

Clean and Diversified Energy Initiative



WESTERN GOVERNORS' ASSOCIATION



Geothermal Task Force Report

Executive Summary
January 2006

Western Governors' Association Clean and Diversified Energy Initiative

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Executive Summary

The Western Governors' Association's Clean and Diversified Energy Advisory Committee (CDEAC) commissioned this task force report in February 2005. Members of the Task Force are listed below. This is one of several task force reports presented to the CDEAC on December 8, 2005 and accepted for further consideration as the CDEAC develops recommendations for the Governors. While this task force report represents the consensus views of the members, it does not represent the adopted policy of WGA or the CDEAC. At their Annual Meeting in June, 2006, Western Governors will consider and adopt a broad range of recommendations for increasing the development of clean and diverse energy, improving the efficient use of energy and ensuring adequate transmission. The CDEAC commends the Task Force for its thorough analysis and thoughtful recommendations.

Members of the Geothermal Task Force

| | |
|----------------------|--|
| Dan Schochet (Chair) | Ormat (CDEAC Member) |
| Frank Barbera | Imperial Irrigation District Energy Division |
| John Bebout | Bureau of Land Management - Washington |
| Peggy Duxbury | Calpine |
| Troy Gagliano | Renewable Northwest Project |
| Karl Gawell | Geothermal Energy Association |
| Sean Hagerty | Bureau of Land Management - Sacramento |
| Roger Hill | Sandia National Laboratories |
| Roy Mink | U.S. Department of Energy |
| Bernie Smith | Alaska Energy Authority |
| Jim States | Rocky Mountain Oilfield Testing Center |
| Martin Vorum | National Renewable Energy Laboratory |
| Jonathan Weisgall | Mid-American Energy |
| Charlene Wardlow | Calpine Corporation |

Facilitator

| | |
|----------------|---------------------|
| Will Singleton | The Keystone Center |
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Quantitative Working Group

The quantitative working group was created by the CDEAC to compare the analysis of data among task forces in order to ensure consistency in assumptions across the reports.

The following members contributed to this report:

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|-----------------|--|
| Doug Arent | National Renewable Energy Laboratory |
| John Tschirhart | Department of Economics, University of Wyoming |
| Dick Watson | Quantitative Working Group |

The Task Force would like to acknowledge the contributions of Alyssa Kagel Geothermal Energy Association; Nathanael Hance Geothermal Energy Association; and Pat Laney Idaho National Laboratory.

The Geothermal Task Force of the Clean and Diversified Energy Initiative reviewed geothermal resources of the states in the Western Governors' Association region. On July 25, 2005, two dozen members of the geothermal community met in Reno, Nevada, to assess the potential for commercial development of roughly 140 known geothermal sites. The Task Force also estimated the economics of developing these sites for commercial power production for projects that could be on-line in a timeframe extending to 2015. Finally, the Task Force compiled a profile of recommendations for interstate policy and regulatory frameworks to induce Western States' renewable energy development by 2015. The options for policy and regulatory direction outlined in this report provide a rich opportunity to set a common, strategic energy development. In summary, the Geothermal Task Force offers these conclusions to the CDEAC and WGA:

