**Final Report on the National Conference of State Legislatures Project
“Assistance to States on Geothermal Energy”
Contract Number DE-FG03-01SF22367**

National Conference of State Legislatures

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I. EXECUTIVE SUMMARY

This final report summarizes work carried out under agreement with the U.S. Department of Energy, related to geothermal energy policy issues. This project has involved a combination of outreach and publications on geothermal energy—Contract Number DE-FG03-01SF22367—with a specific focus on educating state-level policymakers. Education of state policymakers is vitally important because state policy (in the form of incentives or regulation) is a crucial part of the success of geothermal energy. State policymakers wield a significant influence over all of these policies. They are also in need of high quality, non-biased educational resources which this project provided.

This project provided outreach to legislatures, in the form of responses to information requests on geothermal energy and publications. The publications addressed: geothermal leasing, geothermal policy, constitutional and statutory authority for the development of geothermal district energy systems, and state regulation of geothermal district energy systems. These publications were distributed to legislative energy committee members, and chairs, legislative staff, legislative libraries, and other related state officials. The effect of this effort has been to provide an extensive resource of information about geothermal energy for state policymakers in a form that is useful to them. This non-partisan information has been used as state policymakers attempt to develop their own policy proposals related to geothermal energy in the states.

II. PROJECT WORK PLAN

All activities described in the original work plan are complete.

III. FINAL PRODUCTS DEVELOPED UNDER AWARD

The National Conference of State Legislatures (NCSL) addresses the needs of state legislatures by serving as an impartial educational resource for state legislators and legislative staff. This project has enabled the NCSL Energy Project, working in coordination with the Washington State University Energy Extension Program (WSUEP), to meet the increasing demand for information about issues surrounding geothermal power. The effort described in this final report is the result of NCSL's DOE-funded activities in this area.

All of the following proposed deliverables have been completed. In addition to the required deliverables, NCSL Energy Project staff and WSUEP staff made numerous presentations to DOE-funded state geothermal working groups and others involved in the state policymaking process.

The following summarizes the deliverables prepared under this project.

One State Legislative Report (SLR) on Geothermal Electricity Generation

This report, entitled *Geothermal Energy: A Primer on State Policies and Technologies*, focuses on the technology, costs and environmental issues related to generating electricity from geothermal sources. This report also outlines the policy options states can employ to further utilize this technology.

Survey of State Legislative Policies, Programs and Jurisdictional Issues

This survey and analysis of state legislation and regulation regarding geothermal energy outlines the following:

- The utility commission's jurisdiction over the development, operation and rate regulation of geothermal-generated electricity;
- The laws applying to direct-use applications to determine where, and at what point, the utility commission has jurisdiction over such uses;
- A city or township's ability, as specified in the state constitution, to develop geothermal direct use energy systems;
- Protocols and standards required for developing geothermal resources on state lands; and
- The differences among states on how geothermal resources are defined and characterized.

This comprehensive survey served as a basis for examining what laws affecting geothermal energy states may wish to consider updating or changing as many of these laws have been in place for years and may not now reflect the vastly altered energy landscape.

One State Legislative Report (SLR): Addressing Legal and Institutional Policy Barriers to Geothermal Development

NCSL staff, jointly with WSUEP faculty drafted two reports based on the survey of state legislative policies, programs and jurisdictional issues regarding geothermal energy.

The first, entitled *Geothermal Policy*, summarizes the history of geothermal energy policy in the United States at the state and federal level. It goes on to outline how states define and characterize the resource, as well as determine ownership.

The second, entitled *Geothermal Leasing*, provides a detailed analysis of the geothermal leasing process including resource access on state and federal lands; rentals and royalties; and lease terms, adjustments and renewals.

One State Legislative Report (SLR): Analysis and Effectiveness of State Legislative Policies for Geothermal Energy

NCSL staff, jointly with WSUEP faculty drafted two additional reports that further draw on the survey of state legislative policies, programs and jurisdictional issues regarding geothermal energy.

The first, entitled *Constitutional or Statutory Authority to Engage in Geothermal District Energy Development and Operation*, outlines different government structures at the state and local level and how they impact the development of geothermal district energy systems.

The second, entitled *State Regulation of Geothermal District Energy Systems*, looks at the role of various regulatory considerations in encouraging or discouraging the development of geothermal district energy systems.

Responsive Information Assistance and Outreach

Energy Project staff responds daily to information requests from state legislatures. Calls range from locating a specific piece of energy legislation, to providing state-by-state information and comments on pending legislation. NCSL's Energy Project staff provided legislators and staff with information on geothermal technologies, policies and state and federal efforts throughout the legislative sessions from 2000-2005.

Technical Assistance

Technical assistance programs are available at no cost to state legislatures at their request. These formal, on-site assistance programs typically include summaries of key issues, state and federal legislative and programmatic activities, and a review of policy issues and options for consideration by the legislature. Often participating with NCSL staff are legislators from other states with expertise in renewable energy and other national experts and state energy or DOE officials. Technical assistance can also include Energy Project staff providing written testimony to a committee, in-depth research not available to a committee and bill writing and analysis. NCSL provided technical assistance on geothermal energy issues to legislative committees in Arizona, Colorado, Idaho, Maryland, North Dakota and Pennsylvania.

Coordination with the National Geothermal Collaborative

NCSL worked and coordinated with the National Geothermal Collaborative (NGC) to ensure that state legislatures were represented in all aspects of the NGC's efforts. NCSL participated in NGC steering committee conference calls, attended and participated in NGC business meetings and reviewed publications for the NGC.

Additionally, NCSL and WSUEP staff drafted a series of eight issue briefs published by the NGC. The briefs addressed:

- Benefits of Geothermal Energy
- Common Questions about Geothermal Energy
- Geothermal Direct Use
- Geothermal Energy and Economic Development
- Geothermal Energy: Technologies and Costs
- Location of Geothermal Resources
- Geothermal Policy Options for States
- Guidelines for Siting Geothermal Power Plants and Electricity Transmission Lines

BENEFITS OF GEOTHERMAL ENERGY

The heat within the earth is a tremendous, but largely untapped, energy source. Just below the surface the temperature never deviates far from 55°F, but deeper beneath the surface temperatures are hot enough to make hot water or steam. There are two ways to use the earth's heat: for generating electricity and for direct use applications. Only a few states are beginning to tap the true potential of geothermal resources. Geothermal energy has several benefits that state policymakers may wish to consider.

Geothermal energy has the ability to:

- provide reliable electricity at a stable price;
- help states diversify the mix of fuels they use to produce electricity;
- generate electricity in a manner that produces minimal environmental impacts and emissions;
- help states meet renewable portfolio standards;
- generate economic development opportunities, especially in rural areas;
- provide heat for agricultural, industrial and space heating applications.

Geothermal energy can play an important part in a state's energy policy. In addition to identifying the benefits of geothermal energy, this brief also identifies some of the main challenges such as transmission constraints and regulatory barriers.

■ Generating Electricity

Reliable Power

One of the principal benefits of geothermal power plants is that they provide baseload power. Baseload power plants provide power all or most of the time and contrast with "peaker" plants which turn on or off as demand rises, or peaks, throughout the day. Geothermal plants contrast with other renewable energy resources like wind and solar energy that generate power intermittently. Geothermal plants in the United States are available to operate approximately 98 percent of the time. Such high percentages make them compare favorably with fossil fuel and nuclear power plants that operate between 75 and 90 percent of the time depending on the technology and age of the equipment.

Geothermal resources can provide power for many years. The Geysers geothermal field for example, which began commercial production in 1960 in Northern California, had the first

domestic geothermal power plant. Nearly half a century later, the 21 power plants operating there generate power for approximately one million households in California. The key to successful long-term sustainable geothermal production lies in efficiently managing the resource. Technological advances—such as water injection, continue to be developed and allow developers to maximize resources and minimize drilling.

Electricity at Stable Prices

Using geothermal resources for power can help protect against volatile electricity prices. For any power plant, the price of the fuel used to generate power influences the price of the electricity produced; if the price of fuel is unpredictable, the price of electricity is unpredictable. Unlike traditional power plants that require fuel purchases, geothermal power

BENEFITS OF GEOTHERMAL ENERGY

Electricity at Stable Prices (Con't.)

plants secure their fuel supply before the plants begin operating. Since the price of geothermal resources will not change, it is possible to know what the price of electricity generated at a geothermal power plant will be over time. The price of electricity from new geothermal power plants ranges from between \$0.05 per kWh and \$0.08 per kWh. Once capital costs for the projects are recovered, the price of power can decrease below \$0.05 per kWh. Fossil fuels have traditionally generated power for less, but the price of these fuels can suddenly increase to a level that is more expensive than geothermal electricity. For example, in early 2004 the price of natural gas was nearly three times what it was throughout the 1990s.

Figure 1. Natural Gas

Note: In contrast to natural gas, the fuel costs for a geothermal power plant are not dependent upon volatile markets. Electricity price from geothermal power plants is predictable and stable over the life of the project.

Diversify Mix of Resources

Renewable energy resources like geothermal can help states diversify the mix of fuels they rely on for power and protect customers from volatile electricity prices. The fuel costs for a geothermal power plant are not dependent upon volatile markets. In contrast, the price of natural gas is volatile and difficult to predict accurately (See figure one). In addition, using domestic renewable resources can help states reduce the amount of fuel they import from nearby states or overseas.

Clean Electricity

Geothermal power plants produce only a small amount of air emissions. Compared to conventional fossil fuel plants, they emit very small amounts of carbon monoxide, particulate matter, sulfur dioxide, carbon dioxide, and typically no nitrogen oxides.

Figure 2. Carbon Dioxide Emissions

Figure 3. Sulphur Dioxide Emissions

Figure 4. Nitrogen Oxide Emissions

Meet Renewable Energy Standards

Fifteen states now have some sort of renewable portfolio standard (RPS) that requires power providers to supply a certain amount of their power from renewable resources by a specific year. In many of these states, electricity generated from geothermal resources can count toward meeting the standard.

Economic Development Potential

Using geothermal resources can provide economic development opportunities for states in the form of property taxes, royalty payments and jobs. Geothermal power plants are the largest taxpayer in nearly every county where they exist. The 21 geothermal power plants at the Geysers Geothermal Field in California can generate almost 1,000 MW of electricity and have been an important source of revenue and jobs for Lake and Sonoma counties for many years. These power plants employ approximately 425 people full-time plus an additional full-time equivalent contract work force of 225. In 2003, property tax payments to the two counties totaled more than \$11 million.

Another revenue stream flows from royalties that developers pay in exchange for the right to tap resources on federal, state or private lands. These are similar to severance taxes that states charge for extracting fuels or minerals. In 2003, operations at The Geysers generated a total of \$6.15 million in federal royalties and \$4.1 million in royalties to the State of California. Local county governments share in both the federal and state royalties.

■ Direct Use

In addition to generating electricity, the heat in geothermal fluids can be used directly for such purposes as growing flowers, raising fish and heating buildings. There are a number of basic types of direct use applications: aquaculture, greenhouses, industrial and agricultural processes, resorts and spas, space and district heating, and cooling. Generally, direct use projects use fluids with temperatures of between 70°F and 300°F. Direct use systems in the United States currently provide approximately 600 thermal megawatts of heat, enough to heat approximately 115,000 average homes. (The power from direct use systems is measured in megawatts of heat as opposed to power plants that measure power

in megawatts of electricity.) Some geothermal projects “cascade” geothermal energy by using the same resource for different purposes simultaneously such as heating and power. Cascading uses the resource more efficiently and may improve the economics of a project.

Four commercial greenhouses in southern New Mexico, which at times have employed up to 400 people, occupy more than 50 acres and use geothermal heat to grow plants. In 2002, these projects generated nearly \$23 million in sales and paid more than \$6 million in payroll. A large greenhouse in rural Utah that grows flowers employs between 80 and 120 people at different times throughout the year.

■ Main Challenges for Geothermal Energy

There are a variety of technical and regulatory challenges preventing the more widespread use of geothermal power. Leasing and siting processes can take long periods and be fraught with uncertainty. Although the cost of generating power from geothermal resources has decreased by 25 percent during the last two decades, exploration and drilling remain expensive and risky. Drilling costs alone can account for as much as one-third to one-half of the total cost of a project and wells typically cost between \$1 and \$5 million each. Detecting potentially productive geothermal reservoirs is difficult, with only about one in every five exploratory wells drilled confirming a valuable resource. The rate of success increases significantly once the resource has been found. Because some of the best geothermal resources are located in remote areas, tapping them may require an expansion of the power transmission system, which can also be expensive. Finally, power plants and direct use systems must be located near geothermal resources because it is not economic to transport hot water or steam over long distances.

Summary of Benefits and Challenges of Geothermal Energy

Benefits	Challenges
<ul style="list-style-type: none"> Geothermal power plants provide steady and predictable baseload power. 	<ul style="list-style-type: none"> Many of the best potential resources are located in remote or rural areas, often on federal or state lands.
<ul style="list-style-type: none"> New geothermal power plants currently generate electricity for between \$0.05 per kWh and \$0.08 per kWh, which can decrease below \$0.05 per kWh after capital investment has been recovered. 	<ul style="list-style-type: none"> Developing projects on federal or state lands can be a challenge. The leasing process can be very cumbersome, especially when a proposed project might conflict with other land uses, ESA, and historical or cultural resources.
<ul style="list-style-type: none"> Direct use applications and power plants can generate tax revenue and royalty payments for federal, tribal, state and local governments and create construction, operation, administrative and maintenance jobs. 	<ul style="list-style-type: none"> Although costs have decreased in recent years, exploration and drilling for power production remain expensive.
<ul style="list-style-type: none"> Responsibly managed geothermal resources can deliver energy and provide power for decades. 	<ul style="list-style-type: none"> Using the best geothermal resources for electricity production may require an expansion or upgrade of the transmission system.
<ul style="list-style-type: none"> Geothermal power plants in the United States are reliable, capable of operating about 98 percent of the time. 	<ul style="list-style-type: none"> The success rate for discovering geothermal resources in new, untapped areas is approximately 20 percent. In areas where wells already are producing, the chance of locating more wells increases to about 80 percent.
<ul style="list-style-type: none"> Power plants are small, require no fuel purchase and are compatible with agricultural land uses. 	<ul style="list-style-type: none"> The productivity of geothermal wells may decline over time. As a result, it is crucial that developers manage the geothermal resource efficiently.
<ul style="list-style-type: none"> Geothermal plants produce a small amount of pollutant emissions compared to traditional fossil fuel power plants. 	

COMMON QUESTIONS ABOUT GEOTHERMAL ENERGY

1. How much does electricity from geothermal energy cost?

The price of electricity generated at new geothermal power plants currently ranges between \$0.05 and \$0.08 per kilowatt-hour (kWh). Once capital costs for the projects are recovered, the price of power can decrease to below \$0.05 per kWh. Recent federal legislation qualifies new geothermal power plants for a production tax credit of \$0.018 per kilowatt hour for each of the first five years of service. This credit has been a major factor in the growth of the domestic wind industry in recent years. If applied to geothermal energy, this incentive would decrease the price of electricity generated at geothermal power plants. (for more on this see Question 9). Most of the costs associated with geothermal development are related to exploring and defining the resource and plant construction. Drilling for resources can account for as much as one-third to one-half of the total cost of a project. Geothermal power plants also have ongoing operating costs such as royalties paid for using the geothermal resource, property taxes and plant personnel.

2. Where are geothermal resources located?

Generating electricity using geothermal energy requires high-temperature resources that currently are most accessible in the western states. Advances in both drilling and power plant technologies could enable developers to more affordably tap geothermal resources in a larger portion of the country and expand the use of geothermal power.

Lower temperature resources that are sufficient for direct-use applications are located over a larger area and support agricultural activities such as fish farming, commercial greenhouses, mineral extraction, and space and district heating in various western, southwestern and southeastern states. According to the Geo-Heat Center at the Oregon Institute of Technology, more than 400 communities in 16 western states are located within five miles of a geothermal resource that is suitable for district heating. Geothermal heat pumps that simply transfer heat between the ground and buildings are practical nearly everywhere. (For more information and a map see "Location of Geothermal Resources" at www.geocollaborative.org/publications.)

3. Is geothermal energy an intermittent resource like wind or solar energy?

Unlike wind and solar energy, which generate power when the wind blows or the sun shines, geothermal power plants provide electricity almost constantly; this is commonly referred to as baseload power. Another benefit of geothermal power plants is that most can

adjust their electrical output to follow customer demand as it rises and falls throughout the day. Geothermal power plants in the United States are available to operate and produce power nearly 98 percent of the time and experience very few unplanned outages. Such high percentages make them competitive with fossil fuel and nuclear power plants that operate between 75 percent and 90 percent of the time, depending on the technology and age of the equipment.

4. How dependable are geothermal resources?

Geothermal resources can provide electricity for decades. The key to successful geothermal development lies in managing the resource. Use of geothermal energy to generate electricity dates back 100 years. The world's first geothermal resource developed to generate electricity was tapped in Italy in 1904, and that reservoir is still producing. The geothermal field at The Geysers, established in 1960 in northern California, powered the first geothermal plant in the United States. Although the pressure of that resource has diminished, water injection techniques are helping to stabilize the pressure and the field now is expected to produce for many more years. Using geothermal energy to generate electricity for many years would require replacing aging power plant equipment and may require drilling new wells if the productivity of older ones diminishes over time. Recent technological advances—such as improved turbine design—allow developers to maximize resources and minimize drilling.

5. Are there other uses for geothermal energy besides generating electricity?

Certain low temperature geothermal resources are also practical for direct-use applications such as growing flowers, fish farming, and heating buildings. Four large commercial greenhouses in southern New Mexico, which at times currently employs approximately 200 people, use geothermal heat to grow a variety of plants. A one million square-foot greenhouse in rural Utah uses geothermal heat to grow flowers and employs between 80 and 120 people throughout the year. Geothermal-heated water also is used for fish farming operations in California, Colorado, Idaho, New Mexico and in some southeastern states from Georgia to Louisiana. The district heating system in Klamath Falls, Oregon, provides approximately six megawatts of heat to 20 commercial buildings and for melting snow over nearly 105,000 square-feet of sidewalks and bridges. The Oregon Institute of Technology uses this system to heat nearly 700,000 square-feet of space in 11 different buildings. This operation saves approximately \$300,000 per year on heating bills.

COMMON QUESTIONS ABOUT GEOTHERMAL ENERGY *(Page 2)*

Direct-use systems in the United States currently provide approximately 600 thermal megawatts (MW) of heat, enough to heat 115,000 average houses. (The power from direct-use systems is measured in megawatts of heat; power plants measure power in megawatts of electricity.) Generally, direct-use projects use fluids at temperatures of between 70°F and 300°F.

Geothermal heat pumps, which are not considered a form of direct use, are practical across the country. Heat pumps use the constant temperature of the earth at a certain depth to transfer heat to a building in the winter, and from a building to cool it in the summer. More than one million geothermal heat pumps (with a total capacity to generate approximately 8,600 MW of heat) are operating in states across the country. (For more information see “Geothermal Direct-Use” at www.geocollaborative.org/publications.)

6. What are the environmental effects of developing geothermal resources?

Geothermal energy is considered a clean source of energy because geothermal power plants, depending on the technology, emit at most very small amounts of particulate matter, nitrogen oxides, sulfur dioxide and carbon dioxide. Geothermal plants also are compatible with agricultural and industrial land uses, can be designed to blend in with surrounding areas, and occupy small amounts of land. The agriculturally productive Imperial Valley in southern California is home to several geothermal power plants, and the Mammoth Lake power plant, near California’s famous ski resort, is designed to blend into the scenery. The short-term effects of drilling include noise and the visual effects of the drilling equipment. In an operating power plant, noise is minimal under normal conditions. Finally, geothermal fluids contain dissolved minerals and sediments that are controlled to avoid contaminating local water resources. (For more detailed information see “Geothermal Power and the Environment” at www.geocollaborative.org/publications.)

7. Is geothermal energy really a renewable resource?

Yes. Geothermal energy refers to the constant and limitless heat of the earth; water or steam is simply the medium that transmits this heat. After it is used, the water is injected into the ground where it is replenished with heat and used again. Some consider geothermal resources more finite than other renewable resources because of concerns regarding water use. While the heat of the earth remains constant, the water or steam has to be replenished and effectively managed to ensure sustainability of production. Experience at existing fields shows that production can continue indefinitely if resources are properly maintained. Also, most states that have a renewable portfolio standard recognize geothermal energy as a renewable energy resource.

8. Why is geothermal energy not more widely used?

The three main barriers to more widespread use of geothermal resources involve the location of resources, economics and permitting challenges.

Geothermal resources that are suitable for generating power using today’s technology are located mostly in western states, Alaska and Hawaii. Resources that are practical for direct-use applications are more widespread, but also are located predominately in the west.

Technology and public policy greatly influence the economics of geothermal energy. Locating geothermal resources is expensive and risky just as in oil and gas exploration. However, once a reservoir has been identified, the success ratio for developing commercial resources increases to approximately 80 percent. The resource identification tools available to the petroleum industry are more effective than those available to the geothermal industry and geothermal systems are more complex. Therefore, overall fossil fuels have a higher success rate for drilling discovery wells.

The process of obtaining permits to lease land and build geothermal power plants can be lengthy and cumbersome and may increase the costs of developing geothermal resources. (For more information see “Jurisdiction Over Geothermal Energy” at www.geocollaborative.org/publications.)

9. What state and federal incentives exist for geothermal energy?

A few financial and regulatory incentives promote the development of geothermal resources for power generation and direct use. The Database of State Incentives for Renewable Energy (www.dsireusa.org) describes many of them. The major federal incentive is an investment tax credit of 10 percent that is available to commercial businesses that invest in equipment used to produce, distribute or use geothermal energy. The federal production tax credit of \$0.018 per kilowatt-hour (adjusted for inflation) applies to geothermal energy for each of the first five years of service. This production tax credit has been a major factor in the growth of the domestic wind industry in recent years. Geothermal facilities may qualify for both the production tax credit and the investment tax credit, but they cannot receive both. If applied to geothermal energy, this incentive would decrease the price of electricity generated at geothermal power plants and provide a significant incentive to the geothermal industry. States offer a variety of incentives, including investment tax credits, sales and property tax exemptions, and grant and loan programs. States also can use geothermal energy to meet renewable energy portfolio standards (RPS). Currently, 15 states have an RPS that requires power retailers to sell a specific amount of power from renewable resources, and more states are considering implementing such a standard.

GEOTHERMAL DIRECT USE

The direct use of geothermal heat and water dates back thousands of years to when people used hot springs for cooking and for therapeutic purposes. Direct-use applications tap hot underground water and distribute the heat through pipes for various uses. These systems can replace traditional heating sources such as natural gas-fired boilers, furnaces or hot water heaters. Some cities and towns have installed large direct-use heating systems called district heating that heat many buildings from a common geothermal source. Geothermal energy can also be used to cool buildings. Geothermal direct use also has agricultural and industrial applications. The agricultural sector uses geothermal resources to provide a stable source of heat for raising fish and heating greenhouses; industrial uses include mineral extraction, drying timber and dyeing fabric. Resorts and spas also use geothermal water directly.

■ Technology

Direct-use systems use geothermal resources at temperatures between 70°F to 300°F; these temperatures are lower than those required for most geothermal power plants. Approximately 1,300 of these systems operate across the United States. Geothermal direct-use systems use a fairly simple and established technology that generally involves three basic elements:

- A production system that brings water up through a well to the surface;
- A delivery system that distributes hot water through pipes; and
- A disposal system where the cooled water is injected back into the reservoir.

■ Applications for Direct Use

Heating

Direct use of geothermal resources heating can save on energy costs compared to traditional natural gas or electric heating systems. Although direct-use applications often require a significant investment for drilling and installing equipment, they have lower operating and maintenance costs and do not require constant fuel purchases. Generally, space heating uses a single geothermal well to heat one building, whereas district heating uses one or more wells to heat several structures or even portions of entire cities and towns. District heating systems can save from 30

to 50 percent on heating costs, compared to heating systems that use natural gas, and even more compared to systems that use electricity, propane or fuel oil. These savings take into account the capital cost of equipment and efficiencies involved in converting the actual fuels into usable heat.

According to the Geo-Heat Center at the Oregon Institute of Technology, 18 locations in California, Colorado, Idaho, Nevada, New Mexico, Oregon and South Dakota use geothermal energy for district heating, and the potential exists to develop many more. More than 400 communities in 16 western states are located within five miles of a geothermal resource that is suitable for this purpose. Some examples follow of operational district heating projects.

- New Mexico State University heats approximately half the campus with geothermal heat. It is estimated that this system saves between \$100,000 to \$300,000 in heating costs each year, depending on the price of natural gas and the severity of the winter.

- The district heating system in Klamath Falls, Oregon, provides approximately 6 megawatts of heat to 20 commercial buildings and for melting snow over nearly 105,000 square-feet of sidewalks and bridges. A commercial greenhouse that covers three acres recently tapped into the city's system; it is using geothermal heat to grow tree seedlings. **(Con't.)**

Heating (Con't.)

- The Oregon Institute of Technology in Klamath Falls, Oregon, uses a district heating system to heat nearly 700,000 square-feet of space in 11 different buildings. This operation saves approximately \$300,000 per year on heating bills.

- Boise, Idaho, has four district heating systems. The Warm Springs System has operated since 1892 and is the oldest in the country. The other three systems supply heat to many buildings throughout the downtown area, including the State Capitol and the VA Hospital.

Agricultural Applications

Greenhouses and aquaculture (fish farming) are the two main agricultural uses for geothermal energy. Greenhouses typically use resources between 70°F and 220°F. Fish farms use even lower temperature resources of between 60°F and 90°F. Approximately 40 commercial greenhouses in eight western states grow plants such as vegetables, flowers and tree seedlings. In New Mexico, four large geothermal greenhouses currently employ approximately 200 people. In 2002 these operations saved a total of approximately \$655,000 using geothermal resources for heating instead of natural gas. Nearly 50 aquaculture operations are located in 11 western states. In addition, geothermal resources can be used to pasteurize milk and dehydrate fruit and vegetables.

Industrial Processes

Geothermal resources also are used in mineral extraction, timber drying, fruit and vegetable dehydration and textile industries. In the United States, gold is extracted using a process called heap leaching in which a cyanide solution is sprayed over ore. Using the heat of geothermal resources allows the process to continue even in the winter, when the ore would otherwise be frozen solid. This method of mineral extraction, used primarily in Nevada, has resulted in higher rates of gold recovery. In Italy, geothermal energy has been used for centuries to process boron into boric acid. Geothermal heat also is used to dry lumber and to dye fabrics such as silk and wool.

Fig.1

Source: Geothermal Education Office and the Geo-Heat Center, 2004.

GEOTHERMAL ENERGY & ECONOMIC DEVELOPMENT

Whether they are used to generate electricity or for direct-use applications, geothermal energy projects contribute to the economy of areas where they are located. Geothermal power plant operations are often a major source of tax revenue to local governments. Royalties from development are another potential source of revenue for governments and tribes who lease their land to private developers. Using the heat of geothermal resources directly in commercial greenhouses or fish farming can help support a state's agricultural industry, even in areas that have poor farm land or where energy supplies are expensive or difficult to access. Geothermal resources are often located in remote areas and developing them usually provides an opportunity to improve rural economies. The extraction of valuable minerals from geothermal resources is beginning to provide additional economic benefits.

■ Jobs

Geothermal power plants are often located in rural areas, which typically have chronic, high unemployment rates. Building a 50 megawatt (MW) geothermal power plant may create several hundred temporary (from two to three years) construction and related development jobs and between 30 and 50 permanent, highly skilled full-time jobs at the facility that pay well above minimum wage. Considering the economic multiplier effect, this should provide approximately 90 to 150 new full-time jobs in the community. Because geothermal plants have long operating lifetimes, they can become a stable, reliable part of a community's economic base.

Lake County, California (population 64,000) and Sonoma County, California (population 464,000)

Power plants in these counties (five in Lake County and 16 in Sonoma County) employ approximately 425 people full time, of which two-thirds live in Lake County and one-third live in Sonoma County. An additional 225 full-time equivalent contractor work force supports ongoing projects at the Geysers Geothermal Field.

■ Property Tax

Geothermal power plants represent large capital investments in the counties in which they are constructed. The property taxes that the power plants generate can be significant, especially since many are located in more rural areas with an otherwise declining property tax base.

Imperial County, California (population 145,000)

The 10 geothermal power plants in Imperial County have an installed capacity of 330 MW. These plants, worth approximately \$1 billion, generate approximately \$10 million annually in property tax, which represents nearly 20 percent of the total property tax revenue for the county.

Inyo County, California (population 18,000)

Geothermal plants are the second largest taxpayer in Inyo County. The plant owners pay approximately \$6 million annually in property taxes on the three power plants in the county, of which roughly two-thirds are used to fund schools.

Lake County, California and Sonoma County, California

The 21 geothermal power plants at The Geysers Geothermal Field can generate almost 1,000 MW of electricity and have been an important source of tax revenue for Lake and Sonoma counties for many years. In 2003, property tax payments to the two counties totaled more than \$11 million.

■ Royalty Payments

Royalties are based on a percentage of a developer's revenues that come from using geothermal resources on leased land. These royalties could generate significant revenue for western states where substantial geothermal resources lie under federal, state or tribal lands. By 1997, geothermal power plant operators had paid a total of nearly \$500 million to the Federal Government in royalties. In 1999 alone, Nevada received \$2 million from its share of federal royalties from approximately 235 MW of geothermal electric generating capacity that provides 5.5 percent of the state's power. Under the provisions of the federal "Geothermal Steam Act", in states where the Federal Government collects geothermal royalties, it gives back half of the total to the state in which the resource is located. States are free to determine what percentage of their share they give to the county.

Royalties in Lake and Sonoma Counties of California

In 2003, operators at The Geysers Geothermal Field paid a total of \$6.15 million in royalties to the Federal Government for using geothermal resources it owns in California. The Geysers also paid \$4.1 million in lease fees to the State of California for using geothermal steam produced on state property. In California, some geothermal royalties are specifically directed to fund the California school-teacher's retirement fund. Moreover, the state uses its share of these royalties specifically to expand the use of geothermal energy through grants and loans for resource exploration, research and development, mitigation and planning.

Inyo County, California

The power plant located on land that the Bureau of Land Management owns provides royalty payments to the state and county, while the two on Navy land pay royalties to the Navy.

■ Direct Use

Using low temperature geothermal resources (between 70°F and 300°F) generates revenue and creates jobs for some states. For example, four commercial geothermal greenhouses in rural, southern New Mexico occupy more than 50 acres and at times have employed up to 400 people. In 2002, these projects generated nearly \$23 million in sales and paid more than \$6 million in payroll. A one million square-foot greenhouse in rural Utah employs between 80 and 120 people at different times throughout the year. These jobs pay nearly twice the minimum wage. Low temperature geothermal resources also support nearly 50 aquaculture operations (production and sale of farm raised aquatic plants and animals) in 11 western states and some southeastern states.

■ Mineral Extractions

Selling valuable minerals, such as zinc, silica and manganese, that are present in geothermal fluids can make power plants more profitable and provide another base of economic activity for communities. As extraction technology develops, it also may be possible to recover silica, manganese, lithium, silver, gold, and other valuable minerals from geothermal reservoirs. Many of these minerals currently are imported, and some are critical for high-technology industries. Given these factors, it is possible that geothermal resources could become significant sources for future mineral production.

■ Other Economic Benefits

Lake County, California and Sonoma County, California

Lake County is saving millions of dollars in disposal costs by piping treated wastewater (also known as reclaimed water) from the county into geothermal wells to create steam that the power plants use to generate electricity. The Lake County project, which began in 1997, currently uses approximately 8 million gallons of reclaimed water for this purpose each day; a similar project in Sonoma County injects about 11 million gallons per day. These projects not only solved a major disposal problem but allowed for significant new growth in the counties.

GEOTHERMAL ENERGY: TECHNOLOGIES AND COSTS

Geothermal energy provides an affordable, clean method of generating electricity and providing thermal energy. Geothermal power plants tap certain high-temperature resources (above 190°F) to generate electricity with minimal or no air emissions. Heat pumps and ‘direct-use’ applications, which rely on more common low-temperature resources (typically from as low as 70°F up to 300°F) are used throughout the country as an energy and dollar saving alternative to traditional furnaces and boilers. Two challenges for geothermal energy are that resources are difficult to locate and tend to be found in rural areas. The fact that they are found in remote areas constrains generation and direct use development. It is difficult to transmit heat energy or electricity to the population centers where people will use it. *For further discussion, see “Guidelines for Siting Geothermal Power Plants & Electricity Transmission Lines” at www.geo-collaborative.org/publications.*

This brief focuses on:

- Technology and the different types of geothermal power plants;
- Using geothermal energy for agricultural purposes and for heating buildings; and
- The costs and challenges associated with each technology.

■ Current Technology

Geothermal Electricity Production

Geothermal power plants use the earth’s heat— in the form of underground steam or hot water— to spin a turbine and generate electricity. Wells hundreds to thousands of feet deep are used to deliver the hot fluid to the power plant on the surface, where the heat is converted to electrical energy. Nearly all the water is returned to the reservoir through injection wells to be reheated. Currently, geothermal electricity production is limited to certain western states where the hottest resources are closer to the surface. Advances in drilling and energy conversion technologies could make it possible to expand the use of geothermal power plants to other states. The three types of commercial geothermal power plants are dry steam plants that use resources of pure steam, flash steam and binary cycle plants that tap reservoirs of hot water.

Dry Steam

When resources produce pure steam, the steam drives a turbine and generates power. However, these resources are rare; only five such fields have been discovered to date.

The only commercially developed steam field in the United States is The Geysers, located in Northern California, which began the commercial production of electricity in 1960. Another dry steam geothermal field in Lardarello, Italy, began production in the early 20th century.

Flash Steam

Geothermal reservoirs that contain hot, pressurized water are much more common and provide energy for all domestic geothermal power production except The Geysers. Flash-steam power plants use resources that are typically hotter than 350°F. Before fluids enter the plant, the pressure of the fluid is reduced until it begins to boil, or flash. This process produces both steam and water. The steam subsequently is used to drive the turbine; the water is injected back into the reservoir. These types of power plants operate in California, Hawaii, Nevada and Utah.

GEOTHERMAL ENERGY: TECHNOLOGIES AND COSTS

Geothermal Electricity Production (Con't.)

Binary Cycle

This rapidly expanding technology uses geothermal resources with temperatures as low as 190°F. Rather than flashing the geothermal fluid to produce steam, this type of power plant uses heat exchangers to transfer the heat of the water to another working fluid that vaporizes at lower temperatures. This vapor drives a turbine to generate power, after which it is condensed and circulated back to the heat exchangers. This type of geothermal plant has superior environmental characteristics compared to the others because the hot water (which tends to contain dissolved salts and minerals) is never exposed to the atmosphere before it is injected back into the reservoir. Binary power plants were introduced in the mid-1980s and are the fastest growing generating technology currently with more than 350 MW of binary generation capacity in California, Hawaii, Nevada and Utah.

Direct Use

Direct-use applications tap geothermal resources to provide thermal energy. These projects are feasible throughout a larger section of the country because they use more widespread, low-temperature resources (generally from 70°F to 300°F). Direct-use applications commonly support agricultural and industrial activities but are also an efficient means of heating and cooling buildings.

Agricultural Applications

Most western states—and even some in the Southeast—have direct-use projects to support rural businesses such as fish farming, commercial greenhouses, vegetable dehydration, and milk pasteurization. In New Mexico, four large geothermal-heated greenhouses currently employ nearly 200 people. In 2002, the company operating the greenhouses saved approximately \$655,000 using geothermal heat instead of natural gas for their operations.

District Heating

District heating systems distribute geothermal heat to buildings and homes that are connected through a network of pipes. Boise, Idaho has a number of district heating systems to heat more than 350 buildings throughout the city, including the State Capitol. The first system has been

in operation since 1892. In addition to heating buildings, Klamath Falls, Oregon, uses this technology for melting snow on some streets, bridges and sidewalks.

Geothermal Heat Pumps

Geothermal heat pumps provide an efficient means of heating and cooling buildings. Heat pumps use less energy than traditional heating and air conditioning systems because they use the earth as a heat source whose temperature is more constant than the outside air. For example, if the outside air temperature is 20°F a traditional air source heat pump requires electrical coils to boost that temperature to maintain a comfortable indoor climate of approximately 70°F. A heat pump, however, draws on the relatively constant temperature in the ground (usually between 50°F to 60°F) and thus does not require electrical booster coils to maintain that same comfortable indoor climate/air temperature. Heat pumps can reduce a building's energy consumption by 30 percent to 50 percent, compared to conventional electric heating and cooling systems. Although these systems are powered with electricity, the power is used to move, not generate, heat; consequently, a heat pump delivers three to four times more energy than it consumes. More than 1 million geothermal heat pumps (with a total capacity to generate approximately 8,600 MW of heat) operate across the country.

■ Advanced Technology

Geothermal power plants need reservoirs that contain heat, water, and permeable rocks located less than 15,000 feet below the surface to generate affordable electricity. Researchers and geothermal developers are searching for ways to enhance the productivity of geothermal reservoirs and to use more marginal areas, such as those that have ample heat but perhaps are only slightly permeable to water, or which are at greater depths. Advanced power generation techniques may make it possible to generate electricity using much lower temperature resources while advances in drilling may allow developers to tap valuable resources located deeper underground. If successful, these advances will enable developers to recover a much larger portion of the earth's thermal energy closer to areas where electricity customers are located or where there is a need for direct use applications.

■ Cost, Price and Challenges

Unlike traditional power plants that run on fuel that must be purchased over the life of the plant, geothermal power plants use a renewable resource that is not susceptible to price fluctuations.

New geothermal plants currently are generating electricity from \$0.05 to \$0.08 per kilowatt-hour (kWh). Once capital costs for the plant are recovered, the price of power can decrease to below \$0.05 per kWh. The price of geothermal energy is within the range of other electricity choices available today when the costs over the lifetime of a plant are considered (see Table 1).

Most of the costs associated with geothermal power plants are related to resource exploration and plant construction. Like oil and gas exploration, it is expensive and risky to locate geothermal resources because only one in five wells yields a reservoir suitable for development. Geothermal developers must prove that they have a reliable resource before they can secure the millions of dollars required to develop geothermal resources.

Drilling

Although the cost of generating power from geothermal resources has decreased by 25 percent during the last two decades, exploration and drilling remain expensive and risky. Drilling costs alone can account for as much as one-third to one-half of the total cost of a geothermal project. Locating the

best resources can be difficult; and developers may drill many dry wells before they discover a viable resource. Because rocks in geothermal areas are usually extremely hot and hard, developers must frequently replace drilling equipment. Individual, productive geothermal wells generally yield between 2 MW and 5 MW of electricity; each may cost from \$1 million to \$5 million to drill. A few highly productive wells are capable of producing 25 MW or more of electricity.

Transmission

Geothermal power plants must be located in specific areas near a reservoir because it is not practical to transport steam or hot water over distances greater than two miles. Since many of the best geothermal resources are located in rural areas, developers may be limited by their ability to supply electricity to the grid. New power lines are expensive to construct and may be difficult to site. Many existing transmission lines are operating near capacity and may not be able to transmit electricity without significant upgrades. Consequently, any significant increase in the number of geothermal power plants will be limited by those plants' ability to connect, upgrade or build new lines to access to the power grid and whether the grid is able to deliver the additional power to market.

Table 1. Cost of New Electricity Production (cents/kilowatt hour)

Technology	Geothermal Flash	Geothermal Binary	Wind	Hydropower	Natural Gas	Turbine
					<i>Combined Cycle (Baseload)</i>	<i>Simple Cycle (Peaking)</i>
Capital & Financing Cost	3.50	5.14	3.49	4.62	0.93	6.93
Fixed Operating Costs	1.43	3.08	1.79	1.12	0.19	2.43
Taxes (<i>credit</i>)	-0.54	-0.91	-0.34	0.29	0.01	0.12
Total Fixed Costs	4.39	7.28	4.93	6.03	1.12	9.49
Fuel Cost	0.12	0.08	0.00	0.00	3.83	5.11
Variable O&M Costs	0.01	0.00	0.00	0.00	0.24	1.09
Total Variable Costs	0.13	0.08	0.00	0.00	4.06	6.20
Total Levelized Costs	4.52	7.37	4.93	6.03	5.18	15.69

Table 1 Source: Badr, M & Benjamin R. "Comparative Cost of California Central Station Electricity Generation Technologies" California Energy Commission June 5, 2003

• These figures are for comparison only and represent the levelized costs as of June 2003 in California. Numbers will vary depending on the quality of the renewable resource and the price of natural gas. • Figures for wind do not include the federal production tax credit of 1.8 cents per kilowatt-hour. • "Taxes" refers to various state and federal tax provisions. • "Levelized costs" refers to the cost of electricity that a power plant will generate over its lifetime. • "Baseload" refers to plants that operate almost constantly while "peaking" refers to plants that operate only during certain hours when electricity demand is at its highest.

LOCATION OF GEOTHERMAL RESOURCES

Geothermal resources, which utilize the heat of the earth, are located throughout the planet's crust. Those closer to the surface are most commonly used because geothermal drilling costs are currently prohibitive below depths of between 10,000 and 15,000 feet. The hottest domestic geothermal resources are most easily accessible in the western United States, but low temperature resources that are practical for direct use applications are more widespread.

■ Geothermal Resource Potential

The earth generates a tremendous amount of heat energy. Figure 1 shows the expected heat in the earth at a depth of six kilometers (19,685 feet). Oil and gas drilling technology has allowed successful drilling to even greater depths. The drilling depth record of 33,200 feet was established in the Gulf of Mexico in January, 2004. Currently, geothermal drilling technology is best suited to tap resources that are located at an intersection of underground heat, water and fractured rock. Figure 1 shows only estimates of underground heat, but not the places where high heat co-exists with fractured rock and water. Advancements in Enhanced Geothermal Systems technology are expected to tap geothermal resources in areas where these ideal heat, water and rock conditions do not exist, and to economically recover resources at much greater depths.

Figure 1: Estimated Earth Temperatures at 6 km Depth (3.6 miles)

Note:

A significant number of the geothermal areas lack sufficient water and/or permeability to enable the affordable production of geothermal energy. Presently, only high-grade (i.e. shallow, hot, and permeable) hydrothermal reservoirs generate electricity economically.

Source: Geothermal Laboratory, Southern Methodist University, 2003.

<http://www.eere.energy.gov/geothermal/geomap.html>

■ Technology and Resources

Figure 1 gives a general idea of where geothermal resources may exist but much more exploration and drilling is needed to determine precisely where the best resources are located. Geothermal power plants and direct-use projects must be built near the geothermal resource because it is not generally practical to transport steam or hot water over great distances. Heat pumps are useful anywhere in the country because they do not rely on reservoirs of steam or hot water. (Figure 2 indicates where various geothermal technologies are used across the United States.) Since geothermal production occurs near the location of the resource, it costs very little to obtain and transport fuel to the power plant, especially compared to many traditional power plants. Many fossil fuel power plants can be built over a wider range of areas but require constant fuel purchases and shipments over their lifetime.

LOCATION OF GEOTHERMAL RESOURCES (Page 2)

■ Power Generation

The white and dark gray areas of Figure 1 indicate regions with the highest potential for generating electricity. Geothermal power plants generally use resources with temperatures greater than 250°F to generate power economically, although advanced systems can use resources as low as 190°F. Electricity is currently being produced economically in California, Hawaii, Nevada and Utah. Improvements in public policy and advances in technology are expected to expand the use of geothermal power.

■ Direct Use

Direct-use projects are practical throughout a larger area of the country because they use more widespread, low-temperature resources (generally between 70°F and 300°F) to heat and cool buildings, provide heat to dry food and lumber and support fish farming and greenhouses. Although the high-potential regions for resources within this range include all areas of Figure 1 except those in black, the economic limitations of drilling to the depth indicated limit direct use development potential to those areas in dark grey and white. (For more detailed information, see "Geothermal Direct-Use" at www.geocollaborative.org/publications.)

■ Geothermal Heat Pumps

Geothermal heat pumps are practical across the country because they do not rely on the reservoirs of geothermal steam or hot water that are found only in certain states. Instead, heat pumps use the constant temperature of the earth at a much shallower depth to transfer heat to a building in the winter, and from a building to the earth to cool it in the summer. More than one million geothermal heat pumps (with a total capacity to generate approximately 8,600 MW of heat) are in operation across the country and their numbers are growing more than 20 percent a year. Geothermal power plants represent large capital investments in the counties in which they are constructed. The property taxes that the power plants generate can be significant, especially since many are located in more rural areas with an otherwise declining property tax base.

Figure 2: Geothermal Uses in the United States (shown below)

Note: See <http://geoheat.oit.edu/dusys.htm> for an interactive version of this map.

GEOTHERMAL POLICY OPTIONS FOR STATES

States take advantage of an assortment of policies to develop or expand the development of renewable energy resources. They often select a combination of these policies rather than just one and use them whether or not they have restructured their electric industry. States also have an energy office that may be able to assist policymakers with geothermal energy issues. Some of these energy offices have formed working groups, with the help of the *United States Department of Energy's GeoPowering the West* program, to identify and address specific challenges associated with developing geothermal energy.

Table 1 illustrates some policy options that states can use as incentives for geothermal power plants, direct-use systems and heat pumps. *(States listed throughout this brief have many of these policies in place for a variety of renewable energy technologies. This brief focuses on geothermal energy.)*

Table 1. Common Renewable Energy Policy Options

Economic Incentives	Regulatory Mechanisms
State Production Tax Credits	Renewable Portfolio Standard (RPS)
Grants and Loans	Green Pricing Programs
Property Tax Incentives	State Renewable Purchases
Sales Tax Incentives	Disclosure and Certification Programs
Investment Tax Credits	Interconnection Requirements
System Benefit Charges	Transmission Policy
Royalty Payments	

Source: *The National Conference of State Legislatures, 2004.*

■ Economic Incentives

State Production Tax Credits

This option provides a tax credit (usually around 1 cent per kWh) for electricity generated from renewable resources. This is essentially a state version of the federal production tax credit that has helped the growth of wind power in recent years. Such production-based incentives are useful not only because they reduce the price of electricity from renewable sources, but also because they encourage developers to actually generate electricity rather than just install equipment. Maryland, Minnesota, New Mexico and Oklahoma offer production tax credits.

Grants and Loans

Twenty states have grant programs to support renewable energy in the commercial, industrial and government sectors and for schools and utilities. Some programs focus on research and development, but most aim to encourage the purchase and installation of renewable energy equipment. Programs vary in the amount offered—from a few hundred dollars up to \$1 million—and some states set no limit.

States also offer low- or no-interest loans to help citizens buy renewable energy equipment. These loans are available to

GEOTHERMAL ENERGY: GEOTHERMAL POLICY OPTIONS FOR STATES

Grants and Loans *(Con't.)*

various sectors, including residential customers and large businesses. Twenty-five states have some sort of loan program that is administered either through the state or a utility. It also is possible for states to provide a loan guarantee on financing for renewable energy projects. Banks and lending institutions that have no experience financing such projects may be hesitant to do so. However, if a state were to guarantee a loan, it could facilitate renewable energy development by decreasing the risk for the lender and helping projects gain easier access to capital.

The California Energy Commission's Geothermal Program promotes geothermal energy in the state by extending financial and technical assistance to public entities for planning, project impact mitigation, and direct use projects. It also provides financial assistance to private entities for research, development, mitigation and commercialization projects. The funding comes from royalties that developers pay the federal government tied to geothermal energy production on federal leases in California. Typically, this program provides grants and loans each fiscal year.

Property Tax Incentives

Property tax incentives usually come in the form of exemptions, exclusions and credits. Many tax exemptions are structured so that any additional value that a device adds to the property is not included in the value of the property for taxation purposes. For example, if a geothermal heating system costs \$2,000 compared to \$1,000 for a traditional system, the renewable system will be assessed at \$1,000. Because property tax is collected locally, some states give local authorities the option of providing special property tax incentives or exemptions to lure project developers. These incentives are attractive to developers because they can result in millions of dollars in savings each year. However, the current budget shortfalls in many areas have made tax incentives less popular than in previous years. 24 states—including California, Connecticut, Illinois, Iowa, Kansas, Maryland, Montana, Nevada, New Hampshire, Oregon, Vermont and Virginia—provide property tax incentives for renewables.

Sales Tax Incentives

Sales tax incentives usually exempt equipment and labor used to construct a renewable energy facility from the state or local sales taxes. These exemptions can save developers money especially on critical upfront capital expenditures; although property tax incentives usually produce greater savings over the life of the project. This incentive is available in Alaska, Arizona, Connecticut, Florida, Hawaii, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, North Dakota, Ohio, Rhode Island, Utah, Vermont, Washington and Wyoming.

Investment Tax Credits

State investment tax credits can help encourage investment in renewable technologies that are typically more expensive than conventional technologies. The federal government offers a ten percent tax credit for businesses that invest in equipment used to produce, distribute or use geothermal energy.

System Benefit Funds

States use system benefit charges (also known as public benefit funds) to support renewable energy, energy efficiency and energy assistance programs. These funds are collected through a consumption-based charge (typically a fraction of a cent per kWh) that all electricity customers pay. States use them in a variety of ways, including rebates to customers for the purchase of renewable energy systems; to identify their own renewable energy resources; or for energy education programs. A few states now allow certain non-governmental organizations that specialize in energy programs to administer the funds. California, Connecticut, Delaware, Illinois, Maine, Massachusetts, Minnesota, Montana, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island and Wisconsin have such funds.

Royalty Payments

Developers generally pay royalties based on a percentage of their revenue that comes from using geothermal resources on leased land. Flexibility in royalty payments can incentivize geothermal development.

■ Regulatory Mechanisms

Renewable Portfolio Standards (RPS)

This policy requires electricity providers in a state to ensure that a specific percentage of the total power they sell comes from renewable resources. In some states, the standard only applies to investor-owned utilities and not municipal utilities or electrical cooperatives. A carefully crafted RPS can be an effective way to greatly expand the use of renewable energy. 15 states have some form of RPS and nearly a dozen more considered it in the 2004 legislative session. Table 2 lists some of the states that have an RPS, and the amount of renewable energy that the policy requires.

Table 2. Select State RPS Goals

State Renewable Energy Totals	
Arizona	1.1% by 2007 (50% solar)
California	20% by 2017
Connecticut	13% by 2009
Iowa	105 MW for two utilities
Maine	30% by 2000
Massachusetts	4% by 2009
New Jersey	6.5% by 2012
New Mexico	10% by 2011
Nevada	15% by 2013 (5% solar)
Pennsylvania	Varies by utility
Texas	2880 MW by 2009
Wisconsin	2.2% by 2011

Source: The National Conference of State Legislatures, 2004.

Just as each state’s energy situation is unique, so is each RPS policy. States can craft these policies to encourage development of the resources they choose. The standards in Arizona and Nevada are written to encourage solar power, since those states receive a significant amount of sunlight. Similarly, states with strong geothermal resources can structure their RPS to encourage geothermal development. Although an RPS can boost the development of renewable resources, this policy alone does not address other impediments to geothermal development such as the siting and permitting of projects or issues regarding transmission lines.

Table 3. Advantages and Disadvantages of RPS Policies

Advantages of RPS	Disadvantages of RPS
Can create a market by ensuring that there are buyers and sellers for the power.	Complex and difficult to design.
Can be applied in regulated and competitive energy markets.	Exact cost cannot be determined in advance but can be limited.
Can give incentives to specific resources, depending on the state’s priorities.	The RPS is a mandate.
Relatively low administrative cost to the state.	Fairly new policy and experience is limited.

Source: The National Conference of State Legislatures, 2004.
For more detailed information on state renewable portfolio standards see the report “Evaluating State Renewable Portfolio Standards” at www.geocollaborative.org/publications.

Green Pricing Programs

Through green pricing programs, power providers offer a menu of different renewable—or “green”— products to customers. An example would be a program that allows customers to support renewable technologies by purchasing 100 kWh blocks of electricity generated from renewable resources for \$2 to \$3 per month. The utility itself can administer and market these programs to customers or it could contract with another company that specializes in providing these marketing services. These programs are currently available in 33 states, although customer participation often is limited; typically only about 1 percent of customers sign up.

State Renewables Purchases

State governments can elect to purchase a certain amount of its energy from renewable sources for use in state-owned facilities. Since state agencies are significant energy users, this commitment can help support the renewables market in the state; it also gives the government an opportunity to be a model for other power customers. Individual large cities like Seattle and Chicago and smaller municipalities in 12 states also participate in these programs. These purchases can be made through existing utility green pricing programs or, in some cases, through negotiation with the power supplier. Connecticut, Illinois, Maine, Maryland, New Jersey, New York, Pennsylvania, Rhode Island and Tennessee have committed to purchasing a percentage renewable energy to offset energy

■ Regulatory Mechanisms *(Con't.)*

Disclosure and Certification Programs

These programs require electricity retailers to display on a customer's bill the mix of fuel sources that are used to generate electricity. The aim is to provide a sort of "truth in advertising" for electricity retailers. Polls have shown that consumers want more of their power to come from renewable sources and that many are willing to pay a premium. Demand for green power may increase as more customers see the actual amount of energy that is generated from non-renewable sources. This effort is under way in 23 states, including Arizona, Colorado, Delaware, Florida, Illinois, Michigan, Montana, New Jersey, New York, Ohio, Texas and West Virginia.

Interconnection Requirements

Geothermal developers typically must connect their power plants to the existing network of power transmission lines to get their product to market. In most cases, the allocation of the associated interconnection costs are determined in accordance with Federal Energy Regulatory Commission requirements. In some limited situations, state policymakers also regulate interconnection to the power grid.

Transmission

The many challenges associated with siting, permitting and paying for power lines can hinder the development of renewable energy in many states. Many of the nation's best renewable resources are located in remote areas; using them often requires building new lines to deliver the power to customers. States can examine their laws governing how transmission lines are sited and financed in order to determine if these processes impede renewable energy development. Kansas recently passed legislation streamlining the process for siting transmission lines and allowing the issuance of bonds to finance them. In Minnesota, the Public Utility Commission recently approved four new transmission lines for one utility with the condition that it acquire new renewable energy projects at the same time as the new lines. (The utility is allowed to recover costs associated with these specific lines.) This may help guarantee that the renewable energy projects will have transmission capacity available.

