

GEOPOWERING THE WEST  
Meeting Minutes  
January 31, 2007

**Steering Committee Members in attendance:**

Craig Cox, Interwest Energy Alliance  
Angela Crooks, Colorado Governor's Office of Energy Management and Conservation  
Curtis Framel, U.S. Department of Energy  
Matt Sares, Colorado Geological Survey  
Dan Phaure, Dundee Securities Corporation  
Paul Thomsen, Oramt Technologies  
Paul Bony, Delta-Montrose Electric Association  
Randy Manion, Western Area Power Administration  
David Hiller, Senator Ken Salazar's Office  
H.E. "Buzz" Johnson, Enlink Geoenergy Services  
Jeff Holwell, Colorado Office of Economic Development  
John Bilisoly, Colorado Division of Water Resources  
Carsten Mehring, Colorado School of Mines

**Steering Committee Members not in attendance:**

Susan Innis, Western Resource Advocates  
Megan Castle, Colorado Governor's Office of Energy Management and Conservation  
Duane Spencer, Bureau of Land Management  
Gary Klug, Colorado Public Utilities Commission

Randy Manion, renewable resource program manager for Western Area Power Administration (WAPA) called the meeting to order at 8:40 a.m.

Randy welcomed the steering committee members and other attendees to the first annual GeoPowering the West Colorado working group meeting. He then introduced Tom Plant, director of the Colorado Office of Energy Management and Conservation.

Tom began by discussing how newly elected Colorado Gov. Bill Ritter had made the creation of a new energy economy a key part of his campaign. Tom expressed his belief that the governor was already working hard at carrying out this promise. Tom said he believes geothermal electrical generation and direct use applications should serve as a cornerstone in Colorado's renewable energy future.

Tom discussed his educational background, detailing how he had graduated with a degree in geology from Colorado State University. He went on to point out that a recent study and thermal mapping released by the Massachusetts Institute of Technology showed the state's tremendous promise.

Tom discussed how the morning program would focus on various aspects of the geothermal energy industry and the challenges currently facing the industry. The afternoon session would provide an opportunity to begin developing a strategic plan.

Tom then introduced Sandy Glatt and Curtis Framel from the U.S. Department of Energy (DOE) and Paul Bony and Mike Rubala from Delta-Montrose Electric Association (DMEA).

Tom finished by thanking WAPA for the use of their space and their staff's support and introducing David Hiller from Sen. Ken Salazar's office.

Mike Rubala from DMEA then welcomed the group and gave an overview of the days schedule and the facility's layout.

### **GEOPOWERING THE WEST INITIATIVE: GOALS OF THE PROGRAM**

Mike then introduced Curtis Framel from DOE. Curtis reintroduced Sandy Glatt and thanked attendees and WAPA for hosting the event. Curtis expressed his belief that the morning session would help establish a solid foundation of knowledge, while the afternoon session would require that everyone roll up their sleeves and get to the hard work of drafting a strategic plan.

Curtis explained how the Department of Energy hoped to work in concert with the geothermal industry to help establish geothermal produced energy as a leading renewable energy source. He expressed his belief that geothermal could eventually meet a large portion of the nation's heating and power needs. Curtis said he believed geothermal held great promise in helping to secure the nation's energy future while diversifying the country's energy portfolio. It could also serve as a tremendous economic development benefit for rural Colorado.

Curtis said the working group would need to identify and develop processes to resolve market and institutional barriers that are currently inhibiting the industry's growth. He stressed that the groups' goals should include reducing transactional costs, promoting geothermal energy as clean, safe, and reliable, and getting real projects built and operating.

An important way to help accomplish these goals is to network with key stakeholders, increasing their awareness of geothermal and the potential from its three types of uses: electric generation, direct heating, and geothermal heat pumps (GHP).

Curtis said research shows Colorado to have tremendous potential for exploration.

He also explained how the cost of geothermal energy has fallen in recent years, making it a more attractive option. However, there is still more work that needs to be done before the market will fully accept it. He said the price goal should be 5 cents per kWh by the year 2010.

Curtis then presented a graph showing the amount of geothermal generation currently being produced in the western states. Colorado, he explained, wasn't currently generating any electricity. He said that 1500 MWe is currently in development at 58 new project sites across the west.

He then transitioned into how geothermal heat can and is being used for a number of direct applications, including agriculture, aquaculture, industrial uses, residential and district heating, and balneology (the use of heated water for bathing). He also explained how an alligator farm near Alamosa, CO and another in Idaho are using geothermal to heat water for their animals.

