatement equipment shall be installed and maintained in good condition to reduce noise to a level approved by the division or its representative on any drilling or producing geothermal resources well located within 1,500 feet of a habitation, school or church.
[Recompiled 12/31/01]

HISTORY OF 19.14.31 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-112, Noise Abatement, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-113.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 32 SAFETY REGULATIONS

19.14.32.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.32.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.32.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.32.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.32.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.32.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.32.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.32.8 SAFETY REGULATIONS: The well site around any drilling or producing well shall be kept clear of any rubbish or debris or fuel which may constitute a fire hazard. In any area where there is any likelihood of encountering unexpected hydrocarbons, the drilling mud and cuttings shall be stored in a pit a safe distance from the drilling rig. All waste shall be burned or disposed of in such a manner as to avoid creating a fire hazard.
[Recompiled 12/31/01]

HISTORY OF 19.14.32 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-113, Safety Regulations, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-114.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 33 WELL HEADS AND PRODUCTION EQUIPMENT

19.14.33.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.33.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.33.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.33.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.33.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.33.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.33.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.33.8 WELL HEADS AND PRODUCTION EQUIPMENT:

A. Well heads and all fittings appurtenant thereto shall be installed and maintained in good condition so that all necessary pressure tests may be readily made on flowing wells. The well head and related parts and fittings shall have a test pressure equivalent to at least 150 percent of the calculated or known pressure in the reservoir from which production is obtained or expected.

B. Valves shall be installed and maintained in good order to permit pressures to be obtained on the production casing and the annulus between the casing strings.

C. Flow lines shall be of adequate pressure rating and capacity and shall be sufficiently equipped with expansion bends to prevent leakage or rupture.

D. All separators, pumps, mufflers, manifolds, flowlines, and other equipment used for the production of geothermal resources shall be of adequate pressure rating and capacity and shall be maintained in good condition in order to prevent loss of or damage to human life and health or to property or natural resources.
[Recompiled 12/31/01]

HISTORY OF 19.14.33 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-114, Well Heads and Production Equipment, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-115.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 34 CORROSION

19.14.34.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.34.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.34.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.34.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.34.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.34.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.34.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.34.8 CORROSION: All well head equipment, surface production equipment, flowlines and pipelines and subsurface casing and tubing shall be subject to periodic surveillance to prevent leakage or rupture and to safeguard human life and health and property and natural resources.
[Recompiled 12/31/01]

HISTORY OF 19.14.34 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-115, Corrosion, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-116.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 35 DISPOSAL OF PRODUCED WATERS

19.14.35.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.35.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.35.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.35.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.35.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.35.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.35.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.35.8 DISPOSAL OF PRODUCED WATERS: The disposal of highly mineralized waters produced from geothermal resources wells shall be in such a manner as to not constitute a hazard to surface waters or underground supplies of useable water.
[Recompiled 12/31/01]

HISTORY OF 19.14.35 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-116, Disposal of Produced Waters, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-117.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 36 NOTIFICATION OF FIRE, BREAKS, LEAKS, SPILLS AND BLOWOUTS

19.14.36.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.36.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.36.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.36.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.36.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.36.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.36.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.36.8 NOTIFICATION OF FIRE, BREAKS, LEAKS, SPILLS AND BLOWOUTS:

A. The division shall be notified of any fire, break, leak, spill or blowout occurring at any geothermal drilling, producing, transporting, treating, disposal or utilization facility in the state of New Mexico by the person operating or controlling such facility.

B. "Facility", for the purpose of this rule, shall include any geothermal drilling, producing, injection or disposal well; any pipeline through which geothermal resources or the waste products thereof are gathered or transported; any tank or other storage unit into which geothermal products, waters or wastes are produced, received or stored; any treating plant in which geothermal resources are treated or processed; any electrical generating plant in which geothermal resources are utilized; and any drilling pit, slush pit or storage pit or pond associated with geothermal drilling, producing, treating or utilization processes in which hydrocarbons or hydrocarbon waste or residue, salt water, strong caustics or acids, or other deleterious chemicals or harmful substances are present.

C. Notification to the division of such fire, break, leak, spill or blowout shall be in accordance with the provisions set forth below:

(1) Well Blowouts. Notification of well blowouts and/or fires shall be "immediate notification" described below.

(2) "Major" breaks, spills or leaks. Notification of breaks, spills, or leaks of wellheads, pipelines, or tanks, or drilling pits, slush pits or storage pits or ponds, the result of which 50 barrels or more of liquids containing hydrocarbons or hydrocarbon wastes, salt water, strong caustics or strong acids or other deleterious substances reach a water course or enter a stream or lake, or in which noxious gases escape or any quantity of fluids are lost which may with reasonable probability endanger human health or result in substantial damage to property, shall be "immediate notification" described below.

(3) "Minor" breaks, spills or leaks. Notification of breaks, spills or leaks of wellheads, pipelines, or tanks, or drilling pits, slush pits or storage pits or ponds, the result of which 25 barrels or more but less than 50 barrels of liquids containing hydrocarbons or hydrocarbon wastes, salt water, strong caustics or strong acids or other deleterious substances are lost or in which noxious gases escape, but in which there is no danger of human health nor of substantial damage to property shall be "subsequent notice" described below.

(4) Fires. Notification of fires at geothermal installations in which there is reasonable probability of danger to human health or substantial damage to adjoining properties or substantial loss of geothermal resources shall be "immediate notice" described below. Notification of fires of lesser magnitude but of $500.00 or more of property damage or $500.00 or more geothermal resources loss shall be "subsequent notice" described below.
[Recompiled 12/31/01]

19.14.36.9 IMMEDIATE NOTIFICATION: "Immediate Notification" shall be as soon as possible after discovery and shall be in person or by telephone to the Santa Fe office of the nearest district office of the division if the incident occurs

during business hours. If the incident occurs after business hours, notification shall be in accordance with the latest division memorandum on the subject. A complete written report of the incident shall be submitted to the Santa Fe office of the division within ten days after discovery of the incident.
[Recompiled 12/31/01]

19.14.36.10 SUBSEQUENT NOTIFICATION: "Subsequent notification" shall be a complete written report of the incident and shall be submitted to the Santa Fe office of the division within ten days after discovery of the incident.
[Recompiled 12/31/01]

19.14.36.11 CONTENT OF NOTIFICATION: All reports of fires, breaks, spills, leaks or blowouts, whether verbal or written, shall identify the location of the incident by quarter-quarter, section, township and range, and by distance and direction from the nearest town or prominent landmark so that the exact site of the incident can be readily located on the ground. The report shall specify the nature and quantity of the loss and also the general condition prevailing in the area, including precipitation, temperature and soil conditions. The report shall also detail the measures that have been taken and are being taken to remedy the situation reported.
[Recompiled 12/31/01]

19.14.36.12 WATERCOURSE: For the purpose of this Rule, is defined as any lake-bed or gully, draw, streambed, wash, arroyo or natural or man-made channel through which water flows or has flowed.
[Recompiled 12/31/01]

HISTORY OF 19.14.36 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-117, Notification of Fire, Breaks, Leaks, Spills and Blowouts, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-118.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 37 MEASUREMENT OF PRODUCTION

19.14.37.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.37.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.37.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.37.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.37.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.37.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.37.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.37.8 MEASUREMENT OF PRODUCTION: All production from a completed geothermal resources well shall be accounted for by continuous metering or by other method approved by the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.37 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-118, Measurement of Production, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-119.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 38 UTILIZATION OF GEOTHERMAL RESOURCES

19.14.38.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.38.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.38.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.38.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.38.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.38.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.38.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.38.8 UTILIZATION OF GEOTHERMAL RESOURCES: After the completion of a geothermal resources well, all production from said well shall be put to beneficial use. No production shall be permitted unless beneficial use is made thereof except for authorized periods of testing, in which case proper disposition of produced liquids shall be made.
[Recompiled 12/31/01]

HISTORY OF 19.14.38 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-119, Utilization of Geothermal Resources, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-200.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 51 GENERAL PROVISIONS

19.14.51.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.51.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.51.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.51.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.51.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.51.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.51.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.51.8 BOOKS AND RECORDS: All producers, transporters, purchasers or utilizers of geothermal resources within the state of New Mexico shall make and keep appropriate books and records for a period of not less than five years, covering their operations in this state, from which they may be able to substantiate the reports required by these rules.
[Recompiled 12/31/01]

19.14.51.9 WELL RECORDS: The owner or operator of any geothermal resources well shall keep, or cause to be kept, a careful and accurate well log and history of the drilling of any such well, including the lithologic characteristics and depth of formations encountered, and the depths, pressures and temperatures of water-bearing and steam-bearing strata. These data, as well as such other tests, surveys and logs which may be taken on the well including the temperatures, chemical compositions and physical characteristics of fluids encountered in the well, deviation, directional and temperature surveys, logs, including electrical logs, physical logs and core logs, and tests, including potential tests, shall be placed in the custody of the designated agent (see Rule G-100) [now 19.14.12.17 NMAC] of the owner or operator of the well and shall remain in such custody within the state of New Mexico until all required forms and attachments pertaining to the well have been filed with the division. These data shall be subject to inspection, during normal business hours, by the division or its representatives, and by the state engineer or his representatives.
[Recompiled 12/31/01]

19.14.51.10 WHERE TO FILE REPORTS: All forms and reports required by these rules shall be filed with the New Mexico oil conservation division, geothermal section, Post Office Box 2088, Santa Fe, New Mexico 87501.
[Recompiled 12/31/01]

19.14.51.11 ADDITIONAL DATA: These rules shall not be construed to limit or restrict the authority of the division to require the furnishing of such additional reports, data or other information relative to the production, transportation or utilization of geothermal resources in the state of New Mexico as may appear to be necessary or desirable, either generally or specifically, for the prevention of waste and the conservation of natural resources of the state of New Mexico.
[Recompiled 12/31/01]

HISTORY OF 19.14.51 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-200, General, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-201.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 52 APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK-GEOTHERMAL RESOURCES WELL (FORM G-101)

19.14.52.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.52.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.52.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.52.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.52.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.52.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.52.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.52.8 APPLICATION FOR PERMIT TO DRILL, DEEPEN OR PLUG BACK-GEOTHERMAL RESOURCES WELL (FORM G-101): Before commencement of drilling or deepening operations of any geothermal resources well, or before plugging a well back ro another zone, the operator of the well shall obtain a permit to do so. To obtain such a permit the operator shall submit to the division four copies of form G-101, application for permit to drill, deepen or plug back-geothermal resources well, completely filled in. If the operator has an approved bond in accordance with Rule G-101 [now 19.14.20 NMAC] and has filed satisfactory "designation of agent" (Rule G-100) [now 19.14.1.17 NMAC], and the proposed well meets the spacing and well location requirements (Rule G-104) [now 19.14.23 NMAC] , one copy of the drilling permit will be returned to him on which will be noted the division's approval, with any modification deemed advisable. If the proposal cannot be approved for any reason, the forms G-101 will be returned with the cause for rejection stated thereon.

A. Each copy of form G-101 must be accompanied by one copy of form G-102, geothermal resources well location and acreage dedication plat. (See Rule G-202) [now 19.14.53 NMAC].

B. If the well is to be drilled on state land, five copies of forms G-101 and G-102 shall be submitted, the extra copy being for the state land office.
[Recompiled 12/31/01]

HISTORY OF 19.14.52 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-201, Application for Permit to Drill, Deepen or Plug Back-Geothermal Resources Well (Form G-101), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-202.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 53 GEOTHERMAL RESOURCES WELL LOCATION AND ACREAGE DEDICATION PLAT. (FORM G-102)

19.14.53.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.53.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.53.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.53.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.53.5 EFFECTIVE DATE: [Novemver 15, 1983]
[Recompiled 12/31/01]

19.14.53.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.53.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.53.8 GEOTHERMAL RESOURCES WELL LOCATION AND ACREAGE DEDICATION PLAT. (FORM G-102):

A. Form G-102 is a dual purpose form used to show the exact location of the well and the acreage dedicated thereto. The form is also used to show the ownership and status of each lease contained within the dedicated acreage. When there is more than one working interest or royalty owner on a given lease, designation of the majority owner et al. will be sufficient.

B. All information required on form G-102 shall be filled in and certified by the operator of the well except the well location on the plat. This is to be plotted from the outer boundaries of the section and certified by a registered professional engineer and/or land surveyor, registered in the state of New Mexico, or a surveyor approved by the Division. The surveyed location of thermal gradient wells is not required. Instead, an estimated location in a given quarter-quarter section will suffice.

C. Form G-102 shall be submitted in quadruplicate or quintuplicate as provided in Rule G-201 [now 19.14.52 NMAC].

D. Amended form G-102 (in quadruplicate or quintuplicate) shall be filed in the event there is a change in any of the information previously submitted. The well location need not be certified when filing amended form G-102.
[Recompiled 12/31/01]

HISTORY OF 19.14.53 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-202, Geothermal Resources Well Location and Acreage Dedication Plat (Form G-102), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-203.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 54 SUNDRY NOTICES AND REPORTS ON GEOTHERMAL RESOURCES WELL (FORM G-103)

19.14.54.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.54.2 SCOPE: [RESERVED]

19.14.54.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.54.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.54.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.54.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.54.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.54.8 SUNDRY NOTICES AND REPORTS ON GEOTHERMAL RESOURCES WELL (FORM G-103): Form G-103 is a dual purpose form to be filed with the Santa Fe office of the division to obtain approval prior to commencing certain operations and also to report various completed operations.

A. Form G-103 as a notice of intention: form G-103 shall be filed in duplicate by the operator and approval obtained from the division prior to:

(1) Effecting a change of plans from those previously approved on form G-101 or form G-103.

(2) Altering a drilling wells casing program or pulling casing or otherwise altering an existing well's casing installation.

(3) Temporarily abandoning a well. (See Rule G-303 B) [now 19.14.73.9 NMAC].

(4) Plugging and abandoning a well. (See Rules G-302 and G-303 A) [now 19.14.72 NMAC and 19.14.73.8 NMAC].

(5) Performing remedial work on a well which, when completed, will affect the original status of the well. (This shall include making new perforations in existing wells or squeezing old perforations in existing wells, but is not applicable to new wells in the process of being completed not to old wells being deepened or plugged back to another zone when such recompletion has been authorized by an approved form G-101, application for permit to drill, deepen, or plug back, nor to acidizing, fracturing or cleaning out previously completed wells.).

(6) In the case of well plugging operations, the notice of intention shall include a detailed statement of the proposed work, including plans for shooting and pulling casing, plans for mudding, including weight of mud, plans for cementing, including number of sacks of cement and depths of plugs and the time and date of the proposed plugging operations. (See Rules G-302 and G-303 A) [now 19.14.72 NMAC and 19.14.73.8 NMAC].

B. Form G-103 as a Subsequent Report. Form G-103 as a subsequent report of operations shall be filed in accordance with the section of this Rule applicable to the particular operation being reported. Form G-103 is to be used in reporting such completed operations as:

(1) Commencement of drilling operations
(2) Casing and cement test
(3) Altering a well's casing installation
(4) Temporary abandonment
(5) Plugging and Abandonment
(6) Plugging back or deepening
(7) Remedial work
(8) Change in ownership of a drilling well
(9) Such other operations which affect the original status of the well but which are not specifically covered herein.

C. Filing Form G-103 as a Subsequent Report. Information to be entered on form G-103, subsequent report, for a particular operation is as follows:

(1) Report of Commencement of Drilling Operations. Within ten days following the commencement of drilling operations, the operator of the well shall file a report thereof on form G-103 in duplicate. Such report shall indicate the hour and the date the well was spudded.

(2) Report of Results of Test of Casing and Cement Job; Report of Casing Alteration. A report of casing and cement test shall be filed by the operator of the well within ten days following the setting of each string of casing or liner. Said report shall be filed in duplicate on form G-103 and shall present a detailed description of the test method employed and the results obtained by such test, and any other pertinent information required by Rule G-108 B(5) [now Paragraph (5) of Subsection B of 19.14.27.8 NMAC]. The report shall also indicate the top of the cement and the means by which such top was determined. It shall also indicate any changes from the casing program previously authorized for the well.

(3) Report of Temporary Abandonment. A report of temporary abandonment of a well shall be filed by the operator of the well within ten days following completion of the work. The report shall be filed in duplicate and shall present a detailed account of the work done on the well, including location and type of plugs used, if any, type and status of surface and downhole equipment, and other pertinent information relative to the overall status of the well.

(4) Report on Plugging of Well.

(a) A report of plugging operations shall be filed by the operator of the well within 30 days following completion of plugging operations on any well. Said report shall be filed in triplicate on form G-103 and shall include the date the plugging operations were begun and the date the work was completed, a detailed account of the manner in which the work was performed including the depths and lengths of the various plugs set, the nature and quantities of materials employed in the plugging operations including the weight of the mud used, the size and depth of all casing left in the hole and any other pertinent information. (See Rules G-301 - G-303) [now 19.14.71 NMAC - 19.14.73 NMAC] regarding plugging operations.