GUIDELINES FOR SITING GEOTHERMAL POWER PLANTS AND ELECTRICITY TRANSMISSION LINES

■ Siting Geothermal Power Plants

Building geothermal power plants, just like any major energy infrastructure project, usually requires permission from local, tribal, state or federal government agencies before construction can begin. This permitting process differs in every state but usually includes an application process, a time for public comment, a time for agency staff to gather information and make a decision about the project, and a process for appeals, if necessary. Today in the western United States, siting energy facilities is a complex and sometimes contentious process, especially when a proposed facility conflicts with other land uses such as timber harvesting or recreation, or are proposed in environmentally or culturally sensitive areas.

■ Siting Transmission Lines

When geothermal power plant developers construct a power plant, they build it near the best geothermal resources they can find. The steam or hot water cannot be transported economically for any great distance, so it must be used on site. That differs from a natural gas power plant developer, for example, who can build a power plant closer to customers and buy natural gas that has been piped from hundreds or even thousands of miles away. Geothermal resources also are located in sparsely populated areas that use little electricity compared to the more densely populated cities in the West, such as Denver, Phoenix, or Los Angeles. Because of this distance from population centers, geothermal developers are more dependent on the transmission system to get their product to market.

The transmission system operates like a big, interconnected, interdependent machine. State policymakers, local governments and federal authorities all have some control over what is built, where it is built, and who makes the investment in transmission infrastructure. Federal authorities wield the greatest authority over the siting of transmission lines on federal properties and over the rates to send power over the lines. State and local agencies have the greatest authority over issuing permits

to build transmission lines and power plants on private and state lands. It is often challenging to secure a permit to build a new transmission line or expand existing ones. Private parties or others without eminent domain authority find this process still more difficult. People can object to the aesthetics of lines and transmission towers. In many cases, the people who see the lines do not directly benefit from them; they often are built to deliver electricity to people who live many miles away. The key to any siting process is to balance relevant public input and consideration of the merits of an energy facility with the need to obtain decisions in a reasonable time frame.

■ Siting Guidelines

Because few new geothermal energy facilities have been constructed during the past decade, regulatory agencies and siting authorities have relatively little experience with siting them. *However, experience with other energy facilities leads to the following set of ten guidelines that may be helpful in designing a siting process that expedites the review and approval of geothermal energy facilities.* These same guidelines are relevant for siting both electric transmission lines and power generation facilities and they apply to local, state and federal permitting policies.

- 1. The public should be notified early. Provide adequate time and opportunity for the public to comment on the proposed facility.**

No one reacts well to a surprise announcement that a new facility will suddenly be built near them. A process needs to have early notification built in through newspaper announcements and other methods. Soliciting public comment from the community will facilitate discussion and give developers an opportunity to address people's concerns.

2. Explain the need for the facility, its benefits, and how it will solve a specific problem.

It is important that the public understand why a geothermal energy facility is being built and how the facility will solve a particular problem, such as meeting increased demand for power, alleviating natural gas supply constraints or high electricity prices.

3. Regional considerations should be explicitly included in the transmission siting process.

Most states require that the siting authority consider benefits to the people of a single state; Mississippi siting authority asks regulators to consider benefits only to the State of Mississippi, for instance. Yet, transmission provides dispersed benefits to a region, not to just a single state. It may be helpful for state policy to incorporate the regional benefits of transmission in the consideration of a permit for new transmission.

4. Providing thorough guidance to the applicant about the process that must be followed and what information is required for a complete application can make the process more efficient.

Applications to build any new facility can be complex. It is important that the agency accepting the application have all the information it needs to make a well-informed decision.

5. Address the issue of costs associated with the process of permitting transmission lines and power plants.

A permitting process with a clearly laid out timeline, that states how many and what type of studies are required, can save time for all parties involved and help developers avoid unexpected costs and delays.

6. Provide a central place where applicants can obtain all the necessary permits for transmission lines and power plants.

This is an important part of trying to provide oversight without unduly burdening the process. According to the Edison Electric Institute, all but six states have some type of centralized permitting for siting electricity transmission lines. Geothermal production does not qualify for this centralized process in all cases. Where states have such processes, they

should consider making them applicable to geothermal generation regardless of the type and size of the geothermal operation.

7. Lay out a specific set of considerations that can be used to determine if the facility should or should not be constructed. Avoid simple “not in my backyard” objections.

Arizona does this through statute, providing a set of approximately 10 items that can be considered in the siting review process. Environmental impacts, impacts on local affected communities, reliability benefits and security impacts are examples of the kind of considerations for such a list.

8. Lay out an enforceable timetable for consideration of the project.

A thorough process that takes public input into account should not take so long that it deters developers from even proposing to build a facility. Many states set specific statutory time limits or goals, ranging from three months to a year or more, for states to consider and rule on a siting proposal.

9. Attempt to ensure that the timetable and the considerations for the state siting processes are appropriately coordinated with any federal approvals that may be necessary.

Many geothermal energy facilities must go through a set of federal procedures and permitting processes that can be lengthier than a state process. Siting could be expedited if a formal agreement or specific memorandum of understanding existed between relevant agencies at each level to ensure that all worked together to eliminate redundancies in the process.

10. Allow for a coherent and timely appeals process.

Federal and state laws and regulations related to the issuance of permits almost always lay out an appeals process. Parties who disagree with the siting authority's decision can appeal to the courts, or in some cases, to the public utility commission itself. The appeals process should provide a clear and transparent way for all parties to understand who makes decisions. It may help avoid a situation in which aggrieved parties challenge a decision for extended periods of time through multiple forums.

Evaluating State Renewables Portfolio Standards:

A Focus on Geothermal Energy

Executive Summary

For the full version visit www.geocollaborative.org/publications

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ACKNOWLEDGEMENTS

This report was prepared on behalf of the National Geothermal Collaborative (NGC). For their guidance and support throughout, we thank NGC's RPS Working Group: Mike Hughes (RESOLVE), Kathleen Rutherford (RESOLVE), Jody Erikson (RESOLVE), Dan Schochet (Ormat), and Marilynn Semro (Seattle City Light). We also appreciate the written comments provided on previous drafts of this document by Dan Schochet (ORMAT), Marilynn Semro (Seattle City Light), Kathleen Rutherford (RESOLVE), Troy Gagliano (National Conference of State Legislatures), Mike McKinney (Southern California Edison), Ted Clutter (Geothermal Resources Council), Paul Dunlevy (Bureau of Land Management), and Karl Gawell (Geothermal Energy Association). For their extensive verbal comments, we thank the entire NGC Steering Committee. Finally, for being willing to share their opinions through stakeholder interviews, we thank Dan Schochet (ORMAT), Marilynn Semro (Seattle City Light), Christine Watson (Utah Energy Office), Dick Byers (Washington Utilities and Transportation Commission), Tom Rawls (Green Mountain Energy), John Nielsen (Land and Water Fund of the Rockies), Chris Wentz (New Mexico Department of Minerals), Colin Duncan (Sierra Pacific Power Co.), Virinder Singh (PacifiCorp), Liz McDannel (Southern California Edison), Karl Gawell (Geothermal Energy Association), and Bob Cooper (Nevada Attorney General's office). Of course, any remaining errors are our own, and the opinions expressed in this report do not necessarily represent those of the National Geothermal Collaborative or its members.

This research was supported, in whole or in part, by DOE grant DEFG03-01SF22363. The financial support of this DOE grant does not constitute an endorsement by DOE of the views expressed in this article.

ABOUT THE NATIONAL GEOTHERMAL COLLABORATIVE

A U.S. consensus-based collaborative, the National Geothermal Collaborative (NGC), was formed in 2002 to identify issues that impede the use of geothermal power, establish dialogue among key stakeholders, and catalyze appropriate activities to overcome obstacles to appropriate development. Our vision is that geothermal power is environmentally, economically and politically sustainable and fully integrated into mainstream energy markets.

The NGC is led by a steering committee whose membership to date includes representation from both investor owned and public utilities, academia, state energy offices, White House Task Force on Energy Project Streamlining, Center for Energy Efficiency and Renewable Technologies, Council of Energy Resource Tribes, Geothermal Resource Council and Geothermal Energy Association, Departments of Interior, Agriculture and Energy, and the National Conference of State Legislatures.

RESOLVE, a non-profit environmental dispute resolution organization, provides a full range of facilitation services to create opportunities for NGC members and other geothermal stakeholders to build long-term relationships, and to develop a number of land mark products resulting from significant negotiation and reflecting consensus of the Committee.

NGC members represent these sectors:

- Electric Utilities (both investor owned and public)
- Geothermal Industry
- Environmental/Renewable Energy
- National Conference of State Legislatures
- Academia
- Tribes
- State Energy Offices
- Public land managers

NGC members include representatives from:

Bureau of Land Management
Center for Energy Efficiency and Renewable Technologies
Council of Energy Resource Tribes
Geothermal Energy Association
Geothermal Resources Council
National Conference of State Legislatures
Seattle City Lights
Southern California Edison

State of Nevada, Commission on Mineral Resources
U.S. Department of Agriculture (Forest Service)
U.S. Department of Energy, EERE, GPW
Washington State University
White House Task Force on Energy Project Streamlining

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PREFACE

The National Geothermal Collaborative (NGC) is pleased to present this examination of state-level Renewables Portfolio Standards (RPS) and their impact on the development of geothermal energy in the United States. The RPS ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources.¹ The purpose of this report is to evaluate early experience with, and specifically highlight the role of, geothermal energy in state RPS policies. As this report illustrates, creating an effective and well-functioning RPS is a complex endeavor with no uniform approach. The report begins with a discussion of the advantages and disadvantages of using a portfolio standard to develop geothermal markets, and concludes by highlighting principles and best practices that may be effective in guiding future RPS design efforts. It is the consensus of the NGC that this analysis is a valuable tool in determining whether or not, and how, to construct an effective RPS.

The NGC is a national, consensus-based stakeholder group established in 2002. Individual members of the NGC represent federal and state government, trade and educational associations, public and investor-owned utilities, tribal organizations, energy, and environmental interest groups. The purpose of the NGC is to advance the development and use of geothermal heat and power in the U.S., identifying issues that impede the use of geothermal power, establishing dialogue with key stakeholders, and catalyzing activities to overcome obstacles to appropriate development. One critical action identified in the group's first meeting was to develop solutions to mitigate market barriers and remove obstacles to the sustained, orderly development and accelerated procurement of geothermal power. This report was commissioned to move the Collaborative down that road.

To examine the impacts of current and potential RPS policies on geothermal development, the Collaborative formed a Renewables Portfolio Standard Work Group in accordance with NGC protocol and with guidance from the NGC Steering Committee. A Request For Proposals was drafted and competitively bid. The authors' study was presented to the RPS Work Group for review and comment, followed by a recommendation to the entire NGC to review and adopt the document. The NGC recognizes that the ultimate success of any RPS will depend on a variety of other factors including transmission infrastructure, strength of the renewable resource, and other state policies that may already be in place.

Heat from the Earth

Geothermal energy, heat from the Earth's interior, is one of the world's cleanest, most reliable and abundant sources of energy. This heat is brought to the surface as steam or hot water—created when water flows through heated, permeable rock—and converted to electricity or used directly for space heating/cooling in homes and buildings. Higher temperature geothermal

¹ The RPS typically applies to investor-owned electric utilities and competitive energy service providers, but this is not uniformly the case. With few exceptions, publicly-owned utilities have been exempted from the RPS requirements. One such exception is Wisconsin, where most municipalities and coops must meet the RPS along with investor-owned utilities.

resources supply 6 percent of the electricity in California, 10 percent in Northern Nevada, and 20 percent on the Big Island of Hawaii. Additionally, low-temperature, direct-use projects that provide energy for commercial, industrial and residential uses are found in 23 states, mostly in the West.

Benefits of Geothermal

A significant advantage of geothermal energy is its comparatively clean generation of electricity. Generating power with fossil fuels results in major releases of regulated emissions of sulfur dioxide, nitrogen oxides, and gases such as carbon dioxide. Nuclear power plants yield radioactive waste as by-products of the power generation process. The net environmental impact of these by-products contribute to widely acknowledged environmental problems, including acid precipitation, formation of ground-level ozone and the well-publicized greenhouse effect, and longstanding concern surrounding the proper disposal of radioactive waste. Geothermal plants emit relatively minor amounts of gases to the air and produce no radioactive waste. In addition, geothermal power production facilities require a fraction of the land necessary for traditionally-fueled power plants.

The economic benefits of geothermal energy are also important, particularly to states and local communities. Using geothermal energy can contribute to a reduction of our dependence on foreign sources of fuel, create domestic jobs, and provide revenue to federal, state and local governments.

The reliability of electricity produced using geothermal energy can also benefit utilities that need “baseload” energy. Because operation and maintenance is minimal, geothermal plants generate power a greater percentage of the time than coal and nuclear power plants. This remarkably low down-time gives utility planners greater flexibility to meet electricity demand. In addition, direct-use of geothermal heat contributes to better utility planning by off-setting contingency needs for electricity.

The cumulative production of geothermal energy in all of its forms ranks third among renewables, following hydroelectricity and biomass and ahead of solar and wind. Geothermal energy is becoming increasingly cost competitive with other renewables and traditional sources of energy. In fact, the cost of generating power from geothermal resources has decreased approximately 25 percent over the past two decades. The cost of geothermal electricity currently ranges from about 4 to 8 cents per kilowatt-hour depending on the strength of the resource. The geothermal industry and the U.S. Department of Energy are working together to achieve a goal of 3 cents per kilowatt-hour.

Despite these benefits, the current level of geothermal use pales in comparison to its potential. The total U.S. installed capacity is approximately 2700 MW. According to testimony submitted to the Subcommittee on Energy and Mineral Resources of the Committee on Resources of the House of Representatives on July 22, 2003, the U.S. Geological Survey and the Geothermal Energy Association believe that geothermal energy potential exists to provide over 20,000 MW of electricity in coming years. (One hundred megawatts (MW) provide the residential electricity

needs of a city of 200,000 people.)² The key to greater use of our nation's geothermal resources is a combination of a supportive policy framework, technology advancement and public support.

A Policy Approach to Geothermal Development

In a growing number of states, RPS programs are emerging as a policy option for increasing the use of domestic renewable energy. As renewables portfolio standards create and expand the markets for renewable energy sources, use of geothermal energy could increase. The combined effect of greater use of geothermal energy through compliance with an RPS may help:

- Diversify a state's energy portfolio
- Protect customers from fossil-fuel price spikes and supply shortages
- Improve national security by helping to reduce reliance on imported fuel and electricity
- Reduce the cost of renewable energy technologies by creating and expanding markets for renewable energy sources
- Protect the environment and public health
- Increase local economic development opportunities

The greatest opportunity for new geothermal development in the United States exists in many western states, a region characterized by steadily increasing population and demand for energy. California, New Mexico, and Nevada each have an RPS in place in which geothermal energy is an eligible technology. It is the consensus of the NGC that, given the early experiences with the various RPS states' policies, this report provides a thorough analysis of the advantages, disadvantages, opportunities, and obstacles that states may encounter when considering a renewable portfolio standard.

A link to the final report will be provided at www.geocollaborative.org.

² www.eere.energy.gov/geopoweringthewest/geomap.html

EXECUTIVE SUMMARY

Report Objectives and Content

Geothermal energy production can provide fuel diversity, energy security, economic development, and environmental benefits. State policymakers have recognized these potential benefits by creating specific policies to support geothermal and other forms of renewable energy.

Among the available policy tools, the renewables portfolio standard (RPS) has become increasingly popular in some states. Some stakeholders consider the RPS to be an attractive means of supporting renewable energy. Others view the policy less favorably, and early experience with the RPS in U.S. states has been mixed. Moreover, geothermal energy has not yet been the primary beneficiary of many state RPS policies.

The purpose of this report is to evaluate early experience with state RPS policies, and to specifically highlight the role of geothermal energy in these policies. In particular this report: (1) provides a summary of the status and results of state RPS policies; (2) briefly assesses the advantages and disadvantages of the RPS; (3) critiques the effectiveness of state RPS policies based on a series of objective evaluation criteria; and (4) evaluates approaches to specifically encourage geothermal energy under state RPS policies. The report also includes several appendices that provide detailed summaries of state RPS policies, as well as the results of interviews with 12 relevant stakeholders regarding the RPS. The report concludes by highlighting principles and best practices that we believe would be effective in guiding future RPS design efforts.

Because many of the state RPS policies have only recently been established, this report presents merely a snap-shot of this experience. This study should therefore be considered a living document, with updates made over time as additional experiences are gained and lessons learned.

Conclusions of this report include: (1) the RPS is becoming increasingly popular as a policy option to develop renewable and geothermal energy markets; (2) there are several advantages and disadvantages to the RPS as a tool to develop geothermal energy markets; (3) designing a successful and well-functioning RPS can be challenging, as documented by existing experience with state RPS policies; (4) perhaps because of those challenges, there are a number of design pitfalls with state RPS policies that are discussed in this report; (5) in designing an RPS, a policymaker may wish to consider a set of design principles and best practices that are highlighted in this paper; and (6) geothermal energy, because of its unique characteristics, is likely to fare best under a state RPS that meets certain design criteria.

State Experience with RPS Policies

The RPS ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources. It does so by requiring electric suppliers (otherwise referred to as load-serving entities, or LSEs) to include a minimum amount of renewables in their electricity supply.

The RPS, or RPS-like mandates, has been established in 13 U.S. states: Arizona, California, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico,

Pennsylvania, Texas, and Wisconsin. An important observation is that there is no single way to design an RPS, and each of these states has crafted their policies differently, sometimes radically so. These design variations are discussed in Chapters 2 and 4, and in Appendix A and E.

Though the majority of existing RPS policies have only recently been established, their impact over time *could* be substantial. In fact, these policies have already begun to have an impact; this is especially apparent for wind power, and to a far lesser degree for geothermal.

The Advantages and Disadvantages of an RPS

When considering the application of an RPS, it is important to understand both the advantages and disadvantages of the RPS as a policy instrument, as well as alternative policies that might be applied in lieu of or in addition to an RPS. These issues are discussed in Chapter 3.

We find that the RPS has some potential *theoretical* appeal compared to other renewable energy policies: (1) an RPS can drive a known quantity of new renewable development and can ensure that there are buyers for that energy, (2) it may help lower the total cost of that development by giving LSEs the flexibility to meet their purchase targets in the way they deem best, and encouraging competition among renewable developers, (3) an RPS can be competitively neutral if it is applied equally to all retail electricity suppliers, (4) an RPS may impose relatively low administrative burdens and direct administrative costs on those responsible for overseeing the policy, and (5) an RPS can be applied in both restructured and monopoly markets.

And yet we also find that the RPS has some potential disadvantages relative to other types of renewable energy policies: (1) due to its complexity, the RPS can be difficult to design and implement well, (2) an RPS may be less flexible in offering targeted support to renewable energy than some of the other renewable energy policies, (3) the exact cost impacts of an RPS cannot be known with certainty in advance, (4) operating experience with the RPS remains limited, (5) if an RPS does not lead to the availability of long-term power purchase agreements, the ability to finance new renewable projects will be limited and compliance costs may increase, and (6) an RPS is not *necessarily* suited to supporting diversity among renewable technologies, although an RPS can be designed to do so through the use of resource tiers and credit multipliers.

In addition to the RPS, several other state and federal policy approaches have been used to support geothermal energy: integrated resource planning, tax incentives, renewable energy funds, encouragement of voluntary purchases of green power, and government purchases of renewable energy. Some of these policies may serve as alternatives to an RPS, while others might best be considered complements. Though this document does not evaluate these options in detail, we do provide a brief description these policies, compare them with the RPS, and identify the degree to which they might be complementary to an RPS. We also specifically summarize the degree to which these other policies have been or might be used to support geothermal energy markets.

Developing Criteria to Evaluate State RPS Policies

A number of evaluation criteria might be applied to assess the actual or expected effectiveness of a state RPS policy in driving both new renewable energy development in general, as well as the development of geothermal energy resources more specifically. Chapter 4 introduces and applies evaluation criteria that can be used for making such judgments.

State RPS policies are at different phases of implementation: some have been operating for several years, while others have yet to begin. To accommodate these different phases, our evaluation criteria fall within four broad categories: (1) outcome criteria, (2) policy design criteria, (3) market context criteria, and (4) geothermal-specific criteria. We ultimately develop 21 criteria, listed in Text Box ES-1.

Outcome Criteria: The Good, the Bad, and the Ugly

Despite limited experience to date, a variety of states are succeeding on one or more of the outcome-based criteria. In sum, based on the outcome criteria, Texas, Minnesota, and Iowa rate most highly: these RPS policies have worked or are working. Texas' RPS has perhaps shown the most success overall in effectively supporting renewable energy markets. The Texas policy has driven substantial new wind power additions, has done so with reasonable cost impacts that are being passed on to customers, and retail suppliers appear as if they will fully comply with the policy.

Other state policies have had little to no impact on renewable energy markets so far, and therefore rate poorly on the outcome-based criteria; Connecticut, Maine and Pennsylvania all fall within this category. The success of the remaining states in meeting these criteria is mixed, but some success has been achieved or is expected in a number of different jurisdictions: Arizona, California, Massachusetts, Nevada, New Jersey, New Mexico, and Wisconsin.

Policy Design and Market Context Criteria: Pitfalls

We find that experience with state RPS policies has been decidedly mixed. Some of the more common and critical design pitfalls experienced by states include:

- narrow applicability,
- poorly balanced supply-demand conditions,
- insufficient duration and stability of targets,
- insufficient enforcement, and
- poorly defined or non-existent contracting standards and cost recovery mechanisms for regulated utilities and providers of last resort in competitive markets.

TEXT BOX ES-1: RPS EVALUATION CRITERIA

Outcome-Based Criteria

- Amount of New Renewable Energy Development
- Full Compliance with RPS Policies
- Reasonable and Stable Cost Impacts
- Prudently Incurred Compliance Costs Borne by Ratepayers

Policy Design Criteria

- Broad Applicability
- Carefully Balanced Supply-Demand Condition
- Sufficient Duration and Stability of Targets
- Well-Defined and Stable Resource Eligibility Rules
- Well-Defined and Stable Treatment of Out-of-State Resources
- Credible and Effective Enforcement
- Flexible Verification Mechanisms
- Adequate Compliance Flexibility
- Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Standard Offer and Default Service
- Product-Based, as Opposed to Company-Based Compliance

Market Context Criteria

- Presence of Creditworthy Long-Term Power Purchasers
- Stable Political and Regulatory Support
- Adequate and Accessible Developable Resource Potential

Geothermal-Specific Criteria

- Geothermal Development
- Geothermal Resource Availability and Eligibility
- RPS Design Elements that *Specifically* Encourage Geothermal
- RPS Design Elements that *Indirectly* Encourage Geothermal

In addition to these major pitfalls, other pitfalls that states have fallen into are less severe: (1) poorly defined and unstable resource eligibility rules, (2) poorly defined and unstable rules for out-of-state renewable generation, (3) rigid verification mechanisms, (4) inadequate compliance flexibility, and (5) company-based application of an RPS.

Finally, even where the design of an RPS is strong, some state policies do poorly on the market context criteria. In these cases, even an otherwise well-designed policy may fail: (1) lack of credit-worthy long-term power purchasers, (2) unstable political and regulatory support, and (3) inadequate or inaccessible developable resource potential.

Geothermal-Specific Criteria

Only four of the 13 states with an existing RPS have significant geothermal resource potential: California, Nevada, New Mexico, and Arizona. Geothermal electricity, where adequate resource potential exists, is typically an eligible renewable source under RPS policies; Arizona provides the only exception among the 13 existing policies.

While wind power has proven to be the primary beneficiary of state RPS policies so far, geothermal has generally done well, or appears likely to do well, in states with RPS policies in which the geothermal resource base is known, and if other parameters besides the cost of energy delivery are incorporated into the RPS. These parameters include such elements as capacity value and whether the renewable resource is a “least-cost, best-fit match” with a utility’s resource portfolio. The RPS policies in California and Nevada meet these requirements.

Even with these aspects of an RPS in place, however, if the geothermal resource itself is not well known, then the prospects for developing geothermal power plants may diminish. This suggests the need for other government policies or actions to explore the availability of geothermal resources in states where the resource is not proven or well known.

Policy Design Principles and Best Practices

We find there is no single, “ideal” way to design a state RPS. Nonetheless, most effective RPS designs appear to meet a number of minimum requirements. In Chapter 5 we develop a detailed list of broad policy design principles and specific best practice design elements, based on early experience with state RPS policies. We believe that these principles and best practices can be productively used to guide state RPS policy design.

The recommended design principles are as follows:

- **Socially Beneficial.** A well-designed RPS will support increased renewable energy production, and thereby contribute to an improvement in environmental quality, to increased diversity in energy supply, to decreased risk, and to other politically chosen objectives.
- **Cost Effective and Flexible.** A well-designed RPS will be implemented and administered in a straightforward, flexible, cost-effective, and not unduly burdensome manner.
- **Predictable.** A well-designed RPS will provide market stability for all participants, reducing regulatory risk for generators and LSEs and improving the ability of renewable developers to obtain financeable long-term contracts.
- **Nondiscriminatory.** A well-designed RPS will be applied fairly, consistently, and proportionately to all market participants and customers.
- **Enforceable.** An effective RPS will be enforceable, ensuring that the policy's renewable energy targets and broader goals are achieved.
- **Consistency with Market Structure.** A well-designed RPS will be consistent with and complement the structure of a state's electricity market, whether regulated or restructured.
- **Compatibility with Other Policies.** A well-designed RPS will be compatible with other applicable policies and regulations in the state and, where possible, the broader region.

Conclusions: The Role of Geothermal Energy in RPS Policies

With few exceptions, the design principles and best practices described in Chapter 5 (and summarized above) do not *specifically* highlight the role that geothermal energy might play under an RPS. This is by design. The largest challenge with the RPS appears to be avoiding major design pitfalls. Therefore, our analysis leads us to conclude that, to assure that RPS policies are effective in supporting geothermal energy, two major conditions must apply: (1) geothermal must, of course, be eligible, and (2) the RPS should be designed well and implemented effectively in a broader sense.

In constructing a well-designed RPS it will be important for regulators and legislators to recognize the unique features of geothermal energy: geothermal can provide large blocks of baseload power, but the resource is restricted to certain locations and substantial exploration costs and development time are required to prove the adequacy of the resource. To accommodate these features, RPS administrators might wish to place particular emphasis on certain “best practice” RPS design features highlighted in Chapter 5.

- **Even-handed Comparisons of Renewable Sources:** Perhaps most importantly, in designing contracting standards for regulated utilities, renewable energy sources would ideally be compared with one another in an even-handed manner, considering the direct and indirect costs and attributes of each resource (including integration and deliverability characteristics). This may be essential in valuing the unique benefits that geothermal sources provide.
- **Geographic Eligibility:** Determinations on the eligibility of out-of-state renewable plants can also affect the role of geothermal energy under a state RPS. In states with weak geothermal resources, allowing out-of-state generators to qualify will provide access to a market for out-of-state geothermal resources. Conversely, in states with robust geothermal resources, an in-state restriction for eligibility will make in-state geothermal projects less susceptible to lower-priced out-of-state competition.
- **Development Lead Time:** Another important issue for the geothermal industry is the uncertainty in the amount of geothermal resources that exist in certain states and resource

areas, which itself lengthens development lead times for geothermal plants. An RPS in which the targets are known well in advance may be essential to accommodate these lead times.

- **RPS Target Increases and Compliance Flexibility Mechanisms:** Some of the most cost-effective geothermal plants come in large increments. As a result, an RPS that drives substantial geothermal development will be one whose targets are aggressive enough to allow the market to take advantage of geothermal plants that are able to achieve scale economies. For similar reasons, compliance flexibility mechanisms such as banking may be particularly important for geothermal plants.

Beyond those design considerations noted above, state RPS policies may not need additional *specific* encouragement for geothermal energy to adequately support development efforts. This conclusion is driven, at least in part, by the fact that geothermal energy appears likely to compete with some success against other renewable energy sources in those states in which geothermal resources are available and the RPS is reasonably well designed (i.e., Nevada and California).

We acknowledge that the evidence is limited, however, and that other energy sources may prove to benefit more heavily from state RPS policies than does geothermal. Consequently, if relying on “market” forces to ensure geothermal development is deemed insufficient, either because other incentives (e.g., the production tax credit for wind power) skew the competitive playing field or because of a desire to assure a diversity of renewable energy sources, there are at least three methods by which to give geothermal energy more direct support under a state RPS: credit multipliers, technology bands, and resource contribution limits.

Evaluating State Renewables Portfolio Standards:

A Focus on Geothermal Energy

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Prepared for:

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2003

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ACKNOWLEDGEMENTS

This report was prepared on behalf of the National Geothermal Collaborative (NGC). For their guidance and support throughout, we thank NGC's RPS Working Group: Mike Hughes (RESOLVE), Kathleen Rutherford (RESOLVE), Jody Erikson (RESOLVE), Dan Schochet (Ormat), and Marilynn Semro (Seattle City Light). We also appreciate the written comments provided on previous drafts of this document by Dan Schochet (ORMAT), Marilynn Semro (Seattle City Light), Kathleen Rutherford (RESOLVE), Troy Gagliano (National Conference of State Legislatures), Mike McKinney (Southern California Edison), Ted Clutter (Geothermal Resources Council), Paul Dunlevy (Bureau of Land Management), and Karl Gawell (Geothermal Energy Association). For their extensive verbal comments, we thank the entire NGC Steering Committee. Finally, for being willing to share their opinions through stakeholder interviews, we thank Dan Schochet (ORMAT), Marilynn Semro (Seattle City Light), Christine Watson (Utah Energy Office), Dick Byers (Washington Utilities and Transportation Commission), Tom Rawls (Green Mountain Energy), John Nielsen (Land and Water Fund of the Rockies), Chris Wentz (New Mexico Department of Minerals), Colin Duncan (Sierra Pacific Power Co.), Virinder Singh (PacifiCorp), Liz McDannel (Southern California Edison), Karl Gawell (Geothermal Energy Association), and Bob Cooper (Nevada Attorney General's office). Of course, any remaining errors are our own, and the opinions expressed in this report do not necessarily represent those of the National Geothermal Collaborative or its members.

This research was supported, in whole or in part, by DOE grant DEFG03-01SF22363. The financial support of this DOE grant does not constitute an endorsement by DOE of the views expressed in this article.

ABOUT THE NATIONAL GEOTHERMAL COLLABORATIVE

A U.S. consensus-based collaborative, the National Geothermal Collaborative (NGC), was formed in 2002 to identify issues that impede the use of geothermal power, establish dialogue among key stakeholders, and catalyze appropriate activities to overcome obstacles to appropriate development. Our vision is that geothermal power is environmentally, economically and politically sustainable and fully integrated into mainstream energy markets.

The NGC is led by a steering committee whose membership to date includes representation from both investor owned and public utilities, academia, state energy offices, White House Task Force on Energy Project Streamlining, Center for Energy Efficiency and Renewable Technologies, Council of Energy Resource Tribes, Geothermal Resource Council and Geothermal Energy Association, Departments of Interior, Agriculture and Energy, and the National Conference of State Legislatures.

RESOLVE, a non-profit environmental dispute resolution organization, provides a full range of facilitation services to create opportunities for NGC members and other geothermal stakeholders to build long-term relationships, and to develop a number of land mark products resulting from significant negotiation and reflecting consensus of the Committee.

NGC members represent these sectors:

? Electric Utilities (both investor owned and public)	? Academia
? Geothermal Industry	? Tribes
? Environmental/Renewable Energy	? State Energy Offices
? National Conference of State Legislatures	? Public land managers

NGC members include representatives from:

Bureau of Land Management	State of Nevada, Commission on Mineral Resources
Center for Energy Efficiency and Renewable Technologies	U.S. Department of Agriculture (Forest Service)
Council of Energy Resource Tribes	U.S. Department of Energy, EERE, GPW
Geothermal Energy Association	Washington State University
Geothermal Resources Council	White House Task Force on Energy Project Streamlining
National Conference of State Legislatures	
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PREFACE

The National Geothermal Collaborative (NGC) is pleased to present this examination of state-level Renewables Portfolio Standards (RPS) and their impact on the development of geothermal energy in the United States. The RPS ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources.¹ The purpose of this report is to evaluate early experience with, and specifically highlight the role of, geothermal energy in state RPS policies. As this report illustrates, creating an effective and well-functioning RPS is a complex endeavor with no uniform approach. The report begins with a discussion of the advantages and disadvantages of using a portfolio standard to develop geothermal markets, and concludes by highlighting principles and best practices that may be effective in guiding future RPS design efforts. It is the consensus of the NGC that this analysis is a valuable tool in determining whether or not, and how, to construct an effective RPS.

The NGC is a national, consensus-based stakeholder group established in 2002. Individual members of the NGC represent federal and state government, trade and educational associations, public and investor-owned utilities, tribal organizations, energy, and environmental interest groups. The purpose of the NGC is to advance the development and use of geothermal heat and power in the U.S., identifying issues that impede the use of geothermal power, establishing dialogue with key stakeholders, and catalyzing activities to overcome obstacles to appropriate development. One critical action identified in the group's first meeting was to develop solutions to mitigate market barriers and remove obstacles to the sustained, orderly development and accelerated procurement of geothermal power. This report was commissioned to move the Collaborative down that road.

To examine the impacts of current and potential RPS policies on geothermal development, the Collaborative formed a Renewables Portfolio Standard Work Group in accordance with NGC protocol and with guidance from the NGC Steering Committee. A Request For Proposals was drafted and competitively bid. The authors' study was presented to the RPS Work Group for review and comment, followed by a recommendation to the entire NGC to review and adopt the document. The NGC recognizes that the ultimate success of any RPS will depend on a variety of other factors including transmission infrastructure, strength of the renewable resource, and other state policies that may already be in place.

Heat from the Earth

Geothermal energy, heat from the Earth's interior, is one of the world's cleanest, most reliable and abundant sources of energy. This heat is brought to the surface as steam or hot water—created when water flows through heated, permeable rock—and converted to electricity or used directly for space heating/cooling in homes and buildings. Higher temperature geothermal

¹ The RPS typically applies to investor-owned electric utilities and competitive energy service providers, but this is not uniformly the case. With few exceptions, publicly-owned utilities have been exempted from the RPS requirements. One such exception is Wisconsin, where most municipalities and coops must meet the RPS along with investor-owned utilities.

resources supply 6 percent of the electricity in California, 10 percent in Northern Nevada, and 20 percent on the Big Island of Hawaii. Additionally, low-temperature, direct-use projects that provide energy for commercial, industrial and residential uses are found in 23 states, mostly in the West.

Benefits of Geothermal

A significant advantage of geothermal energy is its comparatively clean generation of electricity. Generating power with fossil fuels results in major releases of regulated emissions of sulfur dioxide, nitrogen oxides, and gases such as carbon dioxide. Nuclear power plants yield radioactive waste as by-products of the power generation process. The net environmental impact of these by-products contribute to widely acknowledged environmental problems, including acid precipitation, formation of ground-level ozone and the well-publicized greenhouse effect, and longstanding concern surrounding the proper disposal of radioactive waste. Geothermal plants emit relatively minor amounts of gases to the air and produce no radioactive waste. In addition, geothermal power production facilities require a fraction of the land necessary for traditionally-fueled power plants.

The economic benefits of geothermal energy are also important, particularly to states and local communities. Using geothermal energy can contribute to a reduction of our dependence on foreign sources of fuel, create domestic jobs, and provide revenue to federal, state and local governments.

The reliability of electricity produced using geothermal energy can also benefit utilities that need “baseload” energy. Because operation and maintenance is minimal, geothermal plants generate power a greater percentage of the time than coal and nuclear power plants. This remarkably low down-time gives utility planners greater flexibility to meet electricity demand. In addition, direct-use of geothermal heat contributes to better utility planning by off-setting contingency needs for electricity.

The cumulative production of geothermal energy in all of its forms ranks third among renewables, following hydroelectricity and biomass and ahead of solar and wind. Geothermal energy is becoming increasingly cost competitive with other renewables and traditional sources of energy. In fact, the cost of generating power from geothermal resources has decreased approximately 25 percent over the past two decades. The cost of geothermal electricity currently ranges from about 4 to 8 cents per kilowatt-hour depending on the strength of the resource. The geothermal industry and the U.S. Department of Energy are working together to achieve a goal of 3 cents per kilowatt-hour.

Despite these benefits, the current level of geothermal use pales in comparison to its potential. The total U.S. installed capacity is approximately 2700 MW. According to testimony submitted to the Subcommittee on Energy and Mineral Resources of the Committee on Resources of the House of Representatives on July 22, 2003, the U.S. Geological Survey and the Geothermal Energy Association believe that geothermal energy potential exists to provide over 20,000 MW of electricity in coming years. (One hundred megawatts (MW) provide the residential electricity

needs of a city of 200,000 people.)² The key to greater use of our nation's geothermal resources is a combination of a supportive policy framework, technology advancement and public support.

A Policy Approach to Geothermal Development

In a growing number of states, RPS programs are emerging as a policy option for increasing the use of domestic renewable energy. As renewables portfolio standards create and expand the markets for renewable energy sources, use of geothermal energy could increase. The combined effect of greater use of geothermal energy through compliance with an RPS may help:

- Diversify a state's energy portfolio
- Protect customers from fossil-fuel price spikes and supply shortages
- Improve national security by helping to reduce reliance on imported fuel and electricity
- Reduce the cost of renewable energy technologies by creating and expanding markets for renewable energy sources
- Protect the environment and public health
- Increase local economic development opportunities

The greatest opportunity for new geothermal development in the United States exists in many western states, a region characterized by steadily increasing population and demand for energy. California, New Mexico, and Nevada each have an RPS in place in which geothermal energy is an eligible technology. It is the consensus of the NGC that, given the early experiences with the various RPS states' policies, this report provides a thorough analysis of the advantages, disadvantages, opportunities, and obstacles that states may encounter when considering a renewable portfolio standard.

A link to the final report will be provided at www.geocollaborative.org.

² www.eere.energy.gov/geopoweringthewest/geomap.html

EXECUTIVE SUMMARY

Report Objectives and Content

Geothermal energy production can provide fuel diversity, energy security, economic development, and environmental benefits. State policymakers have recognized these potential benefits by creating specific policies to support geothermal and other forms of renewable energy.

Among the available policy tools, the renewables portfolio standard (RPS) has become increasingly popular in some states. Some stakeholders consider the RPS to be an attractive means of supporting renewable energy. Others view the policy less favorably, and early experience with the RPS in U.S. states has been mixed. Moreover, geothermal energy has not yet been the primary beneficiary of many state RPS policies.

The purpose of this report is to evaluate early experience with state RPS policies, and to specifically highlight the role of geothermal energy in these policies. In particular this report: (1) provides a summary of the status and results of state RPS policies; (2) briefly assesses the advantages and disadvantages of the RPS; (3) critiques the effectiveness of state RPS policies based on a series of objective evaluation criteria; and (4) evaluates approaches to specifically encourage geothermal energy under state RPS policies. The report also includes several appendices that provide detailed summaries of state RPS policies, as well as the results of interviews with 12 relevant stakeholders regarding the RPS. The report concludes by highlighting principles and best practices that we believe would be effective in guiding future RPS design efforts.

Because many of the state RPS policies have only recently been established, this report presents merely a snap-shot of this experience. This study should therefore be considered a living document, with updates made over time as additional experiences are gained and lessons learned.

Conclusions of this report include: (1) the RPS is becoming increasingly popular as a policy option to develop renewable and geothermal energy markets; (2) there are several advantages and disadvantages to the RPS as a tool to develop geothermal energy markets; (3) designing a successful and well-functioning RPS can be challenging, as documented by existing experience with state RPS policies; (4) perhaps because of those challenges, there are a number of design pitfalls with state RPS policies that are discussed in this report; (5) in designing an RPS, a policymaker may wish to consider a set of design principles and best practices that are highlighted in this paper; and (6) geothermal energy, because of its unique characteristics, is likely to fare best under a state RPS that meets certain design criteria.

State Experience with RPS Policies

The RPS ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources. It does so by requiring electric suppliers (otherwise referred to as load-serving entities, or LSEs) to include a minimum amount of renewables in their electricity supply.

The RPS, or RPS-like mandates, has been established in 13 U.S. states: Arizona, California, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico,

Pennsylvania, Texas, and Wisconsin. An important observation is that there is no single way to design an RPS, and each of these states has crafted their policies differently, sometimes radically so. These design variations are discussed in Chapters 2 and 4, and in Appendix A and E.

Though the majority of existing RPS policies have only recently been established, their impact over time *could* be substantial. In fact, these policies have already begun to have an impact; this is especially apparent for wind power, and to a far lesser degree for geothermal.

The Advantages and Disadvantages of an RPS

When considering the application of an RPS, it is important to understand both the advantages and disadvantages of the RPS as a policy instrument, as well as alternative policies that might be applied in lieu of or in addition to an RPS. These issues are discussed in Chapter 3.

We find that the RPS has some potential *theoretical* appeal compared to other renewable energy policies: (1) an RPS can drive a known quantity of new renewable development and can ensure that there are buyers for that energy, (2) it may help lower the total cost of that development by giving LSEs the flexibility to meet their purchase targets in the way they deem best, and encouraging competition among renewable developers, (3) an RPS can be competitively neutral if it is applied equally to all retail electricity suppliers, (4) an RPS may impose relatively low administrative burdens and direct administrative costs on those responsible for overseeing the policy, and (5) an RPS can be applied in both restructured and monopoly markets.

And yet we also find that the RPS has some potential disadvantages relative to other types of renewable energy policies: (1) due to its complexity, the RPS can be difficult to design and implement well, (2) an RPS may be less flexible in offering targeted support to renewable energy than some of the other renewable energy policies, (3) the exact cost impacts of an RPS cannot be known with certainty in advance, (4) operating experience with the RPS remains limited, (5) if an RPS does not lead to the availability of long-term power purchase agreements, the ability to finance new renewable projects will be limited and compliance costs may increase, and (6) an RPS is not *necessarily* suited to supporting diversity among renewable technologies, although an RPS can be designed to do so through the use of resource tiers and credit multipliers.

In addition to the RPS, several other state and federal policy approaches have been used to support geothermal energy: integrated resource planning, tax incentives, renewable energy funds, encouragement of voluntary purchases of green power, and government purchases of renewable energy. Some of these policies may serve as alternatives to an RPS, while others might best be considered complements. Though this document does not evaluate these options in detail, we do provide a brief description these policies, compare them with the RPS, and identify the degree to which they might be complementary to an RPS. We also specifically summarize the degree to which these other policies have been or might be used to support geothermal energy markets.

Developing Criteria to Evaluate State RPS Policies

A number of evaluation criteria might be applied to assess the actual or expected effectiveness of a state RPS policy in driving both new renewable energy development in general, as well as the development of geothermal energy resources more specifically. Chapter 4 introduces and applies evaluation criteria that can be used for making such judgments.

State RPS policies are at different phases of implementation: some have been operating for several years, while others have yet to begin. To accommodate these different phases, our evaluation criteria fall within four broad categories: (1) outcome criteria, (2) policy design criteria, (3) market context criteria, and (4) geothermal-specific criteria. We ultimately develop 21 criteria, listed in Text Box ES-1.

Outcome Criteria: The Good, the Bad, and the Ugly

Despite limited experience to date, a variety of states are succeeding on one or more of the outcome-based criteria. In sum, based on the outcome criteria, Texas, Minnesota, and Iowa rate most highly: these RPS policies have worked or are working. Texas' RPS has perhaps shown the most success overall in effectively supporting renewable energy markets. The Texas policy has driven substantial new wind power additions, has done so with reasonable cost impacts that are being passed on to customers, and retail suppliers appear as if they will fully comply with the policy.

Other state policies have had little to no impact on renewable energy markets so far, and therefore rate poorly on the outcome-based criteria; Connecticut, Maine and Pennsylvania all fall within this category. The success of the remaining states in meeting these criteria is mixed, but some success has been achieved or is expected in a number of different jurisdictions: Arizona, California, Massachusetts, Nevada, New Jersey, New Mexico, and Wisconsin.

Policy Design and Market Context Criteria: Pitfalls

We find that experience with state RPS policies has been decidedly mixed. Some of the more common and critical design pitfalls experienced by states include:

- ? narrow applicability,
- ? poorly balanced supply-demand conditions,
- ? insufficient duration and stability of targets,
- ? insufficient enforcement, and
- ? poorly defined or non-existent contracting standards and cost recovery mechanisms for regulated utilities and providers of last resort in competitive markets.

TEXT BOX ES-1: RPS EVALUATION CRITERIA

Outcome -Based Criteria

- ? Amount of New Renewable Energy Development
- ? Full Compliance with RPS Policies
- ? Reasonable and Stable Cost Impacts
- ? Prudently Incurred Compliance Costs Borne by Ratepayers

Policy Design Criteria

- ? Broad Applicability
- ? Carefully Balanced Supply -Demand Condition
- ? Sufficient Duration and Stability of Targets
- ? Well-Defined and Stable Resource Eligibility Rules
- ? Well-Defined and Stable Treatment of Out-of-State Resources
- ? Credible and Effective Enforcement
- ? Flexible Verification Mechanisms
- ? Adequate Compliance Flexibility
- ? Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Standard Offer and Default Service
- ? Product-Based, as Opposed to Company -Based Compliance

Market Context Criteria

- ? Presence of Creditworthy Long-Term Power Purchasers
- ? Stable Political and Regulatory Support
- ? Adequate and Accessible Developable Resource Potential

Geothermal-Specific Criteria

- ? Geothermal Development
- ? Geothermal Resource Availability and Eligibility
- ? RPS Design Elements that *Specifically* Encourage Geothermal
- ? RPS Design Elements that *Indirectly* Encourage Geothermal

In addition to these major pitfalls, other pitfalls that states have fallen into are less severe: (1) poorly defined and unstable resource eligibility rules, (2) poorly defined and unstable rules for out-of-state renewable generation, (3) rigid verification mechanisms, (4) inadequate compliance flexibility, and (5) company-based application of an RPS.

Finally, even where the design of an RPS is strong, some state policies do poorly on the market context criteria. In these cases, even an otherwise well-designed policy may fail: (1) lack of credit-worthy long-term power purchasers, (2) unstable political and regulatory support, and (3) inadequate or inaccessible developable resource potential.

Geothermal-Specific Criteria

Only four of the 13 states with an existing RPS have significant geothermal resource potential: California, Nevada, New Mexico, and Arizona. Geothermal electricity, where adequate resource potential exists, is typically an eligible renewable source under RPS policies; Arizona provides the only exception among the 13 existing policies.

While wind power has proven to be the primary beneficiary of state RPS policies so far, geothermal has generally done well, or appears likely to do well, in states with RPS policies in which the geothermal resource base is known, and if other parameters besides the cost of energy delivery are incorporated into the RPS. These parameters include such elements as capacity value and whether the renewable resource is a “least-cost, best-fit match” with a utility’s resource portfolio. The RPS policies in California and Nevada meet these requirements.

Even with these aspects of an RPS in place, however, if the geothermal resource itself is not well known, then the prospects for developing geothermal power plants may diminish. This suggests the need for other government policies or actions to explore the availability of geothermal resources in states where the resource is not proven or well known.

Policy Design Principles and Best Practices

We find there is no single, “ideal” way to design a state RPS. Nonetheless, most effective RPS designs appear to meet a number of minimum requirements. In Chapter 5 we develop a detailed list of broad policy design principles and specific best practice design elements, based on early experience with state RPS policies. We believe that these principles and best practices can be productively used to guide state RPS policy design.

The recommended design principles are as follows:

- ? **Socially Beneficial.** A well-designed RPS will support increased renewable energy production, and thereby contribute to an improvement in environmental quality, to increased diversity in energy supply, to decreased risk, and to other politically chosen objectives.
- ? **Cost Effective and Flexible.** A well-designed RPS will be implemented and administered in a straightforward, flexible, cost-effective, and not unduly burdensome manner.
- ? **Predictable.** A well-designed RPS will provide market stability for all participants, reducing regulatory risk for generators and LSEs and improving the ability of renewable developers to obtain financeable long-term contracts.
- ? **Nondiscriminatory.** A well-designed RPS will be applied fairly, consistently, and proportionately to all market participants and customers.
- ? **Enforceable.** An effective RPS will be enforceable, ensuring that the policy's renewable energy targets and broader goals are achieved.
- ? **Consistency with Market Structure.** A well-designed RPS will be consistent with and complement the structure of a state's electricity market, whether regulated or restructured.
- ? **Compatibility with Other Policies.** A well-designed RPS will be compatible with other applicable policies and regulations in the state and, where possible, the broader region.

Conclusions: The Role of Geothermal Energy in RPS Policies

With few exceptions, the design principles and best practices described in Chapter 5 (and summarized above) do not *specifically* highlight the role that geothermal energy might play under an RPS. This is by design. The largest challenge with the RPS appears to be avoiding major design pitfalls. Therefore, our analysis leads us to conclude that, to assure that RPS policies are effective in supporting geothermal energy, two major conditions must apply: (1) geothermal must, of course, be eligible, and (2) the RPS should be designed well and implemented effectively in a broader sense.

In constructing a well-designed RPS it will be important for regulators and legislators to recognize the unique features of geothermal energy: geothermal can provide large blocks of baseload power, but the resource is restricted to certain locations and substantial exploration costs and development time are required to prove the adequacy of the resource. To accommodate these features, RPS administrators might wish to place particular emphasis on certain “best practice” RPS design features highlighted in Chapter 5.

- ? **Even-handed Comparisons of Renewable Sources:** Perhaps most importantly, in designing contracting standards for regulated utilities, renewable energy sources would ideally be compared with one another in an even-handed manner, considering the direct and indirect costs and attributes of each resource (including integration and deliverability characteristics). This may be essential in valuing the unique benefits that geothermal sources provide.
- ? **Geographic Eligibility:** Determinations on the eligibility of out-of-state renewable plants can also affect the role of geothermal energy under a state RPS. In states with weak geothermal resources, allowing out-of-state generators to qualify will provide access to a market for out-of-state geothermal resources. Conversely, in states with robust geothermal resources, an in-state restriction for eligibility will make in-state geothermal projects less susceptible to lower-priced out-of-state competition.
- ? **Development Lead Time:** Another important issue for the geothermal industry is the uncertainty in the amount of geothermal resources that exist in certain states and resource

areas, which itself lengthens development lead times for geothermal plants. An RPS in which the targets are known well in advance may be essential to accommodate these lead times.

- ? **RPS Target Increases and Compliance Flexibility Mechanisms:** Some of the most cost-effective geothermal plants come in large increments. As a result, an RPS that drives substantial geothermal development will be one whose targets are aggressive enough to allow the market to take advantage of geothermal plants that are able to achieve scale economies. For similar reasons, compliance flexibility mechanisms such as banking may be particularly important for geothermal plants.

Beyond those design considerations noted above, state RPS policies may not need additional *specific* encouragement for geothermal energy to adequately support development efforts. This conclusion is driven, at least in part, by the fact that geothermal energy appears likely to compete with some success against other renewable energy sources in those states in which geothermal resources are available and the RPS is reasonably well designed (i.e., Nevada and California).

We acknowledge that the evidence is limited, however, and that other energy sources may prove to benefit more heavily from state RPS policies than does geothermal. Consequently, if relying on “market” forces to ensure geothermal development is deemed insufficient, either because other incentives (e.g., the production tax credit for wind power) skew the competitive playing field or because of a desire to assure a diversity of renewable energy sources, there are at least three methods by which to give geothermal energy more direct support under a state RPS: credit multipliers, technology bands, and resource contribution limits.

1 Introduction

1.1 Background and Objectives

Renewable electricity, including electricity produced from geothermal sources, can provide fuel diversity, security, economic development, and environmental benefits. State policymakers have increasingly recognized these potential benefits through the creation of specific incentives and mandates for renewable energy. Though these policies are often not uniquely targeted at geothermal electricity generators, where substantial resources exist, geothermal may benefit.

Among the available policy tools, the renewables portfolio standard (RPS) has become increasingly popular in some jurisdictions. The RPS ensures that a minimum amount of renewable energy is included in the portfolio of electricity resources. It does so by requiring retail electricity suppliers to include a minimum amount of eligible renewable resources in their electricity supply. To add flexibility and potentially reduce the cost of meeting the requirement, tradable renewable certificates (TRC) can be used to track and verify compliance.

Some stakeholders consider the RPS to be the “ideal” way to encourage renewable energy development; proponents of the RPS claim that it will ensure that renewable energy targets are met at a lower social cost and with less ongoing administrative involvement by the government than other types of renewable energy policies (Rader and Norgaard 1996, Haddad and Jefferiss 1999, Berry and Jaccard 2001, Morthorst 2000). Detailed recommendations for the design of an RPS have been provided in other papers (e.g., Rader and Hempling 2001, Schaeffer et al. 2000).

Despite the recent acclaim and popularity of the RPS, however, the policy also has detractors; as discussed later in this report, just as the RPS has certain advantages relative to other policy types, so too does it have disadvantages. Moreover, with few exceptions (e.g., Wiser and Langniss 2003), little effort has been placed on actually evaluating early experience with the policy. This is in part a result of the fact that the RPS is a relatively new policy, and practical experience in the application of the policy has, until recently, been limited.

The RPS (or RPS-like mandates) has been established in 13 U.S. states, and in a number of other countries. As highlighted later in this report, this early experience has been mixed. On the one hand, experience from Texas and other states demonstrate that a well-crafted and implemented RPS can effectively provide support for renewable energy. Despite this, experience in a number of other U.S. states shows that poorly designed RPS policies are prevalent and that these policies will do little to increase renewable generation.³ More specifically, geothermal energy has not yet been the primary beneficiary of many state RPS policies.

This report was commissioned by the National Geothermal Collaborative (NGC), a group of stakeholders interested in supporting geothermal energy development, as well as those who see potential for efficient, environmentally and economically sound use of the resource, if specific concerns are addressed. The purpose of NGC is to advance the development and use of

³ This is confirmed by other authors; see, for example, Rader (2000).

geothermal energy in the U.S. by identifying issues that impede the use of geothermal energy, establishing dialogue with key stakeholders, and catalyzing activities to overcome obstacles to appropriate development. The NGC vision is that geothermal energy is environmentally, economically and politically sustainable and fully integrated into mainstream energy markets.

The purpose of this report is to describe the status and results of state RPS policies, and to critique the effectiveness of these policies. Though state RPS policies are beginning to create sizable new markets for wind power, the ability of the RPS to support significant expansion of geothermal markets remains unclear. In several ways, geothermal energy resources are unique: geothermal energy often provides large blocks of baseload power, but the resource is restricted to certain locations and substantial exploration costs and development time are often required to prove the adequacy of the resource. Accordingly, the principal objective of this work is not only to evaluate the effectiveness of state RPS policies in driving renewables development generally, but also to specifically highlight the role of geothermal in these policies.⁴

In addition to describing early experience with existing state RPS policies, and judging the effectiveness of these policies based on a series of objective criteria, this report also: (1) briefly assesses the advantages and disadvantages of the RPS relative to other ways of encouraging renewable energy; (2) evaluates approaches to specifically encourage geothermal energy under state RPS policies; and (3) reviews the results of interviews with 12 relevant stakeholders regarding the RPS. The report concludes by highlighting principles and best practices that we believe would be effective in guiding future RPS design efforts.

