Evaluating State Renewables Portfolio Standards:

A Focus on Geothermal Energy

Executive Summary

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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 municipals 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.

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

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.

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 of 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.