Curtis detailed how several communities are using their geothermal resources for district heating, including Steamboat Springs.

Curtis outlined the challenges facing the industry, including the high transactional costs, limited financial resources for exploration and development, technical and general unfamiliarity among many utilities, a complicated permitting process for state and federal lands, and overcoming the public's misconceptions.

He then explained how two states, Alaska and Arizona, have incorporated geothermal energy into their renewable portfolio standards. While they each took unique approaches, they both have had successful outcomes, he said. Colorado will become the 12<sup>th</sup> state to have a geothermal working group.

Curtis also touched on how the group's mission fit nicely with Gov. Ritter's goals of increasing the state's renewable portfolio

standards (RPS) to 20 percent. He then reviewed several of the bills currently before the Colorado State Legislature.

He ended his presentation by revisiting the challenges to geothermal, including establishing a true resource inventory, siting of new sites, the higher-than-market cost of geothermal electric generation, finding financing for the projects, multiple market uncertainties, transmission access, and the cost of deploying the technology.

He closed by stating that a rare window of political opportunity was now open, one that the group needed to seize upon.

During the question and answer session that followed, Curtis was asked if geothermal is allowable under the current state RPS. After a brief discussion, it was established that it was.

#### **COLORADO GEOLOGY: GEOTHERMAL ENERGY IN COLORADO – A NEW LOOK**

Matt Sares, deputy director for the Colorado Geological Society, presented next. Sares's presentation, entitled "Geothermal Energy in Colorado: A New Look" would give participants an insight into Colorado's geothermal potential, he said. Matt began by detailing how geothermal energy had been the focus of much attention 25 years ago and that it had been since the early 1990's that previously identified sites had been reevaluated. Matt said his presentation would focus on three areas, the background of the current uses in Colorado, the broad indicators of geothermal potential, and the newly released data and mapping.

Currently, most of Colorado's geothermal energy was being used in the form of direct heating, including hot and warm springs, defined as water above 95 degrees he explained. Most of these sites are located west of the Front Range. In total there are 93 actual hot springs and wells in Colorado, not including oil or coal wells. Matt presented graphs showing the springs and wells. Matt also gave several examples of businesses using these springs for recreational and direct heating applications, such as heating greenhouses.

While there are some 39 direct use applications, including an alligator farm in Alamosa, CO, the missing element is electrical generation, he said.

Geothermal supplies 17 percent of renewable electricity in the United States, but only 0.3 percent of total U.S. electricity supply, he explained. Matt said public awareness would play a critical role in the industries success or failure. Most of the U.S.'s geothermal activity takes place in California and Nevada, while Utah, New Mexico, and Oregon all have generation as well. In California alone, geothermal energy displaces the equivalent of more than 9 million barrels of oil a year, he said.

Matt then explained that Colorado fits the criteria for geothermal power potential which includes:

- Regionally high elevation -- Colorado is the highest in the U.S.
- Quaternary volcanism (occurring within the last two million years) – Colorado has five such volcanoes
- Quaternary faulting (younger faults have more potential) – Colorado has 90 such faults
- High heat flow – Colorado has the second largest heat flow anomaly in the U.S.

Matt then presented a U.S. heat flow map. Colorado, he said, has a significant heat flow anomaly when compared to other western states.

He then showed a variety of other charts all outlining Colorado high heat flow, emphasizing the state's high elevation, showing locations of quaternary faults, and neogene/quaternary volcanic deposits.

Next, Matt presented a graphic depicting P-wave velocity variations in the region. These waves, he said, take on a lower velocity as they pass through areas of the Earth's thinner crust and warmer upper mantle. Matt explained that an anomaly - called the Aspen Anomaly - is the second largest in the U.S. Only Yellowstone's, with its more recent volcanic activity, is larger.

The P-waves are a good indication of warmer mantle rock being closer to the surface, Matt said.

Another line of evidence is presented by the isostatic gravity anomaly, which Matt presented a chart of. Low gravity, he explained, indicates areas of lower rock density or crustal thinning. When elevation effects are removed, areas of lower gravity confirm warmer mantle.

Matt also said another area of potential development are the oil and gas fields in the Denver basin where bottom hole temperatures can range between 200-250 F at roughly 10,000-11,000 feet. While these resources may not be enough to supply energy to the grid, there is a good potential they could produce enough energy to power the oil and gas pumps, he added.

Similarly, bottom hole temperatures in the San Juan Mountains outside of Durango have also been measured with relatively high temperatures ranging from 150 – 250 F at depths of between 6500 – 9,000 feet.