(b) No plugging report will be approved by the division until all forms and reports on the well have been filed and the pits have been filled and the location levelled and cleared of junk. It shall be the responsibility of the operator to contact the Santa Fe office of the division when the location has been so restored in order to arrange for an inspection of the plugged well and the location by a division representative.

(5) Report of Remedial Work. A report of remedial work performed on a producing well or former producing well shall be filed by the operator of the well within 30 days following completion of such work. Said report shall be filed in duplicate on form G-103 and shall present a detailed account of the work done and the manner in which such work was performed; the daily production from the well both prior to and after the remedial operation; the size and depth of shots; the quantity of sand, acid, chemical or other materials employed in the operation and any other pertinent information. Among the types of remedial work to be reported on form G-103 are the following:

(a) Report on shooting, fluid fracturing or chemical treatment of a previously completed well
(b) Report on squeeze job
(c) Report on setting of liner or packer
(d) Report of any other remedial operations which are not specifically covered herein
(e) Report on deepening or plugging back

(6) Report of Change in Ownership of a Drilling Well. A report of change of ownership shall be filed by the new owner of any drilling well within ten days following actual transfer of ownership. Said report shall be filed in triplicate on form G-103 and shall include the name and address of both the new owner and the previous owner, the effective date of the change of ownership and any other pertinent information. No change in the ownership of a drilling well will be approved by the division unless the new owner has an approved bond in accordance with Rule G-101 [now 19.14.20 NMAC] and has filed satisfactory "Designation of Agent (Rule G-100) [now 19.14.1.17 NMAC]. The former owner of the well, to obtain release of his bond, shall follow the procedures set forth in Rule G-101(b) [now Subsection B of 19.14.20.8 NMAC]. (Form G-104 [now 19.14.23 NMAC] shall be used to report transfer of ownership of a completed well; see Rule G-204) [now 19.14.55 NMAC].

(7) Other Reports on Wells. Reports on any other operations which affect the original status of the well which are not specifically covered herein shall be submitted to the division on form G-103, in triplicate, by the operator of the well within ten days following the completion of such operation.

[Recompiled 12/31/01]

HISTORY OF 19.14.54 NMAC:

Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:

Rule G-203, Sundry Notices and Reports on Geothermal Resources Well (Form G-103), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-204.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 55 CERTIFICATE OF COMPLIANCE AND AUTHORIZATION TO PRODUCE GEOTHERMAL RESOURCES (FORM G-104)

19.14.55.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.55.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.55.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.55.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.55.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.55.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.55.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.55.8 CERTIFICATE OF COMPLIANCE AND AUTHORIZATION TO PRODUCE GEOTHERMAL RESOURCES (FORM G-104):

A. Prior to placing any geothermal resources well on production, injection or disposal, the owner or operator of said well shall file (in quintuplicate) with the division and receive approval thereof form G-104, certificate of compliance and authorization to produce geothermal resources, outlining thereon the information required and certifying that all division rules and regulations pertaining to the well have been complied with. Production of or injection into any well in violation of this rule shall result in the well being shut in by the division subject to the penalties provided by law for violation of the division's rules, orders and regulations. (In addition to form G-104 being approved, additional approval for injection or disposal must be obtained pursuant to Rules G-501- G-505) [now 19.14.91 NMAC - 19.14.95 NMAC]. Form G-104 must be accompanied by three copies of form G-105, geothermal resources well log outlining the data required and with the attachments required by Rule G-205 A [now 19.14.56.8 NMAC], three copies of form G-106, geothermal resources well summary report (See Rule G-206) [now 19.14.57 NMAC] completely filled in and three copies of rorm G-107, geothermal resources well history (See Rule G-207) [now 19.14.58 NMAC] completely filled in.

B. Form G-104 shall also be filed in quintuplicate when there is a change in purchaser from a well or when there is a change of ownership of a producing well, injection well or disposal well. No change of ownership will be approved by the division unless the new owner has an approved bond in accordance with Rule G-101 [now 19.14.20 NMAC] and has filed satisfactory "Designation of Agent" (Rule G-100) [now 19.14.1.17 NMAC]. The former owner of the well, to obtain release of his bond, shall follow the procedures set forth in Rule G-101(b) [now Subsection B or 19.14.20.8 NMAC] (Form G-103 shall be used to report change of ownership of a drilling well; see Rule G-203 C(6).) [now Paragraph (6) of Subsection C of 19.14.54.8 NMAC].

C. After approval of form G-104, distribution of forms G-104, G-105, G-106 and G-107 shall be made by the division as follows:

(1) one approved copy of form G-104 shall be returned to the operator;

(2) one approved copy of form G-104 shall be forwarded to the purchaser from the well (except, of course, in the case of a disposal or injection well);

(3) one approved copy of form G-104 and one copy of each of Forms G-105, G-106 and G-107 shall be forwarded to the New Mexico bureau of mines;

(4) one approved copy of form G-104 and one copy each of forms G-105, G-106 and G-107 shall be forwarded to the United States geological survey; and

(5) one approved copy of form G-104 and one copy each of form G-105, G-106 and G-107 shall be retained by the division.

[Recompiled 12/31/01]

HISTORY OF 19.14.55 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-204, Certificate of Compliance and Authorization to Produce Geothermal Resources (Form G-104), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-205.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 56 GEOTHERMAL RESOURCES WELL LOG (FORM G-105)

19.14.56.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.56.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.56.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.56.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.56.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.56.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.56.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.56.8 FOR PRODUCING, INJECTION, OR DISPOSAL WELLS: Form G-105, geothermal resources well log, shall be filed in triplicate with the form G-104 when it is desired to put any geothermal resources well on production or injection or disposal. It shall be accompanied by copies of such logs, surveys, and tests which may have been conducted on the well, including electric logs, deviation and directional surveys, physical or chemical logs, water analyses, tests, including potential tests and temperature surveys. Failure to include these data and materials with the form G-105 will result in withholding approval of the form G-104, certificate of compliance and authorization to produce geothermal resources. Distribution of form G-105 for producing, injection or disposal wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey, and one copy retained by the division.
[Recompiled 12/31/01]

19.14.56.9 FOR INACTIVE OR TEMPORARILY ABANDONED WELLS: Form G-105, geothermal resources well log, with the attachments described in Rule G-205 A [now 19.14.56.8 NMAC], shall be filed in triplicate for every geothermal resources well, except thermal gradient wells, not on active producing or injection or disposal status within six months after cessation of active drilling operations on the well unless a permit for temporary abandonment shall have been approved for the well in accordance with Rule G-303 B [now 19.14.73.9 NMAC]. In no event, even in the case of prolonged temporary abandonment approved by the division, shall the filing of form G-105 with required attachments be delayed for more than five years after cessation of active drilling operations. Distribution of form G-105 for inactive or temporarily abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey, and one copy retained by the division.
[Recompiled 12/31/01]

19.14.56.10 FOR PLUGGED AND ABANDONED WELLS: Form G-105, geothermal resources well log, together with all the attachments required by Rule G-205 A [now 19.14.56.8 NMAC] above, shall be filed in triplicate for all plugged and abandoned wells, except thermal gradient wells, within six months after abandonment. Distribution of form G-105 for abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey, and one copy retained by the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.56 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives: Rule G-205, Geothermal Resources Well Log (Form G-105), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-206.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 57 GEOTHERMAL RESOURCES WELL SUMMARY REPORT (FORM G-106)

19.14.57.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.57.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.57.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.57.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.57.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.57.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.57.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.57.8 FOR PRODUCING, INJECTION, OR DISPOSAL WELLS: Form G-106, geothermal resources well summary report, completely filled in, shall be filed in triplicate with the form G-104 when it is desired to put any geothermal resources well on production or injection or disposal. Failure to file a completed form G-106 will result in withholding approval of the form G-104, certificate of compliance and authorization to produce geothermal resources. Distribution of form G-106 for producing, injection, or disposal wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey and one copy retained by the division.
[Recompiled 12/31/01]

19.14.57.9 FOR INACTIVE OR TEMPORARILY ABANDONED WELLS: Form G-106, geothermal resources well summary report, shall be filed in triplicate for every geothermal resources well, except thermal gradient wells, not on active producing or injection or disposal status within 90 days after cessation of active drilling operations. The owner or operator of the well shall state on the form the general results of the well's condition, i.e., whether the well is capable of production of geothermal resources and will be retained for such purpose, whether the well will be used for injection or disposal purposes, whether the well has been or will be plugged and abandoned or what other disposition of the well is to be made. A summary of the well's casing and cementing program shall be shown on the form, and in case the well is to be retained for production, injection or disposal purposes, the total mass flow in pounds per hour, flowing temperature in degrees fahrenheit, and flowing pressure in pounds per square inch gauge. Distribution of form G-106 for inactive or temporarily abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey and one copy retained by the division. If form G-106 is filed for an inactive or temporarily abandoned well, and the well later goes on active production or injection, refiling of form G-106 completely filled in accordance with Rule G-206-A [now 19.14.57.8 NMAC] above is required.
[Recompiled 12/31/01]

19.14.57.10 FOR PLUGGING AND ABANDONED WELLS: Form G-106, geothermal resources well summary report, completely filled in, shall be filed in triplicate for plugged and abandoned wells, except thermal gradient wells, within six months after abandonment. Distribution of form G-106 for abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey, and one copy retained by the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.57 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives: Rule G-206, Geothermal Resources Well Summary Report (Form G-106), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-207.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 58 GEOTHERMAL RESOURCES WELL HISTORY (FORM G-107)

19.14.58.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.58.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.58.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.58.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.58.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.58.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.58.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.58.8 FOR PRODUCING, INJECTION, OR DISPOSAL WELLS: Form G-107, geothermal resources well history, is a chronological history of the entire operation of drilling and completing the well and shall be filed in triplicate with the form G-104 when it is desirable to put any geothermal resources well on production or injection or disposal. Failure to file a completed form G-107 will result in witholding approval of form G-104, certificate of compliance and authorization to produce geothermal resources. Distribution of form G-107 for producing, injection or disposal wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey and one copy retained by the division.
[Recompiled 12/31/01]

19.14.58.9 FOR NON-PRODUCING OR TEMPORARILY ABANDONED WELLS OTHER THAN THERMAL GRADIENT WELLS: Form G-107, geothermal resources well history, shall be filed in triplicate for every geothermal resources well not on active producing or injection or disposal status within six months after cessation of active drilling operations on the well unless a permit for temporary abandonment shall have been approved for the well in accordance with Rule G-303 B [now 19.14.73.9 NMAC]. In no event, even in the case of prolonged temporary abandonment approved by the division, shall the filing of form G-107 be delayed for more than five years after cessation of active drilling operations. Distribution of form G-107 for inactive or temporarily abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey and one copy retained by the division.
[Recompiled 12/31/01]

19.14.58.10 FOR PLUGGED AND ABANDONED WELLS OTHER THAN THERMAL GRADIENT WELLS: Form G-107, geothermal resources well history, shall be filed in triplicate for plugged and abandoned wells within six months after abandonment. Distribution of form G-107 for abandoned wells shall be one copy to the New Mexico bureau of mines, one copy to the United States geological survey and one copy retained by the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.58 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-207, Geothermal Resources Well History (Form G-107), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-208.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 59 MONTHLY GEOTHERMAL PRODUCTION REPORT (FORM G-108)

19.14.59.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.59.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.59.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.59.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.59.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.59.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.59.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.59.8 MONTHLY GEOTHERMAL PRODUCTION REPORT (FORM G-108): After placing any geothermal well on production, the owner or operator thereof shall file in duplicate a monthly production report, form G-108, which report shall be due in the Santa Fe office of the division by the 20th day of each month and shall show the production from each well and each lease during the preceding calendar month.
[Recompiled 12/31/01]

HISTORY OF 19.14.59 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-208, Monthly Geothermal Production Report (Form G-108), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-209.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 60 MONTHLY GEOTHERMAL PURCHASER'S REPORT (FORM G-109)

19.14.60.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.60.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.60.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.60.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.60.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.60.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.60.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.60.8 MONTHLY GEOTHERMAL PURCHASER'S REPORT (FORM G-109): The purchaser of production from any geothermal resource well shall file in duplicate a monthly purchaser's report, form G-109, which report shall be due in the Santa Fe office of the division by the 15th day of each month and shall show the purchases made from all leases and wells connected to the purchaser's facilities during the preceding calendar month.
[Recompiled 12/31/01]

HISTORY OF 19.14.60 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-209, Monthly Geothermal Purchaser's Report (Form G-109), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-210.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 61 MONTHLY GEOTHERMAL INJECTION REPORT (FORM G-110)

19.14.61.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.61.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.61.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.61.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.61.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.61.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.61.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.61.8 MONTHLY GEOTHERMAL INJECTION REPORT (FORM G-110): After placing any well on injection or disposal in a geothermal resources field or area, the owner or operator thereof shall file in duplicate a monthly injection report, form G-110, which report shall be due in the Santa Fe office of the division by the 20th day of each month and shall show the zone or formation into which injection is being made, the volume injected, the average temperature of the injected fluid and the average injection pressure at the wellhead.
[Recompiled 12/31/01]

HISTORY OF 19.14.61 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-210, Monthly Geothermal Injection Report (Form G-110), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-211.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 62 ANNUAL GEOTHERMAL TEMPERATURE AND PRESSURE TESTS (FORM G-111)

19.14.62.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.62.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.62.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.62.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.62.5 EFFECTIVE DATE: [November 15, 1983]
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19.14.62.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.62.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.62.8 ANNUAL GEOTHERMAL TEMPERATURE AND PRESSURE TESTS (FORM G-111): Annual temperature and pressure tests shall be submitted by the owner or operator of each geothermal resource producing well in accordance with the annual testing schedule published by the division. Flowing temperatures and flowing pressure tests at the wellhead shall be recorded after at least 72 hours of continuous flow at normal producing rates. The well shall then be shut in for 24 hours and shut-in pressure at the wellhead recorded. Results of these tests shall be submitted in duplicate to the Santa Fe office of the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.62 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-211, Annual Geothermal Temperature and Pressure Tests (Form G-111), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-212.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 63 APPLICATION TO PLACE WELL ON INJECTION-GEOTHERMAL RESOURCES AREA (FORM G-112)

19.14.63.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.63.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.63.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.63.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.63.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.63.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.63.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.63.8 APPLICATION TO PLACE WELL ON INJECTION-GEOTHERMAL RESOURCES AREA (FORM G-112): Before placing any well on injection in a geothermal resources area, whether for charge, recharge or disposal purposes, authority to do so shall be obtained on form G-112 which shall be filed in accordance with Rule G-503 [now 19.14.93 NMAC].
[Recompiled 12/31/01]

HISTORY OF 19.14.63 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-212, Application to Place Well on Injection-Geothermal Resources Area (Form G-112), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-301.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 71 LIABILITY

19.14.71.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.71.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.71.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.71.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.71.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.71.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.71.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.71.8 LIABILITY: The owner of any geothermal resources well or any seismic, core or other hole drilled for geothermal purposes shall be responsible for the plugging thereof.
[Recompiled 12/31/01]

HISTORY OF 19.14.71 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-301, Liability, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-302.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 72 NOTICE

19.14.72.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.72.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.72.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.72.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.72.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.72.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.72.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.72.8 NOTICE: Prior to commencement of plugging operations, notice of intention to plug shall be filed with the division, and approval thereof obtained by the owner or operator of the well. This shall be accomplished by filing form G-103, sundry notices and reports on geothermal wells, which notice shall outline the casing and cementing program of the well, the casing which is to be pulled, the size of proposed cement plugs and their depth and such other information as may be pertinent. In the case of newly drilled wells which are to be plugged, verbal authority and instructions may be given by the division to plug the well provided written notice to plug shall be subsequently filed within 30 days and approval thereof obtained. Written approval or verbal approval of a plugging program shall be subsequently filed within 30 days and approval thereof obtained. Written approval or verbal approval of a plugging program shall be contingent upon evidence being furnished that the plugging program for the well is such as to prevent damage to any producing zone, migration of fluids from one zone to another, the waste or contamination of useable underground waters or other natural resources and the leakage of any substance at the surface, all as substantiated by the filing of form G-105, geothermal resources well log, and form G-106, geothermal well summary report, with the request for approval of the plugging program. Filing of these forms may be delayed as provided in Rule G-205 C [now 19.14.56.10 NMAC] and Rule G-206 C [now 19.14.57.10 NMAC] if a division representative has had access to and has inspected the data and materials described in Rule G-200 B [now 19.14.51.9 NMAC]. Also see Rule G-203 A [now Subsection A of 19.14.54.8 NMAC], Rule G-203 c (4) [now Paragraph (4) of Subsection C of 19.14.54.8 NMAC] and Rule G-303 A [now of 19.14.73.8 NMAC].
[Recompiled 12/31/01]

HISTORY OF 19.14.72 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-302, Notice, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-303.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 73 PLUGGING AND TEMPORARY ABANDONMENT

19.14.73.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.73.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.73.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.73.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.73.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.73.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.73.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.73.8 PLUGGING: Before any well is abandoned, it shall be plugged in a manner that will permanently confine all fluids in the separate strata originally containing them. This operation shall be accomplished by the use of mud-laden fluid, cement and plugs, used singly or in combination, as may be approved by the division. In addition, an adequate cement plug at the surface shall be installed to permanently prevent intrusion of any substance into the well. The exact location of abandoned wells shall be shown by a steel marker at least four inches in diameter set in concrete and extending at least four feet above mean ground level. The name and number of the well and its location (quarter-quarter, section, township and range) shall be welded, stamped, or otherwise permanently engraved into the metal of the marker. seismic, core, thermal gradient or other wells less than 500 feet deep and low-temperature thermal wells less than 500 feet deep shall be plugged in accordance with the applicable provisions recited above but permanent markers shall not be required on such wells.
[Recompiled 12/31/01]

19.14.73.9 TEMPORARY ABANDONMENT: No well shall be temporarily abandoned for a period in excess of six months unless a permit for such temporary abandonment has been approved by the division. Such permit shall be for a period not to exceed six months and shall be requested from the Santa Fe office of the division by filing form G-103 in duplicate. No such permit shall be approved unless evidence is furnished that the condition of the well is such as to prevent damage to any producing zone, migration of fluids from one zone to another, the waste or contamination of useable underground waters or other natural resources and the leakage of any substance at the surface, all as substantiated by the filing of form G-105, geothermal resources well log, and form G-106, geothermal resources well summary report, with the request for a temporary abandonment permit. Filing of these forms may be delayed as provided in Rule G-205 B [now 19.14.56.9 NMAC] and Rule G-206 B[now 19.14.57.9 NMAC] if a division representative has had access to and has inspected the data and materials described in Rule G-200 B [now 19.14.51.9 NMAC] . Also see Rule G-203 A [now subsection A of 19.14.54.8 NMAC] and Rule G-203 C(3) [now Paragraph (3) of Subsection C of 19.14.54.8 NMAC].