This report is best viewed as a living document. Because most RPS policies have only recently been established, much is still being learned about the advantages, disadvantages, and appropriate design of an RPS, as well as the unique role of geothermal energy in these policies. This report is therefore merely a snapshot of early experience with the policy; it would be entirely appropriate to review and revise the preliminary findings discussed in this report as more experience is gained.

1.2 Methodology and Report Organization

This report has benefited from the extensive experience of the authors in helping to design, implement, and evaluate state RPS policies. We have also reviewed relevant literature on the RPS, and where appropriate, contacted state officials to gain the most up-to-date knowledge of the operations of state RPS policies.

Importantly, with the assistance of the NGC, we also identified a small and diverse group of stakeholders to interview in the course of our work. The interviews were intended to supplement our own understanding of the RPS, and to offer diverse perspectives on the value,

⁴ The focus of this report is principally on grid-connected geothermal electricity production. An RPS can, however, also support customer-sited geothermal electricity production and the direct use of geothermal heat. These issues are discussed further in Chapter 4.

appropriateness, design, and effectiveness of state RPS policies. We also sought the comments of these stakeholders on a draft version of our proposed state RPS evaluation criteria.⁵

The remainder of this report is organized as follows:

- ? Chapter 2 provides a more detailed introduction to and description of the RPS, identifies states that have established or are considering RPS policies, and highlights some of the impacts of these policies to date.
- ? Chapter 3 briefly discusses the advantages and disadvantages of the RPS, and compares the RPS with other means of encouraging renewable energy.
- ? Chapter 4 identifies a set of evaluation criteria that can be used to judge the effectiveness or likely effectiveness of state RPS policies. The chapter then applies the evaluation criteria to the 13 existing state RPS policies in order to judge the effectiveness and design of these policies, and to identify policy design failures and successes in each state.
- ? Chapter 5 offers our recommendations and conclusions. The chapter highlights the key successes and failures of state RPS policies, identifies policy design principles and best practices that we believe will be helpful in guiding the design of future RPS policies, and summarizes the role and treatment of geothermal energy under state RPS policies.

In addition to these main chapters, Appendix A provides a detailed table that summarizes the key design variables of the 13 state RPS policies critiqued in the body of the report. Appendix B describes the stakeholder interview process and reviews the results of the interviews; the survey script that we used is provided in Appendix C. Appendix D provides a more thorough description of the evaluation criteria used to judge state RPS policies, while Appendix E offers our detailed evaluation of state RPS policies based on these criteria. Finally, Appendix F provides a resource list of materials from which additional details on the RPS can be obtained, and identifies documents that are referenced in this report.

⁵ Among those interviewed, we sought to include stakeholders with a wide range of perspectives on the role of policy in supporting renewable energy, and a diversity of opinions on the efficacy of specific policy approaches.

2 The RPS in Context

2.1 What Is an RPS?

The RPS is a policy that requires retail suppliers of electricity (otherwise referred to as load-serving entities, or LSEs) to meet a portion of their energy supply needs with eligible forms of renewable energy. RPS policies are generally designed to maintain and/or increase the contribution of renewable energy to electricity supply. The RPS establishes numeric targets for renewable energy supply, and encourages competition among renewable developers to meet those targets. LSEs can meet their requirements with renewable energy facilities that they already own or that they construct, or through bilateral purchases of renewable energy from other suppliers. In some states, LSEs can use tradable renewable certificates, or TRCs, to comply with their RPS requirements. A TRC is created when a megawatt-hour of renewable energy is generated, and it can be traded separately from the underlying electricity generation.

RPS policies can be established at the state or federal level, and can in principal be established either through legislation or via regulatory action. Targeted, legislatively established set-asides for renewable energy date to the 1980s in the United States. The application of uniform renewable energy purchase obligations on all LSEs, with the use of TRCs as an accounting and trading tool, first became popular in the mid-to-late 1990s during state electricity restructuring discussions. In addition, the RPS has since also been applied in regulated electricity markets.

2.2 State RPS Policies: Design and Impacts

State RPS Policies and Their Design

The U.S. Congress has considered the application of the RPS on a federal level, and a number of other countries have recent experience with the RPS as a policy mechanism.⁶ The most extensive and most diverse base of experience with the RPS on a worldwide basis exists in the United States, however, where 13 states have created RPS policies or RPS-like mandates⁷: Arizona, California, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, and Wisconsin. Features of these 13 policies that particularly deserve note include:

- ? **Operating Experience:** While the number of states that have created RPS policies is large, experience with the policies remains limited. Few of the states have more than three years of experience with their RPS programs, and some of the policies have been established but have yet to take effect.

⁶ Other countries with operating RPS or similar policies include Australia, Austria, Belgium, Italy, and the United Kingdom. Several additional countries are in the late stages of RPS development and design.

⁷ There is no single definition of an RPS. The 13 states discussed in this paper all have renewable energy purchase obligations that are applied to all or a subset of electricity suppliers. For the purposes of this paper, we define each of these states to have an RPS.

- ? **Legislative or Regulatory Establishment:** Most of the RPS policies were established via legislation, but the policies in Arizona, New Mexico, and Pennsylvania were established through regulation (AZ and NM) or multi-party regulatory settlement (PA).
- ? **Restructured or Regulated Markets:** Though more than half of the existing RPS policies are in restructured electricity markets, a growing number of RPS policies have been established in monopoly markets. In particular, four states with an RPS (Iowa, Minnesota, New Mexico, and Wisconsin) have monopoly electric service areas; two states have opened their markets to some competition, but remain monopoly markets to a large degree (California and Nevada); and seven states have opened their electric markets to competition (Arizona, Connecticut, Maine, Massachusetts, New Jersey, Pennsylvania, and Texas).
- ? **Application and Exemption:** The RPS typically applies to investor-owned electric utilities and competitive energy service providers, but this is not uniformly the case. With few exceptions, publicly owned utilities have been exempted from the RPS requirements.
- ? **Verification Systems:** TRC trading and verification systems, whether formal or informal, exist in Texas, Massachusetts, Connecticut, Maine, Wisconsin, Nevada, and Arizona. Other states are either using contract-path tracking or have not yet designed a verification system.

An important observation is that there is no single way to design an RPS, and each of the 13 states has crafted their RPS policies differently, sometimes radically so. Some of the key design choices for an RPS are listed in Text Box 1. Appendix A provides a detailed tabular summary of the key design features of each of the 13 state RPS policies, while Chapter 4 and Appendix E offer an evaluation of these policies. cursory observations on the unique characteristics and circumstances associated with each RPS policy include:

- ? **Arizona's** RPS was established through regulatory action, not via legislation. The renewable energy percentage obligations are low, starting at 0.2% in 2001 and increasing to 1.1% by 2007, but much of the standard (50-60%) must be met with new solar electricity production. The RPS is funded, in large part, through a system-benefits charge.⁸ The RPS is up for review based on a cost-benefit evaluation to be completed in 2003, with future targets and RPS design to be determined based on that review.
- ? **California's** RPS was established in 2002, and may be the most complex of the state RPS policies. The targets are aggressive, requiring renewable energy additions of 1% each year on top of existing renewable production, until an ultimate target of 20% is reached. Renewable energy procurements are to be governed largely by the California Public Utilities Commission (CPUC) through a process that is not yet fully designed. Annual RPS purchase obligations begin when a utility has achieved creditworthy status, and LSEs are only obligated to purchase renewable energy to the extent sufficient system-benefits charge funds are available to cover any above-market costs of renewable resources.
- ? **Connecticut** has a two-tiered RPS: Class 1 includes solar, wind, ocean, landfill gas, fuel cells, new run-of-river small hydro, and certain biomass facilities, while Class 2 includes existing run-of-river small hydro, waste-to-energy, and certain other existing biomass facilities. Under legislation passed in 2003, Class 1 targets are to begin at 1% in 2004 and increase to 7% in 2010; the second tier, which can be met with Class 1 or Class 2 resources,

⁸ A system-benefits charge is, effectively, a small tax on electricity rates, the funds from which can be used, in part, to support renewable energy projects.

has a target that remains constant at 3%. Connecticut's RPS began in 2000, but standard offer and default service providers are exempt through 2003, so it has had no effect so far. Legislative changes approved in 2003 offer some hope—only publicly-owned utilities will be exempt from the RPS, and stiff penalties for non-compliance were also adopted.

- ? **Iowa's** legislature passed a law in 1985 (amended in 1991) requiring the state's investor-owned utilities to purchase 105 average MW of new renewable power. After years of legal battles, the utilities made the requisite purchases of wind power; the obligation is therefore no longer enforced.

- ? **Maine** nominally has the distinction of having the most aggressive standard, at 30% of load, beginning in 2000. An oversupply of eligible existing resources and lax eligibility rules that, among other things, allow existing high-efficiency cogeneration to qualify, have rendered the policy ineffective.

- ? **Massachusetts'** RPS focuses on new and incremental generation, and starts at 1% in 2003, increases to 4% in 2009, and increases further thereafter. Unlike the other state RPS policies, the Division of Energy Resources (not the PUC) oversees the policy. An "alternative compliance mechanism" caps the incremental cost of the RPS at 5 cents/kWh, and TRCs are used to verify compliance through a New England wide tracking system.

- ? **Minnesota's** legislature (in 1994) required Xcel Energy to purchase 425 MW of wind and 125 MW of biomass by 2002, as part of a radioactive waste management settlement, with an additional purchase of 400 MW of wind by 2012 (recently moved up to 2006, as part of the PUC's approval of a proposed transmission line). Legislation in 2003 established a statewide RPS goal of 10% by 2015. All utilities must make "good faith efforts" to achieve this goal with the exception of Xcel, which is required to meet the RPS obligations, at least if certain conditions are met.

TEXT BOX 1: RPS DESIGN ELEMENTS

Structure, Size, and Application of the RPS

- ? Basis (energy versus capacity requirement)
- ? Structure (e.g., single tier or multiple tiers)
- ? Percentage purchase obligation targets
- ? Start date
- ? Duration of purchase obligation
- ? Resource diversity requirements or incentives
- ? Application to LSEs – who must meet targets
- ? Product- or company-based application

Eligibility

- ? Geographic eligibility
- ? Resource type eligibility
- ? Eligibility of existing renewable generation
- ? Definition of new/incremental generation
- ? Treatment of multi-fuel facilities
- ? Treatment of off-grid and customer-sited facilities

Administration

- ? Regulatory oversight body(ies)
- ? Verifying compliance – TRCs or contract-path
- ? Certification of eligible generators
- ? Compliance filing requirements
- ? Enforcement mechanisms (i.e., penalties)
- ? Cost caps
- ? Flexibility mechanisms (banking, borrowing, etc.)
- ? Implementing future changes to the RPS
- ? Contracting standards for regulated LSEs
- ? Cost recovery for regulated LSEs

Interactions Between the RPS and Other Policies

- ? Interaction with state system-benefits charges
- ? Treatment of emission credits
- ? Interaction with a future federal RPS

- ? **Nevada** replaced a previously existing RPS with a more aggressive policy in 2001. The renewable energy purchase obligation begins at 5% in 2003 and increases to 15% in 2013; 5% of the RPS must come from solar energy. Both existing and new renewable generation may count towards the RPS, as does certain forms of electricity created by waste heat or pressure. Utilities are required to enter contracts with renewable generators of 10 years or more, and contracts must be approved by the PUC under a “just and reasonable” standard.
- ? **New Jersey**, like Connecticut, has a two-tiered RPS: Class 1 technologies include wind, solar, geothermal, fuel cells, ocean power, landfill gas, and certain biomass technologies, while Class 2 includes certain hydropower and MSW facilities. Purchases of Class 1 technologies must start at 0.5% in 2001, and increase to 4% by 2012; purchases of Class 2 or Class 1 resources remains constant at 2.5%. A recent Task Force to the Governor has recommended significantly strengthening the state’s existing RPS. If adopted, the Class 1 targets would effectively double from 2% to 4% in 2008, with a long-term goal of 20% Class 1 resources by 2020.
- ? **New Mexico** created an RPS through regulation in 2002, with the rule to take effect in mid-2003. The rule has already been challenged, and has been the subject of legislative discussions; the rule is also currently being challenged in the courts. The purchase targets start at 5% by 2006, increasing to 10% by 2011. Existing and new renewables would both qualify under the RPS, and bonus credits would be given to geothermal, biomass, landfill gas, fuel cell and solar energy (as discussed in Chapter 4 and Appendix A).
- ? **Pennsylvania’s** renewable energy purchase obligations only apply to certain competitive suppliers of default service – a very small segment of the overall market. The standards are also quite low, and both existing and new renewable generation are eligible.
- ? **Texas** has perhaps the most well known RPS policy. The policy contains a target of 2000 MW of additional renewables by 2009 (~2.5%), allows TRC trading, and includes explicit penalties for non-compliance. Existing renewable generation is allowed to offset a LSE’s new renewable purchase obligations.
- ? **Wisconsin’s** RPS is applied in a still-regulated market, and begins at 0.5%, growing to 2.2% by 2011. Up to 0.6% can be met with existing renewable generation.

The RPS has been and continues to be considered in a number of additional states: Colorado, Hawaii, Illinois, Iowa, Maryland, New York, Oklahoma, Rhode Island, Utah, Vermont, and Washington, among others.

It also deserves note that three states – Hawaii, Illinois, and Minnesota⁹ – have established legislatively directed renewable energy goals. These goals are not binding, however, and no specific sanctions exist for a utility that fails to meet the goals. While these goals may prove effective, they are not discussed further in this report.

Finally, besides state RPS initiatives, there have been various proposals in Congress for a national RPS. For example, in 2002 the Senate approved a 10% RPS by 2020, though the proposal failed to clear the House and was not enacted. States with RPS policies could face numerous coordination challenges were a federal RPS to be enacted. Among other things, these

⁹ The goal in Minnesota is in addition to the obligatory RPS provisions that apply to Xcel Energy, which are discussed in this report.

include whether the state RPS is to be incremental to the federal RPS; the potential incompatibility between a state RPS placed on retailers and a federal RPS that could be placed on generators; and different verification systems between a state and federal RPS (Wiser 2000).

The Impacts of State RPS Policies

Though the majority of the 13 state RPS policies have just begun, their collective impact over time *could* be substantial. Figure 1 presents estimates by the Union of Concerned Scientists (UCS) of the projected effect of these existing policies on renewable energy development through 2012. The estimates in Figure 1 are derived from estimating the renewable energy generation needed to meet existing state RPS policies, then converting that generation to capacity by applying an average capacity factor of 50%. We note that this figure is somewhat dated, and therefore does not incorporate recent changes to RPS programs in, for example, Minnesota and Connecticut. We also note that although this section emphasizes the impact of state RPS programs, other renewable energy policies (tax incentives, system-benefits charges, integrated resource planning, etc.) will also continue to play a role in renewable energy, and geothermal, development. These other policies are discussed briefly in Chapter 3.

Importantly, the UCS estimates assume that the state RPS programs are designed effectively, and therefore represent an upper bound on the possible impacts of existing state RPS policies; as we show later in this report, the assumption that all state RPS policies will be designed effectively is aggressive. Though one might quibble with some of the details behind the estimate, the figure clearly shows that, in aggregate, the 13 state RPS policies have the possibility of driving a substantial amount of renewable energy development. Unfortunately, because many state RPS policies are at an early stage of implementation or design, it is not possible to estimate the projected mix of renewable resources that will be used to meet individual state RPS policies.

FIGURE 1. THE IMPACT OF STATE RPS POLICIES

Source: Union of Concerned Scientists

While Figure 1 estimates the impacts of state RPS policies in the long run, these policies are already beginning to have an impact; this is especially apparent for wind power, and to a far lesser degree, also for geothermal. In Texas, 915 MW of wind power came on line in 2001 in large part to serve the state's RPS. Iowa's policy has been met with 250 MW of wind installation, while Minnesota's initial mandate for 425 MW of wind and 125 MW of biomass has also largely been met. Wisconsin's RPS has supported approximately 140 MW of renewable energy so far, all but 10 MW of which is wind power, and much of which is new. An interim renewable energy procurement directed by the California PUC, in advance of that state's RPS, has resulted in substantial new procurements by the state's three investor-owned utilities. While the full details of these procurements are not available, the procurement includes at least two contracts with Calpine for a total of 310 MW of existing geothermal generation.¹⁰ In Nevada, a 2001 renewable energy solicitation resulted in contracts for 130 MW of wind, 97 MW of

¹⁰ Though initiated prior to the creation of the Californian RPS, renewable generation purchased under this interim procurement will count towards the state RPS, and the procurement requirement can be considered a "mini-RPS" itself. Under the interim procurement, SCE has entered into five power purchase agreements totalling over 1.5% of SCE's annual retail sales (in at least one filing, SCE has claimed that these contracts would contribute nearly 4% of their retail sales), one of which is for 200 MW of existing geothermal generation and another of which is for 100 MW of new biomass generation. SDG&E, meanwhile, signed contracts with 15 renewable energy projects that will produce nearly 4% of that utility's electricity needs in 2003, rising to approximately 7% in 2004. PG&E has reportedly signed contracts for 1.1% of their electricity requirements, including one contract for 110 MW of existing geothermal power for on-peak delivery and 55 MW for off-peak delivery, and another two contracts for a total of 9 MW of biomass energy. As illustrated by these results, the interim procurement allowed – and even encouraged – utilities to purchase renewable generation from existing in-state facilities.

geothermal, and 50 MW of solar. Arizona's small RPS, meanwhile, has supported nearly 5 MW of solar and 5-10 MW of landfill gas so far. The Massachusetts RPS, though it began in 2003, has already resulted in some merchant landfill gas activity, some incremental production at existing biomass plants, and increased site prospecting by wind, landfill gas, and biomass developers. Although subject to a legal challenge, New Mexico's imminent RPS was perhaps a contributing factor in a 25-year 204 MW wind power contract between FPL Energy and the Public Service Company of New Mexico. Finally, New Jersey's RPS has contributed somewhat to the increased renewable development efforts of renewable companies in the mid-Atlantic region.

3 Comparing the RPS to Other Policy Approaches

Policymakers in the U.S. have long been interested in encouraging the development of renewable (and geothermal) energy markets. Frequently mentioned rationales for this support include the environmental advantages of renewable energy (see, e.g., Serchuk 2000), the ability of renewable electricity to lesson electricity price risks (see, e.g., Awerbuch and Berger 2003, Bolinger et al. 2002), and the impact of renewables deployment on economic development. In addition to the RPS, several other state and federal policy approaches have been used to support renewable energy. When considering the application of an RPS to support geothermal energy, it is useful to consider these other policies as either complements or alternatives to the RPS.

In this chapter we first highlight the theoretical advantages and disadvantages of an RPS relative to other policy mechanisms. We then turn to a discussion of other policies that might be used in lieu of or in addition to an RPS to support renewable energy in general, and geothermal energy in particular; these include integrated resource planning, tax incentives, renewable energy funds, encouragement of voluntary purchases of green power, and government purchases of renewable energy.¹¹ While it is not the role of this document to evaluate these alternative options in detail, in this chapter we briefly describe these policies, compare them with the RPS, and identify the degree to which these other approaches can be complementary to an RPS. Finally, we specifically summarize the degree to which these other policies have been or might be used to support geothermal energy markets. Our evaluation in this chapter has been informed by the stakeholder interviews that we conducted during our research; see Appendix B for a more detailed description of those results.

3.1 Advantages and Disadvantages of an RPS

The use of an RPS to support renewable energy development in general, and geothermal energy in particular, has some *theoretical* appeal compared to other types of policies. After all, in its ideal form some of the advantages of an RPS that are frequently noted include:

- ? The RPS can drive a known quantity of new renewable development, based on the specific standards that are established, and can ensure that there are buyers for that renewable energy.
- ? It can help lower the total cost of that development by giving LSEs the flexibility to meet their purchase targets in the way they deem best, and encouraging competition among renewable developers for contracts with LSEs.
- ? An RPS can be competitively neutral if it is applied equally to all retail electricity suppliers.
- ? An RPS imposes relatively low administrative burdens and direct administrative costs on those responsible for overseeing the policy.
- ? An RPS can be applied in both restructured and monopoly market contexts.

¹¹ Note that this list of policies is not exhaustive, and does not include, for example, policies that might facilitate the development of geothermal projects on federal and state lands. Our focus in this chapter is on policies that would stimulate the market for geothermal energy through direct or indirect incentives, as opposed to the broader array of policies that would be useful in reducing barriers to geothermal development more generally.

While the RPS has some theoretical advantages, and several states have applied the RPS to good effect (see Chapter 4), the RPS also has some potential disadvantages relative to other types of renewable energy policies:

- ? Due to its complexity, the RPS can be difficult to design and implement well.
- ? An RPS may be less flexible in offering targeted support to renewable energy than some of the other renewable energy policies.
- ? The exact cost impacts of an RPS cannot be known with certainty in advance.
- ? Operating experience with the RPS remains limited.
- ? If an RPS does not lead to the availability of long-term power purchase agreements, the ability to finance new renewable projects will be limited and compliance costs may increase.
- ? An RPS is not necessarily suited to supporting diversity among renewable technologies, although an RPS can be designed to do so through the use of resource tiers and credit multipliers.

Finally, it deserves recognition that RPS policies do not directly combat other barriers to renewable energy development, including siting and permitting hurdles, resource assessment needs, transmission requirements, and potential disparities caused by subsidies offered to other non-renewable generation sources. Of particular interest to geothermal developers, state RPS policies do little to combat barriers to geothermal development on federal lands. For these reasons, complementary policies may be required to yield the theoretical benefits of an RPS.

Moreover, though purchase mandates such as the RPS have their own inherent advantages and disadvantages, they are but one of several classes of policies that have been or can be used to support renewable energy. In the following sections, the relative merits of other major policy tools are considered.

3.2 Integrated Resource Planning

Traditional utility resource planning involves forecasting load growth and assessing various supply options to meet that load growth at the lowest possible cost, while maintaining reliability. Integrated resource planning (IRP) emerged in the 1980s as an analytic means of incorporating demand-side resources (i.e., energy efficiency and load management) into resource planning, as well as incorporating other factors such as uncertainty and environmental quality. IRP allows a portfolio approach to minimizing costs, subject to reliability requirements, and can incorporate environmental and diversity factors as well.

IRP is best suited to a regulated monopoly context. It is challenging to apply conventional IRP principles in restructured markets where ratemaking authority for new entrants has been ceded to market forces, especially when generation has been divested and there are no stable utility portfolios. In fact, RPS policies have frequently been adopted (in part) to replace IRP during the transition to restructured electricity markets. As a result, in regulated markets, IRP and RPS approaches may be thought of as substitutes in some circumstances, but this is not the case in restructured markets.

Where IRP is feasible and can be thought of as a substitute for an RPS, IRP does have some potential advantages to an RPS:

- ? **Multi-attribute Decision Making:** In its ideal form, IRP can be an effective way to consider, in a balanced fashion, all of the characteristics, costs, and benefits of renewable energy, conventional generation, and demand-side resources. While an RPS can exert competitive pressures to lower the compliance cost of meeting specific renewable energy targets, IRP can directly address a fuller range of impacts in a multi-attribute analytical framework (reliability, cost, environmental impacts, generation diversity).
- ? **Investor Risk Reduction:** In addition, IRP decisions may have long-term regulatory support, leading to long-term contracts with renewable generators. In contrast, RPS requirements in the absence of long-term contracting standards are concerned only with meeting annual targets, leaving greater potential risk for investors in renewable generation.
- ? **Implementation:** As we note throughout this report, designing an effective RPS can be difficult. While developing a balanced IRP plan is also challenging, once that IRP plan is established, regulators may be in a position to more clearly and easily direct resource planning and contracting efforts to achieve the results suggested by the IRP exercise.

IRP also has some potential shortcomings relative to an RPS:

- ? **Limitations in Competitive Markets:** The use of IRP is largely limited to regulated markets, or to regulated entities in competitive markets, and therefore is not available as a substitute to an RPS in many cases.
- ? **Competitive Bidding and Externalities:** Features that are sometimes included in utility resource planning, such as competitive bidding, may be problematic for renewables. In IRP processes, renewables have often not been found to be competitive unless environmental or diversity externalities are considered, yet monetizing such externalities has proven contentious and, in some states, administratively burdensome or impossible.
- ? **Assurance of Impacts:** Unlike an RPS, an IRP planning process does not ensure that renewable or geothermal energy sources will be developed. Moreover, IRP plans have themselves frequently been disconnected from the actual purchases made by electric utilities. With few exceptions, IRP has not yet been a primary driver of geothermal development.

Finally, it deserves note that, in monopoly markets or even for the remaining regulated entities in competitive markets, IRP and RPS policies can play complementary roles. For example, an IRP process may be an effective means of demonstrating the benefits of renewable energy and even determining an appropriate quantity of renewable energy to include in a utility's mix, thereby justifying an RPS. From this perspective, an RPS may be an effective way of implementing the results of IRP.

3.3 Federal and State Tax Incentives for Renewable Energy

Tax incentives at the state and federal levels have often been used to encourage investments in new renewable generation. Targeted tax incentives for renewable energy can and have taken many forms, including federal production and investment tax credits, state income tax credits,

accelerated depreciation, depletion allowances (in the case of geothermal energy), as well as favorable state sales tax and property tax treatment.

At the federal level, federal investment tax credits in the 1970s and 1980s helped the renewable energy industry to begin penetrating the electricity market. Business investments in renewable energy, including geothermal, were eligible for first a 10% investment tax credit in 1978, then a 15% investment tax credit that lasted through 1985 before being reduced to 10% for geothermal and solar in the late 1980s. The 10% federal investment tax credit for business investments in solar and geothermal was made permanent with the Energy Policy Act of 1992 (EPAct). In addition, investments in solar, wind, and geothermal are eligible for five-year accelerated depreciation. EPAct also ushered in the federal production tax credit (PTC) for wind and closed-loop biomass; the PTC currently provides a 1.8¢/kWh tax credit for 10 years to eligible projects that come on-line before the end of 2003. Geothermal energy is not eligible for the PTC, though there have been various proposals to expand the policy's eligibility to include geothermal and other renewable energy sources (and to extend the PTC beyond 2003).¹² The fact that geothermal does not currently receive the PTC, but that wind projects do receive this incentive, significantly affects the relative competitiveness of these two resources.

Targeted state tax incentives for renewable energy, taking the form of income tax, sales tax, or property tax reductions, are also reasonably common. While these state policies provide some incremental support for renewable energy development (Bird et al. 2003), they have historically not been sufficient to motivate substantial development without the support of other additional policy drivers (Rader and Wiser 1999).

Tax incentives for renewable energy projects may be used as either alternatives to an RPS, or as complementary policy mechanisms. As alternatives to an RPS, state and federal tax incentives have both advantages and disadvantages. In particular, tax incentives, especially when applied at the federal level, can be an effective tool for driving new renewable energy projects, depending on the magnitude of the incentive. If the incentive is sizable, renewable energy development may flourish. If a tax incentive is not set high enough, however, it is unlikely to result in much, if any, new renewable energy. Unlike the specific targets associated with an RPS, tax incentives do not result in a specific quantity of renewable generation. Another specific concern is that tax incentives are sometimes short-lived and unstable, leading to "boom and bust" cycles that may not be as conducive to building a strong renewable energy industry as the steady market growth offered by a well-designed RPS.

Alone, or as complements to an RPS, targeted renewable energy tax incentives are perhaps best suited for levelizing the playing field between different generation technologies to account for externalities or offset advantages given to other competing generation types (including nuclear, fossil, and other renewable energy sources). If set at a high enough level, renewable energy tax incentives can be a useful tool for shifting long-term production patterns and choices, but they are imprecise as to their ultimate cost or impact. Because of these different impacts, targeted

¹² Tax incentives cannot be used by publicly owned renewable energy projects. Accordingly, the federal Renewable Energy Production Incentive (REPI) provides a 10-year, 1.5¢/kWh cash payment to public entities that own renewable power plants. REPI is subject to annual Congressional appropriations, however, and uncertainty over the level and timing of those appropriations has significantly reduced the REPI's effectiveness.

renewable energy tax incentives and RPS requirements are often complementary, but are rarely effective substitutes.

3.4 State Renewable Energy Funds

Several states have recently established non-bypassable charges on electricity rates, often termed system-benefits charges (SBC), to collect funds to support renewable energy. In many cases, these funds were established during the transition from regulated to competitive electric markets. Renewable energy funds collected through an SBC or through other means have been established in 15 states, and these funds are expected to collect over \$3 billion to support renewable energy over the next 10 years. The programs typically provide direct monetary support to renewable energy projects via production incentives and grants, as well as indirect support through such activities as customer education, infrastructure development, and market studies. Such funds can be established in both competitive and monopoly markets.

While the specific merits of a renewable energy fund depend heavily on the types of programs it supports, generally speaking it has both advantages and disadvantages to an RPS:

- ? In contrast to RPS policies, which ensure that a known quantity of renewable energy is achieved but at unknown cost, renewable energy funds collect a specific and known quantity of money but the impact of those funds on renewable generation cannot be determined with precision in advance.
- ? If policy objectives are slanted towards the local economic benefits of renewables, renewable energy funds may be better suited than an RPS at achieving those objectives because such funds can ensure that renewable energy development occurs in-state, while an RPS may not be legally allowed to restrict eligible resources to those located in a specific state.
- ? Renewable energy funds are also more flexible than an RPS, and can accommodate a multitude of activities (e.g., resource assessment) and provide market support to a diversity of renewable sources, some of which would likely fare poorly under a standard RPS design.
- ? A potential disadvantage to renewable energy funds is that, depending on the program design, they may not be competitively neutral. For example, with any competitive supply subsidy, inevitably some market participants may benefit while others do not.
- ? Renewable energy funds also tend to require a high level of administrative oversight relative to an RPS. Under an RPS, the market determines the outcomes of the policy, while a renewable energy fund requires regular oversight and administrative expense.
- ? Renewable energy funds also are a tempting target for state legislators searching for monies to balance state budgets. Legislators have tapped renewable energy funds in Massachusetts, Ohio, and Wisconsin to balance state budgets, and funds in California, Connecticut, Illinois, Oregon, and Rhode Island have been targeted as well.

While many states have either an RPS or a renewable energy fund, and they can therefore be seen as alternatives to one another, the two policies are increasingly seen as complementary options. Several states (e.g., Arizona, California, Connecticut, Massachusetts, Minnesota, New Jersey, and Wisconsin) have established both policies. In many of these instances, the RPS is targeted to support the most commercially available and lowest cost renewable sources, while the renewable energy fund supports higher-cost emerging technologies and other broader market

development efforts. In other states, the SBC is used to directly or indirectly buy down the cost of an RPS (Arizona, California), or to otherwise leverage the financing of projects that are eligible under the RPS (Massachusetts).

3.5 Encouragement of Green Pricing and Green Marketing

Some industry observers assert that explicit policy mechanisms are not necessary, and that voluntary consumer purchases of renewable energy may be sufficient. Such voluntary purchases can take one of three forms. *Green pricing* is the practice of a regulated utility offering its customers a choice to pay a premium to support renewable resources. *Green marketing* is the parallel in competitive retail markets, in which retail electricity providers offer their customers renewable energy products. Finally, sellers of *tradable renewable certificates*, often referred to as “green tags,” offer consumers the ability to provide direct financial support to renewable energy outside of the customer-electric supplier relationship.

Voluntary purchases of renewable energy by the general public do not by themselves constitute a public policy mechanism, but direct and indirect encouragement and support for such markets has been a policy mechanism used on a number of occasions. Examples of policy support for voluntary renewable energy purchases include such activities as funding public education efforts that highlight the benefit of renewable energy, adopting environmental disclosure requirements to support electricity product differentiation and consumer information, making utility billing systems available to marketers of “green tags,”¹³ and offering direct incentives for the purchase of renewable energy. Many of these activities have been funded by renewable energy funds, while others have originated through other means.

It is unlikely that voluntary consumer purchases will be a primary market mover for significant quantities of new renewable energy generation, and therefore a substitute for an RPS policy. First, most voluntary purchases of green power to date have been short-term commitments; in some cases, this type of commitment may not be sufficient to support financing of capital-intensive generation projects like geothermal. More importantly, customer participation rates in voluntary green power programs are typically rather low, and (at least in competitive markets) existing renewables sometimes comprise a substantial fraction of the renewable energy content. According to the National Renewable Energy Lab, as of the end of 2002, total green power demand in the U.S. had resulted in about 980 MW of new renewable energy capacity, with another 430 MW either under construction or planned. Only 16 MW of this new capacity is from geothermal projects. Moreover, some of these projects may have also received other policy support, such as SBC funding. Researchers forecast that green power demand may ultimately result in between 900 and 7000 average MW of new renewable energy capacity, depending on a number of assumptions (Wiser et al., 2001). Little of this capacity is likely to be geothermal, however, unless the production tax credit is extended to geothermal energy, with wind likely to continue dominating this market.

¹³ The opening up of utility billing systems in this way originated in New York, and is now being considered in New England and New Jersey (among other states). Note that this does not necessarily involve giving non-utility marketers open access to a utility’s customer information database.

While green markets are therefore unlikely to be a primary supporter of geothermal energy, these markets are often a way for utilities to gain experience with renewables, and may build public support for renewable energy policies. Green pricing and green marketing may also be effective complements to an RPS or other renewable energy policies. Green markets provide an outlet for renewable generation brought on-line in excess of current year policy targets, allowing investors to gain comfort in bringing on-line larger projects that may capture economies of scale. At the same time, the presence of RPS mandates, which are better suited to supporting financing of renewable energy projects than voluntary demand, can lead to moderate quantities of merchant renewable energy being available to the green power market. Many observers have also noted that successful voluntary green power programs can raise the profile and consumer acceptance of renewable energy, thereby leveraging public support for other renewable energy policies.

3.6 Government Purchases

Governments at the local, state, and federal levels can support renewable energy by installing renewable energy facilities on-site, or by making purchases of bulk renewable supply or TRCs. Examples include New York's Governor Pataki issuing an executive order in June of 2001 committing all state facilities to purchase 20% of their energy requirements from renewables by the year 2010, and New Jersey government agencies and universities meeting 12% of their energy needs with green power.

Such purchases are less likely to be seen as alternatives to an RPS than to be seen as stepping-stones to a broader purchase mandate. They are also often seen as setting an example for voluntary renewable energy purchases by the public at large. The primary advantage of government purchases of renewable energy is that they can often be instituted with a minimum of effort, by executive fiat, and with or without broad public support for broader renewable mandates. A primary disadvantage, at least so far, is that the resultant demand for renewable energy may be insufficient to enable financing of new renewable projects. This is because government purchases are typically only for terms of one to five years, and because the government sector only consumes a limited amount of total electricity supply. Similar to voluntary support for green power, government purchases may raise public visibility and support for clean sources of electricity, but they have not been and likely will not be, by themselves, a major market stimulant for new renewable projects.

3.7 Impact on Geothermal Markets

Section 2.2 described the impact of existing state RPS policies on renewable energy supply generally, while Section 4.3 discusses the impact of these policies on geothermal development in particular. Nonetheless, it is important to acknowledge that other state and federal policy approaches – including those discussed in this chapter – have also had and will continue to have an impact on geothermal development.

- ? **PURPA and Tax Incentives:** Historically, the most successful combination of policy efforts in stimulating geothermal project development has been PURPA implementation and state and federal tax incentives. In fact, most of the geothermal plants on-line today were developed following the passage of PURPA due to (1) high avoided cost price benchmarks in

certain states, leading to long-term favorably priced contracts (e.g., California)¹⁴; and (2) federal and/or state tax incentives.

- ? **IRP:** Geothermal has also, in some limited cases, successfully competed in IRP processes. In California's biennial resource plan update (BRPU), for example, winning bidders included geothermal projects. FERC struck down the proposed PURPA contracts under the BRPU in 1996, asserting that the proposed buy-back rates exceeded the avoided cost requirements of PURPA. As a result, the BRPU contracts were never implemented. With natural gas prices increasing, geothermal projects may fare even better in future IRP processes.
- ? **Renewable Energy Funds:** Finally, geothermal projects have received limited support through renewable energy funds. California presents the only example of this to date, with its renewable energy fund supporting a small number of new geothermal projects.
- ? **Green Power Purchases:** Voluntary customer demand for geothermal energy has been limited so far. There have been a few examples of green power offerings that feature geothermal energy, but NREL estimates that just 16 MW of new geothermal projects were serving the green power market through 2002. To date, there have also been no significant government purchases of geothermal energy.

Looking forward, as we have noted earlier, the various renewable energy policy approaches are inter-related and often potential complements. For example, if a production tax credit was available for geothermal energy, we would anticipate that green marketing of geothermal energy would increase, and geothermal would compete more successfully in IRP processes. Finally, in California, where an RPS and SBC effectively work together, geothermal is expected to continue to be a significant beneficiary of both policies.

¹⁴ Avoided cost rates significantly above the current market level are no longer prevalent, particularly with the use of competitive bidding for power supplies and the development of competitive wholesale markets with visible market indices.

4 Evaluating State RPS Policies

4.1 Overview

A number of evaluation criteria might be applied to assess the actual or expected effectiveness of a state RPS policy in driving both new renewable energy development in general, as well as the development of geothermal energy resources more specifically. The principal goal of this chapter is to introduce and apply criteria for making such judgments.¹⁵

In Section 4.2 we list and briefly describe the 21 evaluation criteria that we developed to evaluate the 13 existing state RPS policies in the United States. These criteria were vetted during the stakeholder interviews, and we therefore also report the opinions of our interviewees towards our evaluation criteria (for more information on the stakeholder interview results, see Appendix B). In Section 4.3 and in Appendix E these criteria are applied to the *existing* state RPS policies identified in Chapter 2. The criteria may also be applied to *future* RPS proposals, and therefore serve as a base for the development of RPS design principles and best practices in Chapter 5.

4.2 Policy Evaluation Criteria

Criteria Categories

State RPS policies are at different phases of implementation: some have been operating for several years, while others have yet to begin. To accommodate the different phases of state RPS implementation, our 21 evaluation criteria fall within four broad categories:

- ? **Outcome criteria** assess the actual impacts and results of state RPS policies. Where an RPS policy has been operating for several years, an assessment of the impact of that RPS on renewable energy development, economic costs, and other factors can be made. In other cases, however, state RPS policies have not been operating for a sufficient duration to conclusively apply the outcome-based criteria.
- ? **Policy design criteria** include legislative and regulatory RPS design features that will affect the success of an RPS. Particularly where an RPS has not been operating for sufficient time to judge its success in meeting the outcome criteria, we must instead judge that state's policy against a series of policy design criteria. A well-designed RPS is more likely to be effective in the long run than a poorly designed policy.
- ? **Market context criteria** are included to reflect the fact that even a well-designed RPS may fail to have its intended effects if the market in which it is applied is not conducive to such a policy, e.g., if viable renewable resource options do not exist or long-term renewable energy contracts are not available.

The criteria that fall within each of these three categories are intended to assess whether an RPS has already or is likely to be effective at driving new renewable resource development at

¹⁵ We note the recent publication of a report by the Union of Concerned Scientists (UCS), which grades states based on their commitment to renewable energy (Deyette et al. 2003). The UCS report focuses on a broader range of policies than does ours, and emphasizes the strength of these policies in theory, while we evaluate actual experience. The two reports are therefore complementary.

reasonable costs and with minimal disruption to the functioning of electricity markets. These criteria are *resource neutral*, and will not be used to assess the effectiveness of a state’s policy in driving geothermal development in particular.

A key goal of the National Geothermal Collaborative, however, is to judge the effectiveness of state RPS policies in supporting geothermal resources. Because the criteria in the above three categories are resource neutral, we also include a fourth category of **geothermal-specific criteria**.

Proposed Evaluation Criteria

We identify and briefly describe our specific evaluation criteria in Table 1, below. We base these criteria on experience with RPS policies in the U.S. and abroad, our own professional judgment, review comments provided by the National Geothermal Collaborative, and comments gathered from the stakeholder interviews. A lengthier description and rationale for these specific criteria can be found in Appendix D.

TABLE 1. RENEWABLES PORTFOLIO STANDARD EVALUATION CRITERIA

OUTCOME CRITERIA	
Amount of New Renewable Energy Development	The principal goal of an RPS is to drive renewable resource development and increased production of renewable electricity.
Full Compliance with RPS Policies	A hallmark of an effective and sustainable RPS is one in which all load-serving entities (LSEs) are in full compliance with the renewable energy purchase obligation. Differential compliance among LSEs is likely to undermine the political stability of the policy as a whole.
Reasonable and Stable Cost Impacts	Load-serving entities, end-use electricity customers, and policymakers desire stable, reliable, and reasonably priced electricity supply. An RPS that unduly raises the cost of electricity to end-use customers, or whose costs vary considerably from one year to the next, is unlikely to be viable over the long run. New resources added to meet an RPS should not substantially impact reliability or add to system costs in a manner not captured in the choice of RPS resources. Compliance with the RPS should not be unduly burdensome.
Prudently Incurred Compliance Costs Borne by Ratepayers	Because the benefits of renewable electricity flow to consumers at large, it is also important that those same consumers bear the costs of the policy. Prudently incurred (i.e., just and reasonable) RPS compliance costs should therefore be recovered from end-use electricity customers.
POLICY DESIGN CRITERIA	
Broad Applicability	A well-designed RPS would ideally apply equally and fairly to all load-serving entities in a state (or, at minimum, to all possible suppliers to any customer whose load is included in the mandate), ensuring that all those who benefit from increased renewable energy production also bear a proportion of the costs.
Carefully Balanced Supply-Demand Condition	An effective RPS will have renewable energy purchase standards of sufficient size and structure coupled with sufficiently tight resource eligibility rules, so as (a) to be binding enough to ensure new renewable energy development, without (b) being so binding as to foreclose feasible compliance.
Sufficient Duration and Stability of Targets	Well-designed RPS policies will be of sufficient duration to allow long-term contracting and financing to occur, and have purchase targets that are stable over time and are not subject to sudden or uncertain shifts.

Well-Defined and Stable Resource Eligibility Rules	The eligibility of specific renewable resources and technologies for a state RPS should be well defined. Ambiguity as to what resources are and are not eligible, or may become eligible, creates market uncertainty for both renewable developers and LSEs.
Well-Defined and Stable Treatment of Out-of-State Resources	Geographic eligibility decisions affect the aggregate impact of an RPS, the location of the benefits delivered by an RPS, and the legal defensibility of the policy as a whole. Well-designed RPS policies have a well-defined, supportable stance on this issue that is both consistent with the stated objectives of the policy as a whole and that is not subject to sudden change.
Credible and Effective Enforcement	An effective RPS must typically be mandatory and impose repercussions on those LSEs that fail to meet the specified renewable energy purchase mandates. Only with credible enforcement will state policymakers ensure that the RPS is met, will renewable developers know that their efforts are not in vain, and will financiers understand the risk of their investments.
Flexible Verification Mechanisms	A variety of approaches can be used to verify compliance with an RPS. The TRC approach is generally preferable because it can simplify verification, provide greater assurance of no double counting, increase contracting flexibility, and lower compliance costs. In monopoly markets with stable resource portfolios and few transmission constraints, however, a contract-path approach may be sufficient. We note here that the use of TRCs for verification purposes does not restrict one's ability to limit imports from other states.
Adequate Compliance Flexibility	Compliance with stringent and unyielding renewable purchase obligations in the face of supply and demand factors that are difficult to predict or control can prove challenging and costly, and may encourage market power. State RPS policies would ideally build in some compliance flexibility. If RPS policies are overly flexible and lenient, however, the likelihood of gaming and non-compliance could intensify, and the complexity of administering the RPS could increase.
Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Standard Offer and Default Service Providers	For competitive suppliers, regulators need not specify contracting standards or RPS compliance cost recovery mechanisms. RPS policies have now been implemented in a number of markets that remain regulated, however, and even in purported competitive markets providers of last resort remain regulated. In these cases, regulatory bodies may need to establish standards for how renewable energy should be procured to ensure that renewable projects receive the long-term contracts necessary to attract financing. Regulators must also establish clear mechanisms for the recovery of prudently incurred RPS compliance costs by rate-regulated LSEs.
Product-Based, as Opposed to Company-Based Compliance Mechanisms	A <i>company-based</i> application of an RPS would allow LSEs to meet their RPS obligation through the sale of green power to those customers willing to pay a premium for that product. An emerging best practice, however, is the application of the renewable energy target to each electricity <i>product</i> sold to end-use customers. Such an application ensures that customers are not misled as to the incremental effect of their purchases, that voluntary customer demand for renewable energy is <i>additive</i> to any demand generated by the RPS, and that the cost of the RPS is shared equitably among all electricity users.
MARKET CONTEXT CRITERIA	
Presence of Creditworthy Long-Term Power Purchasers	In some markets, few creditworthy players are willing to enter into long-term contracts for renewable energy. Renewable projects require long-term contracts to receive financing. Markets in which such contracts are unavailable or extremely scarce are unlikely to be conducive to the effective implementation of an RPS.
Stable Political and Regulatory Support	To minimize uncertainty and allow for the staged development of renewable resources, a stable level of political and regulatory support for an RPS is essential.

Adequate and Accessible Developable Resource Potential	Some regions of the U.S. are poorly endowed with renewable resource potential, while in other regions adequate potential may not be cost-effective given transmission constraints, wholesale market rules, and interconnection barriers. To apply RPS obligations in such regions that severely exceed cost-effective resources is a potential recipe for failure.
GEOHERMAL-SPECIFIC CRITERIA	
Geothermal Development	For those states whose RPS policies have been in place for some time, the first evaluation criteria is simply the extent to which geothermal exploration, leasing, development, and construction activities have been stimulated by the policy.
Geothermal Resource Availability and Eligibility	A large number of U.S. states simply do not have cost-effective geothermal resource opportunities. Even among those states in which geothermal is available, geothermal energy may not be eligible under the state's RPS. Where eligible generally, another question is whether geothermal heat or electricity used on a customer's site would be eligible to meet RPS requirements.
RPS Design Elements that <i>Specifically</i> Encourage Geothermal Development	Some states have created RPS designs that <i>explicitly</i> support diversity among renewable resource types in general, and/or the use of geothermal energy. These tools include credit multipliers and diversity bands. Those states using these tools are more likely to see geothermal development activity, all else equal.
RPS Design Elements that <i>Indirectly</i> Encourage Geothermal Development	Other states may not explicitly support geothermal development relative to other renewable sources, but may instead do so indirectly. Such indirect support may come from specific contracting processes or an incorporation of system integration costs into the resource selection process.

Stakeholder Interview Comments

We specifically vetted the above list of evaluation criteria through the stakeholder interviews. In particular, we asked the interviewees to rate each of the criteria as “very important,” “somewhat important,” or “not important.” We also asked: “Are there any criteria that we have missed, and that should be added? Are there any criteria that should be deleted or altered? Are there any other RPS design elements that you believe are critical to the success of the policy? Are there any design elements that will lead to sure failure?”

All of the stakeholders that we interviewed believe that the evaluation criteria are appropriate. None of the respondents suggested specific criteria that should clearly be added, nor did anyone suggest any criteria that deserve deletion. Except for the geothermal-specific criteria, the interviewees generally rated all of the criteria as either “very important” or “somewhat important,” with very few “not important” ratings.

For the outcome criteria, all but one interviewee believe that it is very important or somewhat important that state RPS policies result in new renewable energy development, that there be full compliance with the RPS, that the RPS have reasonable and stable costs, and that prudently incurred compliance costs be borne by ratepayers.

The majority of the interview respondents felt very strongly that a state RPS should be broadly applicable to all load-serving entities in a state; that the RPS should be established recognizing renewable energy supply and demand conditions; that the RPS should be stable and of sufficient duration; that there should be credible enforcement; and that there should be flexible mechanisms for compliance, such as tradable renewable credits. Most interviewees also believe that it is somewhat to very important that a state RPS have: well-defined and stable resource eligibility rules and rules for treating out-of-state renewables; compliance flexibility; and

contracting standards for providers of last resort. In addition, most interviewees felt that it is somewhat to very important that the RPS be product based.

Almost all of the interviewees felt strongly that the three market context criteria—the presence of creditworthy long-term power purchasers, stable political and regulatory support for an RPS, and accessible development resource potential—are all very important.

Interviewees were more divided on the geothermal-specific criteria. The majority of the stakeholders believe that geothermal should be eligible for state RPS policies. The interviewees were split on whether geothermal development is an important criterion on which to evaluate state RPS policies, with roughly equal proportions believing it is very important, somewhat important and not important. Additionally, all interviewees felt it is either somewhat important or not important that there be direct or indirect encouragement for geothermal in a state RPS. It would appear that most of the stakeholders we interviewed are supportive of geothermal energy, but believe that geothermal should compete head-to-head with other sources of renewable generation without direct or indirect methods of support in the RPS policy. Some felt that other methods of supporting geothermal outside of the RPS were more appropriate, such as extending the federal PTC to geothermal.

Interviewees generally felt that all of the potential criteria for evaluating state RPS policies were identified. Stakeholders identified credit trading, assuring utilities of reasonable RPS compliance costs and cost recovery, broad applicability, and price caps as contributing to the success of an RPS. Interviewees identified two elements that might lead to the sure failure of an RPS: not applying the RPS to all parties and the absence of firm penalties.

4.3 Application of the Evaluation Criteria

The evaluation criteria described above were devised to provide a useful framework for qualitatively assessing the actual or likely effectiveness of a state RPS. Nevertheless, it is challenging to precisely evaluate policies based on this framework. We therefore do not conduct a detailed assessment of each of the state RPS policies based on each individual criterion. Instead, in Appendix E we apply these criteria, identify the most critical strengths and weaknesses of the 13 state RPS policies currently in place, and offer an overall qualitative assessment of each of the existing policies. In this chapter we summarize our key findings from this assessment, discussing each category of criteria in turn. As with most evaluations, a significant amount of judgment was required on our part to complete this assessment.

Outcome Criteria: The Good, the Bad, and the Ugly

Many of the state RPS policies have not been in place long enough to judge them comprehensively based on the outcome criteria. Nonetheless, Appendix E shows that, despite limited experience to date, a variety of states are succeeding on one or more of these criteria.

Of the 13 state RPS policies currently in place, **Texas** has clearly shown the most success overall. The Texas policy has driven substantial new wind power additions, has done so with reasonable cost impacts that are being passed on to customers, and retail suppliers appear as if

they will fully comply with the policy. We do acknowledge, however, that relative to aggregate electricity usage in the state, the Texas RPS contains a very modest renewables requirement.

The renewable energy mandates in the regulated markets of **Iowa** and **Minnesota** have also succeeded in meeting their stated objectives, have met with full compliance (after substantial delay in Iowa), and have had reasonably stable costs supported by end-use customers.¹⁶

The success of other states in meeting these criteria is mixed, but some success has been achieved or is expected in a number of different jurisdictions:

- ? **Arizona's** policy has led to some modest new renewable energy development (most notably, solar), with costs recovered through rate surcharges, but full compliance with the renewable energy targets has not been achieved.
- ? **California's** RPS requirement is among the most aggressive in the nation. The three major investor-owned utilities have already procured a significant amount of renewable resources in a 2002 interim procurement, in advance of the RPS. RPS design decisions have not yet been entirely finalized, however, so the ultimate effectiveness of the policy remains somewhat uncertain. Whether full compliance with the 20% requirement will be achieved is also somewhat uncertain given the potential scarcity of SBC funds to pay for the above-market cost of renewable energy; in California, renewable procurement costs that are deemed to be above-market are to be covered by the state's SBC, limiting the cost of the policy.
- ? **Massachusetts** has a well-designed policy that is leading to increased renewable energy development activity in New England. Whether that development activity results in substantial additions to new renewable energy supply, at reasonable and stable costs, remains unclear given the current scarcity of long-term contracting.
- ? **Nevada** has an aggressive policy that has already led to new renewable energy contracts. Costs are likely to remain reasonable and stable, with prudently incurred costs passed on to customers. Utility compliance will not be complete, however, at least in the initial years.
- ? **New Jersey's** policy has had an indirect influence on renewable energy development in the region, but will not alone help build new markets for renewable energy for years to come unless the RPS targets are strengthened.
- ? **New Mexico's** policy has only recently been established, but could drive reasonably sized renewable energy development in the future. Whether the state's utilities will comply with the standard depends on the fate of the policy as a whole: the utilities have sought to overturn the policy before the legislature and the courts.
- ? **Wisconsin's** program rates highly on the outcome criteria: utilities are complying and in many cases over-complying, costs are reasonable and stable, and prudently incurred costs are being passed on to ratepayers. With a low overall RPS standard combined with early over-compliance, however, the policy is unlikely to drive substantial additional development for years to come.

Other state policies have had little to no impact on renewable energy markets so far, and therefore rate poorly on the outcome-based criteria.

¹⁶ With regards to Minnesota, this assessment is based on the original Xcel mandate, not the renewable requirements included in 2003 legislation.

- ? **Connecticut's** policy has had no effect on new renewables supply thus far, though with recent changes to the statute, the RPS in that state appears to have been greatly improved.
- ? **Maine's** policy is designed in a way that also ensures that no new renewable energy development will occur, and the policy will have no impact without fundamental redesign.
- ? **Pennsylvania's** policy has had no impact on new renewable energy supply, and with few suppliers required to comply with the policy, its impact will remain muted.

In sum, based on the outcome criteria, Texas, Minnesota, and Iowa rate most highly: these policies have worked (Iowa) or are working (Texas and Minnesota). Connecticut, Maine, and Pennsylvania receive failing grades.¹⁷ All other states operate in a gray area where either: (1) some success has been achieved, but that success is not complete, or (2) the policy has not been operating long enough to fairly judge its success on the outcome-based criteria

Policy Design Criteria: Common Pitfalls

Experience with state RPS policies is clearly mixed. Some states have succeeded with their policies, in part due to strong design features, while the policies in many other states are not operating as was expected. It is evident from this experience that crafting a well designed RPS is a balancing act: a number of elements need to be designed well, and if any one design element falls short, the policy may fail to achieve its objectives. Equally clear is that U.S. states have implemented policies that contain a variety of design pitfalls.

Based on our evaluation, the key design weaknesses and strengths of each state's RPS are briefly summarized in Table 2, below (see Appendix E for discussion and further details).