Matt then presented a draft geothermal gradient map, highlighting several promising areas, including near Mt. Princeton outside of Buena Vista, the San Juan mountains near Ouray and Rico, areas of the San Luis Valley near Trinidad, and areas in the West Elk Mountains, where water at 212 C was found just 2500 feet below the surface.

Matt concluded by recapping the various lines of evidence, stating that he believes Colorado's potential is greater than had previously been thought.

During the following question and answer session, the issue of transmission costs arose. Matt said a mapping process is underway to overlay transmission lines with potential geothermal resources to identify areas for likely exploration. He also addressed concerns that funding was inadequate, saying that a swing in political will may help fund more test sites. Lastly, the difficult process of permitting on federal lands was brought up. Matt said it would be critical to address the permitting process on Bureau of Land Management and National Forest Service lands.

Pattie Snidow, from the Department of Agriculture, reminded attendees that grants and loan guarantees are available for anyone wanting to undertake a project on rural land with the goal of putting energy back onto the electric grid.

## **POLICY CHALLENGES & OPPORTUNITIES: REDUCING BARRIERS TO GEOTHERMAL DEVELOPMENT**

Paul Thomsen, public policy manager for Ormat, was the next speaker. Paul began by outlining Ormat's corporate structure and the scope of their projects. With 300 MW installed in the U.S. and 800 MW worldwide, Ormat is an industry leader, he said.

Paul then examined the barriers facing a thriving geothermal industry in the U.S. and Colorado. Barriers included what Paul titled the "energy institution," where the low prices of coal, oil, and gas continue to be a formidable obstacle. He also identified the traditional mindsets of many policy makers and coal, oil, and gas subsidies major hurdles. However as the political landscape changes, geothermal energy continues to gain recognition for providing a critical baseload to back up other sources of renewable generation, he said.

In addition, state Renewable Portfolio Standards (RPS) are helping to create more attractive financial models for investors. These standards are also helping to impact transaction costs. The new state RPS would serve as the tipping point, helping to get projects into the ground. While 23 states have a full-blown RPS, 41 other states have some state standards.

Paul then reviewed the Colorado RPS, highlighting how it mandates 10 percent renewable energy by 2015.

These RPS regulations may help to create a credible system of renewable energy credits as utility companies are forced offset their more polluting generation through an open market system.

In addition, the current production tax credit of 1.9 cents kWh for 10 years would need to be extended. The problem, as he explained, is that geothermal projects often take much longer to bring online than other renewable sources. The current cutoff creates a financial cliff for investors. He said the federal government is looking at extending the credit for an additional 5-10 years or creating a staggered credit system.

Paul then touched on the ongoing green house gas debate and the state of California's efforts to establish a system to accurately monitor, cap, and reduce emissions. Geothermal would be ideal since it produces no greenhouse gases, he said. Other states, including Oregon and Washington, have endorsed California's idea and are looking at adopting state standards of their own.

Utilities may be forced to increasingly purchase renewable energy to offset their own more polluting energy. Paul stressed that only

through heavily promoting geothermal benefit as a secure, domestic base load, with the public and lawmakers will geothermal electrical production take center stage.

He noted that California is also examining ways to tie resources together with cost sharing incentives to build new transmission lines. They are also discussing how to set aside a portion of new transmission lines specifically for renewable energy.

Only a small fraction of the U.S.'s geothermal resources are currently being utilized, he said. The U.S. currently generates 16 billion kWh per year, more than wind and solar combined. There are currently 58 new geothermal energy projects under development in the U.S. that will provide an additional 2,250 MW of electricity.

The Geothermal Energy Association estimates that with state and federal support, geothermal generation could be built up to 30,000 MW within the next 20 years.

Paul suggested one action the federal government could take to help fuel geothermal energy production would be to create a standardized, national RPS. Each state's unique differences create steep learning curves for the utilities, he said. He added that utilities tend to look at geothermal the same as they would natural gas. Members need to help educate the utilities as to the differences, explaining that it takes longer for geothermal plants to come online but that the end payoff is often larger.

Paul also said that more work would need to be done to develop markets, working with regulators to provide incentives for utilities to enter into long-term contracts.

Regulation, including the lack of timely permitting for public lands, is among the most pressing issues facing the industry and needs to be addressed. While the Energy Policy Act 2005 was to have leasing provisions to streamline the process, those regulations have yet to be enacted on the ground. The result is that it's all but impossible to build and meet the tax credit regulations for a "placed-in-service" date. Paul noted that the Bureau of Land Management in California had not issued a geothermal lease in 20 years and that Ormat had very few projects on federal land in last 10 years.