A. The Santa Fe office of the division shall have authority to grant one extention to the permit for temporary abandonment. Such extension shall not exceed one year and shall be requested in the same manner as the original permit for temporary abandonment. No extension shall be approved unless good cause therefor is shown, and evidence is furnished that the continued condition of the well is as described above.

B. Upon expiration of the permit for temporary abandonment and any extension thereto, the well shall be put to beneficial use or shall be permanently plugged and abandoned, unless it can be shown to the division after notice and hearing that good cause exists why the well should not be plugged and abandoned, and a permit for further temporary abandonment should be issued. No such permit for further temporary abandonment shall be approved by the division unless a one-well plugging bond for the well, in an amount satisfactory to the division, but not to exceed $10,000.00, is on file with the division to ensure future plugging of the well.

C. The requirements of the paragraph immediately above may be waived and additional extensions granted

for thermal gradient wells and in those cases where it can be shown that a contract exists for the construction of electric power plants and such plants are being designated, on order, or under construction, where facilities are being designed or are under construction for direct use of geothermal energy, or in the case where a geothermal reservoir has been discovered and there is an ongoing exploration program of the reservoir to determine its commercial feasibility.
[Recompiled 12/31/01]

19.14.73.10 DRILLING WELLS: When drilling operations on a well have been suspended for 60 days, the well shall be plugged and abandoned unless a permit for temporary abandonment has been obtained for the well in accordance with Section B [now 19.14.73.9 NMAC] above.
[Recompiled 12/31/01]

HISTORY OF 19.14.73 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-303, Plugging and Temporary Abandonment, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-304.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 74 WELLS TO BE USED FOR FRESH WATER

19.14.74.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.74.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.74.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.74.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.74.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.74.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.74.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.74.8 WELLS TO BE USED FOR FRESH WATER: When the well to be plugged may safely be used as a fresh water well and such utilization is desired by the land owner, the well need not be filled above a sealing plug set below the fresh water formation, provided that written agreement for such use by the owner of the well and by the land owner is filed with the division. Upon acceptance of the well by the land owner, the well's bond may be released.
[Recompiled 12/31/01]

HISTORY OF 19.14.74 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-304, Wells to be Used for Fresh Water, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-401.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 81 ILLEGAL SALE PROHIBITED

19.14.81.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.81.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.81.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.81.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.81.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.81.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.81.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.81.8 ILLEGAL SALE PROHIBITED: The sale or purchase or acquisition or the transporting or utilization of geothermal resources produced in violation of the laws of this state, or of these rules, is prohibited.
[Recompiled 12/31/01]

HISTORY OF 19.14.81 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-401, Illegal Sale Prohibited, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-402.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 82 RATABLE TAKE

19.14.82.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.82.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.82.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.82.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.82.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.82.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.82.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.82.8 RATABLE TAKE:

A. Any person now or hereafter engaged in purchasing geothermal resources from one or more producers within a single geothermal reservoir shall be a common purchaser within that geothermal reservoir, and shall purchase geothermal resources of like quality, quantity and pressure lawfully produced from that geothermal reservoir and tendered to such common purchaser at a reasonable point. Such purchase shall be made without reasonable discrimination in favor of one producer against another in the price paid, quantities taken, the bases of measurement or the facilities offered.

B. In the event such purchaser is also a producer, he is prohibited to the same extent from discriminating in favor of himself with respect to geothermal resource wells in which he has an interest, direct or indirect, as against other geothermal resource wells in the same geothermal reservoir.

C. For the purposes of this rule, reasonable differences in prices paid or facilities afforded, or both, shall not constitute unreasonable discrimination if such differences bear a fair relationship to difference in quality, quantity, or pressure of the geothermal resource available or to the relative lengths of time during which such geothermal resources will be available to the purchaser.

D. Any common purchaser taking geothermal resources produced from wells within a geothermal reservoir shall take ratably under such rules, regulations and orders, concerning quantity, as may be promulgated by the division after due notice and public hearing. The division, in promulgating such rules, regulations and orders may consider the quality and the quantity of the geothermal resources available, the pressure and temperature of the product at the point of delivery, acreage attributable to the well, market requirements and other pertinent factors.

E. Nothing in this Rule shall be construed or applied to require, directly or indirectly, any person to purchase geothermal resources of a quality or under a pressure or under any other condition by reason of which such geothermal resource cannot be economically and satisfactorily used by such purchaser by means of his geothermal utilization facilities then in service.
[Recompiled 12/31/01]

HISTORY OF 19.14.82 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-402, Ratable Intake, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-403.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 83 REGULATION OF GEOTHERMAL RESOURCES PRODUCTION

19.14.83.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.83.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.83.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.83.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.83.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.83.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.83.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.83.8 REGULATION OF GEOTHERMAL RESOURCES PRODUCTION: Upon determination by the division that geothermal resources production in the state of New Mexico, or in a particular geothermal resources area, is causing waste, the division shall limit and allocate among the producing wells the total amount of geothermal resources which may be produced in the state, or in a particular geothermal area.
[Recompiled 12/31/01]

HISTORY OF 19.14.83 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-403, Regulation of Geothermal Resources Production, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-501.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 91 GEOTHERMAL INJECTION WELLS

19.14.91.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.91.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.91.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.91.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.91.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.91.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.91.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.91.8 GEOTHERMAL INJECTION WELLS: Geothermal injection wells are those wells used for the purpose of injecting fluids into a dry geothermal formation, or into a geothermal reservoir for the purpose of augmenting the natural supply of fluids in the reservoir, pressure maintenance of the reservoir, or such other purpose as authorized by the division. No well shall be utilized as a geothermal injection well until authority for such use has been obtained on an approved form G-112, application to place well on injection-geothermal resources area. Form G-112 shall be filed in accordance with Rule G-503 [now 19.14.93 NMAC] below.
[Recompiled 12/31/01]

HISTORY OF 19.14.91 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-501, Geothermal Injection Wells, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-502.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 92 GEOTHERMAL DISPOSAL WELLS

19.14.92.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.92.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.92.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.92.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.92.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.92.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.92.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.92.8 GEOTHERMAL DISPOSAL WELLS: Geothermal disposal wells are those wells used for the purpose of disposing of waters produced from a geothermal reservoir when disposal is into a zone or formation not classified as a geothermal reservoir. No well shall be utilized as a geothermal disposal well until authority for such use has been obtained on an approved form G-112, application to place well on injection-geothermal resources area. Form G-112 shall be filed in accordance with Rule G-503 [now 19.14.93 NMAC] below.
[Recompiled 12/31/01]

HISTORY OF 19.14.92 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-502, Geothermal Disposal Wells, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-503.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 93 METHOD OF MAKING APPLICATION

19.14.93.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.93.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.93.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.93.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.93.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.93.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.93.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.93.8 METHOD OF MAKING APPLICATION:

A. Application for authority to inject fluids into a geothermal reservoir or to dispose of geothermal waters into a zone or formation not classified as a geothermal reservoir shall be made in duplicate on division form G-112, application to place well on injection-feothermal resources area, and shall be accompanied by one copy of each of the following:

(1) A plat showing the location of the proposed injection/disposal well and the location of all other wells within a radius of one mile from said well, and indicating the perforated or open-hole interval in each of said wells. The plat shall also indicate the ownership of all geothermal leases within said one-mile radius;

(2) The log of the proposed injection well, if available;

(3) A diagrammatic sketch of the proposed injection well showing casing strings, including diameters and setting depths, quantities used and tops of cement, perforated or open-hole interval, tubing strings, including diameters and setting depths, and the type and location of packers, if any.

B. Copies of the form G-112 (without the above attachments) shall be sent to all other geothermal lease owners, if any there be, within a one-half mile radius of the proposed injection/disposal well.

C. If no objection is received within 20 days from the date of receipt of the application, and the division director is satisfied that all of the above requirements have been complied with, that the proposal is in the interest of conservation and will prevent waste and protect correlative rights, and that the well is cased, cemented, and equipped in such a manner that there will be no danger to any natural resource, including geothermal resources, useable underground water supplies, and surface resources, form G-112 will be approved. In the event the form is not approved because of objection from an affected geothermal lease owner or for other reason, the application will be set for public hearing, if the applicant so requests.

D. The division director may dispense with the 20-day waiting period if waivers of objection are received from all geothermal lease owners within a one-half mile radius of the proposed injection/disposal well.
[Recompiled 12/31/01]

HISTORY OF 19.14.93 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-503, Method of Making Application, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-504.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 94 INJECTION REPORTS

19.14.94.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.94.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.94.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.94.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.94.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.94.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.94.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.94.8 INJECTION REPORTS: Monthly injection reports shall be filed for injection/disposal wells in accordance with Rule G-210 [now 19.14.61 NMAC] of these rules and regulations.
[Recompiled 12/31/01]

HISTORY OF 19.14.94 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-504, Injection Reports, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-505.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 95 SURVEILLANCE

19.14.95.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.95.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.95.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.95.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.95.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.95.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.95.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.95.8 SURVEILLANCE:

A. Surveillance of waste water disposal or injection projects is necessary on a continuing basis in order to establish to the satisfaction of the division that all water is confined to the intended zone of injection.

B. When an operator proposes to drill an injection well, convert a producing or inactive well to an injection well or rework an injection well and return it to injection service, he shall be required to demonstrate to the division by means of such tests as the division may deem necessary the integrity of the well's casing.

C. To establish the integrity of the annular cement above the shoe of the casing, the operator shall make sufficient surveys, within 30 days after injection is started into a well, to demonstrate that all the injected fluid is confined to the intended zone of injection. Thereafter, such surveys shall be made at least every two years, or more often if ordered by the division. All such surveys may be witnessed by a representative of the division.

D. After the well has been placed on injection, a division representative shall visit the wellsite periodically. At these times, surface conditions shall be noted and if any unsatisfactory conditions exist, the operator shall be notified of needed remedial work. If this required work is no performed within 90 days, the approval issued by the division may be rescinded. If it is determined that damage is occurring at a rapid rate, the division may order that the repair work be done immediately. Injection pressures shall be recorded by the division representative and compared with the pressure reported on the appropriate forms. Any discrepancies shall be rectified immediately by the operator. A graph of daily injection rates and pressures versus time shall be maintained by the operator. Reasons for anomalies shall be promptly ascertained. If these reasons are such that it appears damage is being done, approval by the division may be rescinded, and injection shall cease.

E. When an injection well has been left idle for six months, the operator shall be informed by letter that approval for use of the well for injection purposes has been rescinded, and that he should proceed in accordance with the provisions of Rule G-302 [now 19.14.72 NMAC] and Rule G-303 A [now 19.14.73.8 NMAC] or Rule G-303 B [now 19.14.73.9 NMAC]. In the event the operator intends to again use the well for injection purposes, he shall be required to demonstrate by means of surveys that the injected water will be confined to the intended zone of injection.
[Recompiled 12/31/01]

HISTORY OF 19.14.95 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-505, Surveillance, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-506.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 96 ABANDONMENT

19.14.96.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.96.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.96.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.96.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.96.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.96.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.96.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.96.8 ABANDONMENT: Injection or disposal wells are required to be abandoned in the same manner as other wells. (See Sec. E, Abandonment, Temporary Abandonment, and Plugging of Wells).
[Recompiled 12/31/01]

HISTORY OF 19.14.96 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-506, Abandonment, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-601.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 101 GENERAL PROVISIONS

19.14.101.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.101.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.101.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.101.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.101.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.101.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.101.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.101.8 GENERAL:
A. In areas where high subsurface pressures are known to exist, or where there is a history of lost circulation and/or blowouts, or in areas where subsurface pressures are not known, all proper and usual precautions shall be taken for keeping the well under control, including the use of blowout preventers and high pressure fittings attached to properly cemented casing strings.
B. The division geothermal supervisor shall have the authority to waive the requirement for casing and/or blowout preventers for holes less than 500 feet deep.
[Recompiled 12/31/01]

HISTORY OF 19.14.101 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-601, General, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-602.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 102 BLOWOUT PREVENTION EQUIPMENT (BOPE)

19.14.102.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.102.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.102.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.102.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.102.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.102.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.102.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.102.8 BLOWOUT PREVENTION EQUIPMENT (BOPE) The following standards are not given as final blowout prevention equipment requirements for the drilling of any geothermal resources well but are given as guidelines for the preparation of a minimum blowout prevention program for certain categories of wells.

A. Using Mud as the Drilling Fluid.

(1) API Class 2M-A or 2M-RR. For wells in geothermal resources areas known to contain geothermal fluids at a temperature greater than 212 degrees F. at depths less than 2,000 feet, and geothermal exploratory wells in areas where subsurface temperatures and pressures are unknown and the proposed depth of the well is less than 2,000 feet.

(a) An annular BOPE and a spool, fitted with a low-pressure safety pop-off and blow-down line, installed on the conductor pipe may be required for wells in the above categories to ensure against possible gas blowouts during the drilling of the surface casing hole.

(b) Annular BOPE or pipe-ram/blind-ram BOPE with minimum working-pressure ratings of 2,000 psi shall be installed on the surface casing so that the well can be shut in at any time.

(c) Hydraulic actuating system.

(d) Kelly cock.

(e) A fill-up line installed above the BOPE.

(f) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary.

(g) A blow-down line fitted with two valves installed below the BOPE. The blow-down line shall be directed in such a manner so as to permit containment of produced fluids and to minimize any safety hazard to personnel.

(h) All lines and fittings shall be steel and have a minimum working-pressure rating of 1,000 psi.

(i) Return mud temperatures shall be entered into the log book after each joint of pipe is drilled down. See Rule G-106(b) [now Subsection B of 19.14.25.8 NMAC].

(2) API Class 2M-RSRA or Eqivalent. For wells in geothermal resources areas known to contain geothermal fluids at temperatures greater than 212 degrees F. at depths more than 2,000 feet, and geothermal exploratory wells in areas where subsurface temperatures and pressures are unknown and the proposed depth of the well is more than 2,000 feet.

(a) An annular BOPE and a spool, fitted with a low-pressure safety pop-off and blow-down line, installed on the conductor pipe may be required to ensure against possible gas blowouts during the drilling of the surface casing hole.

(b) Annular BOPE and pipe-ram/blind-ram BOPE with a minimum working-pressure rating of 2,000 psi shall be installed so that the well can be shut in at any time. The double-ram preventer shall have a mechanical locking device.