¹⁷ Legislation passed in mid-2003 that will greatly strengthen the RPS in Connecticut. Legislative changes are also being considered in Maine.

TABLE 2. RPS POLICY DESIGN STRENGTHS AND WEAKNESSES, BY STATE

State	Design Strengths	Design Weaknesses
AZ	<ul style="list-style-type: none"> ? reasonable supply -demand balance ensuring some limited new supply, especially solar ? well defined and stable resource and geographic eligibility rules ? reasonably broad application, with some exemptions ? adequate verification and compliance flexibility ? cost recovery mechanisms exist for utilities 	<ul style="list-style-type: none"> ? uncertainty in duration and stability of targets due to 2003 evaluation of policy ? lack of enforcement and non-compliance penalties has resulted in significant under-compliance with the standards ? unclear eligibility of geothermal resources ? legality of in-state restriction for some resources is unclear ? company based application of RPS and even encouragement of green power sales to meet RPS
CA	<ul style="list-style-type: none"> ? supply -demand balance ensures substantial new renewables development ? broad applicability, with partial exemption to publicly owned utilities ? well defined and stable resource eligibility rules ? policy duration is sufficient ? PUC and CEC given authority to develop effective enforcement, compliance flexibility, and verification ? detailed contracting standards and cost recovery mechanisms to be established ? legislation appeared to exclude out-of-state resources, but the CEC has allowed those resources to qualify 	<ul style="list-style-type: none"> ? policy design complexity and uncertainty ? decisions that might best be left to the market are instead made administratively in part because of use of SBC funds to support over-market costs ? availability of SBC funds may limit impact of policy ? exemption of non-creditworthy utilities may delay impact of policy, but unlikely to have major long-term effect
CT	<ul style="list-style-type: none"> ? few strengths in original RPS, but new legislation improves RPS design ? supply -demand balance ensures new renewables development ? reasonably broad application, with publicly owned utilities exempt ? duration and stability of targets appear reasonable ? enforcement is strong, with penalty of 5.25¢/kWh ? adequate verification and compliance flexibility ? some long-term contracting standards for utilities 	<ul style="list-style-type: none"> ? original RPS had many weaknesses: it was not broadly applicable, with exemptions provided providers of last resort who dominate the market; the supply -demand balance was poor; there was uncertainty in the duration and stability of targets; it had poorly defined resource eligibility rules, with “sustainable” biomass not adequately defined; and it had vague noncompliance penalties ? new RPS legislation improves RPS, but possible weaknesses include: biomass eligibility rules remain vague; scope of geographic eligibility and inter-region TRC trading is unclear; and not clear if policy applies on company or product basis
IA	<ul style="list-style-type: none"> ? supply -demand balance and policy design led to 250 MW of wind installation ? well defined and stable resource and geographic eligibility rules ? reasonably broad application, with publicly owned utilities exempt 	<ul style="list-style-type: none"> ? with delays and legal maneuvers, policy took more than 15 years to implement; policy stability and enforcement were therefore both problems ? legality of in-state restriction is unclear, though it was never successfully challenged
ME	<ul style="list-style-type: none"> ? reasonably well defined and stable resource and geographic eligibility rules ? reasonably broad application, with publicly owned utilities exempt ? adequate verification and compliance flexibility ? product-based application of targets 	<ul style="list-style-type: none"> ? supply -demand balance is poor, with eligible supply far outweighing RPS-driven demand ? uncertainty in duration and stability of targets given policy review required after 5 years of experience ? vague noncompliance penalties ? perhaps too lenient in compliance flexibility
MA	<ul style="list-style-type: none"> ? reasonably broad application, with publicly owned utilities exempt ? duration and stability of targets are strong ? well defined and stable resource eligibility rules ? enforcement is likely to be adequate, with alternative compliance mechanism of 5¢/kWh ? adequate verification and compliance flexibility ? product-based application of targets 	<ul style="list-style-type: none"> ? lack of contracting standards for standard offer and default service contributes to deficiency of long-term contracts ? some uncertainty in long-term treatment of out-of-region resources ? supply -demand balance weakness possible in early years, due to insufficient lead time provided to bring new renewables on line

State	Design Strengths	Design Weaknesses
MN	<ul style="list-style-type: none"> ? supply -demand balance and policy design has already led to substantial wind and biomass ? well defined resource and geographic eligibility rules ? duration and stability of targets are strong ? contracting guidelines and cost recovery mechanisms ? while penalties are not explicit, regulatory oversight has ensured compliance ? flexible compliance is allowed in future years 	<ul style="list-style-type: none"> ? original mandate and more recent RPS legislation are not broadly applicable; only Xcel is obligated ? in the past, utility has tried to green price its obligated renewable energy capacity (company -based application) ? 2003 legislation has unclear rules for geographic eligibility ? 2003 legislation is not entirely clear on the circumstances in which Xcel might be relieved of its RPS obligations, but such circumstances clearly exist
NV	<ul style="list-style-type: none"> ? supply -demand balance ensures substantial new renewables development ? reasonably broad applicability, with exemption for publicly owned utilities ? well defined and stable resource and geographic eligibility rules ? duration and stability of targets appear strong ? adequate verification and compliance flexibility ? contracting standards and cost recovery mechanisms 	<ul style="list-style-type: none"> ? legality of geographic requirements is unclear ? aggressive purchase requirements may strain resource availability in the long term ? supply -demand balance weakness in early years, with insufficient lead time to bring new renewables on line ? vague noncompliance penalties not yet a concern, but could become an issue in the future ? eligibility recently expanded via legislation
NJ	<ul style="list-style-type: none"> ? reasonably broad applicability, with exemption to publicly owned utilities ? duration and stability of targets appear strong, with consideration given to increasing the policy's stringency ? legislative definition of eligible biomass is unclear, but regulatory authorities have clarified the situation somewhat 	<ul style="list-style-type: none"> ? supply -demand balance is poor in early years, with existing supply exceeding RPS-driven demand ? unclear rules for geographic eligibility ? strong and flexible compliance mechanisms do not exist ? enforcement mechanisms are somewhat limited and vague ? contracting standards once the RPS becomes binding may become an issue for basic generation service supply ? policy appears to apply on a company basis
NM	<ul style="list-style-type: none"> ? reasonably broad applicability, with exemption to publicly owned utilities ? supply -demand balance should drive new renewables ? duration of policy appears strong ? reasonably well defined and stable resource and geographic eligibility rules ? adequate verification and compliance flexibility ? contracting standards and cost recovery mechanisms to be overseen by regulatory commission 	<ul style="list-style-type: none"> ? stability of policy in doubt as utilities are challenging regulatory jurisdiction of PUC ? enforcement mechanisms remain to be developed ? whether costs of policy can be recovered from green power customers (company -based compliance) remains unclear
PA	<ul style="list-style-type: none"> ? resource eligibility rules are reasonable clear and well defined ? policy effectively applies on a product basis 	<ul style="list-style-type: none"> ? not broadly applicable, with all but a very few electric service providers exempt ? poor supply -demand balance ensures that new renewable generation will not be required to meet policy ? unclear policy duration ? enforcement mechanisms are unspecified ? geographic eligibility rules are not specified ? strong and flexible compliance mechanisms do not exist
TX	<ul style="list-style-type: none"> ? supply -demand balance ensures substantial new renewables development ? reasonably broad applicability, with exemption to publicly owned utilities ? well defined and stable resource and geographic eligibility rules ? duration and stability of targets are strong ? adequate verification and compliance flexibility ? enforcement is strong and vigorous ? policy applies on a product basis 	<ul style="list-style-type: none"> ? legality of geographic requirements is unclear ? some have argued that RPS should provide greater compliance flexibility to LSEs, given run-up in TRC prices in late 2002
WI	<ul style="list-style-type: none"> ? supply -demand balance ensures some new supply ? broad applicability, with few exemptions ? well defined resource and geographic eligibility rules ? enforcement is somewhat vague, but in a regulated market this has done little damage ? adequate verification and compliance flexibility 	<ul style="list-style-type: none"> ? low RPS standard ensures limited new supply ? duration of policy is somewhat vague

Rather than describing these weaknesses and strengths by state in detail (see Appendix E), here we identify and provide examples of some of the more common and critical design pitfalls experienced by state RPS policies to date. These are pitfalls that other states may wish to avoid, as they have the possibility of completely undermining the objectives of an RPS:

- ? **Narrow Applicability:** Many states provide partial exemptions in meeting RPS requirements, the most common of which is to exempt publicly owned electric utilities from meeting the standards. Such minor exemptions, while not ideal and certainly not competitively neutral, will not generally do major damage to an RPS. More comprehensive exemptions, however, can destroy the potential impact of RPS requirements. In Connecticut, for example, the legislature originally exempted providers of last resort from meeting the RPS; these providers serve the customers that have chosen not to switch to a competitive provider, and account for over 95% of the total load in the state. Furthermore, in a competitive market like Connecticut, when an RPS requirement does not apply to every potential supplier, it is not competitively neutral and creates barriers to entry. Similarly, Pennsylvania applies their RPS to only a small portion of the overall market, in this case competitive providers of default service (see Appendix E for additional detail), to poor effect.
- ? **Poorly Balanced Supply-Demand Conditions:** Maine provides the quintessential example of a state with a poorly balanced supply-demand condition. Even with a nominally high RPS obligation, resource eligibility rules are so expansive that eligible supply far exceeds demand. As a result, the policy has had no effect on new renewable generation in the region. Other states that have had similar, yet less severe, problems include Connecticut, New Jersey, and Pennsylvania. Still other states may face the opposite condition: RPS-driven demand may exceed available renewable energy supply. The RPS policy in Massachusetts may eventually face this problem due to siting and permitting constraints. Still other states have left insufficient time between finalizing the implementation rules of their RPS and the incidence of the first standard, with early non-compliance or shortages of renewable energy generation a likely result. Massachusetts and Nevada may fall in this camp.
- ? **Insufficient Duration and Stability of Targets:** The renewable energy targets inherent in some state RPS policies are too unclear or of inadequate duration to provide sufficient certainty to renewable energy investors. Arizona's policy suffers from this failure, with a 2003 cost-benefit evaluation that will determine the fate of the policy. The duration of Maine's policy is also unclear, with a legislatively established review of the policy to occur after just 5 years of experience (by 2005). In other cases, the fate of the standard after a certain date is simply left unspecified: this is the case in Pennsylvania and other states.
- ? **Insufficient Enforcement:** We find that some states have inadequate enforcement. Arizona provides the best example. With no penalties for non-compliance, and with specified ratepayer surcharges being collected to help fund the RPS, the utilities appear to have largely opted to comply with the policy only up to the amount of funds that have specifically been collected for that purpose; full compliance has not been achieved. In other cases, the implications of non-compliance are left vague or unspecified: this is the case in Maine, Minnesota, Nevada, New Jersey, New Mexico, and Pennsylvania. In regulated markets, such as Minnesota, Nevada, and Wisconsin, we find that such vague enforcement may be sufficient: as long as obligated utilities know that the regulator is serious, they will comply. In restructured markets, however, a more clear non-compliance penalty such as that used in Texas may be preferred.

- ? **Poorly Defined or Non-Existent Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Providers of Last Resort in Competitive Markets:** This design pitfall has emerged as a critical failure that now faces several states. In restructured markets, providers of last resort (including default, basic and/or standard offer service providers) serve the needs of those customers not served by a new competitive electricity supplier. As a practical matter, these providers therefore serve the majority of customer load and remain regulated by state PUCs. These providers typically rely on short-term contracts to serve this load. Absent contracting standards that require or encourage long-term renewable energy contracts, and cost recovery mechanisms that allow prudently incurred costs to be passed on to customers, the RPS compliance efforts of these LSEs may be sub-optimal. In Massachusetts, for example, a lack of contracting standards has (in part) led to short-term myopia and the absence of long-term contracting; whether this can be resolved by the private market, or requires regulatory or policy intervention remains to be seen. The same situation may ultimately arise in New Jersey and other states. In regulated states, meanwhile, the need for contracting standards is even more evident. Here, the key design variable to consider is how to design those standards in a way that gives utilities the ability to flexibly use their discretion in making renewable energy purchases, while at the same time ensuring the prudence of the costs that are then incurred. In Arizona, the lack of well-defined standards (combined with the unclear fate of the RPS) has arguably led the utilities to procure more costly (but smaller and therefore lower total cost) PV systems than to contract for a larger quantity of potentially lower-cost solar thermal electric generation.

In addition to these major pitfalls, other pitfalls that states have fallen into are less severe. These pitfalls may not undermine the overall goals of RPS policies, but may make the achievement of those goals more costly, uncertain, or undesirable:

- ? **Poorly Defined and Unstable Resource Eligibility Rules:** Renewable resource eligibility rules in some states are poorly defined and unstable. Several states have sought to limit eligible biomass generation to “sustainably” harvested sources, for example, without an adequate definition of what that term means: Connecticut and, to some extent, New Jersey fall into this category.
- ? **Poorly Defined and Unstable Rules for Out-of-State Renewable Generation:** Other states have left the eligibility of out-of-state generation unclear: New Jersey, Pennsylvania, Minnesota, and Connecticut, for example, are somewhat unclear on their geographic eligibility requirements. Still other states have applied “in-state” restrictions on eligibility or rules that have a similar effect, potentially risking legal challenge under the Interstate Commerce Clause and the North American Free Trade Act (NAFTA). Arizona, Iowa, Nevada, and Texas could all face such a challenge.
- ? **Rigid Verification Mechanisms:** The use of TRCs is not an absolutely essential element of a state RPS. This is especially true in regulated, vertically integrated markets where internal transmission constraints are limited: Minnesota and Iowa, for example, have implemented successful requirements without the use of TRCs. In all other cases, however, the use of TRCs provides substantial benefits. Despite this, a couple states do not yet use TRCs as an accounting and trading tool – New Jersey and Pennsylvania are the obvious examples.¹⁸ We

¹⁸ A credit trading system is being considered for PJM, however, which would support the RPS requirements in New Jersey and Pennsylvania.

note here that the application of TRCs for verification purposes does not require wide geographic eligibility. Nevada, for example, has used TRCs to good effect while still placing severe limits on the eligibility of renewable generators located in adjacent states.

- ? **Inadequate Compliance Flexibility:** Some states may not build in sufficient compliance flexibility into their programs. Though experience is not yet sufficient to closely judge RPS policies based on this criterion, some stakeholders in Texas argued for additional flexibility in response to the late 2002 run-up in TRC prices in that state.¹⁹
- ? **Company-Based Application of an RPS:** While not a critical design element for an RPS overall, product-based application is the preferable approach, for the reasons discussed in Table 1, above. And yet, a number of states have instead chosen to allow a company-based application, risking consumer confidence in green power markets; Arizona falls into this category.

Finally, though not an explicit criterion, many of the stakeholders that we interviewed (see Appendix B) revealed an underlying view that the design of RPS policies should be as simple as possible. **Undue design complexity** might therefore also be considered a possible pitfall. The California policy is clearly the most complex and involved of the state RPS policies in place today, with substantial ongoing responsibilities given to the CPUC and CEC. The degree of complexity derives in large part from the fact that, unlikely most RPS policies, the state's system-benefits charge is to be used to cover the above-market cost of renewable energy purchases, requiring a higher degree of regulatory oversight. A fear exists among some stakeholders that this design complexity and regulatory oversight will undermine the policy's overall effectiveness because it may limit "market" decisions, and because the entire design process may bog down in regulatory design details and be subjected to continual review and attack. We acknowledge, however, that whether this is a major design pitfall is an open question.

Market Context Criteria

Even where the design of an RPS is strong, some existing state policies do poorly on the market context criteria. In these cases, even an otherwise well-designed policy may fail.

- ? **Lack of Credit-Worthy Long-Term Power Purchasers:** In regulated markets, utilities can be obligated to purchase renewable energy under long-term contract. Such is the case in Nevada, California, New Mexico and other states. In these cases, the question that remains is one of creditworthiness. Though it is likely to be a transitional problem, the Nevadan RPS has already faced some hurdles on this score, with some renewable developers hesitant to sign contracts with the state's utilities because of credit concerns. California solved this problem by simply exempting non-creditworthy utilities from making annual RPS purchases. In restructured markets, the lack of long-term contracting can be more endemic, a result of the design of the restructured industry. Even in Texas, only the utilities have been willing to enter long-term contracts for renewable energy supply, with the smaller competitive electricity retailers content to purchase TRCs on the short-term market. At the least, in restructured markets, regulators may need to establish renewable energy contracting standards for those providing service to customers who have chosen *not* to switch to a competitive supplier. This has not occurred in a number of states, however, leading to

¹⁹ The Texas PUC raised the TRC deficit allowance from 5% to 10%.

predictable problems in financing renewable energy development. Massachusetts provides perhaps the best example where, as discussed in depth in Appendix E, few suppliers have thus far been willing to enter into long-term contracts with renewable generators.²⁰ The effect has been to slow renewables development and create a tight renewables supply condition.

- ? **Unstable Political and Regulatory Support:** The long-term fate of the RPS in several states is unclear given wavering political support. In Arizona, for example, a 2003 cost-benefit assessment and the application of the policy through the regulatory (as opposed to legislative) process have led to substantial uncertainty. New Mexico's policy, also applied through regulatory action, has been challenged as well. The RPS in Maine, meanwhile, seems to face almost yearly legislative proposals for redesign or even elimination.
- ? **Inadequate or Inaccessible Developable Resource Potential:** Most state RPS policies have not been operating for sufficient time to test supply constraints. However, concerns do exist in Massachusetts that supply may not ultimately be able to keep up with demand, at least from in-region sources. Texas, meanwhile, has run into transmission adequacy issues in delivering west Texas wind to the state's load centers, although the Electric Reliability Council of Texas (the grid administrator in Texas) has approved a package of transmission expansions and improvements in west Texas that will provide some relief.

Geothermal-Specific Criteria

Geothermal electricity, where adequate resource potential exists, is typically an eligible renewable source under RPS policies. States in which geothermal electricity is not automatically eligible include: Arizona, Connecticut, Iowa, Massachusetts and Minnesota. Of the 13 state RPS policies, however, only four are in states where substantial geothermal resource potential exists in-state or in nearby states: Arizona, California, Nevada, and New Mexico. Therefore, the lack of eligibility in four of the other nine states should be of relatively little concern; only in Arizona is a lack of automatic eligibility potentially worrisome.

While this report has emphasized utility-scale geothermal applications, geothermal energy can also be used on a customer's site to serve electrical or heat applications. In some states, customer-sited geothermal electricity would be eligible to receive TRCs, and contribute to state RPS policies. In other cases, such customer-sited applications are not eligible under the RPS. Similarly, RPS policies could offer TRCs to customer-sited geothermal heat applications, though today only in Texas would such applications clearly be allowed under the existing RPS statutes. The ineligibility of geothermal heat applications in some states may be due to lack of awareness of the availability of the resource.

It is perhaps a commonly held view that wind power has been the primary beneficiary of state RPS policies, with geothermal energy not playing as significant a role. The availability of the federal production tax credit makes wind power an especially potent competitor, and there is no doubt that wind power has been the primary player in state RPS policies so far. A review of the evidence, however, suggests that geothermal energy is also beginning to play a significant role, at least in those states in which significant resource potential exists. Because it is an attractive baseload resource, geothermal is likely to continue to play a role in some states. Below we

²⁰ We note that the Massachusetts Renewable Energy Trust released a RFP in June 2003 to purchase TRCs on a long-term basis that may help to alleviate this problem.

summarize the early experiences of the four states in which both an RPS and geothermal resource potential exists. Again, our focus is on utility-scale geothermal electricity applications.

- ? **Nevada:** Nevada's RPS is already beginning to stimulate geothermal development in that state. For example, Nevada Power's and Sierra Pacific Power's first renewable energy solicitation yielded contracts that include 130 MW of wind, 97 MW of geothermal, and 50 MW of solar thermal electric power. At typical project capacity factors, the 97 MW of geothermal capacity will contribute over 60% of the total electricity delivered under these contracts. With additional renewable solicitations expected, geothermal energy appears poised to significantly benefit from the Nevadan RPS.

Nevada's apparent early success is the result of a reasonably well-designed RPS that scores well on many of the evaluation criteria described in this chapter. With respect to the geothermal-specific criteria, geothermal energy is both eligible in Nevada and significant development activity has commenced. Moreover, while Nevada's RPS does not contain design elements that *specifically* encourage geothermal (e.g., credit multipliers, geothermal bands, etc.), it does include at least two design elements that offer *indirect* support: (1) consideration of integration costs and reliability impacts, and (2) in-state TRC trading.

With respect to the first point, Nevada's RPS regulations require electric utilities to submit renewable energy contracts to the PUC for approval under a "just and reasonable standard." In making that determination, the PUC must consider several factors, including the utility's system peak capacity requirements, conditions and limitations of the utility's transmission system, and provisions in the power purchase contract such as scheduling requirements, unit contingent provisions, ancillary service requirements, and whether the utility provider has any economic dispatch rights. This language provides the utilities some discretion to select those contracts that offer the best combination of low-cost supply and attractive delivery profiles. Such considerations played a significant role in the success of geothermal energy in the utilities' first renewable solicitation. Specifically, as a result of utility concerns on the integration of wind power in the Nevada electrical grid, the utilities set a hard limit of 150 MW of wind in the initial renewables solicitation (50 MW in northern Nevada and 100 MW in southern Nevada). Sierra Pacific Power and Nevada Power cited company-performed, but not released, studies that sudden changes in the output of wind projects might cause the utilities to violate reliability standards of either the North American Electric Reliability Council or the Western Electric Reliability Council.²¹ Consideration of these reliability impacts led, in part, to the selection of certain geothermal projects, despite the fact that the geothermal bids came in at a higher cents/kWh level than did the wind bids.²²

In-state trading of TRCs has also been vital to the successful implementation of the Nevadan RPS, and its support for geothermal energy. Sierra Pacific Power and Nevada Power, both

²¹ Both companies note that they will reassess these limits as they gain operational experience with wind projects, and believe they may be able to offset some operational impacts with Hoover Dam hydro generation, which can respond quickly to changes in wind output.

²² Reportedly, the winning geothermal bidders will provide energy at 4.2-5 cents/kWh, with three contracts escalating at 1%, and one staying flat. The winning wind projects apparently quoted 3-4 cents/kWh, with 1% annual increases. The solar thermal electric plant is reportedly priced at 16-17 cents/kWh.

jointly owned by Sierra Pacific Resources (a holding company), are not interconnected to any significant extent, so renewable electricity cannot easily be transmitted between northern and southern Nevada. Furthermore, the vast majority of the existing renewable generation in the state is located in the north (in Sierra Pacific's service territory), and most proposals for new non-solar renewable generation have also come from projects in the north.²³ Because TRC trading is allowed for in-state renewable facilities, however, the utilities have been able to contract with renewable projects largely in the northern part of the state, with separate TRC trade between Sierra Pacific and Nevada Power, benefiting the geothermal projects located in the northern areas of the state.²⁴ While TRC trade is allowed, however, there are also strong restrictions to TRCs generated from facilities located outside of the state; this also has been important for geothermal because the Nevadan RPS might otherwise be met with inexpensive TRCs from out-of-state renewable generators.

Geothermal development in Nevada is likely to continue its fast pace as a result of the state's RPS, especially if wind integration continues to be a major concern. The contracting processes followed by the state's utilities, which includes acknowledgement of the different values that geothermal and wind bring to an electricity system, will indirectly encourage geothermal development. The success of geothermal in Nevada is also at least partly due to the geothermal projects already operating in the state, as the geothermal resource is proven, and there is a successful track record of geothermal project installation and generation.

- ? **California:** The Californian RPS requires utilities and competitive energy service providers to meet an overall 20% RPS by 2017, in 1% annual increments over an utility's existing renewable energy level, or baseline, to be determined by the CPUC. Geothermal energy is eligible under the Californian RPS, and development activity is set to increase based on the new policy. While procurements under the state's RPS have not yet begun, as an indication, Calpine received two contracts under the state's interim renewables procurements in 2002: one for 110 MW of on-peak and 55 MW of off-peak existing geothermal from the Geysers, and the other for 200 MW of existing geothermal from the Geysers.²⁵ California's RPS has no design elements that *specifically* encourage geothermal development, but how geothermal fares under the Californian RPS will depend in large part on how provisions of the legislation are implemented; these RPS elements might *indirectly* encourage geothermal development.

In particular, California's RPS legislation specifically requires electric utilities to select renewables on a "least-cost, best-fit" basis, including consideration of indirect costs from transmission investments and the costs of integrating and operating RPS-eligible renewable energy resources. The legislation also requires consideration of the delivery profile of the renewable generator (as-available vs. baseload, vs. peaking). The detailed implementation rules for these provisions have not been finalized by the CPUC, and even once these rules are

²³ In fact, Nevada Power did not receive enough renewable energy proposals in its 2001 renewable energy solicitation to comply with the Nevadan RPS.

²⁴ Note that there is some risk that renewable energy credit trading in Nevada may come to an early end, as the Nevada PUC put a sunset date of August 1, 2005 on TRC trading, unless the Nevada Legislature appropriates funding to allow the Nevada PUC to administer the program.

²⁵ The 110/55 MW contract was priced at an all-in cost of \$54/MWh.

set, there will be some discretion given to LSEs in the application of the rules. These details will have a sizable impact on the role that geothermal plays under the state's RPS.

Nonetheless, the fact that integration costs, capacity value, and delivery profiles are to be considered in the utilities' renewable energy procurements will likely be a significant boost for geothermal energy. Indeed, some analysts project geothermal to be a major player under the state's RPS. For example, Morris (2003) states that "no reasonable compliance scenario can be constructed without having geothermal generating capacity more than double from its current level by 2017, and provide at least 50 percent of the state's renewable electricity supply at that time." As in Nevada, continued geothermal market development will be aided by the presence of existing geothermal plants, and the knowledge that additional geothermal resource potential exists in the state.

An important detail in the Californian RPS is whether incremental production at existing geothermal sites is to count towards an LSE's baseline of renewable purchases, or can be used to meet the annual 1% increase above that baseline. In particular, geothermal facilities in service before September 26, 1996 can only adjust a LSE's renewable energy baseline, not contribute to the 1% annual incremental RPS requirement, unless specifically determined by the California Energy Commission (CEC) to be incremental. The RPS legislation instructed the CEC to recognize as "incremental" increases in electrical production that results from capital investments that have been made to reverse or slow declining output at a geothermal steamfield. In June 2003, the CEC announced it will limit the designation of incremental geothermal generation to generation resulting from eligible capital expenditures, such as repowering or refurbishing generating equipment, increasing steamfield production through increased water injection, or using geothermal energy more efficiently such as adding a binary bottoming cycle. The CEC will draw up more specific eligibility guidelines for determining incremental geothermal production before the end of 2003. Not clear is whether incremental geothermal will be eligible or not for payments from California's systems benefit charge fund—the CEC also will ultimately rule on this issue.

- ? **New Mexico:** New Mexico's RPS has not yet formally taken effect, so its impact on geothermal is impossible to assess at this time. The policy does, however, contain RPS design elements that would *specifically* encourage geothermal development. In particular, while every MWh of wind generation is to receive one TRC, geothermal energy will create two TRCs for every MWh of generation. Accordingly, if the "above-market" cost of geothermal energy is less than twice that of wind power, geothermal should compete well within this market. New Mexico is the only state so far to design an RPS that specifically encourages geothermal development in this way.

While New Mexico's RPS has been challenged before the New Mexico Supreme Court, and its fate is uncertain, it also contains design elements that might indirectly support geothermal energy. For example, under the rule, each utility must file with the New Mexico Public Regulation Commission a long-term plan for satisfying the RPS by November 2003. The plan must include a "diversified portfolio" with "reasonable levels" of wind, geothermal, solar, biomass and hydro, suggesting that renewable resource diversity will be an important element in complying with the RPS. In addition, utilities must explain, for each renewable

resource, if there is available transmission capacity, the dispatch flexibility of the renewable energy and capacity, and the reliability, availability, and environmental benefits of the renewable energy and capacity. By October 2004, and annually thereafter, each utility must file its proposed renewable energy portfolio, including power, energy and ancillary service requirements. Such provisions suggest that utilities will have some flexibility in determining which renewable resources they will rely on to comply with the RPS. There are no installed geothermal projects in New Mexico, however, and the geothermal resource is not as well understood as in California and Nevada. It is therefore unclear whether even these attempts to directly or indirectly encourage geothermal development will be enough to stimulate the necessary investments in resource assessment and site prospecting.

- ? **Arizona:** Arizona is one of a few states in which geothermal energy is not automatically eligible under the state's RPS. Apparently, this decision was based, in part, on evidence presented at the time the rule was established that the geothermal resource in the state was insufficient to support electricity production. This evidence derived from studies conducted in the 1980s and the 1990s, which indicated that geothermal resources in Arizona may be sufficient to support direct use geothermal such as aquaculture and greenhouse heating, but are perhaps not high enough to support electricity generation. In late 2002, however, Arizona Public Service (APS) received authorization from the Arizona Corporation Commission to count power from a geothermal facility towards the state's RPS. According to APS, Vulcan Power will build a 20 MW geothermal facility, with the first 2 MW planned to come on line in 2005. The Arizona Corporation Commission decided not to re-open their RPS regulations to make geothermal an eligible technology under the RPS on a blanket basis, as that may have taken several months to a year; instead, the Commission chose to approve a simple waiver for the specific geothermal project, which took only about a month. Even were geothermal eligible under the Arizonan RPS, however, there would be little incentive for significant development at this time. This is because the state's existing RPS has low purchase obligations that are mostly directed towards solar generation..

To sum up, geothermal has done well, or appears likely to do well, in states with RPS policies in which the geothermal resource base is known, and if other parameters besides the cost of energy delivery are incorporated into the RPS. These parameters include such elements as capacity value and whether the renewable resource is a "least-cost, best-fit match" with a utility's resource portfolio. The RPS policies in California and Nevada meet these requirements.

Even with these aspects of an RPS in place, however, if the geothermal resource itself is not well known, then the prospects for developing geothermal power plants may diminish; this may be the case in both New Mexico and Arizona. Consequently, there may be a need for other government policies or actions to explore the availability of geothermal resources in states where the resource is not proven or well known. This could involve programs sponsored and funded by state system-benefits charges, if they exist, or U.S. government agencies such as the Department of Energy.

5 Recommendations and Conclusions

This final chapter begins by providing an overall summary of the report highlights (Section 5.1). We then identify a set of general RPS design principles and specific best practices that we believe will be helpful in guiding future efforts to design and implement state RPS policies that will be supportive of renewable energy development generally, and geothermal development in particular (Section 5.2). Finally, we specifically discuss the role of geothermal energy in state RPS policies (Section 5.3).

5.1 Report Highlights

The RPS is becoming an increasingly popular policy to encourage renewable generation. As noted in Chapter 2, the RPS has been implemented in 13 states and in a number of countries overseas. Roughly a dozen additional states are considering such a policy. While wind power has been the primary beneficiary of state RPS policies to date, geothermal energy is also beginning to benefit from these policies.

There are both advantages and disadvantages to the RPS relative to other renewables policies. Chapter 3 shows that the RPS has some potential *theoretical* appeal compared to other policies: (1) the RPS can drive a known quantity of new renewable development and can ensure that there are buyers for that renewable energy, (2) it may help lower the total cost of that development by giving LSEs the flexibility to meet their purchase targets in the way they deem best, and encouraging competition among renewable developers, (3) an RPS can be competitively neutral if it is applied equally to all retail electricity suppliers, (4) an RPS may impose relatively low administrative burdens and direct administrative costs on those responsible for overseeing the policy, and (5) an RPS can be applied in both restructured and monopoly markets.

And yet we also find that the RPS has some potential disadvantages relative to other types of renewable energy policies: (1) due to its complexity, the RPS can be difficult to design and implement well, (2) an RPS may be less flexible in offering targeted support to renewable energy, (3) the exact cost impacts of an RPS cannot be known with certainty in advance, (4) operating experience with the RPS remains limited, (5) if an RPS does not lead to the availability of long-term power purchase agreements, the ability to finance new renewable projects will be limited and compliance costs may increase, and (6) an RPS is not *necessarily* suited to supporting diversity among renewable technologies, although an RPS can be designed to do so through the use of resource tiers and credit multipliers.

Our analysis leads us to conclude that, in order to assure that RPS policies are effective in supporting geothermal energy, geothermal must be eligible and the RPS should be well-designed. While eligibility of geothermal has not been universal, neither has it been controversial, since nearly all RPS policies that omit geothermal energy are in states where there is no developable resource. The features of an RPS that is effectively tailored to the unique characteristics of geothermal energy are discussed in Section 5.3. At least two states, Nevada and California, appear to have developed their policies in a way that will support geothermal development on a large scale; these experiences were discussed in Chapter 4.

As further highlighted in Chapter 4, of the 13 state RPS policies in existence today, Texas' approach has been the most successful so far in driving new renewable capacity at reasonable cost. The renewable energy requirements in Iowa and Minnesota have also been successful. The verdict on other state RPS policies is more mixed, either because the RPS has not been in place long enough to evaluate results, or because some success has been experienced but that success is still incomplete. These states include Arizona, California, Massachusetts, Nevada, New Jersey, New Mexico and Wisconsin. The RPS policies in three other states—Connecticut, Maine and Pennsylvania—have had little or no impact on renewable energy markets so far.

Clearly, a number of poorly designed RPS policies exist, and these policies will do little to advance renewable energy broadly, or geothermal energy in particular. The creation of well-designed RPS policies has proven challenging. This report has therefore identified some of the most critical design pitfalls that various existing state RPS policies have already experienced. These pitfalls, which can be avoided in the future, include narrow applicability of the RPS, poorly balanced renewable energy supply and demand conditions, insufficient duration and stability of the RPS, weak enforcement, and poorly defined contracting standards for regulated utilities in regulated markets and providers of last resort in competitive markets. In addition, we have highlighted market context criteria that, if not present, may undermine even a well-designed RPS, including the presence of credit-worthy long-term power purchasers, a stable level of political and regulatory support, and adequate and accessible renewable resource potential.

Though experience with state RPS policies is still limited, and much will be learned in future years, we have now clearly gained some knowledge of the conditions and design features necessary to make an RPS policy work. Just as important, we understand that getting most design elements right will not matter if one of the major design pitfalls is present. The lesson of this experience is that the details matter. Developing a successful RPS appears to require a clear delineation of objectives; attention to detail; sufficient analysis to assure a reasonable supply-demand balance; and a delicate balancing of design elements in response to objectives or design principles which sometime conflict.

To aid legislators and regulators in developing and implementing a successful RPS that will support geothermal markets, we offer three recommendations. First, policy makers may wish to clearly state the objectives of the RPS, especially in enabling legislation (if applicable). If there are multiple objectives, some guidance on prioritization may be helpful as well. Many states have failed to develop a clear set of objectives in advance of policy implementation, resulting in poorly designed RPS policies. Second, while legislative mandates, rather than RPS policies initiated via regulation, may result in greater regulatory certainty and predictability, legislators rarely have the expertise or time to devote the necessary attention to detail. Furthermore, the compromise typical of legislative work can easily result in an awkward RPS design rather than a fully integrated and balanced RPS policy. Because of this, there may be a role for the NGC and other organizations to develop, or support the development of sample RPS legislation and regulatory rules to guide orderly and balanced RPS development. Finally, we offer a series of preliminary design principles that might be used to guide legislators and policymakers in crafting successful RPS policies, and a series of best practices consistent with these principles. These principles and best practices are described in the following section.

5.2 Policy Design Principles and Best Practices

There is clearly no single, “ideal” way to design a state RPS. Nonetheless, most effective RPS designs seem to meet a number of minimum requirements. Our analysis of early RPS experience suggests a series of broad policy design principles and specific best practice design elements, identified and described below. These seven principles and related best practices derive from our own experience with RPS policies, from the stakeholder interviews summarized in Appendix B, and from the RPS design criteria and state evaluations presented in Chapter 4. We believe that these principles and best practices can be productively used to guide state RPS policy design.²⁶ Nonetheless, we also acknowledge that experience with RPS policies remains somewhat limited. It would therefore be appropriate to revisit these preliminary principles and best practices as additional experience is gained.

Before we begin, three additional items bear mentioning. First, the implications of some of the design principles and best practices differ depending on whether an RPS is applied in a regulated or restructured market context. Simply put, an RPS applied in a still-regulated market will, to some degree, require different design characteristics than an RPS applied in a restructured market; where such difference exist, we note them below. Second, the evaluation of specific RPS design options often requires balancing conflicting policy principles. While the principles and best practices developed below can guide design decisions, considered policy tradeoffs will remain essential. Finally, the reader will note that a number of the “best practices” are listed under more than one “principle.”

The recommended design principles are as follows. *A successful RPS policy will be...*

1. Socially beneficial;
2. Cost-effective and flexible;
3. Predicable;
4. Nondiscriminatory;
5. Enforceable;
6. Consistent with market structure; and
7. Compatible with other policies.

Principle #1: Socially Beneficial. A well-designed RPS will support increased renewable energy production, and thereby contribute to an improvement in environmental quality, to increased diversity in energy supply, to decreased risk, and to other politically chosen objectives.

Best practices for implementing this principle ensure that:

- ? The RPS standard and eligibility rules are structured such that the supply-demand balance is sufficiently binding to lead to new renewable generation.
- ? Renewable energy purchase requirements increase over time to result in increasing benefits.

²⁶ The seven RPS policy design principles described here have been loosely adapted from principles developed by consulting team members for the Massachusetts Division of Energy Resources and its RPS Advisory Group in 2000.

- ? An RPS is designed to increase the *net* amount of renewable electricity serving a state; attrition of existing renewables should be prevented, or offset by increased new renewable energy development.
- ? The RPS applies to as many potential suppliers of retail load as possible so that overall RPS targets can be met and cannot be easily bypassed.
- ? Fuel, technology, and vintage eligibility decisions are guided by policy objectives, by an assessment of the social benefits of particular resources and technologies, and by an evaluation of the need of those projects to receive extra-market revenue from an RPS.²⁷
- ? Customer-sited renewables projects that otherwise meet policy objectives and renewable energy applications that *save* electricity (e.g., geothermal heat) are considered for eligibility.
- ? Whether and under what conditions out-of-state projects are eligible is also guided by the social objectives of the RPS (of course, legal and practical constraints also apply).
- ? If policymakers want to assure a certain level of resource diversity among renewables, they might consider: (1) specific resource bands or tiers, (2) credit multipliers, or (3) complementary policy approaches (e.g., system-benefits charges, tax incentives, etc.).

Principle #2: Cost Effective and Flexible. A well-designed RPS will be implemented and administered in a straightforward, flexible, cost-effective, and not unduly burdensome manner.

Best practices for implementing this principle ensure that:

- ? Renewable energy purchase requirements are achievable given the available resource potential and other potential supply constraints, including the credit quality of the LSEs.
- ? Sufficient lead-time exists between when an RPS target is set (or increases) and when it takes effect to accommodate project development, permitting and construction timelines.
- ? An effective RPS is administered in a simple, straightforward fashion, minimizing regulatory intervention where possible.
- ? In most cases, tradable renewable credits are used for trading and verification purposes to maximize flexibility and lower compliance, transaction, and administrative costs (note that this *does not* require broad geographic eligibility).²⁸
- ? Where there are serious concerns about the costs of an RPS, due especially to potential supply scarcity or market power, policymakers may wish to consider establishing a cost cap.²⁹ A cost cap can mitigate concerns of unbounded RPS compliance costs. An effective

²⁷ States may have multiple underlying policy objectives, and those objectives may vary from state to state (e.g., local environmental improvement, reduction in global climate gasses, resource diversification, local economic development). As a result, best practices for geographic eligibility and technology eligibility depend upon the underlying objectives of the policy. At the very least (unless greenhouse gas reductions are the *only* objective), eligibility rules might be designed to encourage some local generation.

²⁸ In some limited cases, the use of tradable renewable energy credits may not be as important. In particular, the use of TRCs is not as essential in markets with vertically integrated regulated monopolies, located in states with few internal transmission constraints.

²⁹ For example, one cost cap design would grant LSEs the ability to pay a specified cents/kWh price instead of directly procuring renewable energy, with funds collected from the charge used to support renewable energy in other ways. Another approach would be to lower the aggregate targets for renewable energy if costs rise above a certain threshold.

cost cap is one that is set at a multiple of expected RPS compliance costs, so that LSEs are encouraged as much as possible to procure renewable energy to comply with the RPS.

- ? Compliance flexibility tools such as early compliance, banking, and annual (or, especially in the case of regulated markets, even multi-year or rolling-average) compliance periods are considered.
- ? Consideration is given to allowing RPS administrators *limited* flexibility to accelerate or slow the RPS percentage increases (with sufficient notice) in the event of well-defined and extreme circumstances.³⁰
- ? Clarity is provided on eligibility rules (including technology, fuel, vintage, and location) so market participants can assess eligibility *before* making significant financial commitments.³¹
- ? Consideration is given to establishing long-term contracting standards for regulated utilities and regulated providers of default and standard offer service, particularly if conditions suggest that long-term purchases will not result absent such requirements. Such standards should generally assure that the lowest-cost compliance strategies are used, and that even-handed comparisons of different renewable energy sources are made (considering direct and indirect costs).

Principle #3: Predictable. A well-designed RPS will provide market stability for all participants, reducing regulatory risk for generators and LSEs and improving the ability of renewable developers to obtain financeable long-term contracts.

Best practices for implementing this principle ensure that:

- ? Legislative and regulatory support for the RPS policy and its detailed design are strong, and that regular changes or even elimination of the policy are unlikely.
- ? RPS policies have renewable energy targets that are of sufficient duration and stability to minimize risk and enhance the likelihood of long-term contracting.³²
- ? Eligibility rules (including technology, fuel, vintage, and location) are well defined and stable, not subject to sudden change.
- ? Rules for the RPS are clearly defined, and that any material changes to the policy come with ample notice and lead-time, and that changes occur only within narrowly defined parameters.
- ? Enforcement mechanisms are established that provide confidence to renewable energy developers that LSEs will make their required renewable energy purchases.
- ? The RPS applies to all potential suppliers to any retail load covered by the RPS so that the overall RPS targets cannot be easily bypassed, creating uncertain aggregate renewable obligations.
- ? Clear long-term contracting standards are established for regulated utilities and regulated providers of standard offer and default service, if necessary, to help assure long-term contracting.

³⁰ In most cases, this allowance should be limited, clearly bounded, and exercised only with ample notice, to reduce regulatory risk.

³¹ In addition to clear eligibility rules in RPS legislation and regulation, this also includes providing pre-certification and advisory rulings to developers on the eligibility of proposed renewable facilities.

³² This includes assuring that a target percentage requirement, once achieved, is maintained long enough to allow the amortization of generation investments and support long-term financing.

Principle #4: Nondiscriminatory. A well-designed RPS will be applied fairly, consistently, and proportionately to all market participants and customers.

Best practices for implementing this principle ensure that:

- ? The RPS applies to all suppliers of retail load in the state, and thereby spreads the costs and benefits of the policy to all.³³
- ? The RPS applies to all potential suppliers to any retail load covered by the RPS so that the policy does not create barriers to competitive entry.
- ? The RPS applies on an energy basis, requiring megawatt-hour purchases of renewable electricity (or TRCs) rather than megawatt-denominated capacity targets.³⁴
- ? Prudently incurred RPS compliance costs are recovered in electricity rates.³⁵
- ? LSEs are required to meet the minimum RPS requirements for *each product* that they sell (product-based as opposed to company-based compliance).
- ? Eligibility decisions are made fairly and are guided by policy objectives, by an assessment of the social benefits of particular resources and technologies, and by an evaluation of the need of those projects to receive extra-market revenue from an RPS.
- ? Customer-sited projects that otherwise meet the eligibility criteria qualify for the RPS, and renewable energy applications that *save* electricity (e.g., geothermal heat) are also considered for eligibility.
- ? In designing contracting standards for regulated utilities and regulated standard offer and default service supply, renewable energy sources are compared with one another in an even-handed manner, considering the direct and indirect costs and attributes of each resource (including integration and deliverability characteristics).

³³ Some exemptions are possible without dramatically weakening the policy – publicly-owned utilities for instance – but will dilute the strength of the RPS.

³⁴ This is not to say that LSEs should place no value on “capacity,” simply that the RPS itself should require a certain amount or percentage of renewable electricity production, not simply renewable capacity additions. An RPS that only requires renewable capacity additions will provide no encouragement for performance, and will encourage LSEs to contract with renewable projects that operate at low capacity factors (but that nonetheless have high capacity ratings).

³⁵ In a regulated market or for regulated standard offer and default service providers, regulators would deem expenditures prudent through oversight of the procurement process. In competitive markets, the dynamics of competition provide automatic discipline on pricing, and suppliers will only be able to charge what the market bears; if suppliers incur imprudent costs, they automatically risk full recovery of costs.

Principle #5: Enforceable. An effective RPS will be enforceable, ensuring that the policy's renewable energy targets and broader goals are achieved.

Best practices for implementing this principle ensue that:

- ? Clear rules for enforcement in cases of non-compliance are established.
- ? For competitive providers, enforcement might include automatic financial penalties, suspension on the ability to sign up new customers, and supplier license revocation. For regulated standard offer and default service providers in restructured markets, the latter options are not available; instead, financial penalties can be combined with requirements for filing procurement plans and with authorized rate recovery only for prudently incurred costs.
- ? Consideration is given to alternative compliance mechanisms, in which suppliers are given the opportunity to pay a set price into a fund in lieu of procuring renewables, to offer a less punitive approach to enforcement.
- ? In regulated markets, the need for automatic financial penalties is lessened. Instead, strong oversight by regulators with control over renewable energy procurement practices and rate recovery may be sufficient. Nonetheless, clear implications for noncompliance ensure that obligated parties take the requirement seriously.

Principle #6: Consistency with Market Structure. A well-designed RPS will be consistent with and complement the structure of a state's electricity market, whether regulated or restructured.

Best practices for implementing this principle ensue that:

- ? The RPS applies to all potential suppliers to retail load so that the policy does not create barriers to competitive entry.
- ? In most cases, the RPS relies on renewable credits to demonstrate compliance, because the use of TRCs does not constrain least-cost contracting for commodity electricity (note that this *does not* require broad geographic eligibility).³⁶
- ? The RPS builds in compliance flexibility, especially in competitive markets, to account for the poor credit and uncertain load of competitive electricity providers.
- ? Clear long-term contracting standards are established for regulated utilities and regulated providers of standard offer and default service, with sufficient regulatory oversight to ensure prudent compliance practices.
- ? In regulated markets and for regulated providers of standard offer and default service, prudently incurred RPS compliance costs will be recovered in electricity rates.

³⁶ The only reasonable exception is in vertically integrated monopoly markets with few transmission constraints, or where an RPS applies to a single entity.

Principle #7: Compatibility with Other Policies. A well-designed RPS will be compatible with other applicable policies and regulations in the state and, where possible, the broader region.

Best practices for implementing this principle ensure that:

- ? Compliance flexibility mechanisms such as TRC banking are designed to minimize or mitigate conflicts with fuel source and/or emissions disclosure requirements, or other policies.³⁷
- ? Other renewable energy policies (system-benefits charges, tax incentives, etc.) are designed in a way that does not inappropriately distort the market for RPS compliance in favor of some market participants relative to others.³⁸
- ? In the presence of markets for emissions rights, renewable electricity or TRCs remain fully bundled, with all emissions rights intact and not sold to other parties (unless policymakers do not believe that a reduction in these emissions is a key goal of the RPS).³⁹
- ? State RPS rules are developed that authorize the RPS administrator to accommodate the possible creation of a federal RPS in the future.⁴⁰

5.3 The Role of Geothermal in RPS Policies

With few exceptions, the preliminary design principles and best practices described above do not specifically highlight the important role that geothermal energy might play under an RPS. This is by design. In earlier chapters to this report we found that several states have had success with an RPS, but that in many other states the verdict is mixed. The largest challenge with the RPS appears to be avoiding major design pitfalls. Therefore, our analysis of early RPS experience leads us to conclude that, to assure that RPS policies are effective in supporting geothermal energy, two conditions must apply: (1) geothermal energy must, of course, be eligible,⁴¹ and (2) the RPS should be designed well and implemented effectively in a broader sense.

In constructing a well-designed RPS, however, it will be important for regulators and legislators to recognize the unique features of geothermal energy: geothermal can provide large blocks of baseload power, but the resource is restricted to certain locations and substantial exploration costs and development time are required to prove the adequacy of the resource. To accommodate

³⁷ We have not previously discussed this issue in this report. For more information, see Grace et al (2001).

³⁸ It may be appropriate for policymakers to provide more support to certain renewable energy technologies than others. For example, photovoltaics may do poorly under a standard RPS, so other support mechanisms may be necessary. For any given renewable energy application under an RPS, however, other forms of support would ideally be provided on a proportionate basis to minimize market distortions. If this were not the case, outside financial support for a specific renewable energy project would give that project a competitive advantage over other renewable energy projects in the region, not based on cost-effectiveness but based on external policy forces. The most common example noted by geothermal stakeholders is the fact that the federal production tax credit for wind power does not extend to geothermal projects.

³⁹ We have not previously discussed this issue in this report. For more information, see Grace and Wiser (2003).

⁴⁰ We have not previously discussed this issue in this report. For more information, see Grace and Wiser (2003) or Wiser (2000).

⁴¹ To support on-site uses of geothermal energy, policymakers might also consider making customer-sited geothermal electricity and heat applications eligible under an RPS.

these features, RPS administrators might wish to place particular emphasis on certain design principles and best practices noted earlier. Although these design principles and best practices are not explicitly geothermal-specific, several best practices are particularly important from the perspective of geothermal energy:

- ? **Even-handed Comparisons of Different Renewable Sources:** Perhaps most importantly, in designing contracting standards for regulated utilities and regulated standard offer and default service supply, renewable energy sources would ideally be compared with one another in an even-handed manner, considering the direct and indirect costs and attributes of each resource (including integration and deliverability characteristics).⁴² This is required in Nevada and California, but is not strictly required in many other states, and may be necessary in valuing the benefits that geothermal sources provide to an electricity system relative to other renewable sources.
- ? **Geographic Eligibility:** Determinations on the eligibility of out-of-state renewable plants can also play an important role in whether or not a state RPS creates markets for geothermal energy. In states with little or no geothermal resource, a focus on broader regional, national or global objectives may support the eligibility of out-of-state projects, enabling access to a state RPS market for out-of-state geothermal resources. Conversely, in states with robust geothermal resources, specifying local objectives as preeminent may narrow the geographic scope and thereby leave in-state geothermal projects less susceptible to lower-priced out-of-state competition, but at the potential risk of incurring a legal challenge under the U.S. Commerce Clause.
- ? **Development Lead Time:** An important issue for the geothermal industry is the uncertainty that exists in the amount of geothermal resources that exist in certain states and resource areas. Geothermal companies are often reluctant to engage in detailed exploration of new geothermal resource areas unless they have a power purchase agreement, which can extend the development cycle of geothermal projects to three-to-five years. The prospect of a well-designed RPS that creates a growing and reliable long-term market for geothermal energy could help ameliorate these concerns by creating the incentives necessary for the industry to justify the long-term investments required for resource exploration. Because geothermal projects tend to have a longer and more costly development cycle, an RPS should be of sufficient duration, with steadily increasing RPS target levels, to give geothermal developers the confidence they need to invest in potentially costly and time-consuming geothermal resource prospecting and resource assessment activities.
- ? **RPS Target Increases and Compliance Flexibility Mechanisms:** Finally, some of the most cost-effective geothermal plants come in larger increments than other more modular renewable technologies (e.g., solar). As a result, an RPS that drives substantial geothermal development will be one whose targets are aggressive enough to allow the market to take advantage of geothermal plants that are able of achieve scale economies. For similar reasons, compliance flexibility mechanisms such as banking may be particularly important for

⁴² Fully competitive wholesale markets will generally internalize these costs, so that generators can compete head-to-head fairly based on TRC prices alone.

geothermal plants whose size may exceed the scale of the annual increase in the RPS target (allowing a larger project to count its production towards RPS requirements in future years).

Beyond those design considerations noted above, state RPS policies may not need additional *specific* encouragement for geothermal energy to adequately support development efforts.⁴³ This conclusion emerges from early state experience with the RPS and from the stakeholder interviews detailed in Appendix B. It is also driven, at least in part, by the fact that geothermal energy appears likely to compete with some success against other renewable energy sources in those states in which geothermal resources are available and the RPS is reasonably well designed. Nevada and California provide good examples. Because it is an attractive baseload resource, geothermal energy is likely to continue to play a significant role in some state RPS programs. If geothermal energy were eligible to receive the production tax credit, it would be in an even stronger position.

We acknowledge that this evidence is limited, however, and that other energy sources may prove to benefit more heavily from state RPS policies than does geothermal. Consequently, if relying on “market” forces to ensure geothermal development is deemed insufficient, either because other incentives (e.g., the production tax credit for wind power) skew the competitive playing field or because of a desire to assure a diversity of renewable energy sources, there are at least three methods by which to give geothermal energy more direct support under a state RPS: credit multipliers, technology bands, and resource contribution limits. New Mexico provides the best example of credit multipliers, providing a credit multiplier of two for biomass and geothermal for every kWh of such generation. Technology bands, on the other hand, require that LSEs meet their RPS obligation with a minimum amount of specific renewable resources. Arizona and Nevada provide the best examples, albeit for solar energy, and both contain specific solar purchase bands. Finally, states can restrict the contribution of certain lower-cost technologies under an RPS. For example, an earlier version of New Mexico’s proposed RPS would have limited the contribution of wind to 50% of that state’s overall RPS level.

⁴³ As discussed in Chapter 4, however, there may be a need for other government policies or actions to explore the availability of geothermal resources in states where the resource is not proven or well known. This could involve programs sponsored and funded by state system-benefits charges, if they exist, or U.S. government agencies such as the Department of Energy.