Paul also addressed the lack of adequate transmission and federal support for the program. Paul was asked how much federal money

it would take to offset the drilling risks associated with geothermal exploration. While he didn't provide a specific dollar amount, he pointed out that if a small fraction of the funds spent on nuclear power were diverted it would quickly jumpstart the industry.

A discussion then ensued regarding how rural utilities and cooperatives could benefit from local resources. Only with decreased drilling risk would co-ops be interested in taking on these local projects Paul said. It's a real chicken and egg game he explained. However he said resources must be confirmed before financing would be attainable.

Lastly, Paul discussed how federal support for geothermal energy had been zeroed out by the Bush administration last year. While the House and Senate worked to restore some funding, the government is currently operating under a continuing resolution at \$5 million. Daniel said that if the Department of Energy can devote some of its limited resources into doing subsurface research, private investors would be more likely to invest in new developments.

An audience member then asked how geothermal fit in with other energies, expressing his belief that other sources such as solar and wind did not require backup generation. Daniel said that while it is true that other renewables provide energy, geothermal provides capacity and fits nicely into a renewable portfolio including all types of generation.

He concluded by encouraging participants to write to their elected officials to ask them to support the geothermal industry.

## **GEOHERMAL HEAT PUMPS**

The next speaker was H.E. "Buzz" Johnson, senior vice president of EnLink Geoenergy Services. Buzz began by pointing out that geothermal heat pumps were the best-kept secret in energy efficiency. While they didn't generate any electricity, they helped dramatically decrease the consumption of most homes and businesses.

Buzz outlined his presentation, before explaining the fundamentals of how geo heat pumps work by moving energy from a building to the ground when cooling and energy from the ground to a building while heating. He explained that in Texas and other warmer climates, Geothermal Heat Pump's (GHP's) could transfer excess

heat from a building and use it to heat pools, hot tubs, or create free residential hot water. However GHP's weren't limited to warmer areas of the country. The technology could be used in even the northernmost states and Canada where temperatures routinely fall below 0 F. One installation had even taken place north of the Arctic Circle, he said.

Geothermal was a simple term for a wide range of technologies, he explained. While his presentation was focused on vertical closed loop systems, there were several other popular installation techniques, he added. Geothermal was a proven technology, which had been in use for more than 50 years. However it isn't well known among the general public. The reason he said was a lack of an easily identifiable marketing logo, company, or slogan. While there were numerous companies manufacturing the equipment, they were all relatively small with inadequate marketing and advertising budgets.

Buzz explained that 70 percent of a typical commercial building's total energy requirement is consumed by its HVAC equipment. A properly designed geothermal heat pump (GHP) could reduce this amount by 70 percent, he said, cutting a building's total energy requirement by 50 percent.

Buzz then briefly explained how GHPs work by removing heat from or adding heat to a building in a typical condenser/evaporator refrigerant compression cycle. The heat is removed from or added to the refrigerant loop and transferred to the circulating water system through an extended-range heat exchanger, he said. The water then circulates through the ground loop giving up or taking on heat as it tries to reach equilibrium with the Earth's temperature. Buzz explained that for every kW of energy your GHP uses, the GHP will take approximately 4 kW from the Earth or dump 4 kW back into the ground when in cooling mode. This works because the ground's temperature five feet below the surface remains fairly consistent throughout the year.

Buzz then detailed the typical installation. He said his company prefers to use vertical loops, each set about 300 feet deep.

EnLink Geoenergy specializes in larger commercial projects, such as schools, he said. Typically these buildings have adequate green space around them, which makes it relatively easy to install the necessary loops. The loop tubes are comprised of higher density polyethylene, which contain no moving parts and last forever, he said. While these tubes are rated at 160 pounds of pressure per

square inch (PSI) or greater, system-operating pressure rarely exceeds 30 PSI. The systems are also impervious to seismic activity. The heat transfer coefficient of the material is more than four times greater than typical PVC tubing, he added.

Buzz then presented a graphic of several other system designs including a conventional horizontal system, a slinky coil system, a ground water system, and a surface water system. While these systems had different designs, they all served the same function: transferring BTUs, he said.

The presentation concluded with a recap of GHP's superior attributes, including their longevity, accommodating instillation methods, and high efficiency rating. While many consumers assume the added costs of a geothermal system make them unaffordable, Buzz assured audience members that the typical payback on a large commercial system's premium is just a few years. Every MW saved is one less that fossil needs to generate, he added.

In the question and answer session that followed, Buzz was asked about the temperature of air created when in the heating mode. He explained that while the air being produced may not feel "hot" like a scorched air system operating on propane or natural gas, the air was typically 95 F.