(c) A hydraulic actuating system utilizing an accumulator of sufficient capacity and a high pressure auxiliary backup system. This total system shall be equipped with dual controls; one at the driller's station and one at least 50 feet away from the wellhead.

(d) Kelly cock and standpipe valve.

(e) A fill-up line installed above the BOPE.

(f) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary.

(g) A blow-down line fitted with two valves installed below the BOPE. The blow-down line shall be directed in such a manner so as to permit containment of produced fluids and to minimize any safety hazard to personnel.

(h) All lines and fittings shall be steel and have a minimum working-pressure rating of at least that of the BOPE.

(i) Return mud temperatures shall be entered into the log book after each joint of pipe is drilled down. (See Rule G-106(b).) [now Subsection B of 19.14.25.8 NMAC].

B. Using Air as the Drilling Fluid. API Class 2M RSRdG (with Banjo Box). For wells in geothermal resources areas where it is known that dry steam exists at depth and/or formation pressures are known to be less than hydrostatic:

(1) A rotating head installed at the top of the BOPE stack.

(2) A pipe-ram/blind-ram BOPE, with a minimum working-pressure rating of 2,000 psi installed below the rotating head so that the well can be shut in at any time.

(3) A banjo box steam diversion unit installed below the double-ram BOPE fitted with an approved muffler in good working condition.

(4) A blind-ram BOPE, with a minimum working-pressure rating of 2,000 psi installed below the banjo box so that the well can be shut in while removing the rotating head during bit changes.

(5) A gate valve, with a suitable minimum working-pressure rating installed below the blind ram so that the well can be shut in after the well has been completed, prior to removal of the BOPE stack.

(6) All ram-type BOPE shall have a hydraulic actuating system utilizing an accumulator of sufficient capacity and a high-pressure backup system.

(7) Dual control stations for hydraulic backup system: one at the driller's station and the other at least 50 feet away from the wellhead.

(8) Float and standpipe valves.

(9) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary.

(10) All lines and fittings must be steel and have a minimum working-pressure rating of 1,000 psi. Note: If any portion of a well is drilled using mud, Class 2M BOPE shall be installed on the surface casing so that the well can be shut-in at any time.

[Recompiled 12/31/01]

HISTORY OF 19.14.102 NMAC:

Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:

Rule G-602, Blowout Prevention Equipment (BOPE), 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-603.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 103 AREAS WITH HISTORY OF BLOWOUTS

19.14.103.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.103.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.103.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.103.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.103.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.103.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.103.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.103.8 AREAS WITH HISTORY OF BLOWOUTS: Notwithstanding any of the provisions of Rule G-602 [now 19.14.102 NMAC], above, when drilling in any geothermal resources area which has a history of lost circulation and/or blowouts, the operator shall equip the well with adequate blowout prevention equipment to contain such pressures as may have previously been encountered in the other well(s).
[Recompiled 12/31/01]

HISTORY OF 19.14.103 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-603, Areas With History of Blowouts, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-604.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 104 TESTING OF BLOWOUT PREVENTION EQUIPMENT

19.14.104.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.104.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.104.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.104.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.104.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.104.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.104.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.104.8 TESTING OF BLOWOUT PREVENTION EQUIPMENT:

A. Upon installation, ram-type blowout preventers, bag-type blowout preventers, valves and manifolds shall be tested to a minimum of 750 psi pressure. Tests may be witnessed by a division representative on all wells prior to drilling out the shoe of the surface casing, and the division shall be notified of the date and hour any such test is to be conducted sufficiently in advance of the test to allow a division representative to travel to the well to witness the test.

B. Ram-type preventers shall be operated at least once each 24 hours and bag-type preventers closed on the drill pipe at least once each week, provided however, that an exception to this provision may be granted by the division's geothermal section to prevent undue wear and tear on the preventer rubbers when drilling drysteam wells.
[Recompiled 12/31/01]

HISTORY OF 19.14.104 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-604, Testing of Blowout Prevention Equipment, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-701.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 110 NECESSITY FOR HEARING

19.14.110.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.110.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.110.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.110.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.110.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.110.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.110.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.110.8 NECESSITY FOR HEARING: Except as provided in some general rule herein, before any rule, regulation or order, including revocation, changes, renewal or extension thereof, shall be made by the division, a public hearing before the commission or a legally appointed division examiner shall be held at such time and place as may be prescribed by the division.
[Recompiled 12/31/01]

HISTORY OF 19.14.110 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-701, Necessity for Hearing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-702.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 111 EMERGENCY ORDERS

19.14.111.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.111.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.111.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.111.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.111.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.111.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.111.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.111.8 EMERGENCY ORDERS: Notwithstanding any other provision of these rules, in case an emergency is found to exist by the division, which, in its judgment, requires the making of a rule, regulation or order without a hearing having first been had or concluded, such emergency rule, regulation or order when made by the division shall have the same validity as if a hearing with respect to the same had been held before the division after due notice. Such emergency rule, regulation or order shall remain in force no longer than 15 days from its effective date, and in any event, it shall expire when the rule, regulation or order made after due notice and hearing with respect to the subject matter of such emergency rule, regulation or order becomes effective.
[Recompiled 12/31/01]

HISTORY OF 19.14.111 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-702, Emergency Orders, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-703.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 112 METHOD OF INITIATING A HEARING

19.14.112.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.112.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.112.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.112.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.112.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.112.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.112.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.112.8 METHOD OF INITIATING A HEARING:

A. The division upon its own motion, the attorney general on behalf of the state, and any operator or producer, or any other person having a property interest may institute proceedings for a hearing. If the hearing is sought by the division it shall be on motion of the division and if by any other person it shall be by application. The application shall be in triplicate and shall state:

(1) the name of the applicant;

(2) the name or general description of the common source or sources of supply or the area affected by the order sought;

(3) briefly the general nature of the order, rule or regulation sought; and

(4) any other matter required by a particular rule or rules, or order of the division.

B. The application shall be signed by the person seeking the hearing or by his attorney.

C. When conditions are such as to require verbal application to place a matter for hearing on a given docket, the division will accept such verbal application in order to meet publishing deadlines. However, if written application, filed in accordance with the procedures outlined above, has not been received by the division's Santa Fe office at least ten days before the date of the hearing, the case will be dismissed.
[Recompiled 12/31/01]

HISTORY OF 19.14.112 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-703, Method of Initiating a Hearing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-704.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 113 METHOD OF GIVING LEGAL NOTICE FOR HEARING

19.14.113.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.113.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.113.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.113.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.113.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.113.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.113.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.113.8 METHOD OF GIVING LEGAL NOTICE FOR HEARING: Notice of each hearing before the commission and notice of each hearing before a division examiner shall be given by personal service on the person affected or by publication once in a newspaper of general circulation published at Santa Fe, New Mexico, and once in a newspaper of general circulation published in the county or each of the counties, if there be more than one, in which any geothermal resource or other property which may be affected is situated.
[Recompiled 12/31/01]

HISTORY OF 19.14.113 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-704, Method of Giving Legal Notice for Hearing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-705.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 114 CONTENTS OF NOTICE OF HEARING

19.14.114.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.114.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.114.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.114.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.114.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.114.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.114.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.114.8 CONTENTS OF NOTICE OF HEARING:

A. Such notice shall be issued in the name of "the state of New Mexico" and shall be signed by the director of the division, and the seal of the commission shall be impressed thereon.

B. The notice shall specify whether the case is set for hearing before the commission or before a division examiner and shall state the number and style of the case and the time and place of hearing and shall briefly state the general nature of the order or orders, rule or rules, regulation or regulations to be promulgated or effected. The notice shall also state the name of the petitioner or applicant, if any, and unless the contemplated order, rule or regulation is intended to apply to and affect the entire state, it shall specify or generally describe the common source or sources of supply which may be affected by such order, rule or regulation.
[Recompiled 12/31/01]

HISTORY OF 19.14.114 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-705, Contents of Notice of Hearing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-706.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 115 PERSONAL SERVICE OF NOTICE

19.14.115.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.115.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.115.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.115.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.115.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.115.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.115.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.115.8 PERSONAL SERVICE OF NOTICE: Personal service of the notice of hearing may be made by any agent of the division or by any person over the age of 18 years in the same manner as is provided by law for the service of summons in civil actions in the district courts of this state. Such service shall be complete at the time of such personal service or on the date of publication, as the case may be. Proof of service shall be by the affidavit of the person making personal service or of the publisher of the newspaper in which publication is had. Service of the notice shall be made at least 10 days before the hearing.
[Recompiled 12/31/01]

HISTORY OF 19.14.115 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-706, Personal Service of Notice, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-707.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 116 PREPARATION OF NOTICES

19.14.116.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.116.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.116.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.116.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.116.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.116.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.116.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.116.8 PREPARATION OF NOTICES: After a motion or application is filed with the division the notice or notices required shall be prepared by the division and service and publication thereof shall be taken care of by the division without cost to the applicant.
[Recompiled 12/31/01]

HISTORY OF 19.14.116 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-707, Preparation of Notices 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-708.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 117 FILING PLEADINGS: COPY DELIVERED TO ADVERSE PARTY OR PARTIES

19.14.117.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.117.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.117.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.117.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.117.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.117.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.117.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.117.8 FILING PLEADINGS: When any party to a hearing files any pleading, plea, or motion of any character (other than application for hearing) which is not by law or by these rules required to be served upon the adverse party or parties, he shall at the same time either deliver or mail to the adverse party or parties who have entered their appearance therein, or their respective attorneys of record, a copy of such pleading, plea, or motion. For the purposes of these rules, an appearance of any interested party shall be made either by letter addressed to the division or in person at any proceeding before the commission or before an examiner, with notice of such appearance to the parties from whom such pleadings, pleas, or motions are desired.
[Recompiled 12/31/01]

HISTORY OF 19.14.117 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-708, Filing Pleadings: Copy Delivered to Adverse Party or Parties, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-709.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 118 CONTINUANCE OF HEARING WITHOUT NEW SERVICE

19.14.118.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.118.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.118.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.118.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.118.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.118.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.118.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.118.8 CONTINUANCE OF HEARING WITHOUT NEW SERVICE: Any hearing before the commission or an examiner held after due notice may be continued by the person presiding at such hearing to a specified time and place without the necessity of notice of the same being again served or published. In the event of any continuance, a statement thereof shall be made in the record of the hearing which is continued.
[Recompiled 12/31/01]

HISTORY OF 19.14.118 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-709, Continuance of Hearing Without New Service, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-710.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 119 CONDUCT OF HEARINGS

19.14.119.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.119.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.119.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.119.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.119.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.119.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.119.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.119.8 CONDUCT OF HEARINGS: Hearings before the commission or any examiner shall be conducted without rigid formality. A transcript of testimony shall be taken and preserved as a part of the permanent record of the division. Any person testifying in response to a subpoena issued by the commission or any member thereof, or the authorized representative of the division director, and any person seeking to testify in support of an application or motion or in opposition thereto shall be required to do so under oath. However, relevant unsworn comments and observations by any interested party will be designated as such and included in the record. Comments and observations by representatives of operators' committees, the United States geological survey, the United States bureau of mines, the New Mexico bureau of mines, and other competent persons are welcomed. Any examiner legally appointed by the division director may conduct such hearings as may be referred to such examiner by the director.
[Recompiled 12/31/01]

HISTORY OF 19.14.119 NMAC
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-710, Conduct of Hearings, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-711.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 120 POWER TO REQUIRE ATTENDANCE OF WITNESSES AND PRODUCTION OF EVIDENCE

19.14.120.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.120.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.120.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.120.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.120.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.120.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.120.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.120.8 POWER TO REQUIRE ATTENDANCE OF WITNESSES AND PRODUCTION OF EVIDENCE: The commission or any member thereof, or the authorized representative of the division director has statutory power to subpoena witnesses and to require the production of books, papers and records in any proceeding before the commission or division. A subpoena will be issued for attendance at a hearing upon the written request of any person interested in the subject matter of the hearing. In case of the failure of a person or comply with the subpoena issued, an attachment of the person may be issued by the district court of any district in the state, and such court has powers to punish for contempt. Any person found guilty of swearing falsely at any hearing may be punished for contempt.
[Recompiled 12/31/01]

HISTORY OF 19.14.120 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-711, Power to Require Attendance of Witness and Production of Evidence, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-712.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 121 RULES OF EVIDENCE

19.14.121.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.121.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.121.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.121.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.121.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.121.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.121.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.121.8 RULES OF EVIDENCE: Full opportunity shall be afforded all interested parties at a hearing to present evidence and to cross-examine witnesses. In general, the rules of evidence applicable in a trial before a court without a jury shall be applicable, provided that such rules may be relaxed, where, by so doing, the ends of justice will be better served. No order shall be made which is not supported by competent legal evidence.
[Recompiled 12/31/01]

HISTORY OF 19.14.121 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-712, Rules of Evidence, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-713.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 122 EXAMINERS' QUALIFICATIONS AND APPOINTMENT

19.14.122.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.122.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.122.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.122.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.122.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.122.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.122.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.122.8 EXAMINERS' QUALIFICATIONS AND APPOINTMENT: The division director shall, by ex parte order, designate and appoint not more than four individuals to be examiners. Each examiner so appointed shall be a member of the staff of the division, but no examiner need be a full time employee of the division. The director may, by ex parte order, designate and appoint a successor to any person whose status as an dxaminer is terminated for any reason. Each individual designated and appointed as an examiner must have at least six years practical experience as a geologist, petroleum engineer or licensed lawyer, or at least two years of such experience and a college degree in geology, engineering or law; provided however, that nothing herein contained shall prevent any member of the commission from being designated as, or serving as, an examiner.
[Recompiled 12/31/01]

HISTORY OF 19.14.122 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-713, Examiner's Qualifications and Appointment, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-714.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 123 REFERRAL OF CASES TO EXAMINERS

19.14.123.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.123.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.123.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.123.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.123.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.123.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.123.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.123.8 REFERRAL OF CASES TO EXAMINERS: The division director may refer any matter or proceeding to any legally designated and appointed examiner for hearing in accordance with these rules. The examiner appointed to hear any specific case shall be designated by name.
[Recompiled 12/31/01]

HISTORY OF 19.14.123 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-714, Referral of Cases to Examiners, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-715.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 124 EXAMINER'S POWER AND AUTHORITY

19.14.124.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.124.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.124.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.124.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.124.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.124.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.124.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.124.8 EXAMINER'S POWER AND AUTHORITY: The division director may, by ex parte order, limit the powers and duties of the examiner in any particular case to such issues or to the performance of such acts as the director deems expedient; however, subject only to such limitations as may be ordered by the director, the examiner to whom any matter or proceeding is referred under these rules shall have full authority to hold hearings on such matter or proceeding in accordance with and pursuant to these rules. The examiner shall have the power to regulate all proceedings before him and to perform all acts and take all measures necessary or proper for the efficient and orderly conduct of such hearing, including the swearing of witnesses, receiving of testimony and exhibits offered in evidence, subject to such objections as may be imposed, and shall cause a complete record of the proceedings to be made and transcribed and shall certify same to the director as hereinafter provided.
[Recompiled 12/31/01]

HISTORY OF 19.14.124 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-715, Examiner's Power and Authority, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-716.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 125 HEARINGS WHICH MUST BE HELD BEFORE COMMISSION

19.14.125.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.125.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.125.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.125.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.125.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.125.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.125.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.125.8 HEARINGS WHICH MUST BE HELD BEFORE COMMISSION: Notwithstanding any other provisions, of these rules, the hearing on any matter shall be held before the commission (1) if it is a hearing de novo, or (2) if the division director in his discretion desires the commission to hear the matter.
[Recompiled 12/31/01]

HISTORY OF 19.14.125 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-716, Hearings Which Must Be Held Before Commission, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-717.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 126 EXAMINER'S MANNER OF CONDUCTING HEARING

19.14.126.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.126.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.126.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.126.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.126.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.126.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.126.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.126.8 EXAMINER'S MANNER OF CONDUCTING HEARING: An examiner conducting a hearing under these rules shall conduct himself as a disinterested umpire.
[Recompiled 12/31/01]

HISTORY OF 19.14.126 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-717, Examiner's Manner of Conducting Hearing, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-718.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 127 REPORT AND RECOMMENDATIONS, EXAMINER'S HEARINGS

19.14.127.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.127.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.127.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.127.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.127.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.127.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.127.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.127.8 REPORT AND RECOMMENDATIONS, EXAMINER'S HEARINGS: Upon the conclusion of any hearing before an examiner, the examiner shall promptly consider the proceedings in such hearing, and based upon the record of such hearing the examiner shall prepare his written report and recommendations for the disposition of the matter of proceeding by the division. Such report and recommendation shall either be accompanied by a proposed order or shall be in the form of a proposed order, and shall be submitted to the division director with the certified record of the hearing.
[Recompiled 12/31/01]