Appendix A: Detailed Summary of State RPS Design

Table A-1: RPS Requirement and Eligibility

	RPS Requirement	Eligible Resources	Eligibility of Out-of-State Renewables
ARIZONA	0.2% in 2001, rising 0.2%/yr to 1% in 2005, and to 1.05% in 2006, then to 1.1% for 2007-2012. The ACC will conduct a cost-benefit test in 2003 to determine whether the RPS should continue to increase after 2004, or stay at 0.8%. The Working Group will complete the cost/benefit analysis by June 30, 2003. At least 50% of the RPS must be new solar electricity through 2003, and at least 60% starting 2004.	New is defined as being generation installed on or after January 1, 1997. Solar renewables include: PV and solar thermal electric. Non-solar renewables include: solar hot water and air conditioning, and in-state landfill gas, wind, and biomass. Solar hot water and solar air conditioning can contribute to the non-new solar portion of RPS if the provider contributed to the installation of the system. R&D investments can reduce the RPS target by up to 10% in 2001 and 5% in 2002-03. Customer-sited applications are eligible.	Out-of-state solar is eligible if it is proven that the power reaches Arizona customers. Wind, landfill gas, and biomass must be in-state. Renewable energy credit multipliers provide additional incentives for in-state solar.
CALIFORNIA	IOUs must increase their renewable supplies by at least 1% per year starting January 1, 2003, until renewables make up 20% of their supply portfolios. The 20% requirement must be reached no later than 2017, but utilities may not have to meet the requirement if SBC funds are exhausted before the requirement is met: costs of renewables over a to-be-determined market price must be paid for by the state's SBC fund. Competitive Energy Service Providers (ESPs) are required to start increasing renewables by 2006 or when their direct-access contracts expire, whichever comes first. IOUs do not need to make annual RPS purchases until they are creditworthy.	Biomass, solar thermal electric, photovoltaics, wind, geothermal, fuel cells using renewable fuels, existing hydro under 30 MW, digester gas, landfill gas, ocean wave, ocean thermal, or tidal currents. New hydro only eligible if it does not require new or incremental appropriations or diversions of water. Geothermal existing before September 26, 1996 is eligible only for adjusting a retail electric provider's baseline quantity of renewable energy, not for meeting the incremental 1% requirements. Eligible biomass has fuel supply requirements. A restricted set of solid waste facilities is also eligible.	RPS legislation appeared to preclude out-of-state generation, except generators with a dedicated transmission line to the state. However, a CEC ruling clarified this language, and will allow out-of-state generators to be eligible assuming that those generators deliver electricity into California. Legislative clean-up language covering the eligibility of out-of-state generators is also under consideration.
CONNECTICUT	New Requirements After 2003 Legislation: Class I: 1% in 2004, 1.5% in 2005, 2% in 2006, 3.5% by 2007, 5% in 2008, 6% in 2009, 7% by 2010, and thereafter. Class II: 3% in 2004 and thereafter. Original Requirements: Class I or II Technologies: 5.5% in 2000, 6% in 2005, 7% in 2009 and thereafter. Class I Technologies: 0.5% in 2000 + 0.25%/yr to 1% in 2002, 6% in 2009 and thereafter.	Class I: solar, wind, ocean, low emission advanced renewable conversion, landfill gas, fuel cells, new run of river hydro less than 5 MW, and biomass with sustainability and emissions criteria. Customer-sited renewable generation is eligible. Class II: MSW, existing biomass that meets emissions criteria, and existing run of river hydro less than 5 MW.	Renewable energy sources within the NEISO, or within the jurisdiction of NY, PA, NJ, MD and DE provided that the DPUC determines that such states have a comparable RPS.
IOWA	105 average MW (~2 percent of 1999 sales) applied to investor-owned utilities.	Wind, solar, MSW, methane recovery, and biomass.	Out-of-state renewables were not eligible.

Table A-1: RPS Requirement and Eligibility

	RPS Requirement	Eligible Resources	Eligibility of Out-of-State Renewables
MAINE	30% of retail sales in 2000 (start of retail competition) and thereafter as a condition of licensing. PUC will revisit RPS within 5 years after retail competition (by 2005).	Fuel cells, tidal, solar, wind, geothermal, hydro, biomass, MSW facilities under 100 MW, and high efficiency cogeneration. Self-generation is not eligible. High efficiency cogeneration is defined as being constructed before 1997 and that meets an efficiency standard.	Initial RPS required that energy be physically delivered to the ISO-NE control area or the Maritimes control area. The PUC is in process of incorporating the NEPOOL certificates trading system. System will allow New England resources to be eligible, as will be renewable electricity production delivered to New England.
MASSACHUSETTS	1% of sales from new renewables by 2003 +0.5%/yr. to 4% in 2009. 1% increase per year thereafter until date determined by Division of Energy Resources (DOER). No RPS for existing renewables. DOER will adopt RPS standard if there is significant attrition. At legislature's request, DOER has pledged to assess the viability and impact of an RPS for existing renewables by Oct. 1, 2003.	New renewables with a commercial operation date after 1997, including: solar, wind, ocean thermal, wave, tidal, fuel cells using renewable fuels, landfill gas, digester gas, and low-emission advanced biomass, which is defined in detail in DOER RPS rule and includes fuel, technology, and emissions requirements. Existing generators that produce over an historic baseline of production are eligible for the excess production. Off-grid and customer-sited generation are eligible, as is co-fired biomass; DOER can add technologies after hearings.	Using NE GIS system. New England resources are eligible, as is renewable electricity production delivered to New England. Off-grid generation and behind-the-meter generation are eligible if located in-state.
MINNESOTA	For Xcel: initial requirement was 425 MW of wind and 125 MW of biomass by 2002. 400 MW more wind was subsequently required by 2012, which in 2003 was moved to 2006. Legislation in 2003 established a 10% renewable energy "goal" for all utilities in the state, but the 10% goal is a "requirement" only for Xcel; other utilities have to show "good faith efforts." Requirement starts at 1% in 2005, and increases by 1% each year until it reaches 10% in 2015. Not less than 0.5% must be met with biomass in 2005, increasing to 1% by 2010. Xcel's requirement is only binding if the additional renewables meet economic and reliability tests. For Xcel, 300 MW of the 10% requirement must come from wind by 2010. Of this 300 MW, 100 MW must be from small wind projects, while 100 MW of the remaining 200 MW may be owned by Xcel. Legislation also reduced earlier 125 MW goal for biomass to 110 MW, and required the signing of a specific 10-20 MW PPA for biomass.	Original Xcel Mandate: Wind and biomass. 10% Goal: solar, wind, hydro under 60 MW, biomass (including MSW), and hydrogen provided that after 2010 the hydrogen must be produced from renewable energy. Existing MSW under long-term contract is only eligible if a rate adjustment is made. The renewable fuels portion of cofiring is eligible, but only if the cofiring occurs in clean fossil plants. Eligible plants do not include those previously mandated for Xcel, so 10% requirement is additional to earlier requirements. PUC may establish credit multipliers.	For first 425 MW of wind and 125 MW of biomass, in-state was not strictly required, but was agreed upon by the parties. The next 400 MW of wind may be from out-of-state. Geographic eligibility for 10% goal is somewhat unclear in legislation. Appears to allow out-of-state to meet 10%, if electricity is sold into MN. Legislation also says that PUC may facilitate the trade in TRCs between neighboring states, if those neighboring states have a comparable RPS.

Table A-1: RPS Requirement and Eligibility

	RPS Requirement	Eligible Resources	Eligibility of Out-of-State Renewables
NEVADA	5% in 2003 and increasing by 2% every two years, ending at 15% in 2013 and thereafter. At least 5% of the RPS standard must be from solar (PV, solar thermal electric, or solar that offsets electricity, and perhaps even natural gas or propane).	<p>Solar (including solar that offsets electricity, and perhaps even natural gas or propane), wind, geothermal and biomass (includes agricultural waste, wood, MSW, animal waste and aquatic plants). Legislation in 2003 adds electricity produced from certain forms of waste heat or pressure under 15 MW in size as eligible. Certain small hydro plants (including pumped hydro used at mines) under 30 MW in size are also now eligible, with limitations on water diversion, date of installation, and water use.</p> <p>On-site renewable generation qualifies. Distributed renewable generation receives extra-credit multiplier (1.15), except that customer-sited PV receives a far larger credit multiplier (2.4). Waste tire plants are not eligible, except that customer-sited waste tire facilities that use “reverse polymerization” qualify for 0.7 credits per kWh. If an IOU helps fund an end-user’s solar thermal energy system that offsets electric use, then the IOU can count the consumption reduction against the RPS requirement.</p>	Eligible renewables can be located in-state or out-of-state with a dedicated transmission line to an in-state utility. The transmission line cannot be shared with more than one other non-renewable generator.
NEW JERSEY	<p>Class I or II Technologies: 2.5% with no sunset</p> <p>Class I technologies: 0.5% by 2001; 1% by 2006; +0.5%/yr increase to 4 percent by 2012 and then remaining at 4% indefinitely.</p> <p>A Task Force to the Governor of New Jersey has recommended strengthening the RPS significantly. It is expected that the Board of Public Utilities will initiate a rulemaking in 2003 to seek to implement those recommendations.</p>	<p>Class I: solar, wind, fuel cells, geothermal, wave or tidal, methane gas from landfill, and biomass facilities that are considered sustainable, based on NJBPU and DEP criteria.</p> <p>Class II: hydro facilities less than 30 MW and MSW facilities in regions that have retail competition. MSW facilities must meet New Jersey air pollution requirements.</p>	<p>Out-of-state generation is eligible as long as the power flows to PJM or NYISO control areas. Class II technology must come from areas open to retail competition.</p> <p>On-site generation can count towards the RPS if located in-state, has a 100 kW capacity or less, and is a Class I technology.</p>

Table A-1: RPS Requirement and Eligibility

	RPS Requirement	Eligible Resources	Eligibility of Out-of-State Renewables
NEW MEXICO	The Public Regulation Commission (PRC) passed the RPS rule on December 17, 2002, and the rule becomes effective July 1, 2003. The RPS requires 5% of retail sales to be renewable by 2006. RPS requirements increase by at least 1% a year, and utilities must reach 10% by January 1, 2011 and thereafter.	The New Mexico RPS places values on different renewables in order to encourage a diverse mix of renewable resources. The rates are listed below: - 1 kWh wind or hydro = 1 kWh toward compliance; - 1 kWh biomass, geothermal, LFG, or fuel cell = 2 kWh; and - 1 kWh solar = 3 kWh. Other restrictions on resources include: co-firing or fuel switching facilities may only count the biomass contribution toward the requirement; renewables developed in combination with a fossil fuel source may be eligible, but only the renewable portion counts toward the requirement; and, eligible hydro is limited to facilities of 5 MW or less.	Undefined “preference” given to in-state resources; otherwise, renewable electricity must be delivered in-state.
PENNSYLVANIA	For PECO, West Penn, and PP&L, 20 percent of residential customers served by competitive default provider: 2% in 2001, increasing 0.5%/year. For GPU, 0.2% in 2001 for 20% of default service customers increasing to 80% in 2004 and thereafter.	Solar, wind, sustainable biomass, ocean, geothermal. GPU is allowed some waste coal and one municipal solid waste plant.	Out-of-state generation is eligible.
TEXAS	Legislation established capacity targets: 1280 MW by 2003, 1730 MW by 2005, 2280 MW by 2007, 2880 MW by 2009 (of this, 880 MW can be from existing generation). Regulatory rules translate capacity targets into energy-based purchase obligations.	Solar, wind, geothermal, hydro, wave or tidal, and biomass including landfill gas. Self-generation is eligible if it meets metering requirements. To be eligible to produce TRCs and meet the incremental RPS goals, a facility must either be considered new or be small. A new facility must have an initial operation date after Sept 1, 1999. A facility is small if it has a capacity of less than 2 MW. Existing renewable facilities can offset an LSE’s renewable energy purchase obligations, but are not allowed to trade TRCs.	Out-of-state generation is not eligible for TRCs, unless there is a dedicated transmission line into the state. If the proper out-of-state transmission exists, these TRCs can count towards a supplier’s RPS requirement, but will not count towards the aggregate capacity goals established in the legislation.
WISCONSIN	0.5% by 2001, increasing to 2.2% by 2011; 0.6% can come from facilities installed before 1998.	Wind, solar, biomass, geothermal, tidal, fuel cell generation that uses only renewable fuel, and hydroelectric generation with a capacity of less than 60 MW.	Out-of-state is eligible.

Table A-2: Tracking, Penalties, Exemptions, and Funding

	Tracking System and Flexibility Mechanisms	Penalty Mechanisms	Exempt Providers	Supportive RPS Funding
ARIZONA	<p>LSEs can bank or trade renewable energy credits via compliance filings with the ACC. No central renewable energy credit registry or credit trading system exists or is planned. Excess purchases of renewables can be counted towards future annual RPS requirements or sold to other LSEs.</p> <p>Waivers can be requested.</p> <p>Arizona has a detailed system of credit multipliers for early installation before 2003, in-state installation or content, distributed solar, net metering, and utility green pricing.</p> <p>A multiplier works in the following way: if an LSE earns an additional 0.5 credit, then 1 kWh = 1.5 kWh. Multipliers are additive, to maximum of 2, through 2003. LSE can offset ½ of requirement in 2001, ¼ of requirement in 2002-03, and 1/5 of requirement thereafter if they invest in an Arizona solar manufacturing facility.</p>	<p>No explicit penalties until at least 2004. Starting 2004, if new solar requirements are not met, then the ACC <i>may</i> be able to fine an LSE 30¢/kWh; whether this is allowed is to be determined after the 2003 cost/benefit evaluation. The proceeds would then likely go to a solar electric fund to finance solar facilities. But, today, no penalties exist for non-compliance.</p>	<p>The RPS initially only strictly applies to IOUs. Electric Service Providers (ESPs) do not have to participate until 2004, but if they choose to participate before that date, then they may receive Environmental Portfolio Surcharge (EPS) funds.</p> <p>Cooperatives, which are subject to ACC regulation, are collecting the EPS and must submit an RPS plan to the ACC or request further exemptions. Some have requested exemptions, while others have achieved partial compliance.</p> <p>Municipalities and the Salt River Project are outside of ACC jurisdiction, so they are exempt.</p>	<p>ESPs, Coops, and IOUs can receive funds from the EPS fund to help fund the RPS. IOUs are also eligible for RPS support by reallocating DSM funds derived from the Systems Benefits Charge.</p>
CALIFORNIA	<p>Excess renewables procurement in one year can carry over to subsequent years, or inadequate procurement in one year can carry over to no more than the following three years. The CPUC is designing the details.</p> <p>The CEC is charged with the responsibility of designing and implementing an accounting system to verify compliance with the RPS. The CEC is expected to develop an electronic system for the long-term; whether TRCs are allowed to trade separate from electricity is to be determined by the CPUC later.</p> <p>IOUs are not required to make annual RPS purchases if they are not creditworthy.</p> <p>LSE obligations are limited by availability of SBC funds to cover above-market costs of purchases.</p>	<p>Legislation allows CPUC to punish non-compliance though their general authority. Details of non-compliance penalties, if any, have not yet been finally established by the CPUC.</p>	<p>Munis and irrigation districts are to implement RPS policies, but can do so in a flexible manner under the oversight and direction of their own governing boards.</p> <p>IOUs are not required to make yearly RPS purchases until they are creditworthy.</p>	<p>California's renewable energy SBC fund is to be used in large part to cover the above-market cost of LSE purchases of renewable energy under the RPS. LSEs are not required to meet RPS targets absent the availability of SBC funds for this purpose.</p>

Table A-2: Tracking, Penalties, Exemptions, and Funding

	Tracking System and Flexibility Mechanisms	Penalty Mechanisms	Exempt Providers	Supportive RPS Funding
CONNECTICUT	<p>Will use the NEPOOL Generation Information System (GIS), which allows full certificate trading in New England. Also allows participation in TRC programs within NY, PA, NJ, MD and DE if approved by CT PUC.</p> <p>Suppliers can make up deficiencies within the first three months of the succeeding calendar year.</p>	<p>Electric suppliers that fail to comply during a year must pay 5.5 cents/kWh; collected funds are to be used to support the development of Class I renewable technologies through deposit to the “Renewable Energy Investment Fund.” Such penalties are not recoverable in rates for distribution utilities.</p>	<p>Under original law, through 2003, providers of standard offer and default service were exempt; this is no longer the case beginning 2004.</p> <p>Municipals and cooperatives are exempt.</p> <p>Any supplier that provides electricity solely from Class II sources is exempt.</p>	<p>SBC for renewable energy exists in state. The Connecticut Clean Energy Fund would fund RPS-eligible projects, and is required to fund 100 MW of projects under long-term contract.</p>
IOWA	<p>Contract-path, with no banking. Legislative requirement for installed capacity.</p>	<p>No explicit penalty, except through traditional utility regulatory oversight and enforcement by the Iowa Utilities Board.</p>	<p>The capacity requirement was only placed on IOUs.</p>	<p>No.</p>
MAINE	<p>Presently, credit trading is not allowed. However, the PUC has opened a rulemaking for adopting the NEPOOL Generation Information System, which would allow full certificate trading in New England.</p> <p>If an LSE does not meet the 30% requirement, but has met at least 20% of the requirement during a compliance period, then the deficiency can be made up during the next compliance period so that over the two periods there is an average of at least 30% eligible resources. This “cure” period can be further extended for LSEs that can demonstrate ownership interest in new facility that will come on line within 2 years.</p> <p>If LSE service begins less than 6 months prior to December 31, compliance period extends to the next December 31.</p>	<p>Non-compliance can result in license revocation, fines, or whatever the Commission deems appropriate. If a retail electric provider is threatened with license revocation, the Commission may provide the retail electric provider the ability to make a payment into the “renewable resource research development fund.” The payment would be based on the difference in cost between ISO-NE market prices for eligible and non-eligible energy for every deficient kWh.</p> <p>Penalties can be waived if RPS could not be met due to market conditions.</p>	<p>Municipalities, cooperatives, and any entity exempt from electric restructuring do not have to meet the portfolio requirement.</p>	<p>No.</p>

Table A-2: Tracking, Penalties, Exemptions, and Funding

	Tracking System and Flexibility Mechanisms	Penalty Mechanisms	Exempt Providers	Supportive RPS Funding
MASSACHUSETTS	<p>Will use the NEPOOL Generation Information System (GIS), which allows full certificate trading in New England.</p> <p>LSEs can apply certificates to subsequent years. Excess certificates applied to a subsequent year cannot exceed 30% of a providers RPS requirement for that year.</p> <p>Early compliance mechanism existed for 2002.</p>	<p>Alternative compliance mechanism allows LSEs to pay 5¢/kWh to cover RPS requirements if they chose not to purchase renewable energy certificates.</p> <p>If an LSE does not comply with either the RPS or associated reporting requirements, the Commission will issue a public notice of the deficiency, will require an LSE to submit a 3-year plan detailing how future requirements are to be met, and can refer the LSE to the Department of Telecommunications and Energy Licensure, which can take further action, including license revocation.</p>	<p>Municipalities, cooperatives, and any entity exempt from electric restructuring do not have to meet the portfolio requirement.</p>	<p>SBC for renewable energy exists in state. The Massachusetts Renewable Energy Trust is considering how it will support the development of long-term renewable energy contracts under the RPS.</p>
MINNESOTA	<p>Original Xcel mandate: deadline-based capacity obligation.</p> <p>10% Goal: PUC may establish a TRC program. Upon creation of an RPS in a neighboring state with comparable resource eligibility, PUC may facilitate TRC trade between states.</p> <p>For all utilities except Xcel, the 10% is a goal, requiring “good faith efforts.”</p> <p>Xcel’s 10% requirement is subject to “least cost planning” requirements; if implementation of requirement will jeopardize reliability, or is uneconomic, then requirement may be waived.</p>	<p>Original Xcel mandate, and the new 10% goal, were required by legislation, and overseen by utility regulators. No explicit penalties beyond standard tools available to regulators.</p>	<p>Xcel energy required to meet original renewable energy purchases, and required to meet 10% renewable energy goal, if the requirement does not impose undue economic or reliability impacts.</p> <p>All other utilities in state must demonstrate “good faith efforts” to meet 10% goal; whether these efforts result in full or partial compliance is not yet clear.</p>	<p>Minnesota’s renewable energy fund is largely seeking to fund projects that would not otherwise succeed under the Xcel requirement and RPS.</p> <p>2003 renewables goal allows MN utilities that are in compliance with goal to apply 5% of their energy efficiency funds to support in-state renewable energy projects, with more restrictive eligibility rules for biomass.</p>

NEVADA	<p>The Nevada PUC approved the use of tradable renewable energy credits in November 2002.</p> <p>TRCs are valid for a period of four compliance years following the compliance year in which the TRC was issued.</p> <p>Dist. gen. receives extra-credit multipliers.</p> <p>LSEs obligated to meet “estimated” RPS requirements</p>	Administrative fines can be levied by the NPUC of at least the cost differential between the cost of renewable energy and the cost of system power, unless an LSE can claim an exemption because not enough renewable power is available despite best efforts. This fine cannot be claimed in a rate case or paid-off by retail customers.	Neither cooperatives nor municipal utilities are required to participate.	None.
NEW MEXICO	<p>New Mexico plans to use renewable certificates to track transactions between utilities and renewable suppliers. Certificates may be traded, sold or transferred.</p> <p>Unused certificates may be applied for no more than four years from the date of issuance.</p>	The PRC’s order says that specific penalties will be developed.	Rural cooperatives and munis are exempt from the RPS. Texas-New Mexico Power Company is exempt until its all-requirements contract expires or is renegotiated.	None specified.
NEW JERSEY	<p>Legislation allowed the BPU to develop a renewable energy trading program in consultation with the New Jersey Department of Environmental Protection. Such a system has not yet been developed. The state is working with PJM to develop an energy tracking system within the ISO that may or may not include credit trading.</p> <p>Flexible penalties for non-compliance.</p>	An LSE that is not in compliance is required to make-up that shortfall in the following year. An LSE that remains out of compliance may be required to submit quarterly reports and may be subject to license revocation or fines, or be unable to take new customers. If a basic general services provider (BSG) is fined, they will be prohibited from recovering fines in rates.	Public power agencies do not have to comply with RPS requirements. Electric power suppliers and BGS providers both must comply with RPS requirements.	SBC for renewable energy exists in state. The administrator does fund RPS-eligible projects located in New Jersey.

Table A-2: Tracking, Penalties, Exemptions, and Funding

	Tracking System and Flexibility Mechanisms	Penalty Mechanisms	Exempt Providers	Supportive RPS Funding
PENNSYLVANIA	Tracking system not addressed. RPS percentage requirements may be decreased if renewable requirements increase default service costs more than 2 percent.	None specified.	All but limited number of competitive suppliers serving default service load are exempt.	SBCs for renewable energy exist in state. These funds may support renewable projects that are eligible under the RPS.
TEXAS	First state to create and use tradable renewable credits, administered by the Electric Reliability Council of Texas (ERCOT). ERCOT awards TRCs to registered renewable facilities on a quarterly basis, keeps track of retailers' TRCs, retires TRCs that are over 3 years old, and allocates the statewide renewable energy responsibility to competitive retailers. All TRCs have a compliance life of 3 years, after which ERCOT will retire the credits. Early compliance allowance and 3-month settlement period are also provided. Before 2003, an LSE is allowed a 10% TRC shortfall in any given year. After 2003, no shortfalls are allowed. If an LSE has a pre-2003 deficit, then the shortfall must be made up in the next compliance period.	Penalty for noncompliance is set at the lesser of \$50/MWh per deficient TRC or 200 percent of the average market TRC value for the deficient credits. The retailer must prove the average market value to the Public Utilities (PUCT). The PUCT may not impose a penalty on an LSE if the PUCT determines that "events beyond the reasonable control" of the retail electric provider prevented complying with the RPS. The PUCT defines such events as "weather-related damage, mechanical failure, lack of transmission capacity or availability, strikes, lockouts, actions of a governmental authority that adversely effect the generation, transmission, or distribution of renewable energy from an eligible resource under contract to a purchaser," but not failure of the spot or short-term market to supply renewables.	Municipal power producers do not have a TRC requirement unless they open their markets to retail competition, but can sell TRCs to obligated LSEs.	None.
WISCONSIN	Utilities in excess of their RPS requirement can apply to the PUC for TRCs that can be traded with other providers or banked to apply to subsequent RPS requirements. Unlimited banking is allowed. Total retail sales determined by calculating a 3-year rolling average of LSE's retail sales.	Fines of \$5,000 - \$500,000 can be levied for non-compliance. Wisconsin PUC also has typically regulatory powers over regulated utilities.	IOUs, municipalities, and cooperatives are all subject to the RPS requirement; limited exemption given to certain providers.	State has SBC fund that is targeted at non-RPS eligible resources.

Table A-3: Compliance, Cost Caps, Unusual Aspects, and Status

	Compliance Verification and Monitoring	Rate or Cost Caps and Recovery Allowances	Unusual Aspects of the RPS	Legislative and Regulatory Status
ARIZONA	<p>A working group established by the ACC will evaluate the cost/benefit of the RPS in 2003 to see if the standard should continue to increases beyond 2004.</p> <p>LSEs must give reports on sales and their power portfolios demonstrating compliance with RPS on an annual basis.</p>	<p>The ACC will evaluate the RPS from a cost-benefit perspective in 2003 to determine whether increases in the RPS in 2004 and beyond should continue.</p> <p>The availability of EPS and SBC funds has to some degree capped the aggregate cost of the RPS so far.</p>	<p>Set-aside requirement for new solar energy.</p> <p>Arizona's RPS was established via ACC regulation, not legislation.</p> <p>RPS cost recovery through SBC and EPS.</p> <p>R&D investments allowed to reduce RPS requirements.</p> <p>Use of multiple credit multipliers.</p> <p>Solar hot water and air conditioning are eligible.</p>	<p>Commission order in April 2000. Rulemaking later in 2000, completed in March 2001. This RPS was a revision and expansion to a solar RPS passed in 1996. Comprehensive review of policy in 2003 to determine RPS status and level from 2004 onward.</p>
CALIFORNIA	<p>Electrical corporations must prepare and update RPS procurement plans that are reviewed by the CPUC. The plans must show that the corporation can satisfy its RPS requirements.</p> <p>The CPUC will review the results of every electrical corporation's renewable solicitation to determine if the contract terms of bidders are acceptable.</p>	<p>The CPUC must set benchmark prices for renewable energy purchases. Renewable costs over this to-be-decided long-term market price will be covered by the SBC fund. The CPUC will establish the benchmark after the closing date of a competitive solicitation. RPS targets need not be met if sufficient SBC funds are not available.</p>	<p>Relies on benchmark market price and funding of costs above that benchmark by state's existing SBC fund for renewable energy.</p> <p>Munis and irrigation districts required to implement their own RPS requirements.</p>	<p>Legislation passed in late 2002. RPS regulatory rules to be established by CPUC and CEC in 2003. Ongoing procurement decisions to be made throughout life of program.</p>

Table A-3: Compliance, Cost Caps, Unusual Aspects, and Status

	Compliance Verification and Monitoring	Rate or Cost Caps and Recovery Allowances	Unusual Aspects of the RPS	Legislative and Regulatory Status
CONNECTICUT	Annual case to determine whether distribution utilities have met RPS. Annual compliance demonstration procedure.	5.5 cents/kWh penalty effectively sets cap for TRCs, and therefore the RPS. Distribution utilities will recover costs of, at a minimum, the 100 MW of long-term renewable contracts required by 2007.	Under original requirement, standard offer and default service providers were exempt. Under revised 2003 law, the exemption ended. Not later than 2007, distribution utilities must file with the DPUC one or more long-term contracts totaling at least 100 MW with new Class 1 technologies that receive funding from the "Renewable Energy Investment Fund" and whose price is not more than 5.5 cents/kWh over wholesale prices. Costs are recoverable in rate provided that the contracts are long enough to allow financing (not less than 10 yrs). Renewable energy sources within the jurisdictions of NY, PA, NJ, MD and DE are eligible provided that such states have a comparable RPS. May be able to simply purchase TRCs from those states.	Legislation in 1997. Licensing regulation in 1998 established certain RPS provision. Revisions to lay in 1999. RPS began on July 1, 2000. Significant revisions to law in 2003.
IOWA	About 250 MW of renewables (mostly wind) came on-line in response to the requirement. The program is currently inactive.	None specified. Cost of renewable energy procurement recovered in rates.	First state to impose a renewables requirement, although it took years of litigation before it was implemented.	Legislation established in 1981, and revised in 1991. Multiple legal challenges occurred.
MAINE	On or before May 1 of each year, a retail electric provider must submit a report showing program compliance. The Commission can request additional information or choose to audit a retail electric provider.	None.	Fossil cogeneration is eligible. Voluntary payment into renewable energy R&D fund to avoid license revocation if not in compliance with RPS. Multiple flexibility mechanisms.	Restructuring legislation in 1997. PUC worked out design details in 1998. Revisions to RPS in May 1999. RPS took effect March 1, 2000.
MASSACHUSETTS	LSEs must submit annual compliance filings.	Alternative compliance mechanism allows LSEs to pay 5¢/kWh to cover RPS requirements if they chose not to purchase renewable energy certificates. Funds collected through this mechanism will be used by Massachusetts Renewable Energy Trust to support renewable energy.	Alternative compliance mechanism.	Restructuring legislation in 1997. Rule finalized in 2002. RPS began in 2003.

Table A-3: Compliance, Cost Caps, Unusual Aspects, and Status

	Compliance Verification and Monitoring	Rate or Cost Caps and Recovery Allowances	Unusual Aspects of the RPS	Legislative and Regulatory Status
MINNESOTA	<p>Original Xcel Mandate: No need for annual compliance plans because deadline-based capacity obligation applies to one utility.</p> <p>10% Goal: By June 2004 PUC must issue order that details criteria to measure utility efforts. Every 2 years, PUC issues report to legislature on utility efforts. Utilities must periodically file reports that indicate plans, activities, and progress toward meeting goal.</p>	<p>Original Xcel Mandate: None specified. Cost of renewable energy procurement recovered in rates.</p> <p>10% Goal: PUC may develop TRC program. In doing so, the PUC shall develop a system that limits the cost of TRCs. Additionally, 10% requirement as applied to Xcel is only binding if certain economic and reliability tests are met.</p>	<p>Wind and biomass requirement for Xcel Energy applied as part of nuclear waste disposal settlement.</p> <p>10% goal applies “requirement” on Xcel, and “good faith efforts” on other utilities in state.</p> <p>TRC program with other states may develop if neighboring states have comparable RPS.</p> <p>Detailed specification of certain wind and biomass purchases under Xcel’s 10% goal.</p> <p>Partial use of EE funds to support in-state renewables.</p>	<p>Law in 1994 required Xcel to meet renewable obligations. 1999 PUC order determined that 400 MW for wind by 2012 was in the public interest, and 2003 order determined that 400 MW must be built by 2006. 2003 legislation established 10% renewable energy goal.</p>
NEVADA	<p>LSEs must submit an annual report to the NPUC, and must submit quarterly reports to the TRC trading program administrator stating the renewable generator and the number of TRCs purchased from each renewable generator.</p>	<p>No explicit cost cap, but individual contracts are to be evaluated and approved by the NPUC.</p> <p>If contracts for renewable energy are found to contain acceptable prices by the NPUC, then the provider is allowed to recover all associated costs.</p>	<p>5% solar energy set-aside and extra-credit multipliers for customer-sited renewables and customer sited PV in particular.</p> <p>Solar offsets are eligible, as is certain forms of waste heat and pressure.</p> <p>Metering not required for systems under 10 kW and for solar thermal systems.</p> <p>Contracts must exceed 10 years.</p>	<p>Legislation signed in 2001. Initial RPS rules completed in 2001; revised in 2002. Legislation in 2003 altered provisions for customer-sited generation, and altered eligibility rules more generally. RPS began in 2003.</p>
NEW JERSEY	<p>ESPs and BGS providers must file a report every March 1 showing that their RPS requirements were met for the previous calendar year.</p>	<p>A BGS provider’s RPS compliance costs have to be justified to the BPU if a provider wishes to recover them in retail rates.</p>	<p>Hydro and MSW facilities qualify only if in a state that allows retail competition.</p> <p>Detailed criteria for biomass eligibility.</p>	<p>Restructuring legislation in 1999. Interim rule adopted in 2001. RPS began in fourth quarter of 2001. Task Force made recommendations in 2003 for strengthening of the RPS; BPU may consider implementing recommendations in 2003.</p>
NEW MEXICO	<p>Utilities must file a long-term strategy with the PRC. The plan must show a diversified renewable portfolio. Utilities must also file an annual power portfolio plan and an annual portfolio summary. RPS compliance must be addressed in both.</p>	<p>If a utility portfolio filing is approved, the utility is entitled to 100% recovery of any stranded costs that result from its efforts to meet the RPS.</p>	<p>RPS established via regulation, not legislation.</p> <p>The PRC order requires utilities to offer a voluntary renewable energy tariff for customers who want to purchase additional renewables.</p> <p>Credit multipliers to encourage renewable resource diversity.</p>	<p>Original RPS delayed until 2007. PRC order revising original RPS finalized in late 2002, and takes effect in mid-2003. RPS begins in 2006. RPS currently being challenged in court.</p>

Table A-3: Compliance, Cost Caps, Unusual Aspects, and Status

	Compliance Verification and Monitoring	Rate or Cost Caps and Recovery Allowances	Unusual Aspects of the RPS	Legislative and Regulatory Status
PENNSYLVANIA	None specified.	RPS percentage requirements may be decreased if renewable requirements increase default service costs more than 2 percent.	Purchase requirement applies only to certain competitive default suppliers. RPS percentage requirements may be decreased if renewable requirements increase default service costs more than 2 percent.	Restructuring legislation in 1996. Individual utility settlements in 1998.
TEXAS	ERCOT submits an annual report to the PUCT. The report covers new facilities, tracks MWh from new renewable facilities, and tracks competitive retailer participation and compliance.	Effective cap of 5 cents/kWh given penalty mechanism. A renewable facility's above-market cost cannot be included in a municipality retail provider rate, a cooperatives base rate, a power cost recovery factor, stranded cost recovery mechanism, or any other fixed or variable end-user charge to be eligible for the RPS.	Capacity targets converted to energy by conversion factor of 35 percent for 2002 and the first three quarters of 2003, and then adjusted to reflect generator performance data. Conversion factor readjusted every two years. RECs only for new renewable generation, but existing renewable generation can reduce RPS requirements for suppliers.	Legislation in 1999. Final rule complete in December 1999. RPS begins in 2002, with early compliance in 2001. Small changes to TRCs program made in 2003.
WISCONSIN	Annual compliance filings covering the previous calendar year are due every April 15 th .	Prudently incurred costs are recovered from ratepayers.	Credit trading allowed only for utilities that over comply with their RPS requirement.	RPS legislation passed in 1999. Final regulation adopted April 2001.

Appendix B: Stakeholder Interview Results

Methodology and Objectives

In order to supplement our own understanding of the RPS, we conducted a series of interviews with a cross section of stakeholders. These interviews provide a diverse set of perspectives on the value, appropriateness, and design of RPS policies. We also sought comments on a draft of our state RPS evaluation criteria, discussed in more depth in Chapter 4. The survey used to guide the interviews is provided in Appendix C. The survey contains 18 questions, and the interview results are described below. Because we promised not to attribute interview responses with specific interviewees, our summary is necessarily broad.

We specifically sought to include stakeholders with a wide range of perspectives on the role of policy mandates in supporting renewable energy, and a diversity of opinions on the efficacy of the RPS in particular. After creating a proposed list of interviewees, members of the NGC helped us finalize our interview list. We sought to interview 12 stakeholders that fell in several basic categories: (a) geothermal companies and trade associations, (b) state PUCs and energy offices, (c) obligated entities (i.e., utilities and other load serving entities), and (d) consumer and environmental advocates. We placed particular attention on interviewing stakeholders located in states with substantial geothermal resource potential. Interviewees included: Dan Schochet (Ormat), Christine Watson (Utah Energy Office), Dick Byers (Washington Utilities and Transportation Commission), Marilynn Semro (Seattle City Light), Tom Rawls (Green Mountain Energy), John Nielsen (Land and Water Fund of the Rockies), Chris Wentz (New Mexico Department of Minerals), Colin Duncan (Sierra Pacific Power Co.), Virinder Singh (PacifiCorp), Liz McDannel (Southern California Edison), Karl Gawell (Geothermal Energy Association), and Bob Cooper (Nevada Attorney General's office).

Overall Assessment of the RPS

In the first part of each interview we posed general questions about the value of renewable energy policies, the advantages and disadvantages of the RPS in particular, and whether other renewable policies might be more effective than the RPS.

Almost uniformly, the twelve interviewees expressed support for policies to promote renewable energy technologies. Concerning the RPS, no interviewee expressed outright opposition to the policy, and four respondents believe that the RPS is the best policy option. The other eight interviewees listed both positive and negative features of the RPS. The positive feature of an RPS that many people cited was the creation of a long-term market for renewables, while some interviewees said the mandate aspect of an RPS was the main negative feature. One person expressed concern that an RPS may force development of renewable energy resources in regions that do not have enough transmission, or may stimulate renewable energy resources that may not be needed by a utility or may not be a good match for a utility's resource portfolio (e.g., the RPS might stimulate intermittent energy sources when only peaking power is needed).

When asked whether other policy options might be more effective than an RPS, most interviewees did not favor one renewable energy policy over all others, but instead saw different policies as useful in different circumstances, and often as complementary tools. Some noted that renewable energy may be developed under IRP, but that IRP-derived support for renewable energy is not guaranteed. In fact, one commenter noted that the largest utility in their state has called for renewable energy development in their IRP for several years, but has not delivered on those plans. Others saw IRP as complementary to an RPS because IRP can create the long-term planning framework for renewable energy, with the RPS acting as a backstop. Interestingly, people saw the RPS in these circumstances differently, with some viewing the RPS as a ceiling and some seeing the RPS as a floor.

Some of the interviewees specifically indicated that the PTC should be expanded to include other technologies besides wind power, as the combination of a PTC and an RPS benefits wind power over other renewable energy technologies. Others discussed state tax credits, but at least one interviewee said that such incentives have not been effective at the state level because the maximum incentive amount is typically too small to permit large-scale renewables deployment. Some interviewees also thought that expedited permitting for renewable energy projects should be explored. Still others simply said that nothing is more effective than an RPS in catalyzing a market for renewable energy.

State RPS Assessment

The second section of the interviews included two questions:

- ? Of the states that have an RPS today, are there any you believe are likely to be particularly successful? Why do you think these state RPS policies are likely to be successful?
- ? Of the states that have an RPS today, are there any you believe are not likely to be successful? Why do you think these state RPS policies are not likely to be successful?

Not everyone was familiar with many of the state RPS policies. The opinions expressed were therefore somewhat vague and often based on anecdotal information. Many respondents cited Texas as the state with the most successful RPS. Typical reasons cited for the success of that state include the size of the obligation, the increasing level of the obligation over time, the availability of good wind resources, a well-functioning TRC system, and well-established and effective rules. One interviewee did note, however, that transmission problems have emerged in west Texas. Nevada is also cited as a potential success, with a sizable but achievable RPS target and a TRC system. However, concern was expressed that the credit troubles of Nevada's two utilities may make it difficult for those utilities to fully comply with the policy. New Mexico was also seen as likely to have a successful RPS because of strong support by that state's Public Service Commission. Another commenter believed that New Jersey and Massachusetts would ultimately have successful RPS policies, though they will be slow to develop.

Less opinion was voiced about states with RPS policies that are viewed as not successful. One interviewee noted that Maine's RPS is set at a lower level than the amount of eligible resources. Another commenter indicated that the renewable energy purchase standards under the New Jersey RPS may have been set at too low of a level in the early years, and may therefore not result in substantial additions of new renewable capacity. In addition, one respondent asserted

that because renewables are not widely available in Massachusetts and New Jersey, and may be high-cost, a system-benefits charge may be necessary in addition to the RPS.

California's RPS received mixed reviews. Some noted the high level of the RPS standard and the use of system-benefits funds as positives. Others, however, are concerned about the complexity of the policy and mentioned as problematic the fact that much of the implementation will be conducted through rulemakings by two state regulatory agencies (the California Energy Commission [CEC] and the CPUC). One person expressed frustration at the level of complexity of the policy, calling it "hugely burdensome" and a "huge mess."

Best-Practice RPS Design

The survey then asked a series of questions on specific design features of the RPS. Interviewees again expressed a range of opinions in response to these questions.

- ? **Support for Existing and/or New Renewable Resources:** Most respondents believe that existing renewable generating plants should be eligible for an RPS, but that the RPS should be set at a high enough level to drive the development of new renewable resources. Utilities especially wanted assurances that their existing investments in, or power purchases with, existing renewable plants would be eligible under state RPS policies. Those who only want the RPS to support new renewables expressed concerns about supporting technologies that may not need policy support, such as large hydropower facilities.
- ? **Resource Eligibility:** All respondents support the inclusion of geothermal, solar, and wind under RPS programs. There was a wide range of responses on whether to include other technologies. Most respondents support including biomass, although some want tight definitions on what are considered eligible biomass fuels; other interviewees want tight emissions standards for biomass as well. The interviewees were also split on whether to include hydropower. Three interviewees oppose including hydro, two support including only "incremental" hydro, and three others support including hydropower but only with significant attention paid to the implementation details (e.g., how to treat out-of-state hydro). A number of respondents oppose including waste-to-energy or tire-burning generating plants in an RPS, but one stakeholder would include these technologies if they had to meet tight emissions standards.
- ? **Eligibility of Out-of-State Resources:** Most interviewees supported making out-of-state renewables eligible, within some geographic limits, e.g., within a power pool or within a region. One person suggested giving in-state renewables bonus credits (more than 1 MWh of credit for every 1 MWh of actual generation), as a means of respecting the Interstate Commerce Clause but still giving some preference to in-state facilities. Less support was given to making renewables from anywhere in the country eligible for a state RPS, partly because of a desire to encourage renewables at least in a particular region, and partly because of concerns over double counting or gaming. Some suggested that renewable electricity must be delivered into the state with the RPS (thereby restricting eligibility to resources that are able to deliver their electricity into the state without undue costs), and expressed skepticism about allowing TRCs to be imported into a state without the associated renewable electricity.

- ? **Compliance Verification and TRCs:** All but one respondent supports tradable renewable certificates, asserting that the use of TRCs can avoid transmission constraints, widen a geographic market, ease compliance for obligated entities, and help ensure that higher quality and potentially lower cost renewable energy resources are used. The interviewees diverged on the appropriate geographic eligibility of credit trading, however: two people suggested that credit trading be limited to adjoining states, one person suggested a region, another person suggesting a power pool, and a final person expressed support for national trading of TRCs, as long as they can be tracked accurately. One commenter, while supporting TRCs, noted that a sink still must be found for the electrons, and that additional transmission may be needed to access those areas that are rich in renewable resources.

Supporting Geothermal Energy with an RPS

We then asked specific questions on the use of an RPS to directly support geothermal energy. The first question in this sequence asked the interviewees whether they believe that RPS policies should be designed to encourage diversity among different renewable sources. The interviewees were split on whether diversity among renewable energy technologies should be encouraged in a state RPS policy. Some were supportive, citing the use of technology set-asides such as the solar provisions in Arizona and Nevada, or granting certain technologies additional credit such as the approach used in New Mexico. One utility interviewee thought it should be left to individual states to decide. Three others interviewees were opposed to these kinds of provisions, believing that they would raise the costs of complying with an RPS, and that such preferences work against the goal of an RPS to promote vigorous competition among all eligible sources.

Next, we asked about the barriers that exist to the use of geothermal energy in meeting RPS obligations. Interviewees cited a number of barriers, such as higher costs of energy for geothermal; permitting difficulties, especially on public and tribal lands; the lack of geothermal eligibility for the federal PTC; that geothermal is a baseload resource and there is more of a need for peaking resources; perceptions that geothermal energy may not be entirely renewable or sustainable, given resource depletion experience at the Geysers; and lack of public knowledge about the environmental benefits of geothermal energy.

Finally, we asked whether the interviewees believe that RPS policies should be designed to specifically encourage geothermal energy, and if so, how. Most interviewees did not support directly encouraging geothermal energy under a state RPS, such as through the use of a separate tier for geothermal sources. One person said they would support giving geothermal additional renewable energy credits, since geothermal is not eligible for the federal PTC. Two interviewees said it should be left to states to decide whether certain renewable technologies need specific policy encouragement. Four interviewees, while not in favor of direct support mechanisms for geothermal in a state RPS, would support other measures to improve the competitiveness of geothermal under a state RPS, such as state or federal tax credits and ranking renewable energy resources on the basis of “all costs” in any utility bidding solicitations held to procure renewable resources. One interviewee suggested that the use of an IRP process that recognizes the risk associated with possible fossil-fuel price escalation would be an appropriate tool for indirectly encouraging geothermal energy.

Appendix C: Stakeholder Interview Script

Introduction

The National Geothermal Collaborative is an organization sponsored by the U.S. Department of Energy that consists of a broad range of public- and private-sector stakeholders; the organization is exploring the barriers to environmentally, economically, and politically sustainable geothermal energy production. The National Geothermal Collaborative has recently contracted with Exeter Associates, Sustainable Energy Advantage, and Wisser Consulting to help it understand and evaluate state renewables portfolio standards as a tool to encourage geothermal electricity development.

As part of our evaluation, we've been asked to interview a representative range of stakeholders that may have opinions about the appropriateness, value, and design of state renewables portfolio standards. Here we define renewables portfolio standards, or RPS, as policies that require utilities and other retail electricity suppliers in a state to procure a certain fraction of their electricity from eligible renewable electricity sources. As you may know, 15 states have created these kinds of policies so far: Arizona, California, Connecticut, Hawaii, Illinois, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas and Wisconsin.

If you are available, we'd like to ask you a few questions about your opinions on this type of renewable energy policy. We want to assure you that your specific responses to our questions will be kept in confidence. In our final report, we intend to identify those individuals who we interviewed without attributing any particular interview response with the specific individual. Instead, our write-up will describe the results of the interviews in more general terms.

Overall Assessment

We'd first like to ask you about your general views on renewable energy policies and the RPS.

1. Do you believe that there should be policies to support or encourage renewable energy development?
2. There are a variety of ways that a state might support the development of renewable energy markets, such as the renewables portfolio standard, tax incentives, integrated resource planning, and so on. In your opinion, what are the advantages and disadvantages of an RPS compared to other types renewable energy policies?
3. Are there renewable energy policies besides an RPS that you believe might be more effective in promoting renewable energy? If so, which policies and why?

State RPS Assessment

We'd now like to ask two more detailed questions about the 15 states that have already established an RPS, to the extent that you are familiar with these policies.

4. Of the states that have an RPS today, are there any you believe are likely to be particularly successful? Why do you think these state RPS policies are likely to be successful?
5. Of the states that have an RPS today, are there any you believe are not likely to be successful? Why do you think these state RPS policies are not likely to be successful?

Best-Practice RPS Design

There are many ways of designing an RPS. We'd like to get your opinion on some of these design choices.

6. Do you think an RPS should support both existing renewable energy projects and new renewable projects, or just new renewable projects? Why?
7. Are there particular renewable energy technologies that you believe should always be included as eligible in an RPS? Are there any renewable energy technologies that should not be supported by an RPS?
8. States with RPS policies have developed different rules for the eligibility of out-of-state renewable facilities. How do you believe state RPS policies should treat out-of-state facilities? Should only in-state facilities be eligible? Facilities in adjoining states? Facilities in a broader region or power pool? Nationally?
9. There are different ways of verifying compliance with an RPS. One approach is with tradable renewable energy credits. Do you support the use of renewable energy credits for RPS compliance? Why or why not?

Using an RPS to Encourage Resource Diversity

10. Do you believe state RPS policies should be designed to encourage diversity among different renewable energy sources (i.e., support multiple types of renewable energy, not just one)? Why or why not?
11. Other than resource constraints, what specific barriers do you believe exist in using geothermal energy to comply with state RPS policies?
12. Do you believe state RPS policies should be designed to specifically encourage geothermal energy? If so, how do you believe that an RPS should be designed to support this goal?

Review of Evaluation Criteria

We have been asked by the National Geothermal Collaborative to evaluate the 15 state RPS policies based on an agreed-upon set of evaluation criteria. Our proposed list of evaluation criteria is below. Please review and rank the criteria on this list as very important, somewhat important, and not important. For further explanation, please refer to the attachment, “Proposed Evaluation Criteria for Renewables Portfolio Standards.”

13. **Outcome criteria** assess the actual, or projected, impacts and results of state RPS policies. Please evaluate the relative importance of each of the following:

	Very Important	Somewhat Important	Not Important
OUTCOME CRITERIA			
Amount of New Renewable Energy Development	_____	_____	_____
Full Compliance with RPS Policies	_____	_____	_____
Reasonable and Stable Costs	_____	_____	_____
Prudently Incurred Compliance Costs Borne by Ratepayers	_____	_____	_____

14. **Policy design criteria** include legislative and regulatory RPS design features that will affect the success of an RPS. Please evaluate the relative importance of each of the following:

	Very Important	Somewhat Important	Not Important
POLICY DESIGN CRITERIA			
Broad Applicability	_____	_____	_____
Carefully Balanced Supply-Demand Conditions	_____	_____	_____
Sufficient Duration and Stability of Targets	_____	_____	_____
Well-Defined and Stable Resource Eligibility Rules	_____	_____	_____
Treatment of Out-of-State Resources	_____	_____	_____
Credible and Effective Enforcement	_____	_____	_____
Flexible Verification Mechanisms	_____	_____	_____
Adequate Compliance Flexibility	_____	_____	_____
Contracting Standards and Cost Recovery Mechanisms for Standard Offer and Default Service Providers	_____	_____	_____
Product-Based Compliance Mechanisms	_____	_____	_____

15. **Market context criteria** reflect the fact that even a well-designed RPS may fail to have its intended effects if the market in which it is applied is not conducive to such a policy. Please evaluate the relative importance of each of the following:

	Very Important	Somewhat Important	Not Important
MARKET CONTEXT CRITERIA			
Presence of Creditworthy Long-Term Power Purchasers	_____	_____	_____
Stable Political and Regulatory Support for an RPS	_____	_____	_____
Accessible Developable Resource Potential	_____	_____	_____

16. Because a principal goal of the National Geothermal Collaborative is to judge the effectiveness of state RPS policies in supporting geothermal projects, we have also developed **geothermal-specific criteria** to directly evaluate each state RPS from the perspective of driving new geothermal development. Please evaluate the relative importance of each of the following:

	Very Important	Somewhat Important	Not Important
GEOHERMAL-SPECIFIC CRITERIA			
Geothermal Development	_____	_____	_____
Geothermal Resource Availability and Eligibility	_____	_____	_____
RPS Design Elements that Directly Encourage Geothermal Development	_____	_____	_____
RPS Design Elements that Indirectly Encourage Geothermal Development	_____	_____	_____

17. Are there any criteria that we have missed, and that should be added? Are there any criteria that should be deleted or altered?

18. Are there any other RPS design elements that you believe are critical to the success of the policy? Are there any design elements that will lead to sure failure?

Appendix D: RPS Policy Evaluation Criteria

In Chapter 4 we identified and applied a list of policy evaluation criteria to assess the actual or likely effectiveness of state RPS policies. Here we again list those criteria, but also provide a lengthier rationale for their inclusion.

Outcome Criteria

We assume that the principal goals of state RPS policies are to drive new renewable development at reasonable cost without unduly disrupting the functioning of electricity markets. With that in mind, four outcome-based criteria are used.

- ? Amount of New Renewable Energy Development: The principal goal of an RPS is to, over time, drive renewable resource development and the increased production of renewable electricity.
- ? Full Compliance with RPS Policies: A hallmark of an effective and sustainable RPS is one in which all load-serving entities (LSEs) are in full compliance with the renewable energy purchase obligation. If LSEs are not in full compliance with the policy, it suggests that incentives to comply are insufficient, supply is insufficient to meet targets, some other policy design feature is lacking, or the market context is not conducive to the RPS, as designed. Perhaps more importantly, differential compliance among LSEs is likely to undermine the political stability of the policy as a whole.
- ? Reasonable and Stable Cost Impacts: An RPS is intended to drive new renewable energy development, under the expectation that renewable electricity may cost more in the short-term but that the long-term benefits of diversification offset the added costs. Nonetheless, load-serving entities, end-use electricity customers, and policymakers desire stable, reliable, and reasonably priced electricity supply. Compliance with the RPS should not be unduly burdensome. An RPS that unduly raises the cost of electricity to end-use customers is unlikely to be viable over the long run. Accordingly, we qualitatively evaluate: (a) whether the price of renewable electricity under an RPS is reflective of true marginal costs (or whether, alternatively, the price has been bid above long-term marginal cost due to market power or supply constraints); (b) whether new renewable projects are attracting capital at commercially attractive rates to minimize the unit cost of capital-intensive renewable plants; (c) whether the cost of the RPS appears stable from one year to the next, and (d) whether new resources added to meet an RPS have substantially impacted reliability or added to system costs in a manner not captured in the choice of RPS resources.
- ? Prudently Incurred Compliance Costs Borne by Ratepayers: Load-serving entities are concerned that an RPS will raise their costs without providing direct offsetting benefits. Because the benefits of renewable electricity flow to consumers at large, it is also important that those same consumers bear the costs of the policy. Prudently incurred (i.e., just and reasonable) RPS compliance costs should therefore be recovered from end-use electricity customers. Clear guidance to this effect is especially important in regulated markets, and for standard offer and default service providers, where electric utility regulators (and not the competitive market) make cost recovery decisions.

Policy Design Criteria

Particularly where an RPS has not been operating for sufficient time to judge its success in meeting the outcome criteria above, we must instead judge that state's policy against a series of policy design criteria. Our ten criteria include:

- ? Broad Applicability: A well-designed RPS would ideally apply equally and fairly to all load-serving entities in a state (or, at minimum, to all possible suppliers to any customer whose load is included in the mandate), ensuring that all those who benefit from increased renewable energy production also bear a proportion of the costs. Exempting major electricity suppliers from RPS obligations weakens the overall effectiveness of the policy.
- ? Carefully Balanced Supply-Demand Conditions: An effective RPS will have renewable energy purchase standards of sufficient size and structure coupled with sufficiently tight resource eligibility rules, so as (a) to be binding enough to ensure new renewable energy development, without (b) being so binding as to foreclose feasible compliance. Purchase standards should also be achievable: the start date of the policy should accommodate the time it takes for new renewable projects to be developed and come on line, and incremental increases in the standard over time should be achievable at reasonable cost.
- ? Sufficient Duration and Stability of Targets: Minimizing the cost of new renewable energy development requires that developers have access to low-cost financing. Related, minimizing uncertainty for those obligated to purchase renewable energy requires that the RPS clearly specify the renewables purchase obligations well in advance. Both of these needs require an RPS to be of sufficient duration to allow long-term contracting and financing to occur, and to have purchase targets that are stable over time and are not subject to sudden or uncertain shifts.
- ? Well-Defined and Stable Resource Eligibility Rules: The eligibility of specific renewable resources and technologies for a state RPS should be well-defined. Ambiguity as to what resources are and are not eligible creates market uncertainty for both renewable developers and LSEs, thus hindering long-term contracting. Resource eligibility rules should also be stable, and not subject to sudden change.
- ? Well-Defined and Stable Treatment of Out-of-State Resources: States have taken different approaches to the eligibility of out-of-state renewable energy facilities. Geographic eligibility decisions affect the aggregate impact of an RPS, the location of the benefits delivered by an RPS, and the legal defensibility of the policy as a whole. There is no absolute, "correct" approach to the eligibility of out-of-state renewable generators. Well-designed RPS policies, however, have a well-defined, legally supportable stance on this issue that is both consistent with the stated objectives of the policy as a whole and that is not subject to sudden change.
- ? Credible and Effective Enforcement: An effective RPS must typically be mandatory and impose repercussions on those LSEs that fail to meet the specified renewable energy purchase mandates. Only with credible enforcement will state policymakers ensure that the RPS is met, and will renewable developers know that their efforts are not in vein. In competitive markets, automatic financial penalty mechanisms (or alternative compliance systems) are typically considered preferable as they ensure that penalties are levied fairly, and without excessive discretion. In regulated markets, the need to automatic financial

penalties may be less severe if regulatory bodies are serious in their efforts to compel regulated utilities to comply, but the threat of sanction (even if the sanction somewhat undefined) will generally remain critical.