Buzz was also asked about head pressure at full depth. He assured the group that the systems were designed to handle full hydrostatic head pressure at full depth.

When asked why everyone doesn't recognize the obvious benefits of geothermal heat pumps, Buzz replied that the industry as a whole lacks a recognized spokesperson and only accounts for 0.5 to 1 percent of the HVAC market. Without incentives and renewed marketing efforts, the industry wouldn't grow substantially, he said.

#### **INVESTORS VIEWPOINT: FINANCING GEOTHERMAL DEVELOPMENT**

Dan Phaure from Dundee Securities Corporation was the next presenter.

Dan began by discussing how investors' appetite for profit and their aversion to risk influenced their investment decisions.

He then presented a graph outlining the capital cost and timeline for a sample project. It showed the following breakdown of expenses:

- Exploration – 5 percent
- Confirmation – 5 percent
- Drilling and Feasibility Study – 23 percent
- Permits 1 percent
- Steamfield 7 percent
- Generation Plant 54 percent
- Transmission – 4 percent

This sample cumulative process would take about \$3 million per MW to build, he said.

He explained that the process could be broken down into three distinct timeframes: development, feasibility and drilling, and construction. As the process moves forward and the project's value increases, risk decreases, he added.

During the development stage there are a number of milestones, he said. These include securing the land lease rights and conducting geologic surveys. These surveys can include satellite mapping, water testing, soil gas testing, geophysical mapping, and temperature gradient well drilling.

Next in the development stage is determining funding requirements and options. Generally this stage is considered the most risky and financing is hard to secure. Often financing comes from personal resources, industry partners, private equity, and grants from agencies such as the Department of Energy. Even when partners are willing to fund the exploration and confirmation efforts, they often want the largest portion of future revenues.

Performing drilling and feasibility studies come next. These generally include one to four production wells and one or two injection wells, Dan explained. Each well can cost between \$2-\$5 million with the accompanying feasibility study costing \$1 million. Capital requirements can exceed \$13 million at this stage. Without finding investors willing to accept the necessary drilling risk, most projects never make it past this point, he added. Dan suggested bringing in an outside consultant at this stage to verify the prospective resources and give investors a better sense of the project's parameters. This helps developers make investors feel more comfortable with the risks.

While there has been a marked increase in investor interest recently, Dan said that 60 percent of investments in the geothermal sector are currently taking place in Europe.

During the drilling and feasibility stage there are several ways to obtain capital funding, he explained. These include public equity, private equity, and debt capital, which isn't readily available at this point in the process.

Existing federal incentives, including PTCs, accelerated depreciation, and depletion allowances are usually sufficient to spur development at later stages of the process but aren't generally available in pre-study stage.

Dan said that if drilling incentives were offered, it would be instrumental in advancing exploration efforts and enhancing capital availability.

The next stage is construction. The now-completed feasibility study should have addressed permitting, the PPA, and debt financing for about 75 percent of a project's cost. The remainder will be raised as equity as a public or private company, he said.

Permits, plant construction, steam gathering systems, and transmission line and tie-ins are all components of the construction state, Dan said. Roughly 50 percent of any geothermal project will come from the actual plant construction, he added.

The funding requirements in this stage can top \$38 million in capital. This generally comes as a combination of equity, debt and tax-driven financing. In a tax-driven deal, a developer is able to utilize the full tax benefits, which might expire worthless otherwise, he explained. It can also utilize the flip structure to transfer the tax benefits to a taxable investor then return the asset to the developer in later years. The federal incentives form part of the return to the taxable investor and reduces the borrowing cost to the project, he said. Most geothermal projects have the added benefit of not needing large amounts of additional capital to provide for major refurbishments and overhauls.

There are also a variety of tax incentives available, Dan said. These include the PTC of \$19 a MWh for 10 years if a project is online by December 31, 2008. Dan noted that this deadline would likely be extended. Other incentives are an accelerated depreciation of five years on capital costs, a depletion allowance of

the lesser of 15 percent of power revenue or 50 percent of EBIT, and first year write off of intangible drilling costs.

Dan said another driving force in increasing geothermal development and available financing would be successful implementation of the state's RPS. These standards would force utilities to seek out renewable energy and provide a guaranteed market. This in turn would attract investors.

Dan suggested that while the state standards were a good start, investors would rather see a national RPS and a renewable energy certificates system (RCS). In addition, he suggested the implementation of a long-term PTC program.