HISTORY OF 19.14.127 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-718, Report and Recommendations, Examiner's Hearings, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-719.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 128 DISPOSITION OF CASES HEARD BY EXAMINERS

19.14.128.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.128.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.128.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.128.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.128.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.128.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.128.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.128.8 DISPOSITION OF CASES HEARD BY EXAMINERS: After receipt of the report and recommendations of the examiner, the division director shall enter the division's order disposing of the matter or proceeding.
[Recompiled 12/31/01]

HISTORY OF 19.14.128 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-719, Disposition of Cases Heard by Examiners, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-720.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 129 DE NOVO HEARING BEFORE COMMISSION

19.14.129.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.129.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.129.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.129.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.129.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.129.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.129.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.129.8 DE NOVO HEARING BEFORE COMMISSION: When any order has been entered by the division pursuant to any hearing held by an examiner, any party adversely affected by such order shall have the right to have such matter or proceeding heard de novo before the commission, provided that within 30 days from the date such order is rendered such party files with the division a written application for such hearing before the commission. If such application is filed, the matter or proceeding shall be set for hearing before the commission at the first available hearing date following the expiration of fifteen days from the date such application is filed with the division. Any person affected by the order or decision rendered by the commission after hearing before the commission may apply for rehearing pursuant to and in accordance with the provisions of Rule G-722 [now 19.14.131 NMAC], and said Rule G-722 [now 19.14.131 NMAC] together with the law applicable to rehearing and appeals in matters and proceedings before the commission shall thereafter apply to such matter or proceeding.
[Recompiled 12/31/01]

HISTORY OF 19.14.129 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-720, De Novo Hearing Before Commission, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-720.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 129 DE NOVO HEARING BEFORE COMMISSION

19.14.129.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.129.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.129.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.129.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.129.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.129.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.129.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.129.8 DE NOVO HEARING BEFORE COMMISSION: When any order has been entered by the division pursuant to any hearing held by an examiner, any party adversely affected by such order shall have the right to have such matter or proceeding heard de novo before the commission, provided that within 30 days from the date such order is rendered such party files with the division a written application for such hearing before the commission. If such application is filed, the matter or proceeding shall be set for hearing before the commission at the first available hearing date following the expiration of fifteen days from the date such application is filed with the division. Any person affected by the order or decision rendered by the commission after hearing before the commission may apply for rehearing pursuant to and in accordance with the provisions of Rule G-722 [now 19.14.131 NMAC], and said Rule G-722 [now 19.14.131 NMAC] together with the law applicable to rehearing and appeals in matters and proceedings before the commission shall thereafter apply to such matter or proceeding.
[Recompiled 12/31/01]

HISTORY OF 19.14.129 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-720, De Novo Hearing Before Commission, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-721.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 130 NOTICE OF COMMISSION AND DIVISION ORDERS

19.14.130.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.130.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.130.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.130.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.130.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.130.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.130.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.130.8 NOTICE OF COMMISSION AND DIVISION ORDERS: Within ten days after any order, including any order granting or refusing rehearing, or order following rehearing, has been rendered, a copy of such order shall be mailed by the division to each person or his attorney of record who has entered his appearance of record in the matter of proceeding pursuant to which such order is rendered.
[Recompiled 12/31/01]

HISTORY OF 19.14.130 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-721, Notice of Commission and Division Orders, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-722.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 131 REHEARINGS

19.14.131.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.131.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.131.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.131.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.131.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.131.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.131.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.131.8 REHEARINGS: Within 20 days after entry of any order or decision of the commission any person affected thereby may file with the division an application for rehearing in respect of any matter determined by such order or decision, setting forth the respect in which such order or decision is believed to be erroneous. The commission shall grant or refuse any such application in whole or in part within 10 days after the same is filed and failure to act thereon within such period shall be deemed a refusal thereof and a final disposition of such application. In the event the rehearing is granted, the commission may enter such new order or decision after rehearing as may be required under the circumstances.
[Recompiled 12/31/01]

HISTORY OF 19.14.131 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-722, Rehearings, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-723.

TITLE 19 NATURAL RESOURCES AND WILDLIFE
CHAPTER 14 GEOTHERMAL POWER
PART 132 CHANGES IN FORMS AND REPORTS

19.14.132.1 ISSUING AGENCY: Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.
[Recompiled 12/31/01]

19.14.132.2 SCOPE: [RESERVED]
[Recompiled 12/31/01]

19.14.132.3 STATUTORY AUTHORITY: [RESERVED]
[Recompiled 12/31/01]

19.14.132.4 DURATION: [RESERVED]
[Recompiled 12/31/01]

19.14.132.5 EFFECTIVE DATE: [November 15, 1983]
[Recompiled 12/31/01]

19.14.132.6 OBJECTIVE: [RESERVED]
[Recompiled 12/31/01]

19.14.132.7 DEFINITIONS: [RESERVED]
[Recompiled 12/31/01]

19.14.132.8 CHANGES IN FORMS AND REPORTS: Any change in the forms and reports or rules relating to such forms and reports shall be made only by order of the commission or division issued after due notice and hearing.
[Recompiled 12/31/01]

HISTORY OF 19.14.132 NMAC:
Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:
Rule G-723, Changes in Forms and Reports, 11/1/83.

History of Repealed Material: [RESERVED]

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 11, 2010 6:36 AM
To: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; VonGonten, Glenn, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD
Subject: FW: Deep Source Geothermal Commercialization Working Group Meeting
Attachments: Deep Source Geothermal Commercialization Working Group Meeting

Gentlemen:

FYI, please find attached more detailed information on the meeting notice for the Geothermal Working Group.

The EMNRD and Geothermal Working Group mission is briefly stated below.

The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource.

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Some preliminary examples may be: 1) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc.; 2) Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources; 3) Pollution prevention and waste minimization (i.e., environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals; 4) Aesthetic concerns (i.e., noise from well testing; large pits, etc.) need to be developed; 5) Focus on low-quality deeper geothermal gradient water resources in the oil and gas fields of NM accessible to nearby transmission grids; 5) Focus on transmission grid assessment and construction into identified deep-source geothermal resource areas to convey power inter-intra state; ....

I'll be working on these along with Stephen Lucero- EMNRD- ECMD and the working group in the coming months.

Please feel free to forward any recommendations or comments to me that you may have pertaining to the geothermal database and/or any technical and policy recommendations that OCD may have to accelerate the full-scale development of NM's deep-source geothermal resource.

Thank you in advance.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us

Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

Subject:	Deep Source Geothermal Commercialization Working Group Meeting
Location:	Hotel Santa Fe
Start:	Thu 2/11/2010 9:00 AM
End:	Thu 2/11/2010 3:00 PM
Recurrence:	(none)
Organizer:	Chavez, Carl J, EMNRD

Dear Geothermal Group:
The NMC is working with the EMNRD to coordinate and facilitate the Deep Source Geothermal Commercialization Working Group ("Geothermal Group") activities. The proposed date for the first meeting of the working group is February 11th at 9am. It will be an all-day meeting in Santa Fe. Please respond and let us know if you can attend. If that date does not work, please let us know your availability.
NMC will support a website for the Geothermal Group on its private website. Please join the NMC Network by following this link to get access to join the group website. Forward me information you would like to post on the site about your activities, interests and priorities in Deep Source Geothermal Commercialization. Let me know if there is anything we can do to facilitate communication through the website or other means.

The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource.

Please see the following announcement from Stephen Lucero regarding the group and its missions.

Katharine Chartrand
Executive Director
New Mexico Consortium
knc@newmexicoconsortium.org

EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010.

http://www.governor.state.nm.us/press/2010/jan/011210_01.pdf

Chavez, Carl J, EMNRD

From:	Perrin, Charlie, EMNRD
Sent:	Thursday, February 11, 2010 7:24 AM
To:	Chavez, Carl J, EMNRD
Subject:	RE: Deep Source Geothermal Commercialization Working Group Meeting

Thanks Carl, we will kick it around and see what bounces out.

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 11, 2010 7:21 AM
To: Perrin, Charlie, EMNRD
Cc: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Martin, Ed, EMNRD; Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD
Subject: RE: Deep Source Geothermal Commercialization Working Group Meeting

Charlie:

Good morning. We have plenty of time..... at least through December o0f 2010. Any ideas before then would certainly be appreciated by the folks up in Aztec.

What I'm thinking is a quick OCD process for re-entering deep geothermal wells without going through the WQCC DP process. We know that the formation water is greater than 10,000 mg/L TDS; therefore, a G-101, G-102 and G-103 to re-enter any deep PA'd oil and gas well for exploration seems feasible. The issue is with the fresh makeup water that is needed for cooling towers in the oil patch and how OCD could avoid the WQCC public notice process for a discharge permit? No quick way around this it would seem......

Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Perrin, Charlie, EMNRD
Sent: Thursday, February 11, 2010 7:06 AM
To: Chavez, Carl J, EMNRD
Subject: RE: Deep Source Geothermal Commercialization Working Group Meeting

Wish we had more time, the short notice will not allow us to participate.

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 11, 2010 6:36 AM
To: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; VonGonten, Glenn, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD
Subject: FW: Deep Source Geothermal Commercialization Working Group Meeting

Gentlemen:

FYI, please find attached more detailed information on the meeting notice for the Geothermal Working Group.

The EMNRD and Geothermal Working Group mission is briefly stated below.

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Technical and Policy Recommendations:

Some preliminary examples may be: 1) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc.; 2) Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources; 3) Pollution prevention and waste minimization (i.e., environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals; 4) Aesthetic concerns (i.e., noise from well testing; large pits, etc.) need to be developed; 5) Focus on low-quality deeper geothermal gradient water resources in the oil and gas fields of NM accessible to nearby transmission grids; 5) Focus on transmission grid assessment and construction into identified deep-source geothermal resource areas to convey power inter-intra state; ....

I'll be working on these along with Stephen Lucero- EMNRD- ECMD and the working group in the coming months.

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Carl J. Chavez, CHMM
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Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 11, 2010 6:41 AM
To: Brooks, David K., EMNRD
Cc: Sanchez, Daniel J., EMNRD; Ezeanyim, Richard, EMNRD; Jones, William V., EMNRD
Subject: FW: Deep Source Geothermal Commercialization Working Group Meeting
Attachments: Deep Source Geothermal Commercialization Working Group Meeting

FYI.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
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Office: (505) 476-3490
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Cc: Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD
Subject: FW: Deep Source Geothermal Commercialization Working Group Meeting

Gentlemen:

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I'll be working on these along with Stephen Lucero- EMNRD- ECMD and the working group in the coming months.

Please feel free to forward any recommendations or comments to me that you may have pertaining to the geothermal database and/or any technical and policy recommendations that OCD may have to accelerate the full-scale development of NM's deep-source geothermal resource.

Thank you in advance.

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Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 11, 2010 7:01 AM
To: Chavez, Carl J, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; Brooks, David K., EMNRD; Ezeanyim, Richard, EMNRD
Subject: OCD Geothermal Deep-Source Brainstorming Session

The EMNRD and Geothermal Working Group mission is briefly stated below.

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Technical and Policy Recommendations:

Some preliminary examples may be:

1) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc.;

2) Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources;

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4) Aesthetic concerns (i.e., noise from well testing; large pits, etc.) need to be developed; 5) Focus on low-quality deeper geothermal gradient water resources in the oil and gas fields of NM accessible to nearby transmission grids;

5) Focus on transmission grid assessment and construction into identified deep-source geothermal resource areas to convey power inter-intra state;

6) OCD shall facilitate a permit and bonding process for re-entry into existing oil and gas wells that will consist of submittal of G-101, G-102, G-103 along w/ Unnumbered form and C-108 to expedite geothermal applications (including exploratory single well approach without discharge permit issuance and public notice process?) in the oil fields of NM;

7) OCD already has a WQCC process in place for permitting larger geothermal exploration and production projects;

8) OCD geothermal exploration w/o WQCC discharge permit process for geothermal exploration in existing oil and gas wells in the oil fields of NM?;

9) Develop policy for number 8 above?;

10)

11)

12)

13)

Please feel free to forward any recommendations or comments to me that you may have pertaining to the geothermal database and/or any technical and policy recommendations that OCD may have to accelerate the full-scale development of NM's deep-source geothermal resource.

Thank you in advance.

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Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, February 16, 2010 10:48 AM
To: Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Ezeanyim, Richard, EMNRD; Brooks, David K., EMNRD; Jones, William V., EMNRD
Subject: Geothermal Working Group OCD Database, Technical & Policy Recommendations/Comments Requested by April 9, 2010

Hey guys.

I have posted a "brainstorm" file at L:\ENVIRONM\WORD\COMMON\OCD Training\OCD PROGRAMS\UIC PROGRAM\UIC WELLS\UIC Class V Geothermal Well Application Process\Geothermal Work Group 2010 for you to enter your recommendations directly. Please use this file so everyone can view it and get ideas based on comments received from difference offices, people, etc.

I will be compiling and working on a final draft to present to Daniel Sanchez for approval before sending it to Steve Lucero of EMNRD before the May 2010 meeting.

For more background on the issues, please read the "Geothermal Meeting Highlights 2/11/2010 at the same file location.

Please contact me if you have questions. Thank you in advance.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From:	Chavez, Carl J, EMNRD
Sent:	Tuesday, February 16, 2010 10:55 AM
To:	Lucero, Stephen A., EMNRD
Subject:	FW: Geothermal Working Group OCD Database, Technical & Policy Recommendations/Comments Requested by April 9, 2010

Steve:

Good morning.

FYI. Can you send the work group members e-mail addresses out? Also, the free telephone conference phone number for call to obtain code for telephone communication meetings is:(712) 580-7700 (you have to call in to setup a conference call and get the code, once you have it, you distribute it with a date time for callers to phone in to a meeting). Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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To: Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD; Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD; Ezeanyim, Richard, EMNRD; Brooks, David K., EMNRD; Jones, William V., EMNRD
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(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Laura Sparks [info@newmexicoconsortium.org]
Sent: Tuesday, February 09, 2010 3:23 PM
To: Chavez, Carl J, EMNRD
Subject: Like Geothermal Work Group Feb 11 Meeting Location Info

Dear: Carl Chavez,

The Geothermal Work Group Meeting, will be held at The Hotel Santa Fe, located on 1501 Paseo de Peralta, Santa Fe NM. The meeting will be in the Kiva A conference room. Follow this link to see the map provided.

We look forward to meeting with you.

Katharine Chartrand
Executive Director
New Mexico Consortium
4200 West Jemez Rd., Suite 301
Los Alamos, NM 87544
knc@newmexicoconsortium.org

phone: 505-412-4177
cell: 505-412-4188
fax: 888-412-4151

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, January 26, 2010 6:31 AM
To: 'knc@newmexicoconsortium.org'
Subject: Geothermal Working Group Meeting 2/11/2010 Meeting Location in Santa Fe?

Dear Sir or Madam:

I have placed the meeting date and time on my calendar. Where will the meeting location be? Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 04, 2010 12:52 PM
To: Sanchez, Daniel J., EMNRD
Cc: Hill, Larry, EMNRD; Dade, Randy, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD
Subject: FW: RPSEA Releases the Technology Transfer Services RFP Due March 2, 2010.

FYI.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Lucero, Stephen A., EMNRD
Sent: Thursday, February 04, 2010 12:40 PM
To: Albrecht, Michael; Anderson, Kurt; Armijo, Dan; Babers, William; Bakhtiyarov, Sayavur; Balderrama, David; Banerjee, Amian; Chamberlin, Richard; Chavez, Carl J, EMNRD; Cikoski, Colin; Cook, Roger; Creel, Prentice; de la Torre, Kelly; Doyle, Kevin; Duchane, David; Erdlac, Richard; Evans, David; Gagan, Scott; Gibson, Pat; Griscom, David; Hagaman, Tim; Hall, John, NMENV; Heber, David, OSE; Iovenitti, Joe; Johnson, Joel; Lewis, Jeremy, EMNRD; Madueno, Amalio; Majumdar, Bhaskar; Marquez, Phil; Maze, Jay; McMinn, Rory; Melanson, Tom; Miller, Brendan, EDD; Moore, Lucy; OHare, Craig, EMNRD; Ortiz, Joe; Owens, Lara; Pena, Joanne; Person, Mark; Petty, Susan; Reed, Marshall; Rehfeldt, Ken; Reiter, Marshall; Riesterer, Jim; Romero, Van; Sanchez, OB; Silva, Michael; Smith, Mike; Sullivan, Bill; Swick, Don; Timlin, Mike; Tinsley, Kenneth; Wernsdorfer, Andrew; Witcher, Jim; Wolberg, Donald; Zhang, Frank; Zimmerer, Matthew
Subject: FW: RPSEA Releases the Technology Transfer Services RFP Due March 2, 2010.