- ? Flexible Verification Mechanisms: A variety of approaches can be used to verify compliance with an RPS. The two most common approaches are the use of tradable renewable certificates (TRCs) and the use of contract-path tracking. While both of these approaches can work effectively, the TRC approach is generally preferable in that it can simplify verification, provide greater assurance of no double counting, increase contracting flexibility, and lower compliance costs. These benefits are especially acute in competitive (wholesale and retail) markets and where a state has substantial internal transmission constraints. In markets characterized by stable resource portfolios (monopoly or otherwise) and few internal transmission constraints, a contract-path approach may be sufficient. We note here that the use of TRCs for verification purposes does not restrict one's ability to limit imports from other states.
- ? Adequate Compliance Flexibility: Stringent and unyielding renewable purchase obligations can prove challenging and costly, and may encourage market power. Renewable sources often have variable output patterns, come on line in large and discrete blocks, and sometimes meet siting and permitting challenges that make both success and timing difficult to predict. LSEs, particularly in competitive markets, cannot predict their load, and therefore their renewable energy obligations, with precision. Given these circumstances, state RPS policies would ideally build in some compliance flexibility. In addition to the use of TRCs, common sources of compliance flexibility include: (1) extended settlement periods for demonstrating compliance, (2) banking and/or make-up of TRCs or RPS compliance, (3) credit for early compliance, (4) force majeure waivers, and (5) alternative compliance mechanisms that effectively cap the cost of an RPS. By the same token, if RPS policies are overly flexible and lenient, the likelihood of gaming and non-compliance could intensify, and the complexity of administering the RPS could increase.
- ? Contracting Standards and Cost Recovery Mechanisms for Regulated Utilities and Standard Offer and Default Service Providers: In competitive markets, regulators need not specify renewable energy contracting standards or RPS compliance cost recovery mechanisms. RPS policies have now been implemented in a number of markets that remain regulated, however, and even in purported competitive markets the default service providers (which may constitute the largest LSEs in a market where most customers have not chosen to switch providers) remain regulated by the state. In these cases, state regulatory bodies may need to establish reasonable and clear standards for how renewable energy is to be procured to ensure that renewable projects receive long-term contracts that can support financing. As important, these same regulators must establish clear mechanisms for the recovery of prudently incurred RPS compliance costs by rate-regulated LSEs. Without such mechanisms, LSEs will have every incentive to stall or complicate achievement of the RPS, or to favor lowest-risk rather than least-cost compliance strategies. LSEs should, at a minimum, be held harmless for prudently incurred compliance costs, and might even be offered a financial incentive to encourage compliance.
- ? Product-Based, as Opposed to Company-Based Compliance Mechanisms: A *company-based* application of an RPS would allow LSEs to meet their RPS obligation through the sale of green power to those customers willing to pay a premium for that product, thereby shifting the cost of the RPS to a subset of customers. An emerging best practice among state RPS

policies, however, is the application of the renewable energy target to each electricity *product* sold to end-use customers (e.g. every customer purchase must include the minimum proportion of renewables), as opposed to on an aggregate, LSE-wide basis. Such an application ensures that voluntary customer demand for renewable energy is *additive* to any demand for renewable electricity generated by the RPS, and that the cost of the RPS is shared equitably among all electricity users. Product-based application of an RPS therefore reduces the possibility of consumer fraud and confusion in green power markets, and provides confidence to consumer that their green power purchases will add additional renewable energy supply above and beyond that which is required by state law.

Market Context Criteria

Even a well-designed RPS is likely to fail if applied in a market that is fundamentally not conducive to renewable energy development. As such, the following three market-context criteria are used:

- ? Presence of Creditworthy Long-Term Power Purchasers: The current credit crunch in the electricity industry poses substantial challenges to the financing of new generation in generation. Moreover, in some competitive markets, the combination of (a) utility divestiture of generation assets, (b) utility retrenchment to “wires” companies, and (c) uncertain company-specific load obligations, has left few creditworthy players willing to enter into long-term contracts for renewable generation. More so than generators that burn fossil fuels (and thus have avoidable costs in depressed markets), renewable projects require long-term contracts to receive financing. Markets in which such contracts are unavailable or extremely scarce are unlikely to be conducive to the effective implementation of an RPS.
- ? Stable Political and Regulatory Support for an RPS: We have already emphasized the need for stability and certainty in the detailed rules of an RPS. More generally, to minimize uncertainty and allow for the staged development of renewable resources, a stable level of political and regulatory support for an RPS is essential. RPS policies that are established through regulation, without enabling legislation, may be more likely to be subject to ongoing revision or outright elimination upon legal, legislative, or regulatory challenge. Ongoing and vigorous efforts to change or eliminate an RPS, whether established by legislative or regulatory mechanisms, may also demonstrate a lack of political support.
- ? Adequate and Accessible Developable Resource Potential: Some regions of the U.S. are poorly endowed with sizable and reasonably priced renewable resource potential. Other regions may have adequate potential, but that potential may not be accessible or cost-effective given transmission constraints, wholesale market rules, and interconnection barriers. To apply an RPS in such regions that is so large as to severely strain available, cost-effective resource potential would be folly.

Geothermal-Specific Criteria

A key goal of the National Geothermal Collaborative is to judge the effectiveness of state RPS policies in supporting geothermal resources. While the criteria identified earlier are resource neutral, the following four evaluation criteria are intended to address the question of whether a state RPS has or is likely to support geothermal project development in particular.

- ? Geothermal Development: For those states whose RPS policies have been in place for some time, the first evaluation criteria is simply the extent to which geothermal, exploration, leasing, development, and construction activities have been stimulated by the state's policy.
- ? Geothermal Resource Availability and Eligibility: A large number of U.S. states simply do not have cost-effective geothermal resource opportunities. Only RPS policies in states within eligibility regions that have adequate resource potential have any possibility of driving geothermal development. More specifically, even among those states in which geothermal is available, geothermal may not be eligible under the state's RPS rules. Where eligible generally, another question is whether geothermal heat or electricity used on a customer's site would be eligible to meet RPS requirements.
- ? RPS Design Elements that *Specifically* Encourage Geothermal Development: Some states have created RPS designs that *explicitly* support diversity among renewable resource types in general, and/or the use of geothermal energy. Those states are more likely to see geothermal development activity, all else equal.
- ? RPS Design Elements that *Indirectly* Encourage Geothermal Development: Other states may not explicitly and differentially support geothermal development relative to other renewable sources, but may instead do so indirectly. Such indirect support may, for example, come from specific contracting processes or an incorporation of system integration costs into the resource selection process, which may work against wind power relative to a baseload source such as geothermal.

Appendix E: State RPS Evaluations

Arizona

EVALUATION SYNOPSIS

Arizona has a small, solar-focused RPS that began in 2001 and that has created some demand for new renewable energy in the state. Though well designed in some respects, uncertainty over the long-term fate of the policy and the lack of penalties are key weaknesses. A cost-benefit evaluation in 2003 will determine whether the standard is to continue to rise after 2004. Geothermal is not automatically eligible under the RPS, and the policy is not of sufficient size to significantly benefit geothermal energy. Nonetheless, there is at least one small geothermal project that has been granted eligibility under the RPS.

OVERALL RESULTS

Arizona's RPS is creating a market for some new solar and non-solar generation. Solar capacity installed to date is nearing 5 MW, with an additional 5-10 MW of landfill gas also supported; several additional MWs of renewable energy are also planned. A 20 MW geothermal project has received the approval of the ACC as an eligible resource under the RPS. Because the RPS contains no explicit penalties, the utilities appear to be content to meet their RPS obligations only to the extent that sufficient environmental portfolio surcharge (EPS) and system-benefits charge (SBC) funds exist. As a result, the utilities have generally been in compliance with their non-solar purchase requirements, but have not fully complied with the solar requirements; the level of non-compliance is substantial. The cost of the policy is stable. Though a small RPS in percentage terms, aggregate costs are not insignificant due to the solar requirement. Perhaps because the duration of the policy is uncertain, utilities have opted to comply with central-station, modular PV facilities rather than larger and likely more cost-effective solar-thermal electric installations. Compliance costs are successfully being recovered through pre-existing EPS and SBC charges.

POLICY DESIGN STRENGTHS

Arizona's RPS standard and eligibility rules were designed to ensure that some new renewable energy supply is required. Eligibility rules are clear and well defined, as are rules for out-of-state generation eligibility. The policy exempts some providers (munis, ESPs for a limited time, and coops upon request), but applies to most of the major suppliers in the state. The verification system and level of compliance flexibility both appear sufficient for the time being, with limited TRCs and banking allowed.

POLICY DESIGN WEAKNESSES

Uncertainty in the duration and stability of the policy is undermining its effectiveness. Perhaps because of the policy's uncertain fate (and perhaps inadequate contracting standards), utilities have chosen to build more costly but modular central-station PV as opposed to contracting for presumably lower-cost but less modular solar-thermal electric generation. Because penalties are not assessed in cases of non-compliance, utilities appear to be willing to comply only to the extent that sufficient EPS and SBC funds exist, and substantial under-compliance has resulted. Uncertainty over the eligibility of geothermal remains, as a case-by-case determination is now required. The legality of the in-state restriction for certain resources is also unclear. Company-based application of the RPS, and even encouragement of green power sales to achieve RPS compliance, is not customer friendly.

MARKET CONTEXT

Creditworthy long-term power purchasers have been willing to commit to renewable energy. Political and regulatory support, however, is not stable, with a cost-benefit analysis in 2003. Establishment of the RPS via regulation creates incentive for tinkering and policy change as the ACC itself turns-over. Adequate resource potential is of no concern given the small overall standard.

GEOHERMAL-SPECIFIC EVALUATION

Arizona's RPS is too small in percentage terms to drive significant geothermal development. Nonetheless, there is some geothermal development activity in Arizona, including one project that has been granted RPS eligibility. Case-by-case determination of geothermal eligibility is a disadvantage for geothermal companies. No direct or indirect incentives exist to encourage geothermal development under the RPS.

California

EVALUATION SYNOPSIS

California's RPS is among the most aggressive in the nation, potentially requiring large amounts of new renewables. It is also among the most complex RPS policies, with a significant and ongoing role for the CPUC. The CPUC and CEC appear to be aggressively implementing the policy. With numerous key design details yet to be determined by the regulators, however, it is too early to know for certain the impacts of the policy. SBC funding may limit the ultimate impact of the policy, while exemptions provided to utilities that are not creditworthy may limit additional renewable procurement in the near term, though this is unlikely to affect development in the long-term.

OVERALL RESULTS

No procurements under the RPS have yet taken place. A CPUC-required interim renewables procurement in 2002 resulted in numerous contracts for renewable energy, including two sizable contracts with Calpine for existing geothermal; details on many of the contracts have not yet been released. The RPS is very aggressive, with over 2500 aMW of new renewable generation potentially required by 2017. The RPS is limited by the availability of SBC funds to cover the above-market cost of renewable energy, however; full compliance with the policy targets may therefore not be achieved on schedule. Utilities must comply with the RPS through long-term contracting, so above-market costs are likely to be reasonably stable. The incremental cost of renewable generation may rise over time, because the aggressive policy may strain resource availability. Because the policy is limited by the availability of SBC funds, however, the aggregate annual cost of the policy will not increase. With CPUC oversight and with above-market costs being covered by the SBC, the utilities' prudently incurred costs will be recovered.

POLICY DESIGN STRENGTHS

California's RPS is aggressive. IOUs and ESPs are both responsible for meeting the RPS over time, and even publicly owned utilities are required to design and meet their own RPS requirements (though they are given substantial discretion in doing so). Resource eligibility rules are reasonably well defined, with some exceptions. The RPS legislation was unclear in its treatment of out-of-state resources, but a CEC ruling clarified that such projects would be eligible for the RPS. The policy's duration is solid, but there is some uncertainty, since SBC funding has only been authorized for 5 years. Enforcement mechanisms are still being established, as are flexibility mechanisms and compliance verification systems. In principal, the CPUC and CEC are given the authority to implement each of these details, with adequate compliance and verification flexibility likely.

POLICY DESIGN WEAKNESSES

Policy design complexity and uncertainty are potentially key weaknesses; the degree of complexity derives in large part from the fact that, unlikely most RPS policies, the state's system-benefits charge is to be used to cover the above-market cost of renewables purchases. A great deal of authority is therefore given to the CPUC and CEC to design the policy, including (1) defining the benchmark price above which the SBC will cover the above-market cost of renewable purchases, and (2) establishing a least-cost, best-fit process to select winning renewable energy bidders. Decisions that might best be left to "the market" are instead to be made administratively. A fear exists among some stakeholders that the entire design process may bog down in regulatory details and be subjected to continual attack. Another arguable weakness is that the availability of SBC funds may limit the ability of the RPS targets to be achieved. Aggressive purchase requirements may also strain resource availability in the long-term.

MARKET CONTEXT

Utilities are required to enter into long-term (> 10 year) contracts for renewables, but RPS targets are waived for utilities that are not creditworthy – likely a transitional "problem." Regulatory support is strong today, but may be hard to maintain over the long run as the CPUC changes hands; this is especially problematic given the degree of regulatory oversight required in California's policy. Adequate renewable resources are available to meet the near-term targets, but could become somewhat constrained over time given aggressive targets.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal is eligible under the RPS, and if the RPS is implemented well, geothermal should see sizable new markets. Development activity has been present in the state for some time, and the 2002 interim procurement resulted in at least two geothermal contracts. The RPS does not provide specific encouragement of geothermal, but the least-cost, best-fit process is likely to favor baseload geothermal projects over intermittent resources.

Connecticut

EVALUATION SYNOPSIS

Connecticut has had among the most poorly designed RPS policies in the nation. Given exemptions provided to standard offer and default service supply, along with a host of other policy weaknesses, the RPS has so far had no effect on the renewable energy market. The only saving grace is that, in 2003, legislation was passed to “fix” many of the problems with the policy, most importantly applying the RPS to standard offer and default service supply.

OVERALL RESULTS

Connecticut’s RPS has been wholly ineffective to date, and has led to no new renewables development thus far. This is because the majority of customer load has been exempt from the RPS. The cost of the policy has been negligible, and what costs do exist have been passed through to customers via competitive pricing. Legislation in 2003 holds the promise of significantly improving the RPS, however.

POLICY DESIGN STRENGTHS

The policy’s weaknesses have historically far outweighed its strengths. Legislative changes in 2003, however, do hold out promise. Under the new legislation, applicability of the RPS will be broad, with only publicly owned utilities exempt from the requirement. The duration of the standard appears reasonable in the legislation, though the implementing regulations have not yet been issued. Enforcement appears likely to be more than adequate, with legislation applying a 5.25 cent/kWh penalty for renewable purchase shortfalls; funds collected through this penalty are to be used to support Class 1 renewable resources. The new standards should drive some new renewables development. Verification and compliance flexibility are both workable (Connecticut will use the NE GIS certificates system, and perhaps TRC systems in neighboring regions as well). Not later than 2007, distribution utilities must file with the DPUC one or more long-term contracts totaling at least 100 MW with new Class 1 technologies. Costs are recoverable in rate provided that the contracts are long enough to allow financing (not less than 10 yrs). This may provide sufficient incentive for some long-term contracting.

POLICY DESIGN WEAKNESSES

The policy has not historically been broadly applicable, and through 2003 has exempted standard offer and default service supply. These two utility services serve the vast majority of customer load in Connecticut (customer switching in the state has been extremely limited), so over 95% of the state’s load has not been required to meet RPS targets. Only competitive suppliers, which to date have been unable to establish a foothold in the state, have had to comply. As a result, the supply-demand balance has been poor: there has been little demand for renewable energy. The policy itself has also been unstable, as there were continuous efforts to revise the statute to make the policy more effective. Eligible biomass under the initial RPS was required to be from “sustainable” sources, with no definition provided by the legislature or by regulators. The eligibility of out-of-region generation has historically also been unclear. In conjunction with these flaws, non-compliance penalties were vague. The policy has been applied on a company-wide basis so far, but this is likely to change with the adoption of the NE GIS. The new 2003 legislation significantly improves the RPS, but there remain several weaknesses. First, biomass eligibility rules remain unclear in legislation. Second, the scope of geographic eligibility and TRC trading is unclear in the statute. Third, it remains unclear whether the standard is applied on a product- or company-basis.

MARKET CONTEXT

Historically, political and regulatory support for the CT RPS has been weak. The availability of long-term contracts from creditworthy parties has also been a major concern in New England. This is in part due to the design of competitive markets in the region, whereby no LSE can be certain of their long-term load obligations. The current credit crunch in the electricity industry has also not helped the situation. The contracting standards for distribution utilities (requiring a 100 MW long-term purchase) included in the 2003 RPS amendments may ease this barrier.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the region, and in fact geothermal does not even appear to be eligible under the Connecticut RPS. As a result, no direct or indirect mechanisms exist to support geothermal.

Iowa

EVALUATION SYNOPSIS

Iowa's renewable energy mandate was met with wind power installations in the late 1990s. The policy was established in a regulated market, and is no longer driving development in the state.

OVERALL RESULTS

Iowa's renewable energy mandate was met with 250 MW of wind power in the late 1990s, and full compliance was achieved after years of legislative and legal wrangling. The cost of the policy has been stable, and utility costs are recovered from ratepayers.

POLICY DESIGN STRENGTHS

The policy met its purpose: to install 105 aMW of new renewable energy. Resource eligibility rules were well defined, and resources were required to be located in the state. Supply and demand were well balanced, with new resources required to meet the policy's targets. The state's IOUs were obligated to make the renewable energy purchases, with just the state's publicly owned utilities exempted, and cost recovery was allowed.

POLICY DESIGN WEAKNESSES

With legal maneuvers and other delays, this policy took more than 15 years to implement. Policy stability was therefore a major problem, as was enforcement. The legality of the in-state requirement might be questioned, but since the policy has been met, it is a moot point.

MARKET CONTEXT

Creditworthy long-term power purchasers (the IOUs) ultimately purchased renewable energy to comply with the mandate, but not until after years of legislative and legal challenges. Adequate resource potential existed to easily meet the 105 aMW requirement.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the state, and in fact geothermal was not even eligible under the state's policy.

Maine

EVALUATION SYNOPSIS

Maine has among the most poorly designed RPS policies, despite a seemingly aggressive 30% purchase requirement. With supply of eligible resources far above the RPS target, and a host of other policy weaknesses, this RPS is likely to have little to no effect on the renewables market absent legislative changes. It also does little to meet its limited aim of supporting existing in-state biomass generators.

OVERALL RESULTS

Maine's RPS has been completely ineffective, and has led to no new renewable development thus far. This situation is likely to persist, absent changes in the RPS statute itself. The cost of the policy is small, and what costs do exist are passed through to customers via competitive pricing. LSEs have been in full compliance with the policy.

POLICY DESIGN STRENGTHS

The policy's weaknesses far outweigh its strengths. That said, resource eligibility rules and the treatment of out-of-state resources have been reasonably clear and well defined. The policy is broadly applicable, exempting only publicly owned utilities. Verification and compliance flexibility mechanisms are adequate. Product-based application of the policy is customer friendly and helps support the voluntary green power market.

POLICY DESIGN WEAKNESSES

The supply-demand balance for the Maine RPS is poor: eligible resources far outstrip the RPS targets. Loose eligibility rules, allowing existing hydro and cogeneration to qualify, have led to this circumstance. The duration and stability of the standard can also be questioned; with a policy review after 5 years, the long-term fate of the RPS is uncertain. Non-compliance enforcement is somewhat vague, with perhaps too much flexibility given to those that fail to comply.

MARKET CONTEXT

The availability of long-term contracts from creditworthy parties is unimportant because the policy only supports existing generation, which is not in need of long-term contracts. The policy lacks regulatory and legislative stability, as there are seemingly continuous efforts to alter the RPS to make it more effective, or to eliminate it altogether. Given the nature of the standard, adequate resource availability is not an issue.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the region, though geothermal is eligible under the state's RPS. No direct or indirect mechanisms exist to support geothermal.

Massachusetts

EVALUATION SYNOPSIS

Massachusetts' RPS took effect in 2003. The policy itself is well designed and promises to drive new renewable energy development in the region, but a lack of long-term contracting is already posing significant challenges. Siting difficulties in the region will also negatively impact renewable energy development opportunities.

OVERALL RESULTS

It is too early to report definitive results. There is some increased renewable development activity in the region, including merchant landfill gas activity and substantial new wind power development, both on- and off-shore. Long-term contracts have not been made available to generators, however, substantially reducing new development opportunities to date. Full compliance with the RPS is expected from obligated LSEs, but compliance in the early years may include payments to the Alternative Compliance Mechanism (ACM) – a 5 cent/kWh buy-out payment that can be made in lieu of purchasing TRCs. The incremental cost of MA-eligible renewable resources has averaged ~2.5 cents/kWh thus far, and supply and demand appear to be in balance for 2003. With stalled new development, however, and an increasing RPS purchase standard, the cost of TRCs could well rise to the ACM level of 5 cents/kWh in future years. A lack of long-term contracting could exacerbate the situation and lead to temporal fluctuations in the cost of TRCs, though the ACM provides a cap on that variability. RPS compliance costs are to be passed on to end-use customers for default and standard offer service, at the worst through balancing account treatment. Contracting standards and imprudence issues may arise, because the providers of standard offer and default service have not yet been willing to enter into long-term contracts for renewable energy, preferring instead to decrease their risk and purchase certificates on the short-term market or pay into the ACM. These short-term strategies are likely to be more costly in the long run than entering into long-term renewable energy contracts. Accordingly, there have been renewed calls for contracting standards for standard offer and default service. The Massachusetts SBC fund has stepped in to try to support long-term contracting under the RPS.

POLICY DESIGN STRENGTHS

Massachusetts' RPS is relatively well designed. Applicability is broad, with only publicly owned utilities exempt from the requirement. The duration and stability of the standards are good, and resource and geographic eligibility rules are well defined and reasonably stable. Enforcement is likely to be adequate, especially with the ACM, and verification and compliance flexibility are both reasonable (Massachusetts uses the NE GIS certificates system, and allows for limited banking of certificates). The standard is applied on a product basis.

POLICY DESIGN WEAKNESSES

The primary weakness is that the policy lacks contracting standards for standard offer and default service suppliers. These suppliers serve the majority of MA load, but have been unwilling to enter long-term renewable transactions thus far. The current treatment of out-of-state generators is reasonably clear, but the rules themselves have been challenged. Uncertainty over the eligibility rules for out-of-region generators may slow in-region development because renewable generation outside the region is more cost effective. Supply-demand conditions may also prove to be a weakness. The RPS rules were not finalized until March 2002, leaving little time for new renewable energy development before the standard kicked-in; compliance in the early years may therefore prove problematic. Over the long-term, renewables demand may continue to outstrip supply despite an otherwise well-designed policy.

MARKET CONTEXT

The availability of long-term contracts from creditworthy parties is a major concern in New England. This is in part due to the design of competitive markets in the region in which no LSE can be certain of their long-term load obligations, and is in part a result of the fact that the utilities are no longer contracting on a long-term basis for their customers. The current credit crunch in the electricity industry has also not helped the situation. Political and regulatory support appears strong, though siting and permitting issues may thwart new renewable development.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the region, and in fact geothermal is not even eligible under the state's RPS. As a result, no direct or indirect mechanisms exist to support geothermal.

Minnesota

EVALUATION SYNOPSIS

Minnesota's original renewable energy mandate has applied only to Xcel Energy, and has successfully brought on line wind and biomass capacity. An additional 400 MW of wind power is expected by 2006. The policy was established in a regulated market and applies to only a single utility. Legislation in 2003 established an RPS goal for all utilities in the state, though this goal is a "requirement" only for Xcel. Even Xcel's requirement may be waived if undue economic or reliability impacts are expected, while other utilities must demonstrate "good faith efforts." While the implementing regulations for this "goal" have not yet been established, it appears as if it may drive substantial new renewables development in future years, especially to serve Xcel Energy.

OVERALL RESULTS

The original Xcel Energy mandate required 425 MW of wind and 125 MW of biomass by 2002, and the utility largely met its obligations. An additional 400 MW of wind power was required by 2012. A recent settlement on transmission upgrades in the major in-state wind resource area, however, directs that the incremental 400 MW be brought on by 2006. The cost of this original policy has been stable and reasonable, in part due to the low-cost of wind when purchased under long-term contract, and utility costs (including incremental transmission costs to assess the wind resources) are recovered from ratepayers. No results have yet been generated under the goal/requirement legislation passed in 2003.

POLICY DESIGN STRENGTHS

The original Xcel mandate is meeting its purpose: to install new wind and biomass generation. Resource eligibility rules are well defined, and the implicit treatment of out-of-state resources is also relatively clear (in state was preferred in the first round, while out-of-state is more clearly eligible for the next 400 MW). Supply-demand is well balanced, with new resources required to meet the policy. The renewable energy capacity targets have been stable and well known in advance. The PUC established contracting standards, and compliance costs are recovered from ratepayers. Specific non-compliance penalties are not applied, but regulatory oversight has ensured that the targets are met. Though implementing rules have not been developed, strengths of the 2003 renewable goal legislation include: (1) clear resource eligibility rules, (2) targets that will likely ensure significant increases in renewable generation, at least from Xcel and quite possibly from other utilities as well, and (3) possible use of TRCs to facilitate compliance flexibility.

POLICY DESIGN WEAKNESSES

The original Xcel mandate is not broadly applicable, and instead applies to only one utility. The utility has, in the past, tried to sell some of its obligated renewable capacity as a green power product, raising concerns about green product credibility. Weaknesses of the renewable energy goal established in 2003 include: (1) somewhat unclear rules for out-of-state resources, (2) application of "required" renewable purchases only on Xcel Energy, with "good faith efforts" required of all other utilities in the state, and (3) lack of precise clarity about the circumstances in which Xcel might not be required to meet the renewable energy requirement, due to findings of undue economic or reliability impacts. It is also somewhat unclear on whether the 300 MW wind purchase requirement is part of Xcel's 10% requirement or earlier 825 MW requirement, or is to be additional to those requirements. In either case, it appears as if the 300 MW wind requirement is not subject to least-cost review.

MARKET CONTEXT

Xcel has been willing to enter long-term power purchase agreements with renewable generators; though Xcel is now in a weakened financial situation that may lead to contracting difficulties. Political and regulatory support for the policy has remained strong. Adequate resources appear to exist to meet the renewable energy targets, though transmission expansion and augmentation has been and will continue to be needed to access increasing quantities of wind power.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the state, and in fact geothermal is not even eligible under Xcel's renewable energy obligation, or the 2003 renewable energy goal.

Nevada

EVALUATION SYNOPSIS

Nevada's RPS is among the most aggressive, potentially requiring sizable amounts of new geothermal energy. Because it is applied in a regulated market, it is also a policy that will require a strong and ongoing role for the Nevada PUC. The policy has already resulted in increased geothermal prospecting in the state, and has led to nearly 100 MW of new geothermal contracts. Utility financial problems may create some contracting difficulties, however.

OVERALL RESULTS

Nevada's RPS began in 2003, and the utilities' first solicitation led to 130 MW of wind contracts, 97 MW of geothermal contracts, and 50 MW of solar contracts. With utility fears over wind power integration, geothermal is also poised to do well in future solicitations. The state's utilities will not be in full compliance with the RPS in its early years. Though this may simply be a transitional issue, if some of the initial renewable energy projects are unable to come to fruition, non-compliance may continue. Nevada's RPS requires long-term contracting, ensuring that RPS compliance costs are likely to remain reasonable and stable. The utilities' first solicitation led to renewable energy contracts whose costs are competitive with conventional energy sources (with the exception of solar). The Nevada PUC will review and approve all contracts, allowing the utilities to recover all prudently incurred costs.

POLICY DESIGN STRENGTHS

Nevada's RPS is aggressive, requiring substantial sums of additional renewables, and is also reasonably well designed. IOUs and ESPs are both responsible for meeting RPS over time, with only publicly owned utilities exempt from the requirements. Resource eligibility rules are well defined, though 2003 ushered in new legislation that expanded resource eligibility. The policy's duration is solid (it is to last indefinitely). Because resources must be located in or near the state (with a dedicated transmission line shared with at most only one non-renewable generator), the RPS targets support existing generation while rapidly requiring new generation as well. The treatment of out-of-state generators is well defined and stable, though legal questions may arise. TRCs are allowed, a critical feature given a lack of transmission in the state. Credit banking offers compliance flexibility. Detailed contracting standards exist, along with cost recovery mechanisms.

POLICY DESIGN WEAKNESSES

A good deal of authority is given to the Nevada PUC to oversee the RPS policy. Aggressive standards may strain resource availability in the long-term. In the early years, the policy's rules were established too late in the game to allow the utilities to bring new renewable project on-line quickly enough to meet their early-year targets; this will lead to non-compliance during at least a transition period. Legal concerns about the rigid eligibility requirements for out-of-state generators may arise. The policy's somewhat vague non-compliance penalties may become a concern, as utilities will not be in compliance early on, and the discretion given to the PUC in levying fines could become an issue in the future. Resource eligibility was recently expanded to include certain small hydro and waste heat and pressure applications, which may to a small degree reduce the impacts of the policy on renewables development.

MARKET CONTEXT

The poor credit of the major utilities could prove a transitional problem; apparently, credit issues are already proving problematic for the recently announced contracts. Regulatory and legislative support appears strong today, but such support has been illusory in the past so the long-term stability of the policy remains in doubt. Resource potential appears adequate in the early years, but may be strained as the RPS targets increase over time.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal is eligible, and if the RPS remains intact, geothermal should see sizable new markets – 97 MW of geothermal contracts are approved so far, a full 60% of the utilities' total renewables procurement in the first solicitation. The RPS does not provide *specific* encouragement of geothermal (as it does for solar, through a set-aside), but the contracting process allows the utilities to consider integration costs and project output profiles when determining which renewables bids to select. In the first solicitation, the utilities placed a hard limit of 150 MW of wind in the state, given integration concerns. If such concerns and contracting processes continue, geothermal will be strongly supported under the RPS in an *indirect* fashion.

New Jersey

EVALUATION SYNOPSIS

New Jersey has a two-tiered RPS that began in 2001. The policy itself is reasonably well designed, but because of a poor supply-demand balance, it is not likely to drive substantial new development for a number of years. A lack of long-term contracting may also slow new development. A Task Force established by the Governor in 2003 recommended strengthened the RPS, and the BPU is expected to seek the implementations of these recommendations in late 2003.

OVERALL RESULTS

Though the New Jersey RPS is not strictly binding today (aggregate eligible supply exceeds aggregate demand), there has been some new renewable energy development (landfill gas and wind) in the PJM and New York. Though this generation was not built specifically to serve the New Jersey RPS, the existence of the policy has provided a backstop market to help justify some of this investment. Accordingly, the policy has indirectly help drive some new renewable energy development. LSEs are in full compliance with their obligations today, with incremental costs of perhaps ~0.4 cents/kWh for Class I renewable generation and ~0.2 cents/kWh for Class II generation. Costs are reasonable and stable, and are passed on to customers.

POLICY DESIGN STRENGTHS

New Jersey's RPS is well designed in several respects. Applicability is broad, with only publicly owned utilities exempt from the requirement. The duration and stability of the standards are good, although the RPS rules remain "interim." Though the legislation itself is vague in its definition of eligible biomass generation under the Class I standard, subsequent decisions by the BPU and DEP have clarified the eligibility rules to a significant extent. Compliance flexibility is adequate so far.

POLICY DESIGN WEAKNESSES

The supply-demand balance is poor in the early years, with more existing renewable energy supply than RPS-driven demand, ensuring that the policy has little effect on new renewable energy development. This may change over time. Unclear rules for geographic eligibility and an ever-expanding PJM grid, however, may conspire to keep existing renewable generation above the RPS requirements for years to come. The RPS standards also do not grow quickly. A strong verification system for the RPS does not yet exist, and credit trading is not formally allowed under the interim RPS rule. A limited TRC system is under consideration, but it may be years before the system is in place; in the mean time, uncertainty is high. Enforcement rules are reasonably vague and are more flexible than some RPS policies. Once the RPS becomes binding and new renewable energy is needed, contracting standards and imprudence issues may arise for basic generation service (BGS) providers, which serve those customers that do not switch to a new electricity provider. Without contracting standards in place, and given the short-term nature of BGS supply, it remains unclear as to whether industry players will be willing to commit to long-term renewable energy contracts. However, short-term purchasing strategies are likely to be more costly in the long run than entering into long-term renewable energy contracts. The New Jersey RPS also appears to apply on a company basis. If the Governor's Task Force recommendations are approved, many of these weaknesses will be alleviated.

MARKET CONTEXT

The availability of long-term contracts from creditworthy parties is not yet an issue, but may become a concern in later years as the New Jersey RPS begins to drive new renewable energy development. Political and regulatory support for the RPS is strong, and the Governor created a Task Force to recommend changes to the RPS that would, if implemented, strengthen the policy. Adequate renewable resources exist in the PJM and New York to meet the New Jersey RPS, but renewable resource availability within New Jersey is inadequate; if New Jersey's rules became more strict for the eligibility of out-of-state generation, then supply could become a problem over time.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not readily available in the region, though geothermal is eligible under the New Jersey RPS. No direct or indirect mechanisms exist to support geothermal.

New Mexico

EVALUATION SYNOPSIS

New Mexico's RPS is among the few to be established by regulatory action; it is also among the nation's most newly established RPS, with rules finalized in December 2002 and taking effect in mid-2003. With renewable energy purchase standards that do not begin until 2006, it is too early to assess the effectiveness of the policy. The rule itself, however, is well designed and provides *specific* encouragement of geothermal development relative to wind and small hydropower. Policy stability may be a serious issue, however, with the utilities questioning the authority of the PUC to implement an RPS without legislative direction. Because the policy is applied in a regulated market, it will also require a strong and ongoing role for the New Mexico PUC.

OVERALL RESULTS

No renewable energy development has yet taken place that is a direct result of the RPS. A 204 MW wind power contract was signed before the RPS came into effect, perhaps in part in anticipation of the future policy. The utilities are currently challenging the RPS rule in court, so the likelihood of future compliance is unclear. The policy does require longer-term contracting, so if the RPS does take effect, the costs of the policy are likely to be reasonable and stable. Prudently incurred compliance costs will be recovered from ratepayers.

POLICY DESIGN STRENGTHS

New Mexico's RPS is broadly applicable, with exceptions given to publicly owned utilities and (in the short term) Texas-New Mexico Power Company. Assuming that out-of-state existing renewables are not rededicated to New Mexico to meet that state's RPS, then the New Mexico policy will drive new resource development. Sufficient lead-time has been given to bring those new resources online. Policy duration is strong: the standard increases to 10% by 2011, and remains at that level indefinitely. Resource eligibility rules are clearly defined, as is the eligibility of out-of-state generation (though it is not clear how the "preference" for in-state generation will be provided). TRCs are envisioned as the verification mechanism, and banking provides adequate compliance flexibility. Contracting standards and cost recovery mechanisms are both to be overseen by the PUC.

POLICY DESIGN WEAKNESSES

The mere existence of the RPS remains in doubt, as the utilities are questioning the PUC's authority in the courts and before the legislature; the PUC has already rejected the utilities' arguments. Enforcement mechanisms remain to be developed, though this may not be problematic if the PUC uses its normal regulatory powers to ensure compliance. A good deal of authority is given to the New Mexico PUC to continue to oversee the policy effectively. Whether the costs of the RPS can be passed on to green power customers (company-based application) is somewhat unclear.

MARKET CONTEXT

The policy is applied in a regulated market, and requires long-term contracting. Regulatory support is strong today, but legislative support is unclear. Because the policy was established through regulation, ongoing regulatory uncertainty is possible. The mere existence of the policy remains in doubt until the legislature and the courts respond to the utilities' attacks. Resource potential in the region should be more than adequate to meet the renewable energy targets.

GEOHERMAL-SPECIFIC EVALUATION

No geothermal development has yet occurred because of the RPS. Geothermal is eligible under the RPS, however, and in fact the policy has been designed to specifically encourage renewable resource diversity, including geothermal. In particular, while every MWh of wind and small hydropower will receive one renewable energy credit, geothermal, biomass, LFG, and fuel cells will receive two credits (solar will receive three credits). If the incremental cost of geothermal energy is less than two times that of wind, then geothermal should compete well under this RPS. New Mexico was the first state to develop such explicit support for geothermal energy. The RPS also requires LSEs to provide a diversified renewable resource portfolio, and to consider delivery characteristics when selecting among different renewable energy resources.

Pennsylvania

EVALUATION SYNOPSIS

Pennsylvania has a small RPS that applies to only a tiny segment of the overall market. With limited applicability and eligible renewable energy supply far outstripping the limited RPS-driven demand, the policy has had little to no effect so far, and is unlikely to drive new renewable energy development in the future.

OVERALL RESULTS

Pennsylvania's renewable energy requirement has been completely ineffective, and has led to no new renewable development this far. This is because the majority of customer load is exempt from the RPS. The cost of the policy is negligible, and what costs do exist are passed through to customers via competitive pricing. A cost cap exists were the costs of the policy to become unreasonable.

POLICY DESIGN STRENGTHS

The policy has few notable strengths. Resource eligibility rules are reasonably clear, however, and the policy is applied on a product-specific basis.

POLICY DESIGN WEAKNESSES

Pennsylvania's renewable energy targets were developed within utility restructuring settlements, and the targets apply to a fraction of load served by competitive suppliers of default service. The state has been largely unsuccessful in attracting competitive suppliers of default service, however, with the exception of approximately 50,000 customers served by Green Mountain Energy Company in PECO's service territory. Accordingly, the vast majority of load in the state is exempt from the RPS. The targets themselves are small, and allow existing renewable generation to qualify. Supply and demand are therefore not in balance, and no new renewables have or will come online solely due to this policy. The targets themselves are unclear in their duration, and enforcement actions remain vague. The treatment of out-of-state generators is not specified, and an accounting and tracking system to verify compliance has not been developed.

MARKET CONTEXT

Because the policy is not driving new renewable energy development, the need for long-term contracting is minimized. Political and regulatory support of the policy is adequate; in fact, all parties involved largely ignore the policy. Given the small targets and limited applicability, resources are clearly sufficient.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the region, though geothermal is eligible under the mandate. No direct or indirect mechanisms exist to support geothermal.

Texas

EVALUATION SYNOPSIS

Texas' RPS is widely acknowledged to be the most successful in the U.S., if not the world. The policy has driven substantial new wind installation in the state. Additional wind development is expected in future years, though at present the amount of new renewable energy supply outstrips the RPS requirements. Utility providers of retail electricity supply have been willing to enter long-term contracts with renewable energy developers, with smaller competitive suppliers purchasing TRCs from those larger companies. The only dark cloud on the horizon is that transmission constraints are limiting wind power expansion, and have driven the price of TRCs up over recent months. While geothermal is eligible under the Texas RPS, and some geothermal resources may be available in the state, wind power is expected to dominate new installation given its 2.5 cents/kWh cost (with the PTC).

OVERALL RESULTS

In 2001, the Texas RPS helped drive 915 MW of new wind installation and create some new development opportunities for landfill gas, far exceeding the initial 400 MW RPS target. Development in 2002 took a breather, but additional wind project installation is expected in 2003. LSEs appear to be fully complying with the RPS so far. LSEs with long-term contracts for wind supply have only had to pay 2.5 cents/kWh for wind generation (electricity and TRCs), while those purchasing TRCs in the short-term market have seen fluctuating costs of 0.4-1.7 cents/kWh (TRCs only). Costs have remained reasonable, though increasing TRC prices from 0.4 to a high of 1.7 cents/kWh has been cause of some concern. The 5 cent/kWh maximum penalty places an overall limit to the cost of the policy. Other transmission-related costs of the RPS are also recovered through rates, and these costs are not negligible. Prudently incurred compliance costs are being passed on to customers through competitive pricing mechanisms.

POLICY DESIGN STRENGTHS

Texas was the first U.S. state to get its design of the RPS "right." Applicability is broad, with only publicly owned utilities that have not opened their markets to competition exempt from the requirement. The targets and eligibility rules were specifically designed to drive new renewables, so the supply-demand balance is strong. Regulatory rules for the RPS were established well before the first target date, allowing adequate time for projects to come online. The duration and stability of the standards are good, with applicable standards growing until 2009, and then remaining constant for an additional 10 years. Resource and geographic eligibility rules are well defined and stable. Enforcement is vigorous, with automatic financial penalties applied to non-compliant LSEs. The TRC system provides for flexible verification, and forward and deficit banking offer flexibility in compliance. No problems with contracting standards and cost recovery have been expressed. The standard is effectively applied on a product basis.

POLICY DESIGN WEAKNESSES

There are few overt weaknesses of this policy. One possible weakness is that while the current treatment of out-of-state generators is reasonably clear (generators must be located in state, or have in a direct intertie with the state), the legality of these restrictions is not clear. With the recent run-up in TRC prices, some have argued that the policy should give LSEs more flexibility in compliance (specifically, greater allowance for deficit banking); the Texas PUC has already made limited changes to the RPS rules to accommodate these concerns.

MARKET CONTEXT

The utility LSEs have been willing to enter long-term contracts with renewable energy developers, in part because wind power is so cost effective in the state. Smaller LSEs have not been willing or able to offer such contracts, preferring instead to purchase TRCs at higher cost from the short-term market. Political and regulatory support has remained very strong (LSEs know that they have to meet the standards), and adequate resource potential certainly exists to meet the renewable energy targets. Transmission constraints, however, are posing challenges to bringing low-cost wind power to market, and are in part responsible for the recent run-up in TRC prices.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are potentially available in the region, and geothermal is eligible under the Texas RPS. With low-cost wind power dominating the market, however, and with no direct encouragement of geothermal, geothermal development is unlikely to be spurred by the Texas policy.

Wisconsin

EVALUATION SYNOPSIS

Wisconsin has a small but well-designed RPS applied in a regulated market setting. With 80 MW of wind installed in Iowa in 2001, and additional in-state installations, no new development will be required under the policy for several years to come. This has led to calls for increasing the level of the RPS.

OVERALL RESULTS

Wisconsin's RPS has helped to create markets for some new renewable generation. An 80 MW wind project in Iowa came on line in 2001 to serve the Wisconsin RPS. An additional 60 MW of in-state wind and landfill gas also serves the RPS, though much of this generating capacity pre-existed the RPS. With a low aggregate standard (2.2%, at its highest), the policy will not itself drive much new renewable development for several more years. The costs of the policy have been reasonable and stable, with long-term contracting eliminating any sizable cost fluctuations. Compliance costs are passed on to end-use customers.

POLICY DESIGN STRENGTHS

Wisconsin's RPS has a number of strengths. Applicability is among the broadest of all state RPS policies, with even munis and coops responsible for meeting the targets (a limited exemption is provided to one utility). The targets and eligibility rules were designed to drive some new renewable energy development (in part because existing generation was allowed to only contribute 0.6% to the RPS requirements). Resource and geographic eligibility rules are well defined and stable. Enforcement is somewhat vague, but in a regulated market, this is generally of limited concern. A limited renewable energy credit system provides adequate verification flexibility, and significant compliance flexibility (including unlimited banking, among other flexibility mechanisms) is also offered. No problems with contracting standards and cost recovery have been expressed.

POLICY DESIGN WEAKNESSES

There are few overt weaknesses of this policy. Perhaps the primary weakness is that the low percentage standard, combined with early over-compliance and unlimited banking, will result in little incremental renewable energy development until perhaps 2009. Both a strengthened percentage target and limits on credit banking have been proposed. The duration of the policy is also vague, with the percentage targets increasing to 2.2% by 2011, but the standard after that date uncertain.

MARKET CONTEXT

The utility LSEs have been willing to enter long-term contracts with renewable energy developers. Political and regulatory support has remained strong, and there are increasing calls to strengthen the policy. Adequate resource potential exists in the state and surrounding region to meet the renewable energy targets.

GEOHERMAL-SPECIFIC EVALUATION

Geothermal resources are not realistically available in the region, though geothermal is eligible under the Wisconsin RPS. No indirect or direct support mechanisms exist for geothermal.

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Web Links

Union of Concerned Scientists Renewable Energy Page:
http://www.ucsusa.org/clean_energy/index.cfm?pageID=5

Massachusetts RPS Design White Papers:
<http://www.state.ma.us/doer/programs/renew/rps.htm#papers>

Renewable Energy Policy Project Links to State RPS Regulation and Legislation:
http://www.repp.org/rps_map.html

Geothermal Outreach Principles and Comment Analysis Report

National Geothermal Collaborative

Many stakeholders, *one vision.*

Geothermal Outreach Principles and Comment Analysis Report

Final Report

January 2005

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EXECUTIVE SUMMARY

Introduction

The National Geothermal Collaborative (NGC) selected MHA Environmental Consulting, Inc. (MHA) to assist the NGC in conducting a quantitative and qualitative examination of public comments recorded in federal and state environmental and permitting documents for geothermal projects. The primary objectives of this effort are twofold:

- 1) To analyze what categories of interest and sectors are involved and which issues they raise.
- 2) To use this analysis to design a set of recommended principles for developing effective outreach programs.

The comment analysis represents a compilation and review of 3,787 individual comments on eight proposed geothermal development locations throughout the western United States. The comments span issues raised in 1979 for a geothermal leasing Environmental Impact Statement (EIS) to issues raised in 2003 for a 185 megawatt (MW) geothermal power plant at the Salton Sea (the largest geothermal plant proposed to date). Detailed information regarding the types of comments is found in Appendix A to the report, including tables that summarize frequently occurring comments, quantify the types of comments, and outline topics by commenting entities.

Key Conclusions

The comment analysis indicated that the comments and key issues associated with geothermal development were numerous and varied, but did not substantially differ between geothermal projects. The concerns generally did not differ substantially by geographic region, physical setting, or time period, although there may have been very different environmental and regulatory settings in place.

Outreach to the varied stakeholders interested in geothermal development is critical to the success of a project and should result in a reduced schedule for environmental review and permitting. Education, communication, and monitoring are the cornerstones of an effective outreach program, whether addressing others in the industry, public agencies, policy makers, or the broader public. Geothermal developers and industry organizations should play an integral role in this effort by providing these groups with appropriate data, techniques, and experienced professionals for

outreach. This role should focus on fostering education through preparation of background materials regarding:

- Benefits of geothermal development
- Documentation of actual impacts of existing facilities
- Appropriate and effective measures to mitigate anticipated impacts of development

Many successful examples of geothermal development now exist across the western United States, and project operation data and outreach approaches for these projects should be documented to provide accurate information to the public and public agencies. The data should be published and made readily available to interested parties.

Geothermal Sites and Methodology

Eight geothermal sites and corresponding environmental and/or permitting documents were selected for analysis based on several criteria, including document availability, representation from various geographic regions and physical settings, the potential for additional development, and the extent of comments received on the projects. The eight projects selected are described in Table ES-1.

Quantitative (tabular) analysis of the comments was conducted for those documents that included comment letters from agencies, organizations, or individuals. Qualitative analysis of the comments included an identification of the commenting parties and analysis of their major concerns. A peer review panel of five individuals with substantial experience in environmental review and permitting for geothermal projects offered input to the analysis and provided supplemental knowledge of geothermal project issues and concerns.

TABLE ES-1: Geothermal Sites Summary

Geothermal Project	Location and Date	Lead Agencies
Fourmile Hill (Glass Mountain) 49.9 MW Flash Plant and 26 mile Transmission Line	Northern California (1998)	Bureau of Land Management US Forest Service Bonneville Power Administration Siskiyou County Air District
PLES I (Mammoth) 10 MW Binary Plant	Central-Eastern California (1989)	Bureau of Land Management US Forest Service Great Basin Unified Air District
Newberry 30 MW Flash Plant and Transmission Line	Central Oregon (1994)	Bureau of Land Management US Forest Service Bonneville Power Administration
Pueblo Valley 20 MW Binary Plant and 6 mile Transmission Line	Southeastern Oregon (1995)	Bureau of Land Management US Forest Service
Gifford-Pinchot Geothermal Leasing	Washington (1979)	Bureau of Land Management US Forest Service
Salton Sea Unit 6 185 MW Flash Plant	Southern California (2003)	California Energy Commission
Puna Geothermal Venture 30 MW Flash Plant	Hawai'i (1989)	N/A
Steamboat Hills 12 MW Binary Plant	Nevada (1993)	Bureau of Land Management

Comment Analysis Conclusions

Comments on geothermal proposals encompassed the broad range of parameters addressed in the environmental documents. The key comments most often addressed effects on air quality, water quantity and quality, recreation, visual resources, noise, and biological resources. Additional issues commonly addressed included project alternatives, mitigation measures, and hazards. More detailed information regarding the types of comments is found in Appendix A of the report, which includes tables summarizing frequently occurring comments, quantifying the types of comments, and outlining topics by commenting entity.

Comments and key issues associated with geothermal development were numerous and varied, but did not significantly differ between geothermal projects. The comments on geothermal projects were notably consistent across geographic regions, physical environments, time periods, and many types of projects.

Over time - The issues of concern have not changed over time. The primary concerns raised in 1979 are the same as those raised in 1989 and 2003.

Over geographic area - The same issues are typically raised in all areas studied, including the Northwest, the Salton Sea, and Hawaii.

Over physical setting - The public raised concerns regarding noise and visibility of projects whether they were in rural or more urban areas, or in the desert or a forest environment.

Type of project - Geothermal project issues are similar in many respects to those of any development, e.g., other energy facilities, industrial parks, or residential subdivisions.

As indicated, comments on geothermal projects have not changed substantially from 1979 to 2003. For example, well blowouts and pipeline breeches have been consistent public concerns over the last 20 years. Operating geothermal projects over that period, however, have resulted in only a handful of well blowouts and breeches, leading the industry to continue to enhance outreach efforts and develop measures to effectively mitigate those concerns.

Recommended Outreach Principles and Approaches

A wide variety of stakeholders participate in the environmental review and permitting process for geothermal projects. Many of these stakeholders would benefit from education about the need for, impacts of, and benefits of geothermal energy. The geothermal industry and government agencies are the primary intended audience for this report. The industry and regulatory agencies can serve to initiate outreach to the broader public, including policy makers, local agencies, environmental and recreation groups, homeowners, tribe representatives, labor, and other interested parties.

BASIC OUTREACH PRINCIPLES

Approaches to public outreach will vary according to the target audience, the project, and the issues likely to be of concern. However, there are some basic principles that should provide the framework for any outreach effort, given the nature of geothermal projects and related concerns of interested parties

- 1) Educate, educate, educate
- 2) Educate about the need for alternatives to traditional energy development
- 3) Educate before proposing a project
- 4) Establish relationships with key interested parties in advance of formal review
- 5) Maintain communications throughout the permitting process, construction, and operations

- 6) Acknowledge potential impacts and address them with appropriate mitigation
- 7) Monitor extensively, and compile and publish data from operating geothermal projects

TARGET AUDIENCE AND OUTREACH METHODS

Geothermal developers and industry organizations should develop outreach programs to provide a framework for research, public education, and early input from the public. The primary objectives of such outreach efforts are to:

- 1) Disseminate educational materials to agencies and the public
- 2) Provide for monitoring and research to enhance the availability of data
- 3) Establish an early dialogue with potential interested parties
- 4) Develop mitigation approaches to key impact concerns

There are a variety of outreach methods that the geothermal industry and developers should consider implementing to achieve the specified objectives, including:

- 1) Develop informational materials about geothermal development and associated effects
- 2) Prepare standard quality control and reporting methods for monitoring air, water, and other impacts
- 3) Identify and publish industry-wide approaches to mitigation
- 4) Define techniques for early and consistent public education and involvement
- 5) Establish a project-specific point of contact for stakeholders to go to with concerns, and
- 6) Meet with concerned parties regularly

Outreach to Government Agencies

Agency staff and decision makers involved in the approval process for geothermal projects are a critical target audience for outreach. The agency staff will also play an important role in communicating their knowledge and understanding of the project to the decision makers and the public. This outreach effort should emphasize education and participation in the early phases of project development, as well as in the formulation of research and monitoring efforts.

Outreach to Policy Makers

Legislators and agency board members involved in the development of rules and regulations that affect the geothermal industry are another critical outreach target for the geothermal industry. These policy makers are typically more interested in the larger scale benefits and impacts of geothermal development, and less interested in the details. The key to effective outreach with policy makers is to provide them with succinct and timely information so they are not surprised by issues that arise, and to remain in contact and available as concerns are raised.