- The Western States share a capacity of almost 13,000 megawatts of geothermal energy that can be developed on specific sites within a reasonable timeframe. Of these, 5,600 megawatts are considered by the geothermal industry to be viable for commercial development within the next 10 years, i.e. by about 2015. This is a commercially achievable capacity for new generation and does not include the much larger potential of unknown, undiscovered resources.
- The 5,600 MW is estimated to be developable at busbar (General audience may not understand this term) costs in a range of levelized costs of energy (LCOE) (again, general audience may not understand what levelized costs are) of about 5.3 to 7.9 cents per kilowatt-hour (kWh). This assumes commercial project financing conditions and the extension of a production tax credit (PTC) consistent with current federal energy law. Lacking a PTC to catalyze renewable energy development, LCOE values would be 2.3 cents a kilowatt ($\text{\$/kWh}$) higher. (See graph on page 4)
- If actual future markets sustain energy costs up to 20 $\text{\$/kWh}$ or the risk and cost of development is reduced substantially, the Task Force estimates that known resources could support new capacity of about 13000 MW.
- The Task Force recommends policy and regulatory initiatives that will: (1) broadly strengthen and expand the renewable energy market; (2) facilitate timely leasing and permitting; (3) lead to the expansion of the transmission infrastructure; and (4) support key state and federal technology research to expand energy capacity.
- Geothermal power can be a major contributor to the power infrastructure and economic well-being of the Western states. New geothermal power capacity of 5,600 MW could add nearly 10,000 jobs, and also generate about 36,000 person-years (what is a person year?) of construction and manufacturing business. Geothermal power is a reliable, continuously available (24 hours per day – 7 days per week) baseload energy source that typically operates at 90 to 98 percent of the time. Insulated from conventional fossil fuel market volatility, geothermal power supports energy price stability and boosts energy security because it is a domestic resource. Geothermal power can help fulfill Renewable Portfolio Standards (RPS) that strive to diversify the states' and nation's energy supply. Geothermal energy is a clean electricity source, discharging far less emissions, including greenhouse gases, than equivalent fossil-fueled generation.

B. Benefits of Geothermal Power Generation

Geothermal energy is the heat from the earth of which only a small portion has been tapped for either electrical generation or direct use. It has a wide range of benefits that policymakers should consider as detailed below.

Reliable Electricity at Stable Prices

Geothermal power plants supply baseload power, i.e., electricity that is available 24/7. Except for short outages to repair equipment and conduct overhauls every few years, these facilities have very high availability and capacity factors. Most facilities are also capable of load following if preferred by the power system. (?) Geothermal's high reliability compares favorably to conventional power plants.

Geothermal power plants protect against volatile electricity prices because their lifetime fuel is secured at the initiation of the project. The resource is secured through long-term leases with private, state or federal landowners, and the costs to drill the resource in advance of plant start-up are capitalized. This transfers the future fuel cost risk from the consumer's back to the developer and/or operator. The acquisition of a long-term power purchase agreement from a utility further stabilizes the long-term electricity price and supports the financing and operational costs of a project.

Diversity of Resources for Utilities' Renewable Portfolio Standards

Geothermal can help utilities meet a state's RPS. Currently 20 states and the District of Columbia have an RPS. Geothermal energy is one of the only renewable resources that can provide baseload power. Geothermal power plants, ranging from 10 to over 200 megawatts depending upon the resource, can supply enough electricity to meet the needs of 10,000 to 200,000 homes accordingly. And, since geothermal resources are developed locally, geothermal power can reduce our dependence on imported energy resources. Additionally, geothermal plants can lower homeland security risks: they do not rely upon unstable international energy sources, nor are they terrorist targets; also, geothermal facilities are local and smaller than large fossil or nuclear plants.

Economic Development Potential

Geothermal resources provide economic development opportunities for states, bringing jobs to rural areas as well as tax and royalty income. Based upon the findings of a recent industry employment survey (*Geothermal Industry Employment: Survey Results & Analysis*, Cedric Nathanael Hance, September 2005), achieving 5600 MW of geothermal production would result in 9,580 new full-time jobs from geothermal power facilities, and an additional 36,064 person-years of manufacturing and construction employment. An economic multiplier effect would increase these numbers further. New power facilities would also increase state and local tax and royalty income. In 2003, The Geysers Geothermal Field in California, with almost 1,000 MW of geothermal power generation capacity in place, paid \$11 million in property taxes to two counties, while royalty revenues added several million dollars more to state and county revenues.

Clean Electricity

Geothermal energy is one of the cleanest resources for generating electricity. Compared to fossil fuels, geothermal utilizes less land, consumes and discharges less water, has fewer air emissions, and generates fewer wastes. Geothermal particularly stands out when the relative air emissions from geothermal plants and fossil fuel plants are compared. In contrast to fossil fuel plants, geothermal plants only emit small amounts, if any, of carbon dioxide (a greenhouse gas), particulate matter, sulfur dioxides (acid rain) and nitrogen oxides (smog). Standing as a testament to this point, the air basin downwind of the largest geothermal field in the world, The Geysers, is the only air district in California to be in attainment with all federal and state ambient air quality standards for over 18 years.