Please see the below announcement:

Stephen Lucero
Energy Conservation and Management Division
(505) 476-3324
stephen.lucero@state.nm.us

From: Richards, Maria [mailto:mrichard@mail.smu.edu]
Sent: Thursday, February 04, 2010 8:45 AM
To: mrichard@smu.edu
Subject: FW: RPSEA Releases the Technology Transfer Services RFP Due March 2, 2010.

Hello, This is an opportunity to apply for geothermal project funding for development in oil/gas fields.

RPSEA Releases the Technology Transfer Services RFP

Small Producer Program, Ultra-Deepwater Program and Unconventional Resources Program

RPSEA is pleased to release the request for proposals (RFP) for Technology Transfer Services. All interested parties should immediately open and review the RFP documents located on this page (Current Request for Proposals) found under the Business with RPSEA menu button on the RPSEA website.

RPSEA has previously selected for award 71 projects under the 2007 and 2008 programs – Small Producer Abstracts, Unconventional Resources Abstracts and Ultra-Deepwater Abstracts. This solicitation requests proposals for the provision of technology transfer services for the projects awarded in 2007, 2008, 2009 and additional RPSEA awards.

The Technology Transfer contract will be a cost reimbursable, task-order, support services contract, where work will only be accomplished when specifically authorized by RPSEA. Potential contractors are requested to submit proposals describing their capabilities to perform the activities specified in the tasks in the Scope of Work (SOW) in accordance with the listed Selection Criteria. The anticipated number of hours per year that support services may be required is approximately 160 hours (20 days), but the contract will not include a guarantee that a minimum number of hours will be used.

Proposals are due March 2, 2010, 4 p.m. Central Time.

The questions period will be open until February 16, 2010 and must be sent by e-mail to Contract Director Wiley Wells at wwells@rpsea.org.

Danette Mozisek
Communications
Research Partnership to Secure Energy for America
1650 Highway 6, Suite 300
Sugar Land, TX 77478
Office: 281.313.9555
Direct: 281.690.5513
Fax: 281.313.9560
dmozisek@rpsea.org
www.rpsea.org

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, February 04, 2010 9:50 AM
To: Lucero, Stephen A., EMNRD
Cc: Sanchez, Daniel J., EMNRD; 'mrichard@ssmu.edu'
Subject: FW: RPSEA Releases the Technology Transfer Services RFP Due March 2, 2010.

Steve:

Good morning. The information below may be worth sending to EMNRD's Geothermal Subscribers/Contractors that may be interested in applying for research funding for geothermal development in the oil fields of New Mexico. Some interesting research projects may be found under the "Programs" dialogue box at the website provided below.

Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
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Maria Richards
SMU Geothermal Lab Coordinator
Room 220 Heroy
214-768-1975
mrichard@smu.edu
PO Box 75-0395
Dallas, TX 75275-0395
http://smu.edu/geothermal

From: Mozisek, Danette [mailto:dmozisek@rpsea.org]
Sent: Tuesday, February 02, 2010 12:53 PM
To: Richards, Maria
Subject: RPSEA Releases the Technology Transfer Services RFP

RPSEA Releases the Technology Transfer Services RFP

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RPSEA is pleased to release the request for proposals (RFP) for Technology Transfer Services. All interested parties should immediately open and review the RFP documents located on this page (Current Request for Proposals) found under the Business with RPSEA menu button on the RPSEA website.

RPSEA has previously selected for award 71 projects under the 2007 and 2008 programs – Small Producer Abstracts, Unconventional Resources Abstracts and Ultra-Deepwater Abstracts. This solicitation requests proposals for the provision of technology transfer services for the projects awarded in 2007, 2008, 2009 and additional RPSEA awards.

The Technology Transfer contract will be a cost reimbursable, task-order, support services contract, where work will only be accomplished when specifically authorized by RPSEA. Potential contractors are requested to submit proposals describing their capabilities to perform the activities specified in the tasks in the Scope of Work (SOW) in accordance with the listed Selection Criteria. The anticipated number of hours per year that support services may be required is approximately 160 hours (20 days), but the contract will not include a guarantee that a minimum number of hours will be used.

Proposals are due March 2, 2010, 4 p.m. Central Time.

The questions period will be open until February 16, 2010 and must be sent by e-mail to Contract Director Wiley Wells at wwells@rpsea.org.

Danette Mozisek
Communications
Research Partnership to Secure Energy for America
1650 Highway 6, Suite 300
Sugar Land, TX 77478
Office: 281.313.9555
Direct: 281.690.5513
Fax: 281.313.9560
dmozisek@rpsea.org
www.rpsea.org

Chavez, Carl J, EMNRD

From: Sanchez, Daniel J., EMNRD
Sent: Thursday, January 21, 2010 4:03 PM
To: Chavez, Carl J, EMNRD
Subject: RE: Deep Source Geothermal Commercialization Working Group - Announcement

Carl,

When will they start meeting and how often?

From: Chavez, Carl J, EMNRD
Sent: Thursday, January 21, 2010 1:22 PM
To: Sanchez, Daniel J., EMNRD
Subject: FW: Deep Source Geothermal Commercialization Working Group - Announcement

Stephen Lucero had given me a heads up on this work group last month and since it is directly related to the OCD Geothermal Regulations and Programs, consequently, I am requesting permission to participate in the work group (See Governor's HB or Mandate for the Work Group provided below). Thanks.

EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010.

http://www.governor.state.nm.us/press/2010/jan/011210_01.pdf

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Katharine Chartrand [mailto:info@newmexicoconsortium.org]
Sent: Friday, January 15, 2010 3:54 PM
To: Chavez, Carl J, EMNRD
Subject: Deep Source Geothermal Commercialization Working Group - Announcement

Dear Geothermal Group:

The NMC is working with the EMNRD to coordinate and facilitate the Deep Source Geothermal Commercialization Working Group ("Geothermal Group") activities. The proposed date for the first meeting of the working group is February 11th at 9am. It will be an all-day meeting in Santa Fe. Please respond and let us know if you can attend. If that date does not work, please let us know your availability.

NMC will support a website for the Geothermal Group on its private website. Please join the NMC Network by following this link to get access to join the group website. Forward me information you would like to post on the site about your activities, interests and priorities in Deep Source Geothermal Commercialization. Let me know if there is anything we can do to facilitate communication through the website or other means.

The final date, location and agenda for the meeting will be posted on the site soon.

Please see the following announcement from Stephen Lucero regarding the group and its missions.

Katharine Chartrand

Executive Director

New Mexico Consortium

knc@newmexicoconsortium.org

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Chavez, Carl J, EMNRD

From: Brendan Miller [danielle@tradenm.ccsend.com] on behalf of Brendan Miller [brendan.miller@state.nm.us]
Sent: Wednesday, January 20, 2010 3:46 PM
To: Chavez, Carl J, EMNRD
Subject: New Mexico Green Economy Initiative UPDATE

In This Issue

Dear Carl,

Welcome to the newletter of the New Mexico Green Economy Initiative, a project of the New Mexico Economic Development Department. This newsletter will be produced monthly.

Please forward to others you feel may be interested using the "Forward email" link at the bottom of this email. If you no longer wish to receive this newsletter, please click "SafeUnsubscribe" below.

Governor Bill Richardson Sets Bold Agenda for Future of New Mexico's Green Economy

Jan 12, 2010 SANTA FE - Governor Bill Richardson today signed an executive order that outlines the state's course to building a comprehensive green economy. The executive order carries out recommendations and goals detailed in the report developed by the Governor's Green Jobs Cabinet.

Governor Richardson signed the executive order at SCHOTT Solar's Albuquerque manufacturing plant.

"A comprehensive green economy is critical to the future of New Mexico and will lead our state into a new era of economic vitality and stability," Governor Richardson said.

"Today I am outlining a clear path to ensure our state capitalizes economically and environmentally on our abundant renewable resources and assets."

The Green Jobs Cabinet identified five immediate goals for the state to realize its full green economy potential, including:

To become a leader in renewable energy export.
To become the center of the North American solar industry. This includes everything from research and development to manufacturing to the installation of solar elements in our buildings.
To lead the nation in Green Grid innovation.
To continue being a leader in green building and energy efficiency.
To have an educational system that prepares New Mexico students for jobs in green technologies.

Becoming Lean and Green

Energy Data Website

Seeking Green News

Your input

Your input is very important. Please fill out this short form so we can contact you for your input and add you to our mailing list. Thank you for your contribution to New Mexico's Green Economy.

New Mexico EDD

Visit NM EDD

Governor Richardson's executive order lays out a wide scope of directives to reach these goals, and involves several state agencies, including the Economic Development Department, the Energy, Minerals, and Natural Resources Department, the New Mexico Environmental Department, the Indian Affairs Department, the New Mexico Department of Agriculture, Department of Workforce Solutions, Public Education Department and Higher Education Department.

Governor Richardson also announced the release of the New Mexico Green Jobs Guidebook. The Guidebook provides an overview of green occupations, their education requirements, and resources available at New Mexico colleges and universities. The guidebook is available on the Economic Development Departments website, http://www.edd.state.nm.us/.

Additionally, Governor Richardson announced he will seek legislation to expand the state's Renewable Energy Production Tax Credit during the upcoming legislative session. The expansion will double the available credit for solar generators to one million megawatt hours. The Production Tax Credit expansion is critical for ensuring that there is an in-state market for the products from our growing cluster of solar manufacturers like SCHOTT, Emcore, and Signet Solar.

The Green Jobs Cabinet report is available here.

The full text of the executive order is available here.

Governor Bill Richardson Applauds $6 Million Clean Energy Workforce Training Award

Jan 20, 2010 SANTA FE - Governor Bill Richardson today applauded the news that the New Mexico Department of Workforce Solutions has been awarded a nearly $6 million American Recovery and Reinvestment Act grant to create new workforce training for New Mexico's emerging renewable energy and energy efficiency sectors. The award was made by the U.S. Department of Labor.

"Developing a world-class clean energy workforce is critical to New Mexico's economic development," Governor Richardson said. "This grant will allow us to better identify the needs of business in these green energy sectors and to grow and develop worker training opportunities to meet those needs."

Last week, Governor Richardson signed an executive order outlining the state's course to building a comprehensive green economy and detailed how various state agencies would play a part. This grant will help the Department of Workforce Solutions meet its directive to establish a statewide, systemic approach to worker training in energy efficiency and renewable energy jobs.

"Critical components that businesses examine when relocating or opening are workforce skills and education," Secretary-designate Ken Ortiz of the New Mexico Department of Workforce Solutions said. "This award will allow us to fill that need and encourage additional business growth in New Mexico."

The grant will help create four regional Green Industry Councils focused on biofuels, solar energy, wind energy, and green building/energy efficiency. Each council will pair with one of the four local workforce development boards and have representatives from business, education, organized labor, workforce and economic development organizations and state agencies including the Department of Workforce Solutions and the Economic Development Department.

Once training needs are identified, they will be provided through the community college system, four-year universities, apprenticeship programs, and potentially graduate programs, depending on the identified regional needs.

The New Mexico Department of Workforce Solutions will act as the administrative and fiscal agent for the grant. Policy and strategic oversight of the grant will be provided through a subcommittee of the State Workforce Board that includes members from business, education, organized labor, economic development organizations, state agencies and the Governor's Green Jobs Cabinet.

Governor Bill Richardson Announces Wind Tower Manufacturing

Plant to Create 150 Jobs in Santa Teresa

Jan 8, 2010 SANTA FE - Governor Bill Richardson today announced Johnson Plate and Tower will build a wind tower manufacturing facility in Santa Teresa. The facility is expected to create dozens of construction jobs and 150 permanent jobs.

"I am pleased that Johnson Plate and Tower chose New Mexico to build its new wind tower manufacturing plant and plans to create 150 new jobs in our state," Governor Richardson said.

"This announcement shows that our aggressive efforts to create jobs, especially during this global recession, are paying off. Manufacturing of green technology is an important component of building a green jobs economy here in New Mexico."

Today President Obama announced that Johnson Plate and Tower is one 183 projects that will share $2.3 billion in Recovery Act Advanced Energy Manufacturing Tax Credits for clean energy manufacturing projects across the United States. Johnson Plate and Tower was awarded $2,385,000 in credits for its Santa Teresa facility.

Johnson Plate and Tower will build its more than 84,000 square-foot manufacturing facility on 22 acres in the Verde Logistics Park. The company expects to employ 40-50 people during the construction phase and then move to a full time operation employing 150 people in the manufacturing of wind towers for wind farms across the country.

"We are excited that Johnson Plate and Tower chose to locate in our growing industrial border-plex region here in New Mexico," Economic Secretary Fred Mondragon said. "I want to commend Dona Ana County for the passage of the Local Economic Development Act that helped make this project possible."

SunEdison and Xcel Energy Strike Deal for 50MW (AC) / 55MW (DC) of Solar PV Energy in New Mexico

Santa Fe, New Mexico - December 23, 2009 - SunEdison, North America's largest solar energy services provider, a subsidiary of MEMC Electronic Materials (NYSE: WFR), and Xcel Energy's regional operating company, Southwestern Public Service Company, today announced a deal for five photovoltaic solar installations in New Mexico that will total 50 megawatts (MW) in generation capacity.
The five 10MW sites, to be located in Lea and Eddy counties in southeastern New Mexico, will comprise a utility-scale, ground-mount system that will be fully operational by the end of 2011. In total, the installations will generate enough power for more than 10,000 homes in its first full year of operation. This total project will enable Xcel Energy to continue meeting New Mexico's renewable portfolio standard, which requires that regulated electric utilities meet 15 percent of their electricity needs by 2015, and 20 percent by 2020,

through renewable energy sources.

The five installations will be built, financed and maintained by SunEdison, under a 20-year solar power services agreement (SPSA) with Xcel Energy, which will buy the solar power generated by the plant.

"We are thrilled to begin harvesting New Mexico's rich solar resources, and we are equally proud to add this project to our growing base of wind energy, as we diversify our renewable energy portfolio," said Riley Hill, president and CEO of Southwestern Public Service Company, an Xcel Energy company. "We are also pleased to be working with SunEdison, a leader in solar development with the experience and financial strength to ensure a smooth project completion."

This project eclipses the 8.22MW (DC) solar power system SunEdison activated for Xcel Energy in Alamosa, Colorado in December 2007. At 50MW, the Xcel Energy project will be one of the largest in North America.

Governor of New Mexico Bill Richardson said the project reflects New Mexico's sustained commitment to solar energy leadership. "Excellent natural resources, competitive incentives and pro business policies have positioned New Mexico at the forefront of the clean energy economy, and our commitment continues to generate economic development and well-paying jobs throughout the state," Governor Richardson said.

New Mexico State Senator, Carroll Leavell commented, "I am most appreciative of SunEdison and Xcel Energy for working together for a renewable energy source that will serve southeastern New Mexico and West Texas. This will be of benefit not only as an additional source of energy but also as economic development for Lea and Eddy Counties."

Lisa Hardison, interim president of the Economic Development Corporation of Lea County, said, "Thanks to Xcel Energy, our vision to brand and market Lea County as the EnergyPlex is becoming more and more a reality," Hardison said. "Xcel Energy's infrastructure and commitment to the Renewable Portfolio Standard - energy development, overall - are critical to our efforts. With SunEdison in the EnergyPlex now, we have the nation's most significant energy players across the petroleum, nuclear and renewables industries developing their projects right here."

Some system facts:
Once completed, it is estimated the five 10MW systems will:
- Power more than 10,000 homes in the first full year of operation by producing 110 million kWh.
- Produce over 2 billion kWh of clean solar energy over a 20-year lifespan. That is enough energy to power over 187,000 homes for one year.
- Offset more than 1.3 million metric tons of CO_2 over a 20-year lifespan, equivalent of removing more than 290,000 cars from the road for one year.

Carlos Domenech, President of SunEdison and Executive Vice President of MEMC, noted, "Xcel Energy is a visionary electric utility. The company understands how to make utility-scale renewable energy a reality. Their vision enabled by the local and state leadership will facilitate the creation of green jobs in New Mexico". Domenech continues, "SunEdison welcomes the opportunity to bring its proven track record in utility-scale solar, financial strength and the most cost-effective technologies to address Xcel Energy's needs."

PNM, First Solar Sign Contract for 22 Megawatts of Utility Scale Solar Power for New Mexico

Jan 19, 2010 Albuquerque: PNM, New Mexico's largest electric utility, has signed a contract with First Solar (Nasdaq: FSLR) to construct 22 megawatts (MW) AC of utility scale photovoltaic

(PV) solar power plants in New Mexico.

First Solar, based in Tempe, Arizona, will construct the facilities using its advanced PV panels at five separate sites within PNM's service territory. The sites will be chosen based on cost, availability and suitability of land; the quality of a site's solar potential; environmental and permitting considerations; and level of local support.