He also proposed that state's need to make more grants and credit programs available to help bolster projects up to the completion of the feasibility study stage. To help streamline the grant process, he suggested there be just two conditions: ensuring private equity investors are willing to share in the risk and receiving a positive recommendation from an independent geologist consultant based on surface measurement techniques. Once these conditions are met, states should match private equity funds, he said. Lastly, he suggested that states adopt a new tax incentive allowing tax losses to flow through to the investors to be used as a tax deduction.

In the question and answer session that followed, Dan was asked if the permitting process was a major stumbling block. He said that permitting often is a very drawn out process, which can make it difficult to create a detailed timeline to present to investors. Dan was also asked how his company approaches each project. He said Dundee applies value to each project individually depending upon which stage the project is at.

## **GEOHERMAL POWER GENERATION: AN OVERVIEW OF TECHNOLOGIES**

Daniel Schochet from Ormat Nevada, Inc. was the next presenter. Daniel began by giving a brief background on Ormat, highlighting how they a vertically integrated company, focusing on renewable and sustainable projects since 1965. With 40 years of experience and a variety of renewable projects, generating 0.2 MW to 130 MW, they supplied more than 850 MW of geothermal and heat recovery power generation in 21 countries with 250MW of that in the U.S.

Daniel gave examples of several of their research and development projects from around the world over the past 20 years. He then showed a chart of generation totals within the western U.S.

An overview of Ormat's technology then followed. It highlighted how a resource often dictated the type of technology necessary. For temperatures ranging from 250-350 F, the Organic Rankine cycle technology is the most appropriate, while temperatures over 350 F are often coupled with flash technologies. For dry high-pressure steam production, conventional steam turbine technology is most appropriate.

Other factors for consideration include matching the geothermal fluid characteristics with the optimum power cycle, system simplicity, maintenance requirements, reservoir management, and environmental considerations.

Daniel then explained the binary power plant efficiency criteria and how it impacts technology decisions. He then presented several graphics showing how their systems are matched to the resource and explained several simplified schematics illustrating how the systems work.

In addition to traditional geothermal systems, Daniel detailed how Ormat is also installing systems to generate electricity using recovered energy. The advantages of these systems include simplified and rugged design, with a very cost effective structure highlighted by low operating and maintenance requirements. They also leave a small footprint and have near zero emissions, he said.

He then went on to outline how integrated two level units (ITLU) can increase plant efficiency, offering significant advantages over conventional geothermal flash steam plants by re-injecting fluids thus decreasing the consumption of water and helping prevent power reductions. He explained that these systems also have low or no emissions, a low profile, and aren't sensitive to the quality of brine and steam.

The focus then shifted to several pre-packaged generation projects ideal for self-construction. Advantages of these systems included being accommodating to a wide range of temperatures, changing resource conditions, unmanned operation, low environmental impacts, and output ranges from 200-1,000 kW.

Daniel then discussed and presented graphics on several other operational systems, including sites in Nevada, Kenya, and

Austria. He concluded by recapping Ormat's technology offerings and the amount of generation produced by their systems to date.

He concluded his presentation with a review of Ormat and their projects worldwide. He also reviewed how each resource is evaluated and solutions are designed based on the resource.

In the question and answer session that followed, Daniel was asked to put the noise level of a standard 250 kW unit into perspective. He answered that the noise level was relatively low and could often be successfully combated with simple noise abatement measures, such as noise reducing fencing.

He was also asked about recent reports of seismic activity resulting from high-pressure injection methods. Daniel relayed his belief that this isn't a major problem and that the activities were likely unrelated.

After Daniel's presentation the meeting was temporarily adjourned and lunch was served.

Joe Bourg of Millennium Energy resumed the meeting at 1:05 p.m.

He introduced Pattie Snidow of the USDA who reminded participants that there would be a renewable energy training on February 12, 2007 in Rifle, Colo. to cover the renewable energy bill and application process.

Joe reiterated to attendees that it was time to get down to the hard work of drafting a strategic plan. He summarized the key points from the morning's presentations and detailed how there were four new projects on Colorado's horizon, including three direct use projects and one-generation project.

Sandy Glatt from the DOE encouraged participants to seize upon the opportunity saying that the political climate was ripe for renewable options at both state and federal levels. Windows of opportunity come around rarely and leave quickly, she said. Geothermal energy was not at the table during Colorado's now passed amendment 37 debate and she encouraged participants to step up to the table now. Direct use applications would be the biggest opportunity in state of Colorado she said. She also discussed a DOE loan program that was currently under development to help finance direct use projects. She also said it would be important for any strategic plan to look at co-locating with the oil and gas industries. Several other state working groups

are exploring this option, she said. She also reiterated the opportunity Pattie Snidow had brought up, saying not many geothermal applications had been submitted. As a result, she felt there would be a good chance these projects may be funded. She also encouraged participants to go on a trade mission to Nevada to learn more about their geothermal industry.