New Technology

Although geothermal power plants have been producing electricity for decades, only a small fraction of geothermal potential has been tapped. With new technology and rising energy costs, geothermal resources that historically have not been economical to develop will become increasingly more attractive to investors and utilities. New geothermal technologies for direct use, such as for greenhouses, district heating, and fish farms, can also play an important role in reducing a community’s overall need for other energy supplies.

C. Siting - Where are the Geothermal Sites?

The state-by-state capacity subtotals are listed in the following table. This listing reflects a consensus of diverse experts in geothermal technology, development, and power generating operations.

**Summary of Western States' Near-Term
New Geothermal Power Capacity**

| | Capacities (in Megawatts) | Number of Sites |
|-------------------|--------------------------------------|----------------------------|
| Alaska | 20 | 3 |
| Arizona | 20 | 2 |
| Colorado | 20 | 9 |
| California | 2,400 | 25 |
| Hawaii | 70 | 3 |
| Idaho | 860 | 6 |
| Nevada | 1,500 | 63 |
| New Mexico | 80 | 6 |
| Oregon | 380 | 11 |
| Utah | 230 | 5 |
| Washington | 50 | 5 |
| Total | 5,630 MW | 138 |

NOTE: The capacity of **Wyoming, Montana, Texas, Kansas, Nebraska, South Dakota, North Dakota** was not analyzed during the July 25 Geothermal Task Force Sub Group meeting on Supply. This information will be incorporated into this report once available.

The U.S. Geologic Survey is in the process of updating assessment data for geothermal resources as mandated by The Energy Policy Act of 2005. That information, when available, should provide additional insight into the long-term potential for geothermal resources to meet the West's energy needs.

E. Geothermal Priority Recommendations

Market Development- The marketplace needs to support the continued development of geothermal resources.

1. Federal and state tax credits are important to reduce the risk and high capital cost of new projects. The federal production tax credit (and clean renewable bonding authority) should be made permanent, or at least extended ten years.
2. State laws and regulations should promote a continuing series of opportunities for power purchase agreements between developers and utilities. Whether generated through Renewable Portfolio Standards, Integrated Resource Planning, or other mechanisms, power purchase contracts are fundamental drivers of the market.
3. Federal and state laws and regulations should provide incentives for utilities and others to enter into long-term contracts for renewable power. Accounting and regulatory standards should treat renewable power contracts as benefits instead of liabilities, and power purchase contracts should have the backing of the government to ensure their credit worthiness.

Timely Permitting and Environmental Reviews- Geothermal projects should be prioritized to ensure that permitting, leasing, and environmental reviews are completed in a timely and efficient manner.

1. Federal, state, and local agencies should coordinate resources and requirements. Agencies should be designated to take the lead on specific issues to avoid duplication, and once issues are resolved, they should not be revisited without cause.
2. A critical path for new projects should be defined as part of this cooperative effort, and timeframes for key agency decisions along the pathway should be established.

Transmission Access and Adequacy- The Western Governors should lead the process to ensure that adequate transmission is available for the identified resources.

1. There should be consistent Western state policies on inter-connection to the grid that facilitate new geothermal (and other renewable) power development.
2. A fee to support the cost of new transmission could be set that would spread the cost across all states, parties and technologies on a capacity basis.
3. Both inter- and intra-state transmission is needed to support the identified resources and should be fast-tracked for permitting and environmental reviews.

Federal Program Support- Continuing support from key federal programs is needed to achieve the 2015 goals. Federal programs should be coordinated with state agencies.

1. As the National Research Council concluded (*Renewable Power Pathways, 2002*), given the enormous potential of the resource base, geothermal research by the U.S. Department of Energy should be increased, particularly into technologies that can reduce risk, reduce costs, or expand the accessible resource base.

2. Better resource information is needed. The USGS' new resource assessment and DOE's cost-shared drilling and exploration technology efforts should be priorities. The US Department of Energy's *GeoPowering the West* initiative should continue to support state and local governments, Indian Tribes, and others seeking to utilize the West's untapped geothermal resources.