"We are proud to have a company with First Solar's internationally recognized expertise and reputation building these facilities to help us meet the growing energy needs of our customers," said Pat Vincent-Collawn, PNM president and CEO. More than 1,800 MW of First Solar's PV panel technology has been deployed in multiple projects throughout the world.

"PNM's decision to use First Solar's panels demonstrates the value PV technology can bring to electric utilities seeking to adopt renewable energy generation," said Bruce Sohn, First Solar president. "We are pleased to be working with PNM in New Mexico, a state that has excellent solar resources and is well positioned to take advantage of clean, affordable energy."

If approved by state regulators, the 22 MW AC of new solar capacity - which, according to PNM, can produce enough power to supply 7,000 average sized New Mexico homes - would be the first contracted under the terms of an agreement PNM reached with state environmental, renewable energy and governmental organizations two weeks ago. The specifics of that plan, to be filed with the New Mexico Public Regulation Commission (PRC) on Jan. 25, call for a total of 45 MW of utility scale solar PV to be added to PNM's system in the 2010-2011 timeframe.

Vincent-Collawn said that sites chosen to host the solar PV facilities will be announced as they are determined. Construction on the first site is expected to start by 2011, or as soon as the PRC approves PNM's renewable plan. First Solar expects construction at all five sites to be completed by late 2011. The build-outs will create approximately 100 construction jobs. Once completed, PNM will own the sites as part of its generation portfolio to serve New Mexico customers.

Governor Bill Richardson Applauds More Than $38 Million in Recovery Act Tax Credits For Clean Energy Manufacturing

Jan 8, 2010 SANTA FE- Governor Bill Richardson today applauded the news that three companies with operations in New Mexico have been awarded more than $38 million in Recovery Act Advanced Energy Manufacturing Tax Credits by the U.S. Departments of Treasury and Energy.

The awards are part of $2.3 billion announced by President Obama today to create high quality, clean energy jobs and domestic manufacturing of clean energy technologies.

"These tax credits are a major boost to our efforts to build a green economy here In New Mexico," Governor Richardson said. "Manufacturing clean technologies here at home is a major component of a sustainable green industry that creates high-tech and high-wage jobs for New Mexicans across the state."

"As chair of the state's Green Jobs Cabinet, I believe these advanced energy manufacturing tax credits, combined with our state's renewable energy incentives, are a big step forward in establishing long-term renewable energy manufacturing jobs for our workforce," said Economic Development Secretary Fred Mondragon.

Companies with New Mexico operations included in today's announcement include Schott Solar, Johnson Plate and Tower Fabrication and Sumco Phoenix.

$10M Grants for Green Training Includes NM

By Michael Hartranft, ABQ Journal
Wednesday, 06 January 2010 16:59

New Mexicans are among those who will get training opportunities for green industry jobs thanks to two grants totaling nearly $10 million, the U.S. Department of Labor Employment and Training Administration said Wednesday. The International Training Institute for the Sheet Metal and Air Conditioning Industry was awarded $4.99 million to train individuals in energy-efficient building construction, retrofitting and manufacturing in seven Midwest and western states, including New Mexico.

Meanwhile, the Texas-based Austin Electrical Joint Apprenticeship Training Committee will receive $4.84 million to create an electrician solar training initiative in that state, New Mexico, Arizona, Oklahoma and Kansas.

The projects are among 25 receiving Energy Training Partnership grants ranging from $1.4 million to $5 million for training tailored for occupations and skills in demand around the country.

"Today's announcement is part of the administration's long-term commitment to fostering both immediate economic revitalization and a clean energy future," Labor Secretary Hilda L. Solis said in a statement.
The International Training Institute, based in Alexandria, Va., will provide training for about 1,200 people through partnerships with the sheet metal and air conditioning organizations and their local affiliates, training centers, work-force investment boards and career centers.
The Austin Electrical Joint Apprenticeship Training Committee intends to train about 950 people to meet immediate employment needs at new solar power plants in Austin and San Antonio, director Gilbert Ferrales said. It then plans to train several hundred more in the other participating states through "train the trainer" programs.

"What we want to do is get New Mexico people here and then train them to train more New Mexico people," he said. Its Albuquerque connection will be Local 611 of the International Brotherhood of Electrical Workers.

Secretary Chu Announces Nearly $80 Million Investment for Advanced Biofuels Research and Fueling Infrastructure

NMSU and LANL are partners

Investment builds upon the Department's ongoing effort to spur the creation of the domestic bio-industry and create new jobs

Jan 13, 2010 Washington, DC - U.S. Department of Energy Secretary Steven Chu today announced the investment of nearly $80 million under the American Recovery and Reinvestment Act for advanced biofuels research and fueling infrastructure that will help support the development of a clean sustainable transportation sector. The selections announced today - two biofuels consortia for up to $78 million to research algae-based- are part of the Department's continued effort to spur the creation of the domestic bio-industry while creating jobs.

"Advanced biofuels are crucial to building a clean energy economy," said Secretary Chu. "By harnessing the power of science and technology, we can bring new biofuels to the market and develop a cleaner and more sustainable transportation sector. This investment will help spur the creation of the domestic bio-industry, while creating jobs and reducing our dependence on foreign oil."

Biofuels Consortia

Two cross-functional groups will seek to break down critical barriers to the commercialization of algae-based and other advanced biofuels such as green aviation fuels, diesel, and gasoline that can be transported and sold using today's existing fueling infrastructure. The selected projects consist of leading scientists and engineers from universities, private industry, and government, and will facilitate sharing expertise and technologies.

For a complete list and project descriptions of awards announced today please visit LINK

Sandia's Battery Abuse Testing Lab Awarded Stimulus Funds

by Staff Writers
Albuquerque NM (SPX) Dec 23, 2009

Sandia researcher Pete Roth examines a lithium-ion battery before dismantling it for testing in the chamber behind him. Photo by Randy Montoya

Sandia National Laboratories will use $4.2 million in American Recovery and Reinvestment Act funds to modify and enhance its existing Battery Abuse Testing Laboratory (BATLab), with the goal of developing low-cost batteries for electric and plug-in hybrid electric vehicles.

Sandia's BATLab is internationally recognized as a leader in the field of battery testing to ensure they meet real-world performance requirements.

The tests help to determine how much abuse lithium ion batteries can safely handle, including being crushed, pounded with nails and heated to boiling hot temperatures. Sandia tests everything from regular small cells about the size of a laptop computer battery up to full-sized modules and packs weighing several hundred pounds for hybrid vehicles.

The $4.2 million in funding is part of a $104.7 million economic stimulus package to further develop the nation's efforts in clean energy and efficient technologies across seven DOE national laboratories. Deputy Secretary of Energy Daniel Poneman made the announcement during a recent visit to Sandia to be briefed on the Labs' capabilities and programs.

"As we look to the future and the challenges this nation will continue to face in terms of national security, in terms of energy security, in terms of climate, we can continue to rely on the insights, innovation, technology, dedication and patriotism of the people at Sandia and at our other national laboratories," said Poneman.

The nation's first full-scale debut of electric cars that can run up to 40 miles on a single charge is expected late next year, and Sandia has played an instrumental role in ensuring the safety and reliability of the batteries that power those vehicles.

The DOE-funded FreedomCAR program turned to Sandia to investigate the possibility of safely using lithium-ion batteries, which have more power and weigh less than the nickel-metal hydride batteries currently being used in hybrid vehicles. But before lithium-ion batteries could be placed in vehicles, extensive safety tests needed to take place. With the recent stimulus funds, the BATLab will be able to greatly increase the number of tests it does.

"The equipment and facilities that we currently have allow us to do only one test at a time, so our throughput has been somewhat limited," said Pete Roth, lead researcher for Sandia's FreedomCAR program.

"The new equipment and upgrades that we will be able to implement will enhance the amount and range of testing and diagnostics that we can do, and we expect to at least be able to double our throughput." Those upgrades include fire suppression, improved lighting and advanced electrical systems, in addition to new software and analytical equipment to help diagnose battery responses and provide data for manufacturers.

Such improved efficiency will allow Sandia to continue to offer increasingly valuable contributions to the nation's FreedomCAR effort.

"Pete and his team are already internationally recognized for this work, and this funding will help us to sustain that leadership position into the future as auto manufacturers start to implement these lithium battery modules and packs into their vehicles," said Tom Wunsch, manager of Sandia's Advanced Power Sources R and D group.

The $104.7 million ARRA funding is concentrated on three priorities: advancing carbon fiber manufacturing and processing technologies to help reduce the weight of vehicles; developing integrated building systems to reduce U.S. carbon emissions and expanding facilities for fabricating and testing advanced battery prototypes for fuel-efficient vehicles.

"It's so terribly important that we keep the nation's work moving in this direction," said Poneman.

"We as a nation have relied on the national laboratories since the time of World War II, well over half a century, to keep this nation strong, to keep us at the cutting-edge of science, of innovation in the service of the nation and in the service of the American people. The scientists and engineers who've been working all these years at Sandia are owed a great debt of gratitude by the American people for the tremendous progress they have made in keeping our nation safe."

SCHOTT Solar Expands Production, Hires 60 in Albuquerque

** Photovoltaic Production to be 24/7 by January 1*

<u>December 17, 2009</u> *(Albuquerque, NM)* - Less than nine months after beginning production at its new Albuquerque facility, SCHOTT Solar today announced the expansion of its photovoltaic (PV) module production line. PV production will double, from two shifts to four shifts on a rotating schedule, effectively creating a 24 hour-a-day, 7 days-a-week production capacity at SCHOTT Solar's flagship facility.

In order to meet this increased production schedule, SCHOTT Solar has been hiring up to 10 new employees per week since the first of November; the majority of the new positions have been PV Production Technicians. In addition to more than doubling the ranks of Production Technicians, new Materials Handlers, and Tech Services/Facilities Technicians positions have also been filled. These 60 new employees will bring the PV production lines to full capacity of 160 employees by the end of December.

"Creating jobs in today's economic environment is a tremendous achievement for any company," said Dr. Gerald Fine, CEO & President, SCHOTT Solar, Inc. "To be able to almost double our PV workforce in such a short time is a testament to the hard work and dedication of the people who have been with us from the start. They put in the work that allows us to grow."

In order to fill a large number of positions in a relatively short amount of time, SCHOTT Solar partnered with Manpower of Albuquerque.

"We have an ongoing relationship with Manpower," said Lauren Lake, Director of Human Resources, SCHOTT Solar. "They provided a vital service when we first began hiring in early 2009. The skill level of candidates we bring on from Manpower is superb. For that reason, we have been able to hire a significant number of full-time employees from the Manpower ranks."

SCHOTT Solar continues to build its Sales and Marketing team in the US, recently opening an East Coast sales office in Elmsford, NY, and relocating the West Coast sales office to San Jose, California. At the same time, Tom Hecht was appointed Executive Vice President of Sales & Marketing

ENMU, RISC and Xcel break ground for solar installation

<u>December 16, 2009</u>

Representatives from Xcel Energy, the Roswell Independent School District and Eastern New Mexico University-Roswell broke ground on a new solar installation on ENMU-R's campus at the Roswell International Air Center, Tuesday.

The purpose of the project is primarily education, although the 35-kilowatt installation will produce enough energy to power about 10 average-size homes. Wes Reeves, a spokesman for Xcel Energy, said construction will begin in January and is expected to be completed by March

New Mexico Business Converts Home Offices to Solar Energy; System Among Largest for a Private Business in New Mexico

Thursday, Jan 14, 2010

Local construction and asphalt paving company Constructors, Inc. is today announcing the conversion of its two Carlsbad-based administrative offices to solar energy. This makes the company one of just several private businesses in New Mexico to convert to solar.

According to Brendan Miller, Green Economy Manager for the New Mexico Economic Development Department, the scope of the conversion is unique. "This project is the largest solar installation for a private company in New Mexico, as far as I know," he said.

The government's recent introduction of tax credits and incentives is a major factor in Constructors' ability to go solar, according to Constructors president David Shoup. "At both Federal and State levels, the government has made it affordable for companies like ours to implement these types of programs," said Shoup.

This summer, Constructors' management challenged intern Janea Dickson, a sophomore at University of New Mexico, to create a proposal on the conversion to solar, and by the end of July the proposal was complete. At that time, Constructors decided to move forward.

The new system will generate approximately 8,300 Kilowatt hours per month via a system that uses 216 interconnected 210-Watt solar panels, which cover approximately 1,300 square feet. This nearly eliminates electricity consumption from the company's standard power grid for both offices.

The solar offices' energy will now be produced by a photovoltaic system, which eliminates the need for power to be pulled from the grid during an average day's operation; this includes HVAC, lighting, and power for computers, fax machines, copiers and other office equipment.

The solar panels were manufactured by Sanyo, and Solar Smart Living completed the installation. Constructors' system will be powered by Xcel Energy. Carlsbad-based Murrill Electric handled the electrical interconnection between the offices, the power grid and the solar array.

Constructors has long been committed to reducing its negative impact on the

environment. "The asphalt products we produce use up to 35% recycled material, which requires less oil usage and reuses existing material," said Shoup. "Converting to solar energy is another way we can make an impact, because it helps us reduce our dependence on traditional energy sources.".

Constructors also recently implemented a battery recycling program at their offices in Carlsbad, Roswell and Hobbs - a project undertaken by intern Katy Cox, a sophomore at New Mexico State University. The company also encouraged reduced paper/plastic consumption by giving away cloth shopping bags on Earth Day last year.

"We are really excited about our Carlsbad offices becoming energy independent," said Shoup. "'Environmental Excellence' is among our top strategic objectives, and the conversion to solar definitely aligns with that commitment."

Sandia's New Supercomputer Helps Energize NREL's Research

<u>**Thursday, December 17, 2009**</u>

There's a new high-performance computer at U.S. Department of Energy's Sandia National Laboratories, and it stands on the shoulders of giants. Red Sky is located in the space where legendary system ASCI Red once stood, ready to assist the Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) and Sandia in solving the nation's pressing energy challenges. Red Sky is listed by Top 500 Supercomputer Sites as the 10th fastest computer in the world.

The top 10 ranking was achieved by temporarily aggregating Red Sky, Sandia's newest institutional machine, with a second system being constructed using the same architecture and components on behalf of NREL.The second system is sited adjacent to Red Sky and operated by Sandia to support work sponsored by the DOE's Office of Energy Efficiency and Renewable Energy.

The overall attributes of Red Sky, combined with promising early application results, made for an easy choice when faced with the opportunity to stand up additional capability for the Sandia/NREL high-performance computing (HPC) collaboration. The collaboration leverages Sandia's experience in HPC to provide a computational resource for applications in the energy sector, as NREL grows its computational science capabilities and expertise

Steve Hammond, director of the computational science center at NREL, said he is excited about this collaboration. "The staff at Sandia are outstanding and the collaboration allows NREL scientists access to vital HPC capabilities to meet our needs for modeling and simulation in support of energy efficiency and renewable energy technologies critical to the nation. Red Sky fills a key capability gap for NREL until our new facility is completed in 2012," Hammond said.

The flexibility of the Red Sky architecture enabled this super-configuration which achieved a peak performance of more than 500 Teraflops (or 500 trillion mathematical operations per second), and an impressive 433.5 Teraflops against the Linpack benchmark commonly used for ranking supercomputing speed.

"One thing that's really exciting to me about this project," said Rob Leland, director of Sandia's Computing and Network Services Center, "is that we're taking the architectural philosophy and design principles that we pioneered in systems for the weapons program such as ASCI Red and Red Storm and building a machine that will be broadly available."

The use of "red" in the name evokes the legacy of Sandia's earlier successful supercomputing systems and programs. The designers and builders of Red Sky built on the design principles and successes of earlier machines such as ASCI Red from the mid-1990s and Red Storm from early 2000. "Red" also conveys to the broader computing community that this is a machine consistent in its approach and its philosophy with those previous Sandia machines that were so highly regarded in industry.

Red Sky is intended to be a capacity machine. "It's not designed with the full-system job as its target," said Dino Pavlakos, Sandia manager of scientific computing support. "It's designed to run lots and lots of jobs. While we were at it, we wanted to do a design that could accommodate a higher degree of scalability than you would ordinarily see in a commodity-based system." The trick is to leverage the economics of commodity parts and yet incorporate the design principles learned from previous generations of specialized HPC systems.

"It's a scalable design," Leland said, "but it's also an extensible design, meaning we can physically build it out." One key feature that enables this is the simple "topology," which uses a three-dimensional mesh-type grid. "It turns out," Leland said, "that structure is a good choice for mapping physical codes onto the machine because physics is typically expressed mathematically in a three-dimensional grid that matches well to the machine."