Angels Crooks from the Colorado Office of Energy Management and Conservation (OEMC) took the floor, announcing there were 90 participants in attendance. She then read the proposed mission statement:

“Facilitate geological exploration, foster capital investment, enhance technical application, and create innovative policies in order to maximize the utilization of geothermal energy resources in the state.”

Attendees suggested that goals should also include publicity and marketing, education, and getting more stakeholders involved. Some felt the statement was too lengthy and needed to be more straightforward. Others felt it needed to include the word Colorado. Still others believed it needed to reference the state legislature. It was also suggested that the phrase “removal of barriers” needed to be included.

While the statement was being considered, other suggestions were made, including hosting a legislative awareness day and reaching out to other educational, regulatory, utility, and media organizations.

Angela summarized their thoughts and revised the mission statement to include their comments. The revised statement read:

“To foster the awareness and use of geothermal energy, including both direct use and electrical generation, in the state of Colorado.”

This statement was approved.

Angela then asked for participants’ thoughts on a group of proposed subgroups to draft individual sections of the strategic plan. The subgroups included:

- Geological assessment
- Financial
- Education
- Policy

- Power generation development
- Direct use development
- Marketing

The discussion that ensued had a variety of suggestions, including revising the GeoPowering the West logo, developing an in-state resource of information for private and public groups, and creating a dedicated Web site. Angela offered that OEMC would be happy to host a Web site but that it would need to use the state's standards, which may be limiting.

It was suggested that geothermal heat pumps should receive their own working group.

It was decided that education and marketing would be combined into one subgroup with the responsibility for developing the content for the Web site.

Members offered several other suggestions, including strengthening ties to Colorado State University, placing the positive environmental aspects of geothermal production in the forefront of any outreach campaign, and providing testimonials from actual users.

It was also suggested that while the Colorado Renewable Energy Authority was not in attendance, they should be approached and encouraged to be active participant.

Angela reiterated that the steering committee would need to be active in their outreach efforts. She then passed around signup sheets for the subgroups. Angela assured the group that members could participate in more than one group, meet how and where they chose, and could be involved at various levels. It would be up to the committee leaders to drive the strategic plan and step up to the plate on this grassroots effort, she said.

The finalized list of subgroups and participants was compiled.

**Education / Marketing**

Scott Shulda	Chevron ES
Jeff Holwell	
Vince Mathews	CGS
Toni Boyd	Geo-Heat Center
Tom Konrad	CRES
Singfoong Cheah	

Terry Proffer	Major Geothermal
Larry Lindquist	Geothermal Development Co.
Jeff Hager	Ameresco
Mike Maish	
Laszki I Varga	Alternative EnergyGroup
John Kelly	Geothermal Heat Pump Consortium
Stephanie Steffens	CO OEDIT
Carsten Mehring	Colorado School of Mines
Ellen Glover	BCS, INC

**Financing**

Lead	Joe Bourg	Millennium Energy LLC
	Dan Phaure	Dundee Securities
	Pattie Snidow	USDA Rural Dev
	Vince Mathews	CGS
Co-Chair	Larry Lindquist	Geothermal Development Co.
	Gary McKay	Global Power Solutions
	Buck Adams	B.A. Enterprises

**Geological Assessment**

Lead	Matt Sares	Colorado Geo Survey
Chair	Fred Henderson	Hendco
	Dave McElhaney	CDWR
	Fred Berkman	Colo. Geol. Survey
	Gerry Huttier	Geothermal Mgmnt. Co, Inc
	Mike Maish	
	Ed Berg	
Facilitator	Carsten Mehring	Colorado School of Mines

**Utilities**

Lead	Randy Manion	WAPA
	Pattie Snidow	USDA Rural Dev
	Paul Bony	DMEA
	Ken Phair	Shaw Stone & Webster
	Rich Mignogna	Colorado PUC
	Linda Swails	WAPA
	John Kelly	Geothermal Heat Pump Consortium

**Heat Pumps**

Lead	Laszlo I. Varga	Alternative Energy Group
	Paul Bony	DMEA
	H. E. "Buzz" Johnson	EnLink GoeEnergy
	Stephanie Steffens	CO OEDIT