TOPICS FOR EDUCATION IN OUTREACH EFFORTS

The comment analysis identified an extensive number of issues that may be of concern in the environmental review and permitting of geothermal development. While all issues raised will need to be addressed, there are several that occur frequently and for which the industry should prepare standardized information for response. Frequently occurring issues and recommended approaches to address them include:

- 1) Emphasizing the benefits of geothermal energy

- 2) Describing the project and purpose clearly
- 3) Outlining the environmental review and permitting process
- 4) Explaining common misconceptions about geothermal development
- 5) Identifying effective mitigation and monitoring approaches to impacts
- 6) Targeting interested parties for outreach

LIST OF ACRONYMS

BACT	Best available control technology
BLM	Bureau of Land Management
CDFG	California Department of Fish and Game
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CURE	California Unions for Reliable Energy
DEIR	Draft Environmental Impact Report (CEQA)
EA	Environmental Assessment (NEPA)
EIS	Environmental Impact Statement (NEPA)
EIR	Environmental Impact Report (CEQA)
EERE	Office of Energy Efficiency and Renewable Energy, Department of Energy
GPW	GeoPowering the West (a program of the Department of Energy)
IBLA	Interior Board of Land Appeals
KGRA	Known Geothermal Resource Area
KOP	Key observation points
LAER	Lowest allowable emission rate
MW	Megawatts
NEPA	National Environmental Policy Act
NGC	National Geothermal Collaborative
NGO	Non-governmental organization
NNVM	Newberry National Volcanic Monument
NSO	No Surface Occupancy
OHDPA	Oregon High Desert Protection Act

LIST OF ACRONYMS

PAO	Public Advisor's Office
PGV	Puna Geothermal Venture
PM ₁₀	Particulate matter less than 10 microns in diameter or less
PMPD	Presiding Members Proposed Decision
SEIR	Supplemental Environmental Impact Report
SSU6	Salton Sea Unit 6
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VQO	Visual quality objectives
YCJV	Yankee/Caithness Joint Venture, L.P.

ACKNOWLEDGEMENTS

This report was prepared on behalf of the National Geothermal Collaborative (NGC). For their guidance and support throughout, we thank the NGC Working Group that guided this project and provided insightful comments for the report:

Kathleen Rutherford, RESOLVE
Jody Erikson, RESOLVE
Charlene Wardlow, Calpine Corporation
Gordon Bloomquist, Washington State University
Dan Schochet, ORMAT
Martin Letourneau, White House Task Force on Energy Project Streamlining
Matthew Brown, National Conference of State Legislatures
Karl Gawell, Geothermal Energy Association
Alyssa Kagel, Geothermal Energy Association

We also extend our sincere thanks and appreciation for our Geothermal Roundtable reviewers, a team of highly experienced experts in the analysis of geothermal projects:

Dwight Carey, Environmental Management Associates, Brea, California
Terry Thomas, Environmental Management Associates, Brea, California
Jill Haizlip, Geologica, San Francisco, California
Gene Suemnicht, Geologica, San Francisco, California
Robert Worl, California Energy Commission, Sacramento, California
Alice Doremus, U.S. Forest Service, Bend, Oregon

This research was supported by the Department of Energy, Office of Energy Efficiency and Renewable Energy. The financial support of DOE does not constitute an endorsement by DOE of the views expressed in this report.

ABOUT THE NATIONAL GEOTHERMAL COLLABORATIVE

A U.S. consensus-based collaborative, the National Geothermal Collaborative (NGC), was formed in 2002 to identify issues that impede the use of geothermal power, establish dialogue among key stakeholders, and catalyze appropriate activities to overcome obstacles to appropriate development. Our vision is that geothermal power is environmentally, economically and politically sustainable and fully integrated into mainstream energy markets.

The NGC is led by a steering committee whose membership to date includes representation from a variety of sectors, including environmental groups, tribes, industry, both investor owned and public utilities, academia, and government.

RESOLVE, a non-profit environmental dispute resolution organization, provides a full range of facilitation services to create opportunities for NGC members and other geothermal stakeholders to build long-term relationships, and to develop a number of landmark products resulting from significant negotiation and reflecting consensus of the Committee.

NGC members include representatives from:

- Bureau of Land Management
- Center for Energy Efficiency and Renewable Technologies
- Council of Energy Resource Tribes
- Geothermal Energy Association
- Geothermal Resources Council
- National Conference of State Legislators
- Seattle City Lights
- Southern California Edison
- State of Nevada, Commission on Mineral Resources
- U.S. Department of Agriculture (Forest Service)
- U.S. Department of Energy, EERE, GeoPowering the West
- Washington State University
- White House Task Force on Energy Project Streamlining

ABOUT THE AUTHORS

MHA Environmental Consulting, Inc.

This report was prepared by MHA Environmental Consulting, Inc. (MHA). MHA provides strategic environmental consulting services to public and private clients throughout the western United States. MHA has over 20 years of experience leading environmental review and permitting of geothermal, infrastructure, water, and energy projects. MHA has prepared state, federal, and joint state/federal environmental documents and conducted environmental permitting for energy production and direct-use geothermal projects in California, Oregon, and Nevada. MHA's key areas of expertise include:

- Project definition and planning
- Baseline data collection
- Public involvement programs
- Permit acquisition
- California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) compliance

Laurie McClenahan, MHA Principal, founded MHA in 1983 with the vision of taking her government agency environmental review experience to private and public sector clients to help design projects that can withstand rigorous public scrutiny under environmental review. She is an expert in NEPA, CEQA, environmental regulations, permitting, and public involvement programs. She has extensive experience permitting geothermal development, natural gas storage, pipelines, power plants, recreation, and infrastructure projects. Ms. McClenahan is frequently called upon to provide training in environmental regulations and the impacts of energy development. Ms. McClenahan holds a B.S. in Geology from California State University at San José.

Curtis Williams, AICP, is a senior associate at MHA. Mr. Williams has 25 years of planning and environmental experience, including an extensive background in public participation. He has conducted public workshops for local agencies and has facilitated negotiations and agreements between interested parties to development disputes, including residents, environmental organizations, cities and counties, and property developers. Mr. Williams holds a Master's Degree in Urban Planning from the University of California at Los Angeles, and is trained as a mediator and facilitator.

Andrew Gentile is an environmental analyst who has prepared environmental documents for a variety of projects under both NEPA and CEQA. Mr. Gentile has contributed to environmental documents for a direct use geothermal project and for a geothermal power exploration and development project. Mr. Gentile graduated from the University of Waterloo with a B.S. in Biochemistry, and from the University of San Francisco with a M.S. in Environmental Management.

INTRODUCTION

Purpose of this Report

The National Geothermal Collaborative (NGC) conducted a quantitative and qualitative examination of public comments recorded in federal and state environmental and permitting documents for geothermal projects. The primary objectives of this effort are twofold:

- 1) To analyze what categories of interest and sectors are involved and which issues they raise.
- 2) To use this analysis to design a set of recommended principles for developing effective outreach programs.

This report reflects the results of the analysis and defines the key public issues identified during permitting of geothermal development, the primary organizations that comment on geothermal development, and outreach principles for those considering geothermal development, including developers, agency staff, and policymakers. A notable conclusion of the report is that the issues and recommendations are generally universal over time, over geographic areas and physical settings, and across many types of projects:

Over time - The issues of concern have not changed over time. The primary concerns raised in 1979 are the same as those raised in 1989 and 2003.

Over geographic area - The same issues are typically raised in all areas studied, including the Northwest, the Salton Sea in southern California, and Hawaii.

Over physical setting - Comparable issues were typically identified in different physical settings, such as a desert or a forested environment

Type of project - Geothermal project issues are similar in many respects to those of any development, e.g., other energy facilities, industrial parks, or residential subdivisions.

Methodology

The NGC requested that outreach principles be based on a detailed analysis of comments on various environmental documents for a variety of geothermal activities. The purpose of the comment analysis was to identify the typical issues in geothermal development and identify the entities that participate in the environmental review of geothermal projects. Identifying the issues and the commenters would allow for more focused outreach principles.

The first task was to identify appropriate geothermal projects to analyze. MHA proposed eight sites for the analysis based on:

- Availability of documents
- Representation of various geographic regions and physical settings
- Potential for additional development
- Extent of public, agency, and non-governmental organization (NGO) participation

Recently permitted sites were preferred over older projects, when other factors were equal.

The documents were analyzed from a quantitative perspective, where possible, and from a qualitative viewpoint. The quantitative analysis resulted in tabulation of data regarding the number and nature of comments received on the documents. Of the eight selected sites, five had documents containing comment letters (Fourmile Hill, PLES I, Newberry, Pueblo Valley, Gifford Pinchot). Comments from these five documents were counted and organized into pre-selected categories (such as hydrology, wildlife, visual resources, purpose and need for the project, and comments on project alternatives among others). The three remaining documents did not contain letters of comment on the project or environmental issues and generally only included summaries of issues raised; these documents were not appropriate for quantification of comments.

The comments on the environmental or permitting documents were analyzed to identify the primary issues of concern and the key commenting entities. A roundtable of geothermal experts was convened to provide peer review of the comment analysis.

A more detailed discussion of the methodology is included in Appendix A.

Geothermal Sites

Eight geothermal projects were identified for analysis. The sites were selected to provide a full range of issues, physical environments, and geographic locations. The eight sites selected for comment analysis are shown in Table 1. The site locations are shown in Figure 1.

TABLE 1: Geothermal Sites Summary

Geothermal Project	Location and Date	Lead Agencies
Fourmile Hill (Glass Mountain) 49.9 megawatt (MW) Flash Plant and 26 mile Transmission Line	Northern California 1998	Bureau of Land Management US Forest Service Bonneville Power Administration Siskiyou County Air District
PLES I (Mammoth) 10 MW Binary Plant	Central-Eastern California 1989	Bureau of Land Management US Forest Service Great Basin Unified Air District
Newberry 30 MW Flash Plant and Transmission Line	Central Oregon 1994	Bureau of Land Management US Forest Service Bonneville Power Administration
Pueblo Valley 20 MW Binary Plant and 6 mile Transmission Line	Southeastern Oregon 1995	Bureau of Land Management US Forest Service
Gifford-Pinchot Geothermal Leasing	Washington 1979	Bureau of Land Management US Forest Service
Salton Sea Unit 6 185 MW Flash Plant	Southern California 2003	California Energy Commission
Puna Geothermal Venture 30 MW Flash Plant	Hawai'i 1989	N/A
Steamboat Hills 12 MW Binary Plant	Nevada 1993	Bureau of Land Management

Figure 1: Locations of Selected Geothermal Sites

Comment Analysis Conclusions

COMMENT ANALYSIS

The comment analysis represents a compilation and review of 3,787 individual comments on eight proposed geothermal development locations throughout the western United States. The comments span issues raised in 1979 for a geothermal leasing Environmental Impact Statement (EIS) to issues raised in 2003 for a 185 MW geothermal power plant at the Salton Sea (the largest geothermal plant proposed to date).

Comments on geothermal proposals encompassed the broad range of parameters addressed in the environmental documents. The key comments most often addressed effects on air quality, water quantity and quality, recreation, visual resources, noise, and biological resources. Additional issues commonly addressed included project alternatives, mitigation measures, and hazards. More detailed information regarding the types of comments is found in Appendix A, which includes tables summarizing frequently occurring comments, quantifying the types of comments, and outlining topics by commenting entity.

Project comments are typically addressed with clarifying responses by the project proponent and/or environmental professionals, and in some instances additional mitigation might also be applied (usually when suggested by a permitting agency). Most impacts are mitigated either through project design considerations or other standard mitigation measures. Remaining significant effects are usually limited to visual effects where the drill rigs, steam plumes, power plant, or transmission line is visible from key viewing points.

Comments and key issues associated with geothermal development were many and varied, but did not substantially differ between geothermal projects. The comments on geothermal projects were notably consistent across geographic regions, physical environments, and time periods.

The comments or issues generally did not differ extensively by region, although there may be very different environmental and regulatory settings in place. For example, the public raised similar concerns regarding noise and visibility of projects whether they were in rural or more urban areas, or in the desert or forested environment.

The comments on geothermal projects have not changed substantially from 1979 to 2003. For example, well blowouts and pipeline breeches have been consistent public concerns over the last 20 years. Operating geothermal projects over that period, however, have resulted in only a handful of well blowouts and breeches, leading the industry to continue to enhance outreach efforts and develop measures to effectively mitigate those concerns.

Review and analysis of all of the comments should therefore still be useful to anyone contemplating geothermal development today.

The typical issues and commenting entities identified in the analysis are described for each site in extensive detail in Appendix A. This analysis serves as the basis of the Recommended Outreach Principles.

SUMMARY OF COMMENTERS

The analysis of the comments on the environmental documents showed that the key commenters on documents could be categorized by agencies and by local interest groups. The commenters and their key issues are presented in tables (by project) in Appendix A. The agencies commenting routinely included local permitting agencies, such as air pollution control districts and water quality control boards, and adjacent land management and land use regulatory agencies, such as counties or the National Park Service. The U.S. Fish and Wildlife and state fish and game agencies also routinely comments on projects.

Commenting groups most often include local special interest or environmental groups. Examples of these groups include winter recreationalists, adjacent landowners (homeowner associations), and local environmental groups (desert protection groups and local Sierra Club or Audubon Society chapters).

Tribes and labor unions have become increasingly active in commenting on geothermal projects. Tribal concerns include effects on the landscape, air, water, historic and archaeological resources, and the potential for interference with religious or ceremonial practices. Union groups (such as the California Unions for Reliable Energy) have been increasingly active on all industrial projects and their comments usually address virtually every parameter and aspect of the project.

Comments frequently indicate a lack of knowledge of geothermal development. Responses to comments are often clarifications of project construction or operational procedures, analysis methodology, or mitigation implementation. Project opposition is minimized where outreach efforts, including education and interaction with interested parties, occurs at an early stage.

RECOMMENDED OUTREACH PRINCIPLES AND APPROACHES

Introduction

The analysis of comments and commenters provides a sound basis to design a set of recommended principles for developing effective geothermal outreach programs. The range of comments, frequently occurring comments, and identification of commenting parties suggested how such outreach programs should be targeted.

A wide variety of stakeholders participate in the environmental review and permitting process for geothermal projects. Each category of stakeholder has a different perspective and can have very different goals regarding geothermal development. Most of these stakeholders would benefit from education about the need for, impacts of, and benefits of geothermal energy. The methods of education may differ by group but would generally be the same across all regions where geothermal development occurs. Appropriate approaches to outreach and the targets of the outreach effort also are likely to vary for each group.

The geothermal industry and government agencies are the primary intended audience for this report. For purposes of the report, the geothermal industry includes geothermal developers, geothermal service providers, and associated groups, such as the Geothermal Energy Association (GEA) and the Geothermal Resources Council (GRC).

Government agencies include the land management agency and regulatory staff and decision makers who contribute to or would oversee environmental review and permitting of geothermal development. Federal agencies could include:

- Bureau of Land Management
- Forest Service
- Department of Defense
- Bureau of Indian Affairs
- President's Advisory Council on Historic Preservation
- Bonneville Power Administration
- Western Area Power Administration
- Fish and Wildlife Service
- Environmental Protection Agency
- Department of Energy
- Tribes

State, local and regional agencies may be involved as well and could be sources of outreach to project area stakeholders. These agencies could include:

- Regional water quality control boards
- Geology and mineral resource agencies
- Air quality management districts
- Biological resource protection agencies
- Local water districts
- Local and regional land use agencies

The industry and regulatory agencies can serve to initiate outreach to the broader public, including policy makers, local agencies, environmental and recreation groups, homeowners, tribe representatives, labor, and other interested parties. The policy makers group could include legislators or agency boards who develop rules and regulations that affect the geothermal industry. Examples of agencies that might fulfill this role include the U.S. Department of Energy, the Bureau of Land Management, US Forest Service, key State agencies, and in some cases County or regional agencies.

This section of the document includes a discussion of:

- Basic Outreach Principles
- Target Audience and Outreach Approach
- Outreach to Government Agencies
- Outreach to Policy Makers
- Topics for Education in Outreach Efforts

Basic Outreach Principles

Approaches to public outreach will vary according to the target audience, the project, and the issues likely to be of concern. However, there are some basic principles that should provide the framework for any outreach effort, given the nature of geothermal projects and related concerns of interested parties.

Educate, educate, educate. Many of the concerns of geothermal development are misconceptions that can best be addressed through education of the target audience, with appropriate studies and data provided to document the facts about geothermal energy and the associated environmental effects.

Educate before proposing. The industry and associated agencies should not wait for a scoping meeting for a project to present background information to interested parties. Early educational efforts, establishing websites and/or field offices, and other approaches are valuable to address community concerns early in project design and to minimize later conflicts in the process.

Educate about the need for alternatives. The public, agencies and policy makers need to be educated to think beyond the project-specific issues of the immediate area to understand the larger benefits of developing renewable resources, such as geothermal.

Establish relationships with key interested parties. For most projects, it is apparent from the comments received who the key interested parties are likely to be. These agencies, organizations, or individuals should be contacted and included in early project discussions and, where possible, may be invited to participate in advisory groups in advance of the formal review process.

Maintain communications throughout the permitting process, construction, and operations. Providing for continued communication with these parties throughout the life of the project can avoid misunderstandings, provide for enhanced monitoring, and set the stage for a more positive relationship for the next project.

Acknowledge potential impacts and address them. Where potential concerns are not misconceptions addressed through education, they should be acknowledged and addressed with appropriate mitigation or revised project design. Enabling early input and addressing specific concerns provides for trust from interested parties that carries through the project.

Monitor extensively, and compile and publish data. Each geothermal development project is a prelude to the next. An improved information base is valuable for educating the target audience regarding potential impacts (or non-impacts) of development. An effective monitoring program, with data readily available to the public, provides assurance to concerned parties that their issues are not forgotten. Document the findings in published case studies that can be used throughout the industry.

Target Audience and Outreach Approach

Geothermal developers and industry organizations should develop outreach programs to provide a framework for research, public education, and early input from the public. The industry's target audience is likely to include the following groups, as they may be relevant to a particular region or project.

- Government (federal, state, regional and local) agency staff
- Project area-specific decision makers (e.g., forest supervisors, area managers)
- Policy makers at all levels
- Local and regional environmental groups
- Local and regional recreational groups
- Homeowner associations
- Local Native American tribes
- Labor groups
- Business organizations
- Water suppliers and users

OUTREACH OBJECTIVES

The primary objectives of such outreach efforts should be to:

- Disseminate educational materials to agencies and the public
- Provide for monitoring and research to enhance the availability of data
- Establish an early dialogue with potential interested parties
- Develop mitigation approaches to key impact concerns

BASIC OUTREACH METHODS

There are a variety of outreach methods that the geothermal industry and developers should consider implementing to achieve the specified objectives, including:

- 1) Developing informational materials related to common misconceptions about geothermal development, such as the impacts of air emissions deposition on water quality, the frequency and nature of blowouts, the contamination of groundwater, and the depletion of the geothermal resource.
- 2) Preparing standard quality control and reporting methods for monitoring data related to emissions, air and water quality, and other parameters of concern, where applicable.

- 3) Identifying industry-wide approaches to mitigation of potential impacts, such as odor impacts from hydrogen sulfide, visual impacts, loss of habitat, construction in roadless areas, and effects on hot springs.
- 4) Providing techniques for early public education and involvement, some of which may include:
 - a) Initiating (and funding) a community committee to receive intensive education on the proposed project, geothermal development in general, and the environmental effects of exploration, development, operation, and decommissioning
 - b) Conducting community informational seminars at a local public facility (community college, high school, etc.)
 - c) Establishing a staffed local field office early in the process with informational materials available and committing someone specifically to outreach
 - d) Setting up a website providing information on the proposed project, environmental protection measures, the decision-making process and factors, and opportunities for public input
 - e) Arranging for site visits to better educate the public about the area and to indicate how various constraints have been considered in the project location and design
- 5) Establishing a consistent point of contact initially and throughout the project to field concerns from the public, with priority attention to providing prompt response to any complaints or questions.
- 6) Meeting with concerned parties as necessary, either one-on-one or in a group setting or workshop to address their concerns.

The following sections discuss specific approaches to providing outreach to government agencies and to policy makers. Some of the key issues to be addressed and site- and region-specific concerns to consider are outlined in a subsequent section.

Outreach to Government Agency Staff

Agency staff and decision makers involved in the approval process for geothermal projects are a critical target audience for outreach. The agency staff will also play an important role in communicating their knowledge and understanding of the project to the decision makers and the public. This effort should emphasize education and participation in the early phases of project development, as well as in the formulation of research and monitoring efforts.

OUTREACH OBJECTIVES

The primary objectives of the industry's outreach to agency staff and decision makers should be to:

- Establish and maintain regular channels of communication with selected key agency staff, even when no projects are proposed.
- Provide educational materials and research to the agencies as the information is developed.
- Involve the agencies in developing the methodology for research, monitoring, and data collection efforts, including developing memorandums of understanding (MOUs) with the agencies where necessary.
- Invite agency representatives to participate in all phases of project development and review and in the development of approaches to mitigation of key impact concerns

OUTREACH METHODS

Industry organizations and developers should provide outreach to public agencies in several ways, including:

- 1) Identifying the key personnel in each agency and assuring that regular contact is maintained with that person or group of persons, through meetings or other communications.
- 2) Soliciting agency input into the development of research efforts, monitoring programs, and data collection efforts.
- 3) Sharing the results of research and monitoring efforts with the agencies, including presentations or newsletters targeted to the relevant staff and decision makers.
- 4) Inviting agency staff and decision makers on site visits to view existing operations or potential sites for development or to garner their ideas regarding how to address a specific concern.
- 5) Inviting agency staff and decision makers to attend industry conferences and seminars.
- 6) Involving agency staff and decision makers in committees or other meetings to solicit input regarding techniques to mitigate potential impacts that are likely to be of concern on a project.

The desired result of this outreach approach is to inform agency staff, develop constructive working relationships, keep staff informed in the review and permitting process, and to assist the staff in becoming a conduit for providing accurate information to the decision makers, other interested parties, and the public.

Outreach to Policy Makers

Legislators and agency board members involved in the development of rules and regulations that affect the geothermal industry are another critical outreach target for the geothermal industry. These policy makers are typically more interested in the larger scale benefits and impacts of geothermal development, and less interested in the details.

OUTREACH OBJECTIVES

The primary goal of the outreach effort to policy makers should be to educate them about geothermal energy. Key objectives for effectively educating policy makers should include:

- Educating them about the environmental and economic benefits of geothermal energy.
- Providing information that they may pass along to interested constituents, particularly as to how issues of concern are being or have been addressed.
- Maintaining regular contact with the policy makers and their key staff to quickly respond to their questions and concerns.

OUTREACH METHODS

Outreach to policy makers should focus on education and meetings, including:

- 1) Establishing a relationship with the policy makers through meetings with them or their key staff and regular follow-up communication. Meetings are the most effective form of contact, assuring the policy maker's full attention. Someone in a senior capacity should be designated as a regular contact for each policy maker.
- 2) Arranging site visits or tours of facilities for policy makers and their staff and other agency staff, to familiarize them with the on-the-ground constraints and/or operations of geothermal development. Inviting decision-makers to visit a functioning geothermal site

is an excellent opportunity to highlight the benefits of geothermal energy, to describe how a geothermal facility operates, and to explain the surrounding issues.

- 3) Providing concise background educational materials outlining the benefits of geothermal energy development. Some key components of this information could include the reliability of geothermal energy, the environmental impacts as compared to traditional sources of energy, energy diversity and independence, the relative costs compared to other alternative energy sources, and the socioeconomic impacts for a community, especially job creation and increased local tax revenues.
- 4) Providing concise information about the industry or the developer's efforts to work with interested parties and to address key issues that are likely to arise during the environmental and permitting process or in the course of considering legislation. This presentation should clearly distinguish between a) misconceptions about certain types of impacts, b) other impacts that may be effectively mitigated, or c) still others that are acknowledged as being unavoidable.

The key to effective outreach with policy makers is to provide them with succinct and timely information so they are not surprised by issues that arise, and to remain in contact and available as concerns are raised.

Topics for Education in Outreach Efforts

ISSUE- AND INTEREST-SPECIFIC OUTREACH CONSIDERATIONS

The Comment Analysis section of the report outlined an extensive number of issues that may be of concern in the environmental review and permitting of geothermal development. While all issues raised will need to be addressed, there are several that occur frequently and for which the industry should prepare standardized information for response. Others issues tend to be specific to certain interested parties and are more likely to be addressed on a case-by-case basis. The common topics include:

- Benefits of Geothermal Energy
- Project Description
- Process
- Common Misconceptions About Geothermal Development
- Impact Mitigation and Monitoring
- Interested Parties

Suggested approaches to dealing with each topic are outlined below.

Benefits of Geothermal Energy

As outlined in the discussion of outreach to policy makers, the industry should provide user-friendly documentation of the benefits of geothermal development, including cost comparisons, socioeconomic impacts to the community, and diversification of energy sources.

Project Description

The project should be clearly outlined for the public, agencies, organizations, and decision makers. The project should define plans for phasing of exploration and production and the likely ultimate potential for development in an area. A description of the decommissioning process and operation is also frequently requested.

Environmental and Permitting Process

The environmental review and permitting process should also be clearly identified, including all of the approvals required, their sequence, and interrelationships between them.

Common Misconceptions About Geothermal Development

A number of issues are consistently raised for which current data are available that indicate significant impacts will not occur. Documentation of these data (and development of further monitoring, research, and data as needed) should be produced and made available in a user-friendly format to address these issues. Some of the common misconceptions include impacts from:

- Air emissions and effects on ambient air quality
- Deposition of air emissions on surface water
- Contamination of groundwater
- Reduction in the quantity of groundwater and surface waters
- Well blowouts and pipeline ruptures
- Sustainability of the geothermal resource

Impact Mitigation and Monitoring

Some of the identified issues are best addressed with proven mitigation measures and/or with effective pollutant monitoring. For those impacts anticipated for geothermal development, materials should be developed outlining mitigation approaches and how impacts will be monitored to assure compliance. Some of these impacts typically include:

- Odors from hydrogen sulfide
- Visual impacts
- Loss of biological habitat
- Construction in roadless areas
- Effects on hot springs

Interested Parties

Concerns voiced about geothermal development come from a variety of sources. For example, water quality impacts from deposition of air emissions could be a comment from environmental organizations or agencies, homeowners, recreational groups, or labor unions. Other issues are more typically specific to a certain interested party and should be dealt with through early consultation and discussions with that group (see *Target Audience and Outreach Approach*). Some examples include:

- Homeowners and other nearby residents, who may be particularly affected by noise, odors, or visual impacts
- Recreational users, who may perceive specific impacts to their recreational resource
- Labor unions, who are likely to have concerns about the use of local labor and particularly union labor
- Local Native American tribes, who may have concerns about interference with tribal and cultural land uses

SITE-SPECIFIC AND REGION-SPECIFIC CONSIDERATIONS

There are only a few issues and concerns that occur specific to a site or region, as noted in the comment analysis comparison of the eight selected projects (Appendix A). These eight sites represent a diversity of environmental, regulatory, and political settings in the western U.S. and each presented some challenges unique to its circumstances. Suggested approaches for outreach again require early involvement of agencies, affected organizations, and the public to address these concerns through techniques outlined in the Target Audience and Outreach Approach section. Some of these differences are outlined below.

National Parks/Monuments – Projects located near National Parks or Monuments (or proposed parks, monuments, or wilderness areas) elicit substantial concerns about potential conflicts with the purposes of those areas. Some of the key issues were visual impacts, the use of roadless areas, and conflicts with recreational users of the area.

Multiple Jurisdictions – Projects that involved working with multiple jurisdictions (Fourmile Hill, PLES I) and/or multiple agency approvals presented additional complexities, which are often difficult for the public to understand.

Tribal Areas – Proposed projects located in areas of Native American tribes' interest (Fourmile Hill, Puna, PLES I) require extensive communication and negotiation with tribe representatives to identify Native American concerns. A high level of sensitivity to the cultural issues and culture of the tribes is critical in discussions and meetings.

Residential Uses – Geothermal facilities are not frequently located in proximity to residential uses, but when they are (Puna), impacts of noise and odors become paramount and require extensive education of the residents and monitoring of impacts.

Geothermal Features – The presence of geothermal features (generally hot springs) can often be a focus of concern surrounding geothermal development, especially regarding the potential depletion of the source for the geothermal feature. Providing data and ongoing monitoring to assure protection of the geothermal feature is helpful for these sites.

Notably, the environmental issues do not vary substantially between the different physical environments in which the projects are located. Noise and odors are just as much of a concern in a remote forest as they are next to a more urban area. Concerns about roadless areas can be raised in both the forest and the desert.

Conclusion

Outreach to the varied stakeholders interested in geothermal development is critical to the success of a project. Extensive outreach should also result in a reduced schedule for environmental review and permitting as the public is engaged earlier and is better educated about geothermal development. Education of agency staff and the public can result in less extensive comments on environmental documents, thereby reducing costs and schedules. Education, communication, and monitoring are the cornerstones of an effective outreach program, whether addressing others in the industry, public agencies and policy makers, or the broader public. Geothermal developers and industry organizations should play an integral role in this effort by providing these groups with appropriate data, techniques, and experienced professionals for outreach. This role should focus on fostering education through preparation of background materials regarding:

- The benefits of geothermal development
- Documentation of actual impacts of existing facilities
- Appropriate and effective measures to mitigate anticipated impacts of development

Industry representatives should also help to assure that monitoring of existing facilities occurs and is recorded, and that resultant data is collected and published to make readily available to interested parties.

APPENDIX A:

COMMENT ANALYSIS

COMMENT ANALYSIS

Introduction

The National Geothermal Collaborative (NGC) conducted a quantitative and qualitative examination of public comments recorded in federal and state environmental and permitting documents for geothermal projects. The primary objectives of this effort are twofold:

- 1) To analyze what categories of interest and sectors are involved and which issues they raise.
- 2) To use this analysis to design a set of recommended principles for developing effective outreach programs.

This report reflects the results of the analysis and defines the key public issues identified during permitting of geothermal development, the primary organizations that comment on geothermal development, and outreach principles for those considering geothermal development, including developers, agency staff, and policymakers.

This appendix to the report provides the detailed analysis of the comments and commenters.

Site Selection Criteria

The NGC Steering Committee identified an initial list of geothermal development projects that had undergone environmental review and permitting, including varying degrees of public review and participation. MHA reviewed the identified sites and considered other potential projects based on environmental review experience and knowledge of the public involvement process for the projects.

MHA proposed eight sites for the analysis based on:

- Availability of documents
- Representation of various geographic regions and physical settings
- Potential for additional development
- Extent of public, agency, and non-governmental organization (NGO) participation

Recently permitted sites were preferred over older projects, when other factors were equal.

Selected Sites

The sites selected for comment analysis are identified below and their locations are shown in Figure A-1. After each site are some of the key elements for selection:

Fourmile Hill (Glass Mountain), Northern California (1998) – Wide range of commenters and issues, comments already categorized, relatively recent, extensive public involvement program, significant tribal issues

PLES I (Mammoth), Central-Eastern California (1989) – Extensive public controversy, binary plant

Salton Sea, Southern California (2003) – Recent project in geothermal area with additional potential for development, extensive public involvement process through the California Energy Commission (CEC)

Newberry, Central Oregon (1994) – Extensive and successful public involvement program in the Northwest

Pueblo Valley, Southeastern Oregon (1995) – Extensive public controversy, participation by major environmental groups from the Northwest, Northwest region has potential for geothermal development

Gifford-Pinchot Geothermal Leasing, Washington (1979) – Substantial public participation, leasing issues in the Northwest

Puna, Hawai'i (1989) – Extensive public involvement

Steamboat Hills, Nevada (1993) – Flash plant in Nevada near urban area

The location and lead agencies for the projects are shown in Table A-1.

Additional Sites Considered

Additional geothermal development sites and documents were considered for analysis. The sites considered included the 1973 federal geothermal leasing EIS, a project on Department of Defense lands (Coso or Fallon), and a New Mexico project.

The geothermal leasing EIS was initiated before substantial geothermal development had occurred in the U.S. The projects on Department of Defense lands generated much less public comment because the lands had been withdrawn from public access. Activity in New Mexico was investigated but there are no recent documents readily available. Little development has occurred in New Mexico.

Other geothermal project sites were rejected from detailed consideration for a variety of reasons. Some of the sites and reasons for rejection are summarized below:

Other Imperial Valley Projects – Salton Sea project is most recent and had CEC public participation process

Other Nevada Projects – Less public proximity and involvement than at Steamboat

Utah Projects – Limited development, prospects, and public involvement

The Steering Committee members on the Outreach Materials Working Group determined that eight documents would be adequate for the proposed analysis.

Figure A-1: Locations of Selected Geothermal Sites

Overview of Analysis Methodology

APPROACH TO ANALYSIS

Eight environmental documents for leasing or permitting for geothermal projects were selected for review, representing a variety of geographic locations, environmental settings, and environmental issues. The documents were analyzed from a quantitative perspective where possible and from a qualitative viewpoint, as well. Quantitative analysis was deemed appropriate for those documents that included letters of comment from agencies, organizations, or individuals. The documents that do not contain letters of comment on the project or environmental issues generally only included summaries of issues raised; these documents were not appropriate for quantification of comments.

Projects, documents, locations, and lead agencies are shown in Table A-1.

TABLE A-1: Geothermal Sites

Geothermal Project	Location and Date	Lead Agencies
Fourmile Hill (Glass Mountain) 49.9 MW Flash Plant and 26 mile Transmission Line Final EIS/EIR	Northern California September 1998	Bureau of Land Management US Forest Service Bonneville Power Administration Siskiyou County Air District
PLES I (Mammoth) 10 MW Binary Plant Final EIS/EIR	Central-Eastern California June 1989	Bureau of Land Management US Forest Service Great Basin Unified Air District
Newberry 30 MW Flash Plant and Transmission Line Final EIS	Central Oregon July 1994	Bureau of Land Management US Forest Service Bonneville Power Administration
Pueblo Valley 20 MW Binary Plant and 6 mile Transmission Line Preliminary Scoping Report	Southeastern Oregon December 1995	Bureau of Land Management US Forest Service
Gifford-Pinchot Geothermal Leasing Final EIS	Washington May 1979	Bureau of Land Management US Forest Service
Salton Sea Unit 6 185 MW Flash Plant Supplemental Testimony and Comments	Southern California December 2003	California Energy Commission
Puna Geothermal Venture 30 MW Flash Plant Final Report, Mediation of Geothermal Resource Permit Application 87-1	Hawai'i August 1989	N/A
Steamboat Hills 12 MW Binary Plant Amendment for Geothermal Fluid Rate Increase, Environmental Assessment	Nevada September 1993	Bureau of Land Management

Letters of comment were available for five of the eight documents. Transcribed oral comments from scoping meetings were also available for one of these five documents (Pueblo Valley). Specific letters of comment were not available for three projects; these documents were subject to a qualitative analysis:

- Puna Geothermal Venture, Final Report, Mediation of Geothermal Resource Permit Application 87-1, Hawai'i, August 1989
- Steamboat Hills Geothermal Project, Yankee/Caithness Joint Venture, L.P., Amendment for Geothermal Fluid Rate Increase, Environmental Assessment, Nevada, September 1993
- Salton Sea Unit 6, California Energy Commission Staff PMPD Supplemental Testimony and Comments for Salton Sea Unit 6 (02-AFC-02), Imperial County, California, December 2003

An environmental document was not prepared for the Puna Geothermal Venture (PGV). The project was not located on federal land and did not trigger a National Environmental Policy Act (NEPA) document. Hawai'i does not have a state-equivalent of NEPA; therefore, a state environmental review process was not conducted. Available comment information for PGV was

limited to a summary of issues within a report from an extensive mediation process that took place in 1989.

The Steamboat Hills project did not have a final environmental document with comment letters and responses. Issues from Steamboat Hills were highlighted in the Environmental Assessment with supplemental information provided by the author of the environmental document.

The Salton Sea project underwent extensive environmental review by the California Energy Commission (CEC) through the CEC Application for Certification process. The CEC process does not result in a final environmental document with comment letters and responses; however, the CEC staff issues a final staff assessment and the Commission issues a final decision on the project, incorporating findings and mitigation measures. The CEC Staff Comments on the project were reviewed, along with a written summary of issues provided by the CEC Salton Sea Unit 6 Permitting Project Manager, Robert Worl.

TYPES OF COMMENTS

The comments on environmental documents varied from very specific concerns about air emissions from a representative of an Air Pollution Control District to concerns about “toxic plumes” raised by someone who lives hundreds of miles away in a remotely located project. Comments on projects sometimes included concerns based on experience at other geothermal project locations, but comments were frequently based on inadequate information or inadequate understanding of the project and its impacts. Mitigation was usually proposed to address any remaining potential adverse effects, either in project design or through modification of operational procedures. Most of the comments are typical not only for geothermal projects, but for many other type of energy or land development projects as well.

QUANTITATIVE ANALYSIS OF COMMENTS

Comments were counted and organized into pre-selected categories (such as hydrology, wildlife, visual resources, purpose and need for the project, and comments on project alternatives among others) for the five documents that included comments (Fourmile Hill, PLES I, Newberry, Pueblo Valley, Gifford Pinchot).

The quantitative analysis resulted in tabulation of data regarding the number and nature of comments received on the documents. These data are presented in three ways:

- 1) The total number of comments received on each document, which allows the reader to see which projects attracted the most comments from the public, government agencies, or other interested parties.
- 2) The number of comments received on each topic per document, which allows the reader to see which topics were of particular concern on a project-specific basis.
- 3) The total number of comments received on each topic for all documents, which allows the reader to see which topics were of greatest concern for the studied geothermal projects.

In cases where certain topics (such as hydrology) received substantial comments on particular subtopics (such as impacts to groundwater or impacts to surface water), these subtopics were broken out in the matrix. Comments in most of the selected documents were already indexed to some extent. However, each document used slightly different categories. The Fourmile Hill project received the greatest number of comments and provided detailed classification of these comments. Subcategories were largely chosen from the set provided in the Fourmile Hill EIS/EIR. Comments for other projects were grouped as closely as possible into the categories outlined for Fourmile Hill.

The quantitative results are intended to provide a generalized sense of how the documents compared in terms of level of public input and in the primary areas of concern. It should be noted, however, that the separation, identification, and categorization of comments is somewhat subjective. Some comments may apply to more than one category, and multiple comments about one topic may have been combined and represented as a single comment.

QUALITATIVE ANALYSIS OF COMMENTS

Three types of qualitative analysis were conducted for each project:

- Identification of primary issues
- Analysis of commenting parties
- Geothermal expert questionnaire

The approach to these analyses is described below.

Identification of Primary Issues

All documents were reviewed to identify those topics of frequent or recurring concern. Those issues that were emphasized or raised repeatedly are outlined and discussed for each document, and common issues for geothermal projects in general are summarized in the Results Section.

Analysis of Commenting Parties

The analysis of commenting parties included identification of the commenting parties and analysis of their major concerns. Commenting parties included:

- Public agencies (local, regional, state, and federal)
- Nongovernmental organizations (environmental, recreation, homeowner associations, business groups, etc.)
- Energy industry firms or organizations
- The general public

Comment letters were reviewed and are summarized in a narrative discussion in the text. A more detailed listing of the parties and their comments is included for each project.

The analysis of commenting parties did not include a detailed analysis of the level of understanding of geothermal issues by the commenters. Such an analysis might have affected the results but is beyond the scope of this report.

Geothermal Expert Questionnaire

A questionnaire was developed to solicit peer review of the initial findings of the analysis and to ensure project issues and commenters were fully identified. The questionnaire was distributed to five selected individuals with substantial experience in environmental review and permitting for geothermal projects. The individuals were selected to provide supplemental knowledge of particular geothermal projects that were not subject to quantitative analysis. MHA consulted the following individuals:

- Jill Haizlip, Geochemist, Geologica, San Francisco, California
- Gene Suemnicht, Geologist, Geologica, San Francisco, California
- Dwight Carey, Principal, Environmental Management Associates, Inc., Brea, California
- Alice Doremus, Realty & Geothermal Project Manager, U.S. Forest Service, Deschutes National Forest, Oregon

- Robert Worl, Permitting Project Manager for Salton Sea Unit 6 Project, California Energy Commission

Questions to the peer review team included:

- 1) What are the top five environmental issues that you have experienced as causing conflicts or delay for approval of geothermal projects?
- 2) List any issues that have not been identified in the report's list of issues.
- 3) List any interest groups not represented in the report.
- 4) What public outreach steps do you feel would be helpful for the following groups to take to address the key issues identified?
 - a) Geothermal developers
 - b) Public agencies
 - c) Geothermal industry organizations

The team's responses resulted in refinements to the qualitative analysis and provided input to the development of strategies for public outreach. A summary of the results of the roundtable review and questionnaire is provided at the end of this appendix.

Results

INTRODUCTION

This section provides an overview of the results of the quantitative and qualitative analyses of comments. This section includes:

- The tabulated results of the quantitative analysis of comments
- An overview of topics of interest common to several of the projects
- A summary of the quantitative and qualitative analysis for each document, including the comments of the interested parties and their concerns on each project

QUANTITATIVE RESULTS

Table A-2 details the number of comments identified for each document, for each topic and subtopics of concern for each document, and for all of the documents in total. The data are useful in developing summaries of the primary concerns for each project and for geothermal projects in general. The quantitative analysis is supplemented by the qualitative analysis as input in developing strategies defined in the Recommended Outreach Principles and Approach section of this report.

QUALITATIVE RESULTS

Comments or issue summaries were reviewed for all eight selected documents. Some topics of concern were found to be common across all or several documents, while other comments are more specific to the environmental, regulatory, or political setting of an individual project. The qualitative results are presented later in this chapter. The comments on these projects are generally relevant also to future projects that are in similar environmental, regulatory, and political settings.

Table A-2: Quantitative Summary of Comments						
TOPIC	DOCUMENT					TOTALS
	Fourmile Hill	PLES I	Newberry	Pueblo Valley	Gifford Pinchot	
General¹	387	20	62	84	8	561
Vegetation and Wildlife	205	94	20	71	17	407
Potential Impacts to Special-Status Species	68	0	1	39	4	112
Project Preference	292	0	4	1	10	307
Hydrology	165	56	40	25	13	299
Groundwater Drawdown	20	0	4	0	0	24
Groundwater Contamination	9	1	10	2	3	25
Surface Waters and Effects from Construction Activities	2	1	0	0	2	5
Surface Waters and Effects from Discharge	0	0	3	3	3	9
Surface Waters and Effects from Deposition ²	23	0	7	0	0	30
Air Quality	150	7	65	4	9	235
Emissions	29	2	13	4	2	50
Odor Impacts	12	0	3	0	0	15
Health Impacts	15	0	2	0	0	17
Visual Range	6	0	2	0	1	9
Monitoring and Reporting	7	0	0	0	0	7
Alternatives, Including the Proposed Action	107	17	43	14	38	223
Transmission Line Design and Capacity	35	0	0	0	2	37

NOTE: Subtopic comment numbers do not always add up to the bolded numbers for main topics; the subtopics selected for inclusion in this table do not represent all comments received on the main topics.

¹ General comments included typographical errors, general comments about geothermal development, requests for clarification, and comments that were not related to a specific topic identified.

² Deposition - the process whereby air pollutants are deposited on land and water.

Table A-2 (Continued): Quantitative Summary of Comments

TOPIC	DOCUMENT					TOTALS
	Fourmile	PLES I	Newberry	Pueblo Valley	Gifford Pinchot	
Introduction and Purpose and Need	128	1	16	15	2	162
Purpose and Need for the Proposed Action	37	1	16	12	2	68
Economic Justification for and Viability of the Proposed Action	54	0	0	3	0	57
Land Use and Recreation	98	16	14	12	19	159
Land Use and Planning	11	4	6	5	13	39
Effects on Recreation	87	12	8	5	6	118
Geothermal Resources	39	57	17	21	7	141
Effects on Life Expectancy of the Geothermal Resource	16	36	0	0	0	52
Effects on Regional Thermal Features	3	21	7	20	0	51
Noise	115	8	7	2	7	139
Construction	19	2	0	0	4	25
Operation	16	6	3	2	3	30
Visual Quality	85	15	16	10	9	135
General Impacts of Project Facilities	37	1	3	7	6	54
Impacts from Specific Key Observation Points (KOP)	24	1	3	3	0	31
Traditional Cultural Values/Native American Issues	119	0	0	0	0	119

NOTE: Subtopic comment numbers do not always add up to the bolded numbers for main topics; the subtopics selected for inclusion in this table do not represent all comments received on the main topics.

Table A-2 (Continued): Quantitative Summary of Comments						
TOPIC	DOCUMENT					TOTALS
	Fourmile	PLES I	Newberry	Pueblo Valley	Gifford Pinchot	
Cumulative Effects³	95	3	2	10	0	110
Cumulative Projects	49	0	2	5	0	56
Cumulative Effects	46	0	0	5	0	51
NEPA/CEQA Issues	93	7	0	0	4	104
NEPA/CEQA Adequacy	40	4	0	0	4	44
Geology and Soils	20	15	21	22	5	83
Subsidence	2	3	2	2	0	9
Geologic Hazards	15	5	7	10	1	38
Human Health and Safety	48	1	12	14	4	79
Hazardous Materials	22	1	6	3	0	32
Well Blowout Hazards	5	0	2	6	4	17
Socioeconomics	43	7	3	24	2	79
Property Values	13	0	0	2	0	15
Plans and Policies	59	0	4	0	15	78
Cultural Resources⁴	35	2	1	2	0	40
Project Support	21	0	0	3	1	25
Transportation	5	1	7	3	3	19
Other Statutory Sections	10	0	0	0	0	10
TOTALS	2285	327	356	337	173	3476

NOTE: Subtopic comment numbers do not always add up to the bolded numbers for main topics; the subtopics selected for inclusion in this table do not represent all comments received on the main topics.

³ Cumulative effects that result from adding the impacts of an action to other past, present, and reasonably foreseeable future actions, regardless of which agency (federal or non-federal) or person undertakes the individual actions.

⁴ Cultural resources are archaeological and historic resources eligible for or listed on the National Register of Historic Places. Cultural resources include buildings, sites, districts, structures, or objects having historical, architectural, archaeological, cultural, or scientific importance.

COMMON TOPICS OF COMMENT ON GEOTHERMAL PROJECTS

Many comments were found to be common to most, if not all of the projects reviewed. Such comments were generally related to environmental impacts specific to geothermal development and operation, as well issues related to environmental review documents that are not specific to geothermal projects. Many of the comments would be common to any type of development in a natural environment, including the potential for noise, visual effects, dust generation, and erosion effects to water quality. The topics that attracted the greatest numbers of comments included air quality and hydrology. Issues related to the sustainability of the geothermal resource and the effects of the project on nearby geothermal features were also dominant in some documents, depending on the presence of such features (not all areas of geothermal development have obvious surface manifestations of thermal activity). Common concerns related to geology and hazards were centered on the potential for induced seismic activity and well blowouts, respectively. Specific concerns under each general topic category are listed below.

Comments regarding the positive aspects of geothermal development were rare and included:

- Diversification of the energy supply for the nation and the state
- Economic benefits of construction labor spending in the community
- Economic benefits of property tax revenue
- Economic benefits of geothermal project and related industry jobs

A summary of the key comments is shown in Table A-3.

Table A-3: Comment Topics	
Topic	Impact/Concern
Air Quality	
	<ul style="list-style-type: none"> • Emissions during geothermal well flow testing, power plant operation (venting and cooling tower emissions), and potential for blowouts • Constituents of concern include: hydrogen sulfide, ammonia, boron, arsenic, mercury, and particulates (from geothermal fluids, dust, and diesel engines)
Hydrology	
<i>Surface Water Effects</i>	<ul style="list-style-type: none"> • Potential for construction-related erosion to affect surface water quality • Potential for drilling activities (spills of drilling fluids, drilling mud) to degrade surface water quality • Potential for geothermal fluid discharge from well blowouts and/or pipeline rupture to degrade surface water quality • Potential for degradation of surface water quality or groundwater quality or quantity related to connection between the geothermal reservoir and surface waters and groundwater during production • Potential for deposition of air pollutants (from drilling, well testing, or power plant operation) on surface waters

Table A-3 (Continued): Comment Topics	
Topic	Impact/Concern
<i>Groundwater Effects</i>	<ul style="list-style-type: none"> • Potential for groundwater extraction (for drilling or cooling tower make-up water) to cause drawdown of local groundwater table • Potential for drilling activities to degrade groundwater quality • Potential for leaking well casing to degrade groundwater quality • Potential for geothermal reservoir production to cause increased shallow boiling or cold groundwater inflow on geothermal features
Geothermal Resources	
	<ul style="list-style-type: none"> • Potential for withdrawal of geothermal fluids to decrease reservoir pressure and temperature • Potential for geothermal production to decrease the life expectancy of the geothermal reservoir • Potential for geothermal production to affect regional thermal features such as other hot springs, geysers, and secondary uses such as heated swimming pools and fish hatcheries • Potential for injection to cause thermal pits (cold water areas) in the geothermal reservoir and reduce viability of the resource
Geology	
	<ul style="list-style-type: none"> • Potential for geothermal fluid extraction to induce subsidence • Potential for seismic activity to impact project facilities, including causing pipeline ruptures • Potential for drilling and production to induce seismic activity
Hazards	
	<ul style="list-style-type: none"> • Potential for blowouts or pipeline ruptures and related releases of geothermal fluids • Potential for hazardous materials such as fuels, lubricants, and drilling muds to affect local resources • Potential to cause indoor radon levels that are unsafe for workers
Biology	
	<ul style="list-style-type: none"> • Potential effects of construction of roads, pads, plants, pipelines and transmission lines on special status species, other wildlife, and habitat in general via habitat removal/modification/fragmentation, noise, light, changes in surface water quality, changes in air quality • Potential for pipeline rupture (particularly from an earthquake) to release geothermal fluids that could impact fish and wildlife habitat (including creek temperatures, water quality) • Cumulative effects of several pipeline ruptures or overflows on same creeks • Potential effects of decreased temperature or pressure of geothermal reservoir on thermal features, including marshes and other plant communities that depend on surface flows from geothermal features

Table A-3 (Continued): Comment Topics

Topic	Impact/Concern
Cultural and Native American Issues	
	<ul style="list-style-type: none"> • Potential effects of construction, surface disturbance, and operation on undocumented cultural sites • Potential effects of visual impacts, light, odor, and noise on sacred sites (prayer, ceremonial, traditional use, and others) • Adequacy of compliance with regulations and Executive Orders • Issues related to adequacy of Native American consultation and participation
Noise	
	<ul style="list-style-type: none"> • Effects of construction and operational noise on wildlife • Effects of construction and operational noise on recreational users
Socioeconomics	
	<ul style="list-style-type: none"> • Effects of commercial activity and required personnel on jobs, support services, government services, roads, etc.
Analysis and Methodology	
	<ul style="list-style-type: none"> • Depth of analysis • Choice of analytical models • Errors in analysis • Adequacy of document under NEPA/CEQA • Validity of background data
Proposed Project and Alternatives	
	<ul style="list-style-type: none"> • Expressions of preference for a particular alternative • Preference for completing exploration before analyzing or initiating development activities • Project support or opposition • Adequacy of detail in description or analysis of alternatives
Mitigation	
	<ul style="list-style-type: none"> • Sufficiency or feasibility of proposed mitigation
General	
	<ul style="list-style-type: none"> • Typographical errors • Requests for clarifications in analysis

SUMMARY OF COMMENTERS

The analysis of the comments on the environmental documents showed that the key commenters on documents could be categorized by agencies and by local interest groups. The commenters and their key issues are presented in tables (by project) below. The agencies commenting routinely included local permitting agencies, such as air pollution control districts and water quality control boards, and adjacent land management and land use regulatory agencies, such as counties or the National Park Service. The U.S. Fish and Wildlife and state fish and game agencies also routinely comments on projects.

Commenting groups most often included local special interest or environmental groups. Examples of these groups include winter recreationalists, adjacent landowners (homeowner associations), and local environmental groups (desert protection groups and local Sierra Club or Audubon Society chapters).

Tribes and labor unions have become increasingly active in commenting on geothermal projects. Tribal concerns included effects on the landscape, air, water, historic and archaeological resources, and the potential for interference with religious or ceremonial practices. Union groups (such as the California Unions for Reliable Energy) have been increasingly active on all industrial projects. Their comments usually address virtually every parameter and aspect of the project, although the primary goal is most often to negotiate a commitment to use union labor on the project.

Comments frequently indicated a lack of knowledge of geothermal development. Responses to comments were often clarifications of project construction or operational procedures, analysis methodology, or mitigation implementation. Project opposition was minimized where outreach efforts, including education and interaction with interested parties, occurred at an early stage.

COMMENTS BY DOCUMENT

This section provides a narrative description of the nature of comments received on each of the documents analyzed. Some comment topics were common to many geothermal projects, such as air emissions, noise, aesthetics, hydrology and geothermal resources. Other comments, however, varied according to the environmental, regulatory, or political setting of each project. Examples of more setting-specific comments include Native American issues, recreation concerns, and special-status species impacts.

Prior to the discussion of the comments there is a summary of the project description to give the reader an understanding of the type and scale of project proposed. The regulatory and environmental settings are also described. The operational results of the projects are described for those projects that have been operational.

Fourmile Hill (Modoc and Siskiyou Counties, California)

Project Description

In 1995, Calpine Corporation proposed geothermal well drilling and testing, construction, and operation of a 49.9 MW dual-flash geothermal power plant, associated wellfield and pipelines, and a 26-mile transmission line. The project is in the Glass Mountain Known Geothermal Resource Area (KGRA).

Regulatory Setting

The power plant location is in the Klamath National Forest. The transmission line would traverse both Klamath and Modoc National Forest lands. The lead permitting agencies included:

- U.S. Bureau of Land Management (BLM), Alturas Resource Area Office, Alturas, California (geothermal lease and resource managers)

- U.S. Forest Service (USFS), Modoc National Forest (Doublehead Ranger District) and the Klamath National Forest (Goosenest Ranger District) (land surface managers)
- Bonneville Power Administration, Portland, Oregon (power sales agreement)
- Siskiyou County Air Pollution Control District, Yreka, California (air permit and CEQA lead agency)

Participating agencies included the U.S. Fish and Wildlife Service, California Department of Fish and Game, North Coast and Central Valley Regional Water Quality Control Boards, Fall River Mills Resource Conservation District, State Historic Preservation Office, President's Advisory Council on Historic Preservation, National Park Service (Lava Beds National Monument), Siskiyou County, and Modoc County.

The agencies and Calpine (the applicant) conducted an extensive outreach program to the public and the tribes. The agencies conducted five scoping meetings, five meetings to present and discuss the Draft EIR, and over 15 meetings with local tribes prior to the issuance of the Record of Decision for the project.

Environmental Setting

The proposed project was located on the forested flanks of the Medicine Lake Highlands shield volcano. The power plant was sited outside of the caldera, about 1.5 miles from Medicine Lake, and 2 miles from the privately owned cabins on the south shore of the lake. The transmission line was routed on the north flank of the caldera, within the forested area of the Highlands. The transmission line exited the Highlands, crossed the Modoc Plateau and was to terminate at the Bonneville Power Administration Malin-Warner transmission line, near the small community of Tionesta. The Medicine Lake Highlands include a campground, picnic areas, and private cabins.