A project of this complexity and ambition requires a close partnership with leading-edge vendors. In this case, Sandia worked with Sun Microsystems and Intel.

"Sun was willing to take substantial risks and create and invest in technology for the partnership," Leland said, "so it was a very good fit for our needs and goals." Sun was also willing to work with Sandia to innovate in several key dimensions, he said.

Red Sky is a commodity machine, but off-the-shelf is not the complete story. "Many of the system components are leading-edge, but they are commodity parts," Pavlakos said.

"Intel gave us early access to their latest processing technology and very competitive pricing for that new technology," Leland said. Intel was a natural choice, he said because it has been very actively re-establishing itself in the scientific high-performance computing market in recent years. Leland said Intel's processor technology is moving intentionally toward incorporating certain key technologies and design features that support Sandia's goals for the machine.

The Red Sky project, Leland said, required both a commitment to technical innovation and strong value because the machine must provide the highest-quality service for the lowest prices possible. The Labs also wanted the project to continue Sandia's legacy of innovation, excellence and leadership in high-performance computing.

Another area of innovation in Red Sky is in its energy efficiency. "Red Sky should really be called Green Sky," said John Zepper, senior manager of computing systems. "This machine is the most energy efficient HPC system we have deployed to date."

Resource: Business Opportunity Session (BOS) Webcast

December 17, 2009 - The Office of Small and Disadvantaged Business Utilization will host its Business Opportunity Session (BOS) today at the Department of Energy's (DOE's) headquarters in Washington, D.C.

Department of Energy program office representatives, as well as representatives from local state small business offices and the US Small Business Administration, will present at the event to discuss subcontracting and contracting opportunities as well as financial assistance available to small businesses interested in working with DOE.

The entire event broadcast through a LIVE WEBCAST via the Office of Small and Disadvantaged Business Utilization's website: http://smallbusiness.doe.gov/.

For additional information about this event, please contact BOS Coordinator Kent.Hibben@hq.doe.gov.

To download information from the September 2009 BOS:

$6 Billion of Funding Opportunities at DOE
September 2009 - Business Opportunity Session
(Watch Video)
(Download Presentations)

How do Businesses Become Lean and Green?

Do you want to start a green business or make your existing business more sustainable? Are you looking for how to do it and where to start? Where and how do you learn about sustainable business practices and the opportunities and pitfalls associated with sustainable business?

Entrepreneurs and business owners across the country are looking toward the future and facing the dilemmas associated with these very real questions. Not surprisingly, thousands of aspiring and existing entrepreneurs are testing a variety of tools for learning the basics of sustainable business, including the popular do-it-yourself model, by taking a class, attending a workshop or learning about sustainability from books or online resources.

Yet, since entrepreneurs often learn best from other entrepreneurs, many business owners are embracing new business networks focused on green or sustainable business practices and issues. There are literally hundreds, if not thousands, of such networks popping up across the globe. In the U.S., they range from social mixer events, such as those sponsored by the growing number of "Green Drinks" groups. Started in a London pub in 1989, "Green Drinks" has evolved into a global self-organizing network of people with an interest in learning more about environmental sustainability while also having fun. Local networks operate in nearly every U.S. state, with more than 641 active groups worldwide.

Networks focused more directly on business issues are also emerging. Many groups focus on a single community or a single sector. For example, the construction industry is aggressively embracing green building practices, and, as a result, several new green building networks are emerging. At the national level, groups like the Green Building Institute and the U.S. Green Building Council are generating attention. Other national networks combine business training and collaboration with advocacy. E2, the Environmental Entrepreneurs, works with the Natural Resources Defense Council, an environmental action organization with 1.3 million members and online activists, to advocate issues that affect the environment and environmental entrepreneurs.

Green business certification is an even more formal approach to learning the latest trends in sustainable business practices. In general, the field of green certification, pioneered by the well known LEED (Leadership in Energy and Environmental Design) standards, is booming. Following the pattern set by LEED, many of the early certification efforts focused on issues of design and energy use. Other efforts, such as Green Seal, seek to combat the practice of greenwashing, a practice in which firms erroneously claim that their products or policies are environmentally friendly, by promoting rigorous global standards for green products.

Meanwhile, a whole host of small business certification efforts are also being introduced. These programs focus heavily on energy use, but also seek to introduce other sustainable business practices. Green Plus, developed by the North Carolina-based Institute for Sustainable Development, is one of the more expansive of these small business education and certification programs. The Green Plus program is built on partnerships with local groups, such as Chambers of Commerce or economic development organizations, which sponsor the specialized Green Plus training and education programs for their members. Firms can opt to use the Green Plus How-To Guide, or they can pursue formal certification. All participating firms also develop their own in-house diagnostic survey that helps them benchmark their performance and identify problem areas.

The Green Plus model, and related efforts, seek to get companies focused on the triple bottom line. They envision that firms can do the right thing for people and place, including their employees, their customers and their communities. But, the green business movement will never succeed unless it also improves performance - the company bottom line. These programs hope to succeed by combining a commitment to people, place and performance.

For more information visit:
www.greendrinks.org/
www.greenbuildinginstitute.org/
www.usgbc.org/
www.e2.org/
www.greenseal.org/
www.gogreenplus.org/

Source: EDA News newsletter

Resource: Energy Data Available Anywhere, Anytime

NREL launches a new Internet site to allow organizations around the world to both post their own energy data and download data, for free. Full story

Seeking green news

Send us information on green businesses around the state

Each month, this newsletter will highlight news from green businesses and initiatives around New Mexico. Please forward press releases, accomplishments, awards and other notable news for possible inclusion. This is a great way to get the word out and begin to strengthen the green business community across New Mexico. We can also include short profiles of green businesses around the state. Please make contact if you would like your business to be considered for a profile.

Submissions should be sent to Brendan Miller at brendan.miller@state.nm.us. Thank you.

The New Mexico Green Economy Initiative is a project of the New Mexico Economic Development Department in cooperation with Governor Richardson's Green Jobs Cabinet. This Cabinet was created in recognition of the important role the Green Economy plays in New Mexico. More information can be found on our website.

Sincerely,

Brendan Miller

Green Economy Manager

Forward email

Email Marketing by

OCD Draft Geothermal Work Group Brainstorm Sheet
for Comments & Recommendations
Last Updated: 2-12-2010

OCD Training Folder ..\Geothermal Work Group 2010

The EMNRD and Geothermal Working Group mission is briefly stated below.

The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource.

All OCD Staff wishing to post draft comments and/or recommendations are welcome to do so. Please add your name at the end of your comments so we may contact you if we have questions. Thanks in advance for your assistance.

Database Recommendations:

1) Geothermal GIS high-temperature (>250F) thematic maps on Google Earth (GlennvG)

Technical Recommendations:

1) Development of geothermal resources in areas with prolific water resources (siting criteria?) that will provide make-up water for cooling towers, etc.(CarlC);

2) Geothermal engineering applications must be efficient to minimize loss of the water resource and depletion of hydrologic resources (CarlC);

3) Pollution prevention and waste minimization (i.e., environmentally friendly chemicals, biocides or technologies that will control scale, fouling and corrosion problems without the application of toxic chemicals (CarlC);

4) Aesthetic concerns (i.e., noise from well testing; large pits, etc.) need to be developed; 5) Focus on low-quality deeper geothermal gradient water resources in the oil and gas fields of NM accessible to nearby transmission grids (CarlC);

5) Focus on transmission grid assessment and construction into identified deep-source geothermal resource areas to convey power inter-intra state (CarlC);

6) OCD shall facilitate a permit and bonding process for re-entry into existing oil and gas wells that will consist of submittal of G-101, G-102, G-103 along w/ Unnumbered form and C-108 to expedite geothermal applications (including

exploratory single well approach without discharge permit issuance and public notice process?) in the oil fields of NM (CarlC);

7) OCD already has a WQCC process in place for permitting larger geothermal exploration and production projects (CarlC);

8) Other renewable technologies need to work together and make deals to install renewable and make more efficient use of the power transmission lines. For example, geothermal plants have plenty of surface area to install solar and wind energy system to boost power production (CarlC).

9) Oil and gas well conversion, workover, and/or re-drill of PA's wells into geothermal production and/or WQCC injection wells shall require a minimum casing diameter of 12 in. (could accept 7 – 12 in. or greater?) with appropriate well construction (CarlC).

10) EGS shall be controlled to allow the use of more efficient geothermal power generating systems (i.e., binary cycle). Flash steam geothermal is prohibited (CarlC).

11) EGS shall not be allowed to inject (blind injection) over fault zones and highly fractured rock areas due to seismicity concerns (siting consideration shall apply) (CarlC).

Policy Recommendations:

1) More funding is needed to move NM's geothermal program forward and to maintain the day-to-day upkeep of data to sustain long-term geothermal power production (CarlC). The nuclear power industry received much more funding to accomplish the goals of the Federal Government.

2) OCD geothermal exploration w/o WQCC discharge permit process for geothermal exploration in existing oil and gas wells in the oil fields of NM? (CarlC);

3) Geothermal power producers shall have all mineral, land and water rights issues resolved in advance of geothermal permit application, unless the applicant is willing to undergo a longer-term permit geothermal process with hearings, etc (CarlC).

4) OCD should strive to resolve land mineral, land and water rights issues in a policy that would allow geothermal power generation in oilfields of NM where transmission grid systems are already in position (CarlC).

Chavez, Carl J, EMNRD

From: Richards, Maria [mrichard@mail.smu.edu]
Sent: Tuesday, January 19, 2010 2:23 PM
To: mrichard@smu.edu
Subject: Texas Geothermal Energy Development - Rule making, meetings, person to Hire!

Hello!

Here are a few items for you to keep up-to-date on Texas Geothermal development. Regardless of where you are in the world, this first item may impact your geothermal projects in the future. (How's that for thinking like a Texan.)

The Texas **Non-Wind Renewable Portfolio Standard** could be adopted this year with your assistance.

The Texas Public Utility Board needs your feedback on the **Strawman regulation before Feb 12**. Rulemaking to Relating to the Goal for Renewable Energy Project #35792 http://www.puc.state.tx.us/rules/rulemake/35792/35792.cfm

To help understand the documents, **Good Company Associates** has put together information on their website. http://www.goodcompanyassociates.com/news/nonwindrpsdraft

Feedback regarding this rulemaking will be discussed at the **TREIA meeting this Thursday** (see below). Comments maybe sent to Loy Sneary, who is the lead for the geothermal energy development subcommittee. (loys@sbcglobal.net) or 979-240-3512.

From: loy sneary [mailto:loys@sbcglobal.net]
Sent: Sunday, January 17, 2010 7:00 PM
Thank all of you who attended the meeting last week. I think that it was a very productive meeting as we began the dialogue.

I want to remind everyone about the TREIA meeting on Thursday, January 21 in Austin. I have included the information about the meeting below.

Please remember that to attend the meeting you will first need to be a TREIA member if you are not already. To do so, just go to www.treia.org and join on-line. You will have the opportunity when you join to select the sub-committee's you'd like to be a part of. Be sure and check Geothermal Electric if you want to attend Thursday's meeting. Again, the meeting on Thursday is to determine our recommendations for the TREIA Board, thus the TREIA Membership requirement.

TREIA POLICY FORUM & LUNCHEON & TREIA BOARD OF DIRECTORS MEETING

What/When:
TREIA Policy Forum & Luncheon
January 21, 2010
9:30 a.m. – 3:30 p.m.

TREIA Board of Directors Meeting
January 22, 2010 9:00 a.m. – 3:30 p.m.

Where: OMNI Austin Hotel Southpark
4140 Governor's Row
Austin, Texas 78744
(S.E. Intersection of IH-35 & Ben White Blvd/Hwy. 71)

Spending a night or two? Special Group Room Rates - $119 single/$139 double, nights of January 20 and/or 21. (See more details below.)

Please mark you calendars and register early for this Policy Forum on Thursday, January 21. It precedes the meeting of the TREIA Board of Directors set for Friday the 22nd at the same location. A preliminary agenda can be found below. The major objective will be to make refinements and additions to the work product of the Policy Subcommittees from the September Policy meeting. The resulting reports are what the board will work from to begin shaping the official priorities of TREIA for the 2011 legislative session. Members who wish to are welcome to sit in and observe the Friday Board meeting.

This will be an opportunity to:

* bring up items which are hindering the development of your renewable energy industry sector, or are needed to stimulate that development;
* begin to fashion the elements of proposed initiatives;
* hear an important keynote presenter (tba) at the luncheon;
* get the latest info. From our staff and policy team on legislative interim charges, the Sunset Commission process, and PUC rulemakings;
* share positions with the larger TREIA membership;
* network with members you know, and meet others who have recently joined; and
* meet new and continuing board members.

Looking to Hire? Recent MIT graduate looking for opportunity in geothermal industry is now living in Texas!

ANDREW GREENHUT
Mechanical Engineering, MIT
Professor Jefferson Tester Group
(740) 473-6488
Andrew.Greenhut@gmail.com

Research in solar thermal and geothermal power systems.
Advised by Professor Jeff Tester, Professor Ronald DiPippo, and Mr. Randall Field from MIT Energy Initiative.
Skills in Aspen Software Suite (steady-state, dynamic, cost estimation, and detailed heat exchanger design).
Strong background in thermodynamics, heat transfer, and fluids.
Member of MIT Energy Club - Panel lead organizer for MIT Energy Conference.
Semifinalist in MIT $100K Business Plan competition 2009 for wave energy proposal.
Available January 2010.

For full resume, please contact Andrew directly.

GEOTHERMAL ENERGY: A GIFT FROM THE EARTH

SIERRA CLUB

TUESDAY, JANUARY 19, 2010, 6:30 PM

San Antonio, Texas WITTE MUSEUM, 3801 BROADWAY

Charles Lonsberry of Southwest Mechanical Services; **Howard Rogers**, geothermal aficionado; and green engineer **Randy Carroll-Bradd** will present an evening of geothermal energy, one of the least known of the clean energy alternatives.

Geothermal is a reliable source of energy that uses mature technology and is fuel- as well as emissions-free. The cost and payback time for residential and small-building geothermal are roughly equivalent to those of solar photovoltaics. The cost for central geothermal in Texas can be lower than elsewhere because already drilled oil and gas wells can be used for geothermal piping.

Free Admission. Free Parking at Museum or in Parking Garage across Tuleta St., South of Museum

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Here's to your fabulous 2010!

Maria Richards
SMU Geothermal Lab Coordinator
Room 220 Heroy
214-768-1975
mrichard@smu.edu
PO Box 75-0395
Dallas, TX 75275-0395
http://smu.edu/geothermal

Chavez, Carl J, EMNRD

From: Katharine Chartrand [info@newmexicoconsortium.org]
Sent: Friday, January 15, 2010 3:54 PM
To: Chavez, Carl J, EMNRD
Subject: Deep Source Geothermal Commercialization Working Group - Announcement

Dear Geothermal Group:

The NMC is working with the EMNRD to coordinate and facilitate the Deep Source Geothermal Commercialization Working Group ("Geothermal Group") activities. The proposed date for the first meeting of the working group is February 11th at 9am. It will be an all-day meeting in Santa Fe. Please respond and let us know if you can attend. If that date does not work, please let us know your availability.

NMC will support a website for the Geothermal Group on its private website. Please join the NMC Network by following this link to get access to join the group website. Forward me information you would like to post on the site about your activities, interests and priorities in Deep Source Geothermal Commercialization. Let me know if there is anything we can do to facilitate communication through the website or other means.

The final date, location and agenda for the meeting will be posted on the site soon.

Please see the following announcement from Stephen Lucero regarding the group and its missions.

Katharine Chartrand

Executive Director

New Mexico Consortium

knc@newmexicoconsortium.org

EMNRD, with the cooperation of the New Mexico Institute of Mining and Technology ("NMT"), shall convene a Deep Source Geothermal Commercialization Working Group ("Geothermal Group") no later than March 1, 2010. The Geothermal Group shall be chaired by EMNRD. The Geothermal Group shall oversee the development of a Statewide geothermal resource assessment and database. The purpose of the resource assessment and database shall be to sufficiently characterize the State's geothermal resource and provide a database to prospective geothermal developers that shall promote commercial-scale development of the State's geothermal resource. The Geothermal Group shall also develop technical and policy recommendations to accelerate full-scale development of New Mexico's deep-source geothermal resource. The Geothermal Group shall include representatives from NMT and representatives from EMNRD (including the Oil Conservation Division), the Economic Development Department, the New Mexico Environment Department, and other stakeholders as deemed appropriate by EMNRD. Based on the recommendations of the Geothermal Group, EMNRD shall issue a report with technical and policy recommendations for developing the State's geothermal resource to the GJC and the CEDC no later than December 1, 2010.

http://www.governor.state.nm.us/press/2010/jan/011210_01.pdf