Andrew Chiasson	Geo heat Center
Gerry Huttier	Geothermal Mgmt. Co, Inc
Terry Proffer	Major Geothermal
Bill Slaughter	Major Geothermal
Mike Maish	
Gary McKay	Global Power Solutions
John Kelly	Geothermal Heat Pump Consortium

**March Conference**

Dan Phaure	Dundee Securities
Matt Sares	Colorado Geo Survey
Curtis Framel	US DOE
Pattie Snidow	USDA Rural Dev
Fred Henderson	Hendco
Paul Thomsen	Ormat
Vince Mathews	CGS/DNR
Terry Proffer	Major Geothermal
Linda Swails	WAPA
Mike Maish	
Buck Adams	B.A. Enterprises

**Policy**

Lead	Craig Cox	Interwest Energy Alliance
	Dan Phaure	Dundee Securities
	David Hiller	Office of Sen Ken Salazar
	Fred Henderson	Hendco
	Paul Thomsen	Ormat
	Vince Mathews	CGS/DNR
	Dick Wolfe	DWR/DNR
	Rich Mignogna	Colorado PUC
	Terry Proffer	Major Geothermal
	Buck Adams	B.A. Enterprises
	John Kelly	Geothermal Heat Pump Consortium
	Ellen Glover	BCS, INC

**Direct Use**

Lead	Jack Whittier	McNeil Technologies
	Matt Sares	Colorado Geo Survey
	Stephanie Steffens	CO OEDIT
	John Lund	Geo-Heat Center
	Gerry Huttier	Geothermal Mgmt. Co, Inc
	Terry Proffer	Major Geothermal
	Bill Petrillo	Storm Mt. Equipment

**Power Generation**

Gary McKay	Global Power Solutions
Matt Sares	Colorado Geo Survey
Curtis Framel	US DOE
Paul Bony	DMEA
Dan Schochet	Ormat Technologies, Inc
Ken Nichols	Barber-Nichols
Ken Phair	Shaw Stone & Webster
Mike Maish	
Buck Adams	B.A. Enterprises

Members spent several moments sorting out specific duties and assigning them to subgroups. Tasks and topics included transmission (aspects assigned to policy, utilities, and power generation) and land use (assigned to policy).

Anglea then asked the group for their thoughts on a timeline. While much discussion centered around trying to have the strategic plan prepared for Sen. Ken Salazar's renewable energy conference March 24, it was determined more time would be needed. Instead, it was decided that a subgroup would prepare a briefer document to be presented at the event.

David Hiller, a representative from Sen. Salazar's office, said he would ensure the working group received a spot on the renewable event's agenda in March. He also said the senator would host a separate energy conference somewhere on the Western Slope in August and that geothermal could play a more significant role then. He encouraged the group to submit a page of information for insertion in the conference's event booklet. David also suggested members contact the Colorado statehouse subcommittee on renewable resources to make them aware of the group's actions.

After several questions regarding the specifics of the strategic plan, including length and format, and who would draft the executive summary, it was suggested that June 1, 2007 be the goal date for a finalized document. Many participants felt this deadline was too far out and suggested shorting the timeframe. It was agreed the draft plan would be due April 1, 2007 with a final version completed by May 1, 2007.

It was also suggested that a brief press release and/or one page information sheet be drafted detailing how geothermal power could benefit the people of Colorado. It was agreed that a release would be generated.

With those issues decided, Angela asked participants if a second meeting later this year would be beneficial? She suggested having an investors' forum somewhere on the Western Slope to coincide with Sen. Salazar's conference. She then raised the question of whether to invite other states to participate. It was widely acknowledged that having more states in attendance would increase national investors' participation. It was suggested that the group contact the National Geothermal Association and the Rockies Venture Club, as they both had experience hosting similar events. It was decided that Arizona, New Mexico, and Utah would be invited to make it a "four-corners" investor event.

A member asked if it would be too early to start involving federal installations to participate. After a brief discussion it was decided that the sub groups would need to examine how to include federal facilities.

Angela reiterated that the strategic plan would be posted on the OEMC Web site upon completion, along with the contact information for the working group members and chairs, meeting minutes, and the morning's PowerPoint presentations.

David Hiller added that Sen. Salazar was well aware of production tax credits time-lapse problem. He assured members the senator was taking the problem seriously and there were currently a number of bills to extend credits to 2010, 2017, 2020, and even a permanent proposal. He added that Sen. Salazar would support a national RPS.

Curtis Framel ended the meeting by thanking everyone for their participation, including Angela and the OEMC, Western Area Power for hosting the event, and Mike Rubala from Delta-Montrose Electric Association for coordinating the meeting.

The meeting was adjourned at 2:55 p.m.