Comments

Commenters raised all potential issues related to construction and operation in a national forest. Key issues included:

- Native American concerns regarding effects on the spirituality of the area and effects on Native American use of 31 Traditional Cultural Properties
- Potential for effects to local and regional hydrologic features (Medicine Lake and Fall River Mills 35 miles south of the Highlands)
- Potential for land use and recreation conflicts
- Visual effects on the landscape of the Highlands

A total of 2,285 comments were received for the Fourmile Hill EIS/EIR. Comments were submitted on a wide variety of issues.

General – General comments included requests about information, statements and opinions about the project, and power export issues.

Hydrology – Issues addressed included the adequacy of the hydrology analysis and baseline information, potential for depletion of groundwater at Arnica Sink and at the project site, the details of the underground injection control program, potential connections between the local groundwater and the geothermal reservoir, effects of deposition of air emissions on surface waters, and the potential for groundwater depletion due to geothermal fluid use, both locally and 35 miles south at Fall River Mills.

Air Quality – Air quality comments primarily addressed regulatory standards for specific pollutants, the analysis methodology, odor impact thresholds, health impacts and impacts to vegetation and

wildlife, effects on visibility, air quality monitoring and reporting, and mitigation measures related to construction, well-venting, and operating emissions.

Cultural Resources – Comments related to cultural resources (other than Native American issues) generally addressed the incompleteness of the Section 106 Process (consultation under the National Historic Preservation Act), the timing and adequacy of transmission line surveys, potential transmission line impacts to prehistoric resources, and the inadequacy of the proposed mitigation measures.

Traditional Cultural Values/Native American Issues – The Fourmile Hill project was unique among the documents analyzed in the amount of participation from Native American tribes. The project area is located in the Siskiyou and Modoc National Forests, within the Medicine Lake Highlands. Native Americans from the Modoc/Klamath, Pit River, and Shasta Tribes traditionally used the Highlands. The Highlands are not lands that are currently owned or under the jurisdiction of any tribes.

As part of the impact analysis, an ethnographic study was conducted that documented Native American use of the area and identified Traditional Cultural Properties. The project represented to the tribes the industrialization of a landscape previously unmarred by any major anthropogenic features (with the exception of the dozens of cabins around Medicine Lake and 80-years of logging).

This topic did not rank high in the numbers of written comments, but Native American issues were highly controversial and were the focus of extensive studies and consultations with Native Americans (over 15 consultation meetings and extensive interviews with individual tribal members). Comments related to Native American issues primarily addressed the sanctity of the project region including Medicine Lake and the Glass Mountain Area, regulatory compliance, Native American status regarding lands in the project region, Native American consultation/involvement, project impacts on Medicine Lake Highlands, gathering sites, traditional sites and uses, landscape views, the effects of amending the Klamath National Forest Land and Resource Management Plan Standard 24-25 (to protect traditional Native American cultural and religious uses and practices), adequacy of the mitigation measures, and the ethnographic report.

Purpose and Need – Several comments addressed the purpose of and need for the proposed facility, as well as the economic justification for and viability of the plant and operations. Key comments questioned the need for power both generally and within the Medicine Lake Highlands (at the time of the scoping for the Draft EIS/EIR there was a surplus of hydro-electric power; by the time the Final EIS/EIR was published, there was a shortage of energy).

Wildlife – Wildlife concerns included the adequacy of the wildlife section, the adequacy of consultation with regulatory agencies, exposure of wildlife to noise, sump contents, power plant emissions and other toxic materials, effects of new roads on wildlife, effects of transmission lines on birds, effects of habitat fragmentation, impacts to specific special-status wildlife, and effects on wildlife migration.

Noise – Concerns about noise impacts primarily addressed adequacy of the analysis, the chosen study area for analysis, modeling and sampling, methodology to evaluate potential impacts at Medicine Lake, effects on existing sensitive receptors (cabin owners, recreational visitors, Native Americans using Traditional Cultural Properties, residents of the Tionesta area), applicability and use of County noise standards, determination of significant impacts, potential helicopter noise during construction, effects on forest users, characterization of power plant and infill well drilling noise, determination of operational noise levels, adequacy of alternatives analysis, and adequacy and enforcement of mitigation measures.

Alternatives – Extensive comments about alternatives to the project primarily addressed alternatives considered but eliminated from detailed study, preferences for alternative sites, and preferences for wind, solar, or other technologies.

Land Use and Recreation – Land use and recreation comments primarily addressed the adequacy of the analysis, the adequacy of baseline data, effects on the overall recreational experience within the area, effects on recreation in and near Medicine Lake and other specific areas (Mt. Hoffman Released Roadless Area, Little Mt. Hoffman Lookout, Lava Beds National Monument), effects on snowmobile use, (both dispersed and in specific areas), effects of road plowing, effects on hunters, effects on mushroom harvesting, and effects on Medicine Lake campgrounds and cabins.

NEPA/CEQA – Issues related to the NEPA and CEQA process included NEPA/CEQA adequacy, including the adequacy of the document, of the proposed mitigation, and the lead agencies' role in ensuring NEPA/CEQA adequacy; the EIS/EIR approach, such as the purpose of the EIS/EIR; the definition of "effect;" the use of a single EIS for all the activities proposed in the Highlands; the Draft EIS/EIR public involvement, including the public scoping process, document distribution, and the document's review period; and plans to act against the project approval based on the inadequacy of the environmental review.

Cumulative Effects – A key issue at Fourmile Hill was the concern about industrialization of the natural forest environment. The area is a national forest with developed recreation areas and a community of privately owned cabins around Medicine Lake. The power plant was proposed to be located about 2 miles from the lake and the cabins.

Several members of the public raised concerns that up to eight power plants would be built in the Highlands, based on the estimated 500 MW resource potential suggested by the U.S. Geological Survey in 1978. The public requested a full discussion of the cumulative effects of up to eight power plants in the area, although only two power plants had been proposed in the KGRA and the resource potential was expected to be substantially less than originally estimated in 1978. Cumulative project comments questioned the analysis of reasonably foreseeable geothermal development, and the potential for a geothermal project on the nearby Mount Hoffman, as well as the effects from the nearby Telephone Flat project.

Resource-specific cumulative impacts included reduction in water quality (especially at Medicine Lake) through mercury deposition and acid rain, effects on surface and subsurface flows within the Fall River Mills Watershed and other natural spring sources (35 miles south of the proposed power plant), effects to Fall River Mills spring water quality, effects on geothermal reservoir, reduction in groundwater levels and quantities in the Arnica Sink area, cumulative loss of cultural resources, including impacts to undiscovered sites, cumulative effect on traditional cultural values and Native American use of the Medicine Lake Highlands, loss of vegetation and wildlife habitat, especially related to construction of the transmission line corridor, effects on visual landscape, including new sources of light and glare at night, and steam plumes during the day, air quality and noise effects relative to the nearby Telephone Flat project, and cumulative air quality impacts of the project combined with USFS controlled burns.

Vegetation – Comments regarding vegetation addressed effects of emissions on vegetation (boron, fluorine, lithium, bromine, barium, strontium), effects of herbicides, effects of noxious weeds and exotic species, impacts to specific special-status plants, impacts to specific plant communities (old-growth forests, wetlands, fungus), and adequacy of proposed mitigation.

Visual Resources – Concerns about visual impacts addressed adequacy of the visual quality objectives (VQOs) analysis; visual impacts from the power plant, well field, lighting at night, steam plumes, the transmission line; visual impacts from specific key observation points (KOPs); consistency with VQOs; and adequacy of mitigation measures.

Plans and Policies – Forest Service plans and policy issues included consistency with land and resource management plans, effects on areas designated as old-growth reserve, and impacts to released roadless areas.

Proposed Action – Comments related to the proposed action addressed the size of the project, the need for well testing prior to power plant construction and development [note: Calpine proposed to conduct exploration prior to initiating power plant development activities], well drilling/maintenance during operation, transmission line design (capacity, routes, and system reliability), and questions and concerns regarding decommissioning.

Human Health and Safety – Comments regarding human health and safety primarily addressed accidental releases of hazardous materials, chlorine handling and storage, the potential for hazardous waste production and disposal, hazardous materials transport, well blowouts, fire hazards, well field hazards, and waste minimization and recycling.

Socioeconomics – Socioeconomic impacts of concern included local employment opportunities, potential effects on property values (particularly at Medicine Lake), effects on tourism, and potential economic benefits of the project.

Geothermal Resources – Substantial comments were received regarding characterization of the geothermal reservoir and groundwater aquifer, proprietary temperature gradient data, chemical composition of geothermal fluid, effects of the project on the life expectancy of the geothermal resource, and effects on regional geothermal features, specifically, the “Hot Spot” on Glass Mountain.

Fourmile Hill Commenters and their Key Issues

Parties commenting on the Fourmile Hill document and their primary areas of concern are summarized in Table A-4. Key commenters included the Native American tribes, property owners within the National Forest, and local NGOs. Key issues included locating an industrial facility in a National Forest, effects on traditional cultural values, potential hydrologic effects, potential recreational conflicts, noise, air quality, and visual resources.

Operational Outcomes

The full development project described in the Fourmile Hill EIS/EIR has not yet been implemented. The project environmental documents were appealed but the appeals were denied. Lawsuits were initiated by the Pit River Tribe and other local groups. Initial drilling was conducted but the project was subsequently put on hold by Calpine. Project opponents closely monitored all drilling operations and made many visits to the offices of the lead agencies (Siskiyou County Air Pollution Control District, the US Forest Service, and the BLM).

PLES I (Mono County, California)

Project Description

Pacific Energy proposed to construct and operate a 10 MW (net) binary power plant and geothermal wellfield development project (PLES I Project). PLES I was originally approved in 1987 under an EA/EIR. The Sierra Club and CDFG then appealed the project to the Interior Board of Land Appeals (IBLA). Following the 9th Circuit Court of Appeal's Methow Valley decision requiring worst-case analysis, the BLM asked the IBLA to remand the decision to do the EIS/Supplemental EIR (which was reviewed in this analysis). The US Supreme Court ultimately rejected the Methow Valley decision. The EIS/EIR was used to approve the project in 1988. Following some litigation and settlement between the applicant and the CDFG, the project was constructed and began operation in 1990.

Table A-4: Commenters on the Fourmile Hill Document and Primary Areas of Interest

AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST IN ORDER OF DESCENDING NUMBER OF COMMENTS
Federal Agencies	
U.S. Environmental Protection Agency	Hydrology; Cumulative effects; Alternatives; Air quality; Human health and safety
U.S. Fish and Wildlife Service	Wildlife
U.S. Geological Survey	Geology and soils
State and Local Agencies	
California Department of Fish and Game	Vegetation; Hydrology; Wildlife; Cumulative effects
Siskiyou County Planning Department	NEPA/CEQA issues; Air quality
North Coast Regional Water Quality Control Board	Hydrology; Geothermal resources; Alternatives
Office of Historic Preservation	Cultural resources
Environmental Organizations	
California Native Plant Society	Vegetation
California Wilderness Coalition	Plans and policies
Desert Survivors	Wildlife; Vegetation; Traditional cultural values; Hydrology; Project preference (one comment per subject)
Fall River Resource Conservation District	Hydrology; NEPA/CEQA issues
Fall River Wild Trout Foundation	Wildlife; Cumulative effects; Hydrology; Vegetation; Visual quality; Purpose and need
Friends of the River	Wildlife; Vegetation; Geology and soils; Plans and policies
Klamath Forest Alliance	Project preference; Wildlife
Medicine Lake Citizens for Quality Environment	Air quality; Noise; Hydrology; Land use and recreation; NEPA/CEQA issues; Plans and policies; Alternatives including the proposed action; Cumulative effects
Mount Shasta Area Audubon Society Board of Directors	Wildlife; Vegetation
Mount Shasta Bioregional Ecology Center	Plans and policies; NEPA/CEQA issues; Introduction and purpose and need; Visual quality; Hydrology; Air quality
North Coast Environmental Center	Traditional cultural values; Project preference; Plans and policies
Santa Cruz Rainforest Action Group	Project preference
Renewable Northwest Project	Project preference
Wise Earth Council	Traditional cultural values

Table A-4 (Continued): Commenters on the Fourmile Hill Document and Primary Areas of Interest	
AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST IN ORDER OF DESCENDING NUMBER OF COMMENTS
Recreational Organizations	
American Motorcyclist Association	Visual resources; Land use and recreation; Noise; Cumulative effects; Alternatives
Mount Shasta Sno-mobilers Inc.	Land use and recreation
Native American Organizations	
Kalapooya Sacred Circle Alliance	Traditional cultural values
Native Coalition for Cultural Resources of Mount Shasta	Traditional cultural values; Project preference
The Klamath Tribes	Traditional cultural values
Pit River Tribe	Cultural resources, Traditional cultural values; Visual quality; Cumulative effects
Unions	
Plumbers & Steamfitters	Noise; Air quality; Vegetation; Wildlife; Hydrology; Visual effects; Traditional cultural values; Cumulative effects; Human health and safety, NEPA/CEQA issues, Socioeconomics, with fewer comments on most other topics
Others	
CalEnergy International Ltd.	Project preference
Lawrence Livermore National Laboratory	Hydrology
Mount Shasta Tomorrow	Noise; Cumulative effects
Pacific Gas & Electric	Hydrology
Residents/Public	
Tionesta Residents	Visual quality; Alternatives, including the proposed action
General Public: 1,257 comments were received from the public and spanned a wide range of topics. The following list of topics is organized in descending order of number of comments received	<p><i>General:</i> Statements and opinions; General concern about project effects, Requests to be kept informed.</p> <p><i>Project Preference:</i> Project opposition; Preference for specific alternatives; Project support.</p> <p><i>Introduction and Purpose and Need:</i> Project economics and viability; Need for the proposed action, Purpose of the proposed action.</p> <p><i>Hydrology:</i> General deposition effects on surface waters; Life expectancy of the geothermal resource.</p> <p><i>Alternatives, Including the Proposed Action:</i> Decommissioning; Need for well testing prior to development; Transmission line design and capacity.</p> <p><i>Land Use and Recreation:</i> Effects on recreation in and near Medicine Lake; Effects on dispersed snowmobile use.</p>

Regulatory Setting

The proposed project is located on federal land administered by the Inyo National Forest. The BLM was the lead agency for this project since it administered the geothermal lease for the project. The key agencies that participated in permitting the project included:

- BLM (resource manager)
- Mono County Energy Office (CEQA lead agency)

Pacific Energy conducted an extensive public and agency outreach program to address issues and to resolve concerns.

Environmental Setting

The project is located near Mammoth Lakes, California, north of Bishop. The power plant was sited east of Highway 395, visible from the highway. The power plant is in an area of desert scrub vegetation, and is near Hot Creek and a fish hatchery.

Comments

A total of 470 comments were received for the PLES I Geothermal Development Project EIS/SEIR. Comments on the PLES document centered on concerns regarding effects on the geothermal resource, and related impacts to regional geothermal features and their associated resources. Wildlife concerns primarily revolved around impacts to migrating species, such as mule deer. Many comments were also received on the inadequacy of the document, both in general and in regard to specific aspects of the report. A lesser number of comments were also received on aesthetics, recreation, noise, and air quality impacts.

Key comment issues for the Mammoth project are described below.

Geothermal Resources – Many comments were received on the potential decrease in the viability of the geothermal reservoir and the impacts on nearby hot springs and the Hot Creek Fish Hatchery. The concept of thermal pits (areas of cold, injected fluids within the geothermal reservoir) developing and migrating to geothermal features, thereby reducing temperatures at those features, was also often raised, along with the related effects on flora and fauna that depend on those features. Concerns regarding impacts to thermal marsh habitat were also expressed.

Migrating Deer and Other Wildlife – Commenters were concerned that construction of the project would cumulatively reduce habitat for deer and other species in the region and would be inconsistent with local deer herd management plans. Concerns were also expressed regarding the geothermal fluid pipelines posing a barrier to migration for deer, and burial of the pipelines was suggested.

Visual resources – Concerns regarding visual impacts were related both to residents of the area, and also its potential effects on tourism through the industrialization of a pre-project natural landscape. One comment noted that the Mono County Board of Supervisors previously refused to permit a proposed power plant due to the impacts it would have on views from Highway 395 and the intersection of Hot Springs Road and the extension of State Route 203. Suggestions were provided to reduce visual impacts, including the burying of geothermal fluid pipelines, as well as the maximization of cut and minimization of fill for the power plant itself. Several comments of criticism were received over the document's failure to consider more than a single viewpoint in its analysis, the lack of a revegetation plan, and the lack of a description of nighttime lighting. A contradiction within the DEIS was also noted regarding the period of time the project would take in meeting the visual quality objective (VQO) of "retention".

Feasibility of the Proposed Project – Comments were offered regarding characterization of the geothermal resource, indicating that it would be unable to support all of the proposed projects.

Suggestions were provided for staging implementation of the project such that monitoring of the resource could be done between stages to determine sufficiency of the resource.

Inadequacy of the Document – This document received a large number of comments regarding its inadequacy. Specific criticisms included its pro-project bias, lack of recognition of existing resources, failure to address decommissioning, lack of detail in describing the alternatives, insufficient or infeasible mitigation measures, and inadequate visual resources analysis (the document only considered views from a single viewpoint).

PLES I Commenters and their Key Issues

Parties commenting on the PLES I document and their primary areas of concern are summarized in Table A-5.

Table A-5: Commenters on the PLES I Document and their Primary Areas of Interest	
AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST
Federal Agencies	
U.S. Geological Survey	Characterization of the geothermal reservoir; Effects on nearby geothermal features
U.S. Department of Health and Human Services	Indoor air quality issues (hydrogen sulfide, hydrocarbons, radon gas)
U.S. Fish and Wildlife Service	Characterization of the geothermal reservoir; Creation of thermal pits; Potential effects on nearby geothermal features and associated endangered fish
State and Local Agencies	
California Department of Fish and Game	Impacts to hot springs, fish hatchery; Potential destruction of deer herd habitat; Inconsistency with local herd management plans; Criticism of proposed mitigation
Mono County Planning Department	Visual impacts of plant and pipelines
Great Basin Unified Air Pollution Control District	Potential impacts of noise and human activity on deer populations; Impacts to recreation; Adequacy of visual analysis
Sierra Club	Document adequacy (mitigation, alternatives analysis, cumulative impact analysis); Pro-project bias of the document; Lack of consideration of issues such as recreation and air traffic routes; Effects on geothermal reservoir and local discharge features such as thermal marshes; Document's visual analysis; Post-abandonment mitigation; Spills of geothermal fluids; Noise; Impacts on deer migration; Dust mitigation during decommissioning; Hydrogen sulfide emissions during well blowouts; Adequacy of containment basins for spills

Operational Outcomes

After 14 years of operation, none of the major impacts contemplated in the comments on the EIS/EIR have materialized. The PLES I Project (and the adjacent 7 MW (net) MP I Project (which began operation on private land in 1984) and the 10 MW (net) MP II Project (the twin project to PLES I, which also began operation on private land in 1990) continue to operate using the geothermal resources produced from the same geothermal reservoir. Based on a recent third-party analysis of the over 20 years of extensive groundwater and geothermal resource data collected under a cooperative monitoring program, the operation of all of these plants was found to have not had a quantifiable effect on the thermal features in the area. The plants have not had an adverse effect on migrating deer or other wildlife, and are very well hidden from public view. Elected officials, trade associations, and community groups have frequently recognized the plants for their outstanding record on environmental protection and operations excellence.

Newberry (Deschutes County, Oregon)***Project Description***

CE Exploration (CalEnergy, Inc.) proposed to drill and test geothermal exploration wells, and construct and operate a 30 MW power plant and transmission line. CE Exploration drilled and tested exploration wells but abandoned the project due to a lack of commercial wells. The project is located in the Newberry KGRA.

Regulatory Setting

The proposed project was located in the Deschutes National Forest, adjacent to the Newberry National Volcanic Monument (NNVM). The key agencies included:

- USFS (surfacing managing agency)
- BLM (resource manager)
- State of Oregon, Energy Facility Siting Council

Environmental Setting

The project was located on the flank of Newberry volcano in a forested environment. Paulina Creek bisects the project area. East and Paulina Lakes are located in the caldera, above the proposed development.

Key Issues

The key issues for the project were related to changes in air quality, surface water quality through deposition of mercury and boron, effects to groundwater, project phasing and timing (exploration and development), and depletion of the geothermal resource.

Comments

The Newberry Geothermal Pilot Project is significant for its location in the Pacific Northwest, in a National Forest adjacent to a National Monument, and for the extensive number of comments and commenting parties involved in the Final EIS. A comprehensive quantitative and qualitative analysis of issues of concern were available for this document. A total of 405 comments were received and recorded in the Final EIS.

Comments on the Newberry document were related to:

- Changes in air quality
- Effects on surface water quality (Paulina and East Lakes, and Paulina Creek)
- Effects on groundwater levels, quality and temperature

- The timing of the exploration and power plant development for the project
- Protection of the geothermal resource

Less extensive comments were received on impacts to wildlife and vegetation, seismic activity, hazardous materials, well blowouts, visual resources, transportation, and recreation. Non-environmental comments were received on the purpose and need for the project, as well as on the project alternatives.

Key issues for the Newberry project are described below.

Air Emissions and Deposition into Surface Waters – Extensive comments related to emissions from plant operations and the subsequent deposition of pollutants into Paulina and East Lakes, with associated impacts on fish, mammals, and predatory birds. Mercury was of particular concern, though boron and arsenic were also frequently mentioned. Many comments were received calling for ongoing air and water quality monitoring of toxins such as mercury. Investigations related to responses to comments on mercury resulted in the identification of elevated baseline levels of mercury in the lake.

Groundwater Quality, Temperature, and Levels – Concern was expressed regarding potential changes in groundwater quality and temperature through a possible connection between the geothermal reservoir and the shallower groundwater aquifers. Concern was also expressed about drawdown of local groundwater through extractions from the proposed water well that was proposed to supply drilling water.

Geothermal Reservoir – The public commented that the EIS lacked an evaluation of the underground route of injected fluids (not normally included in an EIS).

Project Staging – Multiple comments suggested that the project be staged, with initial exploration followed by production, to avoid commitment to disturbing more area than necessary, and to better assure sustainable use of the geothermal resource.

Roadless Areas and Newberry National Volcanic Monument (NNVM) – Many commenters objected to disturbance in roadless areas and impacts to the NNVM.

Newberry Commenters and their Key Issues

Parties commenting on the Newberry document and their primary areas of concern are summarized in Table A-6.

In summary, most of the agency and public comments related to the concerns of air and water quality impacts from deposition of geothermal well testing and power plant emissions, with mercury being the primary pollutant of concern. Extensive monitoring of these impacts was a common theme of most commenters. The general public and environmental groups also indicated strong objections to the sequence of the project, preferring that exploration drilling and testing be conducted prior to approval of power plant development. The use of public lands and the roadless areas for this use were of particular concern. The industry representatives, on the other hand, emphasized the need to provide more information about the benefits of geothermal as an alternate energy source.

Operational Outcomes

Geothermal development at Newberry to date has included only drilling two exploration wells. Exploration efforts discovered very high temperatures, however, CE Exploration did not find the full results they were hoping for with the two production wells. No notable environmental issues materialized during exploratory drilling activities. In August 1996, the company decided to suspend

Table A-6: Commenters on the Newberry Document and their Primary Areas of Interest

AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST
Federal Agencies (U.S. Environmental Protection Agency)	Need for well-defined monitoring plan, a more extensive discussion of the process for subsequent approvals of well pad siting, power plant siting, and additional mitigation.
Oregon Environmental and Energy Agencies	Air and water quality impacts (surface and groundwater) and monitoring.
Recreational and Astronomical Organizations	Project support; Request for development of a snowpark in the area; Disturbance of roadless areas; Off-site visibility of lighting and reflections on the night sky.
Environmental Groups (Sierra Club, Audubon, Oregon Natural Resources Council, and Clean Air Committee of Bend)	Air and water quality impacts of the project; Deposition on surface waters; Chemical and thermal impacts on groundwater; Preference for project phasing into exploration separate from development; Concern about potential impacts on the Newberry Roadless Areas and the NNVM.
Unions (Local #290 of the United Association of Plumbers and Pipefitters Union)	Wide range of issues focusing on air and water quality; Request for analysis of the costs of using out-of-area construction workers and imposition of related mitigation fees for public services in the area.
Representatives of the Geothermal Industry	Project support; Consistency with land use designations; Economic benefits to the area; Objections to some of the air pollution deposition findings, especially for mercury, as being overstated impacts.
Eugene Water and Electric Board (Local utility)	Request for information about local/regional power needs; Concern about potential conflicts with recreational uses, groundwater contamination impacts, and water consumption required for the project.
General Public (Primarily area residents)	Project opposition based on perceptions of potential air, water, visual, noise and wildlife impacts; Support of geothermal development diversification of the Northwest's energy supply; Use of public lands conflicts with the beauty of Newberry Crater and Paulina Creek, with recreational uses, and with the purpose of the NNVM; Development should be phased, with exploration first and then production; Mercury deposition (and other toxics such as boron and arsenic) in Paulina and East Lakes and related water quality impacts to drinking water, aquatic life and recreational standards

further exploration plans and focus on other projects and company ventures. At the present time, the Newberry Pilot Geothermal project is in an indefinite suspension status.

Pueblo Valley (Harney County, Oregon)

Project Description

Anadarko Petroleum proposed geothermal well drilling and exploration, and the construction and operation of a 20 MW binary geothermal power plant and 6-mile transmission line. Anadarko abandoned the project and relinquished the geothermal leases when the project received intense opposition in the scoping phase of the environmental review. The project was located in the Alvord KGRA.

Regulatory Setting

The proposed project was located on BLM land leased for geothermal development. Oregon state agencies also participated in the project scoping. An extensive scoping program was defined and implemented for the project. The project was located in Harney County, in southeastern Oregon. Scoping meetings were held throughout Oregon, including Fields (closest to the project area), Burns, Bend, and Portland. The project received statewide attention with comments from groups throughout the state.

Environmental Setting

The project location is the eastern Oregon, high-desert environment of Pueblo Valley. The location is a remote valley that is overlooked by the Steens Mountains, a popular recreation area. The region is sparsely populated.

Comments

The primary issue was the potential for effects on the Borax Lake chub. The proposed project was located adjacent to Borax Lake, which is fed by a hot spring. The public was also concerned about effects to thermal marshes, and introducing an industrial facility in the remote Pueblo Valley (an existing transmission line was the only facility in the valley).

A total of 423 comments were received for the Pueblo Valley Preliminary Scoping Report. Scoping comments on the Pueblo Valley project focused on impacts to regional geothermal features and related impacts to wildlife. Substantial comment was also received on geological hazards and visual resources. Fewer comments were received on hazards (particularly related to well blow-outs), land use, recreation, and cumulative impacts.

Key issues for the Pueblo Valley Geothermal project are described below.

Borax Lake and Borax Lake Chub – The Borax Lake chub is a federally-listed endangered species that lives solely in Borax Lake, a 10-acre lake fed by hot springs, where surface temperatures can reach 105 degrees Fahrenheit. Concern regarding decreases in the temperatures and pressures of the hot springs feeding Borax Lake as a result of project-related geothermal fluid extraction were extensive, particularly in how they relate to the viability of the Borax Lake chub in its unique and sensitive ecosystem.

Thermal Marshes – Hot water marshes exist near hot springs in the area. Some comments related to decreasing temperatures or pressures in the geothermal resource that would have the potential to alter the size and/or nature of these marshes and the wildlife (especially birds) that utilize them.

Geology and Seismicity – Concerns were expressed regarding siting of the project atop a fault line and the project's potential to induce earthquakes through drilling and injection. Project-induced subsidence was also a concern.

Pipelines as Barriers to Mammalian Migration (deer, elk) – Several comments indicated concern that the proposed pipelines could act as a barrier for the migration of mammals and suggested relocation or mitigation approaches.

Visual Resources – The impacts on viewpoints from Steens Mountain were of particular concern, since the project site was in a valley with many overlooking viewpoints.

Land Use and Recreation – Several comments included concern about conflicts between the proposed geothermal use and open space, wilderness and recreational uses. The Sierra Club proposed a Steens Mountain National Recreation Area. BLM had proposed wilderness areas in the surrounding areas. Borax Lake and the Alvord Desert were part of a proposed Oregon High Desert Protection Act (OHDPA), an ongoing legislative effort to protect Oregon's most unique desert ecosystems. The primary concern was the potential destruction of a recreational resource for a project with an estimated lifespan of 30 years.

Socioeconomics – Both positive and negative comments were received, although most were positive. The positive comments on socioeconomics included increased jobs, increased County tax revenue, and increased reliability of the local electricity supply. Negative comments addressed an expected "boom-bust" effect since the project had a projected lifespan of 30 years.

Pueblo Valley Commenters and their Key Issues

Table A-7 summarizes agency and organization comments regarding the Pueblo Valley project, as reflected in the Scoping Report. The Report included a number of letters, but also summarized several public meetings at which a substantial number of comments were received.

Table A-7: Commenters on the Pueblo Valley Document and their Primary Areas of Interest	
AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST
The Oregon Department of Geology and Mineral Industries	This is the State agency with regulatory authority for well drilling (in addition to the BLM authority), including exploratory and production wells and injection wells. Conservation of resources (including well spacing and unitization); Groundwater protection; Protection of public health and safety; Reclamation and subsequent beneficial use of land; Drill site construction and inspection; Bonding requirements, mineral ownership and revenue distribution
The Harney County Chamber of Commerce	Project support describing the fiscal benefits for the County
Environmental Organizations (Nature Conservancy, the Oregon Natural Desert Association, the Sierra Club and the Wilderness Society)	Potential impacts to Borax Lake Chub; Conflicts with the natural area from visual, recreational and ecological perspectives; The potential for substantial additional geothermal development; Geologic and hydrologic concerns about groundwater and reinjection wells; Air pollution impacts; Monitoring; Potential to impact nearby hot springs and geysers
General Public	Impacts on Borax Lake and the Borax Lake Chub; Conflicts with the natural area; Potential hazards from accidents; Hydrologic and geologic unknowns at the site; Air quality and water quality impacts; Need for the project and the cumulative effects of increased geothermal development in the area in the future; Effects on the geothermal resource and on adjacent geothermal features

Operational Outcomes

Anadarko abandoned the project and relinquished the geothermal leases when the project received intense opposition in the scoping phase of the environmental review.

Gifford Pinchot National Forest (Skamania and Cowlitz Counties, Washington)

Project Description

The Gifford Pinchot EIS presented an environmental analysis of proposed geothermal leasing for a portion of the Gifford Pinchot National Forest. The project (leasing) did not include a specific geothermal development. Geothermal leases were not issued in the Forest. There has been no geothermal or exploration in Gifford Pinchot.

Regulatory Setting

The U.S. Forest Service, Pacific Northwest Region was the lead agency for this document.

Environmental Setting

The Gifford Pinchot National Forest is located in southwest Washington State, contains 1,312,000 acres and includes the 110,000-acre Mount St. Helens National Volcanic Monument established by Congress in 1982.

Comments

A total of 204 comments were received on the EIS for the Gifford Pinchot National Forest Geothermal Leasing and Development. Issues raised in comments on the Leasing EIS focused on the evaluation of alternatives and, to a lesser extent, on various environmental issues, including conflicts with recreation and biological resources.

Alternatives – The issues surrounding alternatives included the timing of authorizations for geothermal exploration and development, stipulations regarding no surface occupancy, and potential for conflicts with recreation and biological resources. Consideration of other technologies and the need for the proposed geothermal development were also raised. Commenters endorsed options to conduct the exploration and development processes slowly, and to avoid unnecessary surface disturbance.

Environmental Issues – Comments regarding environmental issues primarily addressed:

- Recreation and land use conflicts
- Erosion
- Effects on water quality
- Water waste discharge
- Wildlife habitat loss and conflict
- Hazards from wildfires
- Aesthetics
- Noise

Gifford Pinchot Commenters and their Key Issues

Parties commenting on the Gifford Pinchot document and their primary areas of concern are summarized in Table A-8.

Table A-8: Commenters on the Gifford Pinchot Document and their Primary Areas of Interest

AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST
Federal Agencies	
U.S. Environmental Protection Agency	Pipeline rupture; Radon levels; Pipeline blockage of migration routes; Feasibility of use permits on USFS land should be discussed if direct use is likely to result from exploration
U.S. Department of Energy	Pointed out that there are existing transmission line corridors under study through the Forest; Noted the lack of a cost/benefit analysis to help evaluate alternatives; Concerns regarding a lack of contingency plans for blowout and geologic hazards
U.S. National Park Service Office of the Secretary Department of the Interior	Visual impacts; Land use compatibility Nearly all environmental issues including air, water, soils, seismicity, recreation, noise, energy and mineral uses, and land use
State of Washington Environmental Agencies	Water quality; Conflicts between No Surface Occupancy (NSO) and energy policies; Need to assess the resource area; Fish resources; Stream habitat; Impacts to big game
Industries (Burlington Northern Incorporated, Atlantic Richfield Company)	Emphasis on project need; Alternatives; Refute supposed conflicts in regard to NSO
Local Recreational Groups (The Mazamas, Mountaineers and Ptarmigans)	Recreational impacts; Suggestion for areas for exclusion from leasing; Proposal for buffers along a major trail; Support for the phased-exploration alternative
Environmental Groups (Sierra Club, Washington Environmental Council, Wildlife Management Institute, Audubon Society)	Conflicts with NSO in the preferred alternative; Inadequacy of the noise analysis; Need for visual and noise buffers; Impacts of construction on habitat, water, air and visual resources; The need to protect old-growth forests; Hydrogen sulfide emissions and acid rain; Blowout and rupture hazards; Preference for phased-exploration alternative
General Public	Only five letters of comment were received from individuals. Comments covered a wide range of topics including impacts to streams, big game habitat, traffic, roadless and wilderness areas, questioning of Report's impact conclusions, and expressions of preference for specific alternatives

Operational Outcomes

The project (leasing) did not include a specific geothermal development. Geothermal leases were not issued in the Forest. There has been no geothermal exploration or development in the Gifford Pinchot National Forest.

Salton Sea (Imperial County, California)

Project Description

Salton Sea Unit 6 (SSU6) is slated to become the largest single geothermal plant built in the United States and will be located on the nation's largest fluid-dominated geothermal field. The project includes a geothermal resource production facility, a geothermal steam power generation facility, production and injection wells and pads, above-ground geothermal fluid production pipelines, and a brine waste solids handling system. The new plant will supply the Imperial Irrigation District (IID) with 170 megawatts beginning in 2007 and up to 185 megawatts in 2011.

Regulatory Setting

CE Obsidian Energy, the company developing the project, owns some of the land on which the project is located and leases the rest from surrounding farmers, as well as a small parcel from the California State Lands Commission. The plant will supply electricity to the IID. The environmental review of the project was conducted through the California Energy Commission (CEC) energy facility siting process where the applicant submits an Application for Certification of the facility.

Participating agencies included the U.S. Fish and Wildlife Service, the Bureau of Land Management, U.S. Army Corps of Engineers, California Department of Fish and Game, Regional Water Quality Control Board, the County of Imperial, the Imperial County Air Pollution Control District and the staff at the Salton Sea Wildlife Refuge (USFWS).

The CEC process allows for, and encourages, public participation through several means:

- Agencies, jurisdictional municipalities, property owners, Native American tribes, and others with known interest in the area or the project are contacted by the applicant and also by CEC staff, and provided with information, contacts and schedules of events. Participation is solicited.
- Public Advisor's Office (PAO), working with the project manager and the Media Relations Office, sends notices of the project activities and documents to local papers, agencies, and individuals who contact the CEC. These notices and documents include schedules of meetings, contact information, and flyers and inserts that are distributed through the schools and newspapers. The PAO can also assist citizens and citizen groups with information regarding how to participate in the process including how to become a formal intervenor if desired. The PAO's focus is on participation and access, though it does not act as an advocate for either the project, or any participant.
- Documents are made available at local libraries and statewide libraries, with information on schedules, contact points, and opportunities for participation.
- Intervenor Status. For groups with more focused participation goals, intervenor status may be requested. An intervenor may be an individual, association, or formal group, and may have legal and/or technical representation. An intervenor may participate in all meetings, workshops, and hearings, and can issue data requests to the applicant, prepare and present testimony, cross-examine witnesses at hearings.

Environmental Setting

The project site is in the Imperial Valley, approximately 1,000 feet southeast of the Salton Sea, within the unincorporated area of Imperial County, California. The region is characterized mostly by agriculture and geothermal power production. The surrounding area is dominated by agriculture. The Sonny Bono Salton Sea Wildlife Refuge Headquarters is approximately 4,000 feet from the plant site. The nearest towns of Niland and Calipatria are 7.5 and 6.1 miles away, respectively.

Comments

A quantified analysis of the Salton Sea Unit 6 report was not conducted due to the lack of comment letters included within the available documentation. The CEC summary of testimony, comments, and issues raised indicates that the primary issues of concern for the project included impacts on cultural resources, biological resources, soil and water, and air quality.

Cultural Resources and Native American Issues – Several individuals and Native American groups expressed particular concern about impacts to an important historical area and feature known as Obsidian Butte. The focus was continued access to the site for Native Americans, degradation of the feature, and the site's historical, cultural, and religious significance.

Biological Resources – Comments related to biological resources were primarily submitted by agencies and an intervenor (special status given to certain interest groups that want to participate in the CEC process), particularly concerning threatened and endangered species, such as the Yuma clapper rail, the migratory mountain plover, and brown pelicans. Potential sources of biological impacts of concern also included noise, proximity to critical habitat, and the potential for increased bird strikes on new transmission lines. Burrowing owls are found throughout the area and impacts to burrows were also of concern, as were project timing, electric transmission line routing, and potential impacts from construction and drilling.

Air Resources – Intervenors and Energy Commission staff were the primary parties to raise air quality concerns. These concerns centered around hydrogen sulfide emissions, as well as ammonia emissions, and their potential to convert to particulate matter less than 10 microns in diameter (PM₁₀).

Salton Sea Commenters and their Key Issues

The U.S. Fish and Wildlife Service, the Bureau of Land Management, U.S. Army Corps of Engineers, California Department of Fish and Game, Regional Water Quality Control Board, the County of Imperial, Imperial County Air Pollution Control District and the staff at the Salton Sea Wildlife Refuge (USFWS) all participated in the CEC process and had important permitting and resource protection roles. Various civic groups, and local City governments also participated.

Most of the public input from citizens and citizen groups focused on economic opportunities (jobs, taxes, electrical power) but was not focused to the extent of requiring specific responses or project considerations from CEC technical staff.

Salton Sea had one formal intervenor, the organization CURE (California Unions for Reliable Energy), which represents a coalition of labor unions. CURE has legal counsel and skilled professional technical consultants that participated in the process.

Each of the above entities played a role in the process for Salton Sea, and had an impact on the direction and the outcome of CEC technical staff analyses.

Operational Outcomes

The project proponents are still in financing and submitting preconstruction filings to the CEC; the project has not yet been built. CEC staff do not see any environmental issues on the horizon. Electricity sales are planned to commence in 2007.

Steamboat Hills (Washoe County, Nevada)

Project Description

Yankee/Caithness Joint Venture, L.P. (YCJV) owned the 12.5 MW Steamboat Hills flash steam geothermal power plant, which became operational in 1988. In 1991 YCJV proposed an expansion of this project by constructing a 12 MW binary power plant on private land and doubling of the

production and injection of geothermal fluid. The increased production and injection capacity would be supplied by existing or previously approved but as yet unconstructed geothermal wells. This project was approved but never constructed, principally due to the lack of a power sales agreement for the additional power.

Regulatory Setting

The proposed project was located on a mix of private and Bureau of Land Management (BLM)-managed public lands within a Federal geothermal unit. Washoe County had previously approved the Conditional Use Permit to construct and operate the new binary power plant when in 1992 the BLM determined that they needed to prepare an Environmental Assessment for the increased rate of geothermal production and injection. Participating agencies included the U.S. Fish and Wildlife Service and the Washoe County District Health Department, Air Quality Management Division.

Environmental Setting

The existing (and proposed) project is located at the southern end of the Truckee Meadows area of Washoe County, approximately nine miles south of downtown Reno, Nevada, and approximately one mile west of (and partially visible from) U.S. Highway 395. The existing (and proposed) power plant and well field is in an area of desert scrub vegetation.

Key Issues

The key issues for the project were related to potential effects of additional geothermal fluid production and injection on local off-site hot springs and the state and Federal listed endangered Steamboat buckwheat (which grew only on the old hot springs deposits), the extensively developed shallow groundwater, visual resources, and air quality effects on nearby residents through hydrogen sulfide emissions. A minimal public outreach program was conducted.

Comments

The key issues for the project were related to potential effects to local hot springs and related biological and visual resources, and air quality effects on nearby residents through hydrogen sulfide emissions.

Comment letters were not provided with the Environmental Assessment for Steamboat Hills for an Amendment for Geothermal Fluid Rate Increase. The primary issues of concern outlined in the Assessment included impacts on biological resources, hydrology, visual resources, and air quality.

Biological Resources – The main biological impacts of concern were the effects of the project on the Steamboat buckwheat, a federally-listed endangered plant species that has evolved to grow selectively on decomposing siliceous sinter deposited by the hot springs and geysers in the project region. The proposed project was located more than a mile from the closest location of the Steamboat buckwheat - none were located in the project area. Concerns were raised regarding the potential for the project's extraction of geothermal fluids to decrease activity at the surrounding geothermal features (hot springs and geysers), thus prohibiting the formation of new habitat for the Steamboat buckwheat.

Hydrology – Concerns were raised regarding effects on groundwater since local groundwater quality analysis had shown chemical influence from geothermal fluids.

Visual Resources – Visual impact issues focused on the siting of the existing plant atop a ridge where it would be highly visible from Pleasant Valley.

Air Quality – The existing plant resulted in occasional hydrogen sulfide emissions that would drift downhill, exposing inhabitants of Pleasant Valley to the odor of hydrogen sulfide. Washoe County adopted stringent hydrogen sulfide standards as a result of this situation.

Steamboat Hills Commenters and their Key Issues

Table A-9 summarizes several comments from agencies and organizations that provided input regarding the Steamboat Hills expansion project. In this case, the comments are limited to scoping for a proposed expansion of the geothermal fluid production and injection for the existing geothermal facility.

Operational Outcomes

The project was not constructed.

Table A-9: Commenters on the Steamboat Hills Document and their Primary Areas of Interest	
AGENCIES AND ORGANIZATIONS	PRIMARY AREAS OF INTEREST
The Washoe County District Health Department	Current emissions do not exceed the permitted limits. The Nevada Division of Environmental Protection is overseeing a continuing groundwater monitoring program in the Pleasant Valley area; no groundwater degradation has been observed.
Sierra Club (Toiyabe Chapter)	Concern about the scoping process, the impact on expanded pumping on Steamboat Hot Springs and the site of the Steamboat buckwheat, and increased air pollution from expanded operations; Request for more information on geothermal resource to address potential effects on thermal features; Flow tests were based on production quantities well below the maximum allowed
The U.S. Fish and Wildlife Service	Impact of increased activity on the endangered Steamboat buckwheat; General impacts on the wildlife population and habitat; Potential impacts on water quality; Measures to reduce impacts from a well blowout that may result in a geothermal water surface discharge

Puna (Hawai'i County, Hawai'i)

Project Description

The Puna Geothermal Venture (PGV) involved the construction of production wells and a 30 MW power plant. PGV came online in 1993 and under a Power Purchase Agreement with Hawai'i Electric Company. PGV delivers an average of 25-30 MW of firm energy on a continuous basis, supplying approximately 20 percent of the total electricity needs of the Big Island.

Regulatory Setting

PGV is a Hawai'iian partnership formed under the guidelines and laws of the State of Hawai'i and the Federal Energy Regulatory Commission. PGV did not trigger a NEPA document. Hawai'i does not have a state-equivalent of NEPA; therefore, a state environmental review process was not triggered either. Available comment information for PGV was limited to a summary of issues within a report from an extensive mediation process that took place in 1989.

Environmental Setting

The PGV power plant is located about 21 miles south of Hilo on the Big Island of Hawai'i. The facility is situated on about 25 acres of a 500-acre undeveloped plot along the Lower East Rift Zone of the Kilauea Volcano.

Comments

PGV was sited close to residential areas and was subject to local opposition because of potential noise and air emissions.

Comment letters were not available for the PGV Geothermal Resource Application because there was no environmental review or assessment document. The comment analysis was based on the Final Mediation Report for the project. The primary issues raised during mediation spanned a wide range of topics and included hydrology, air quality, noise, health and safety, and visual resources, and especially impacts on neighboring residents. A key concern and the subject of the few comment letters available was the use of the mediation process in lieu of adjudication by the Planning Commission to review the project.

Hydrology – Some of the issues discussed included monitoring and enforcement related to the Green Lake water supply, and funding and construction of water lines by the applicant to connect Kapoho to the existing Pahoa water system.

Air Quality – Key mediation issues addressed hydrogen sulfide impacts during open venting (and all other aspects of the project) and their abatement, compliance with air quality standards (and the lack of State emission and ambient air quality standards), monitoring and impacts of boron emissions, the use of Best Available Control Technology (BACT) versus Lowest Allowable Emission Rate (LAER) technology, and developing a worst-case air emissions map.

Noise – The extensive concerns of participants regarding noise included the need for a notification plan for letting residents know when drilling, venting, and cleanout would occur, fugitive noises (yelling, radios, etc.), abatement or mitigation of noise during drilling, construction, venting, and power plant operations, the siting and location of wells and well pads, and the creation of buffer zones around the geothermal development. A proposal was considered in the mediation to require the developer to provide and manage funds for relocation and/or compensation of nearby residents.

Health and Safety – Health and safety concerns included requesting a process for handling inquiries and complaints, the use of non-toxic drilling muds and drilling discharges, the need for emergency plans and procedures, and potential short and long-term health problems attributable to geothermal development.

Visual Resources – Visual impacts listed in the mediation report included landscaping and siting of the project, design criteria, equipment storage, restoration of abandoned areas, and lighting impacts.

Puna Commenters and their Key Issues

The following discussion summarizes comments from the local community and public agencies that provided input to the County of Hawai'i Rule 12 mediation proceedings conducted for the project. The listing, therefore, does not represent detailed comments of the interested parties, but captures the primary concerns of some key participants. The comments in the mediation report tend to be directed more at the mediation process than the specific impacts of the project.

Community representatives (including several local residents), the Hawai'i Sierra Club and the Pele Defense Fund, indicated that the mediation process is an unacceptable alternative to the contested case hearing process, and does not entitle the public to due process and adjudication. These parties requested relocation assistance to residents

adversely impacted by noise and during venting activities. The parties requested creation of and funding for an asset fund for local community and residents impacted by geothermal development, particularly for noise impacts. They also emphasized the need for extensive monitoring of air quality and noise impacts.

A local County Council representative also expressed his concern that the mediation process is an inadequate substitute for the contested case hearing process, and limits appeals as well. He felt that the County Planning Commission should review the project first, with mediation appropriate only if the project is appealed.

The County of Hawai'i noted that it is not in an adjudicatory role, but would attempt to implement any agreements that come out of the mediation. They also indicated there were remaining concerns about mitigation of contamination of the Green Lake county water supply and of noise impacts from well drilling and testing activities.

Operational Outcomes

Project operations began with a lot of opposition from residents of the nearby subdivision. PGV conducted minimal public outreach, and early communications with residents were largely adversarial. A well blowout that occurred soon after operations began increased the negative sentiments toward PGV, but no actual health effects were reported as a result of the event. In later years, public outreach efforts improved dramatically, as has local sentiment for the plant. Residents now have access to an information hotline, and PGV uses newsletters and other means to communicate PGV information to the public.

Roundtable Questionnaire Responses

Experts in geothermal development were asked to review the comment analysis with the goal of identifying any issues that may not have been represented in the comments. Reviewer comments were incorporated into the Comment Analysis section.

The roundtable reviewers were also requested to respond to a questionnaire. Key points and themes in the experts' responses are summarized below.

Q1. MAJOR ENVIRONMENTAL ISSUES FACING GEOTHERMAL DEVELOPMENT

The following issues were raised by the roundtable members in the approximate order of priority as being the environmental issues that most often cause project conflicts or delays:

Potential impacts to groundwater quality and quantity. Groundwater quality concerns were centered on surface spills seeping into shallow aquifers, and on subsurface mixing of geothermal fluids into groundwater aquifers as a result of drilling, production, and injection. Groundwater quantity issues focused on the potential for declines in shallow groundwater levels from reservoir production, and on the extraction of shallow groundwater for facility needs.

Potential impacts to geothermal resources. Geothermal resource issues included the potential for declining reservoir pressures due to extraction of fluids, and the potential effects on other surface thermal manifestations that may be connected to the same geothermal reservoir.

Potential impacts to biological resources. Biological resource concerns focus on potential effects on special-status, indicator, and game species, as well as critical habitats through habitat loss/degradation.

Potential impacts to air quality. Construction-related emissions from dust and diesel combustion, and operation-related emissions during testing, production, and venting are common air quality issues. Constituents of concern include hydrogen sulfide, boron, bicarbonate, mercury, arsenic, and particulates. Other concerns were the odors from

hydrogen sulfide, and the potential effects on local vegetation from deposition of boron and bicarbonate.

Effects of industrializing pristine/recreational areas. Industrial development, including increases in noise and traffic in natural areas highly valued as wilderness may conflict with recreation and preservation interests.

Potential impacts to cultural resources. Perceived impacts on public lands historically used and considered sacred by Native Americans are key concerns on or near tribal lands. The impacts of industrial activity on site-specific cultural resources is also a common issue.

Potential impacts to visual resources. Impacts from the visibility of steam plumes, drill rigs, cooling towers, fences, and pipelines often raise concerns.

Q2. ISSUES NOT IDENTIFIED IN COMMENT ANALYSIS

The following issues were identified by roundtable members as not being captured fully or as being underrepresented in the analysis of the eight selected documents:

Induced seismicity. Concerns sometimes are voiced about the potential for drilling, production, and injection to induce seismic activity in an area.

Wild horses & burros/livestock. These animals can pose a potential for conflict in geothermal exploration projects, such as in Basalt Canyon and Upper Basalt in Mono County, California (livestock) and for most geothermal projects in Nevada.

Noxious weeds. These plants are now a common issue since being added to BLM's "critical elements" list. Occurrence was an issue at Basalt Canyon and Upper Basalt geothermal exploration projects in Mono County, California. This issue was addressed at Fourmile Hill.

Groundwater or surface water depletion. The depletion of groundwater or surface water may be an issue due to its use for reservoir injection to sustain declining resources or augment water lost during production processes (Mammoth, Coso, Newberry)

Effects of particulate emissions. These emissions come from a) geothermal fluids, b) dust, particularly during construction, and c) diesel engines particularly during construction and exploration and wellfield development (drilling).

Q3. INTEREST GROUPS NOT IDENTIFIED IN COMMENT ANALYSIS

The following interest groups were identified by roundtable members as not being reflected in the analysis of the eight selected documents:

- Local sewer and water districts
- Engineering organizations and businesses
- Educators
- Ranchers and grazing allotment permittees

Q4. RECOMMENDED PUBLIC OUTREACH EFFORTS

Public outreach efforts identified by roundtable members have generally been incorporated into the Recommended Outreach Principles and Approach section of the report. General themes identified by participants included:

Community Involvement – Establish and maintain a local presence. Become involved and be visible in the local community to establish credibility. Try to become the best citizen within the community. Establish contact with key people in the communities, including political representatives, environmental groups, and agencies.

Active Public Education Campaigns – Continue this throughout public scoping and environmental document preparation, providing factual information to dispel misconceptions.

Public awareness can be enhanced by working with agency and public policy groups and individuals. Chambers of Commerce, schools, elected officials, agency staff, media outlets, all need to be used early and often in areas where geothermal potential exists.

Effective Communication – Provide clear and accurate information on the benefits of geothermal development, the long-term effects, and the need for renewable energy resources.

Early Identification of Agencies and their Constituents – Identify early the agencies with jurisdictional and/or resource management interests impacted by project development. Establish contact and discuss scoping issues such as project size, timing, and permits required.

Develop Data on Geothermal Projects – Establish how many predicted impacts (positive and negative) actually occurred as the result of a given development, and the effectiveness of monitoring and mitigation. Compare geothermal development with other forms of power generation and highlight the net benefit of geothermal development. Publish information on technological advances developed to mitigate most measures.

Conclusions

This comment analysis represents a compilation and review of 3,787 individual comments on eight proposed geothermal development locations throughout the western United States. The comments span issues raised in 1979 for a geothermal leasing EIS to issues raised in 2003 for a 185 MW geothermal power plant at the Salton Sea (the largest geothermal plant proposed to date).

The comments on geothermal projects were notably consistent across geographic regions, physical environments, and time periods. Comments and key issues associated with geothermal development were many and varied, but did not substantially differ from those for other types of land development projects.

The concerns generally did not differ extensively by region, although there may be very different environmental and regulatory settings in place. The public raised similar concerns regarding noise and visibility of projects whether they were in rural or more urban areas, or in the desert or forested environment.

The comments have not changed substantially from 1979 to 2003. For example, well blowouts and pipeline breeches have been consistent public concerns over the last 20 years. Operating geothermal projects over that period, however, have resulted in only a handful of well blowouts and breeches, leading the industry to continue to enhance outreach efforts and develop measures to effectively mitigate those concerns. Review and analysis of all of the comments would still be useful to anyone contemplating geothermal development today.

Limitations

The study was limited by the availability of standardized environmental documents. The documents used for comment analysis included scoping⁵ reports to Environmental Impact Report/Environmental Impact Statement (EIR/EIS) comments and responses. One of the projects, Puna in Hawai'i, was not subject to typical environmental review because it was not located on federal land, the resource was not managed by a federal agency, and the state does not have a

⁵ Scoping – The process by which the scope of the environmental impact statement (or equivalent state document) is determined, including the range of actions, alternatives, and impacts to be considered. The scoping process can involve public scoping sessions as well as other means to gather early input on environmental documents.

formal environmental review process such as the California Environmental Quality Act. For this project, the only documentation available was a brief record of mediation proceedings.

The counting and categorization of comments is subjective, is approached differently by different reviewers, and can result in varied categorization and quantification. Recategorization of comments was beyond the scope of this analysis.

The intent of the comment analysis was to obtain a textured review of commonly raised concerns with respect to geothermal development. Schedule and budget limitations prevented an evaluation of the veracity of individual comments. The reader should recognize that the impacts discussed here range from insignificant changes in the environment to potentially significant environmental effects for which mitigation is usually defined to reduce or avoid significant adverse effects.

Geothermal Outreach Principles and Comment Analysis Report

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