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Policymakers' Guidebook for Geothermal Electricity Generation

This document identifies and describes five steps for implementing geothermal policies that may reduce barriers and result in deployment and implementation of geothermal technologies that can be used for electricity generation, such as conventional hydrothermal, enhanced geothermal systems (EGS), geopressured, co-production, and low temperature geothermal resources.

STEP 1 Assess the Local Industry and Resource Potential → **STEP 2** Identify Challenges to Local Development → **STEP 3** Evaluate Current Policy → **STEP 4** Consider Policy Options → **STEP 5** Implement Policies → **Increased Development**

Step 1: Assess the Local Industry and Resource Potential

Increasing the use of geothermal energy requires a baseline level of knowledge about the industry and market trends in your locality. As you assess your area, consider the historical activity of the local geothermal industry, take a look at the current geothermal resource availability, and identify possible stakeholders you can contact for more information. This will provide you with insights into the scale of the geothermal opportunity in your area, and allow you to design policy that is realistic and feasible while addressing your area's existing strengths and weaknesses.

Review Historical Activity of Local Industry

The following activities will help you identify what is, and is not, functioning well with your locality's current policy as well as lessons learned from past activities.

- Check public records on investments and site testing to gain knowledge of local resources.
- Contact current geothermal power generation experts in the area (if any) to identify successful development practices.
- Locate proposed projects to understand recent trends and challenges.

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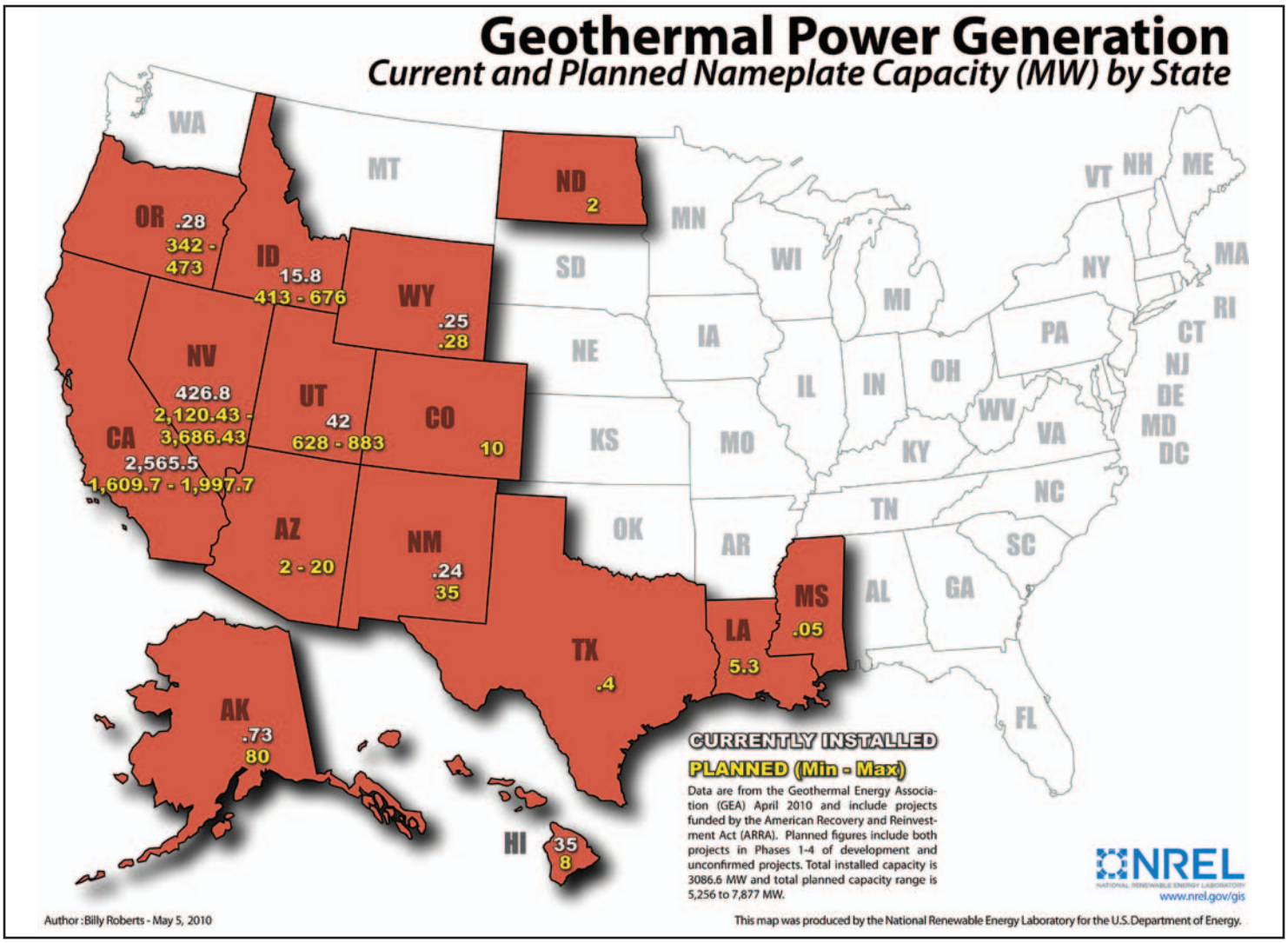


Use maps like this one, which shows the current and planned nameplate capacity for geothermal power plants across the United States, to locate proposed projects in your area.

- Meet with developers and project owners to get their input on local market conditions and opportunities.

If there are no active developers, or there has never been active development, examining why or why not is a critical component in understanding the broader market context of your area and designing relevant policy.

Characterize Resource Potential

To obtain a comprehensive understanding of the resources in your state or region, additional research and survey work may be necessary. Policymakers can take initial steps to support the industry by funding resource potential research. Members of regional universities, U.S. Department of Energy (DOE) national laboratories, the geothermal trade organizations, such as the Geothermal Energy Association, and the U.S. Geological Survey (USGS), may be able to provide guidance on potential contractors who could carry out detailed analysis and identification of local and regional resources.

Identify Stakeholders

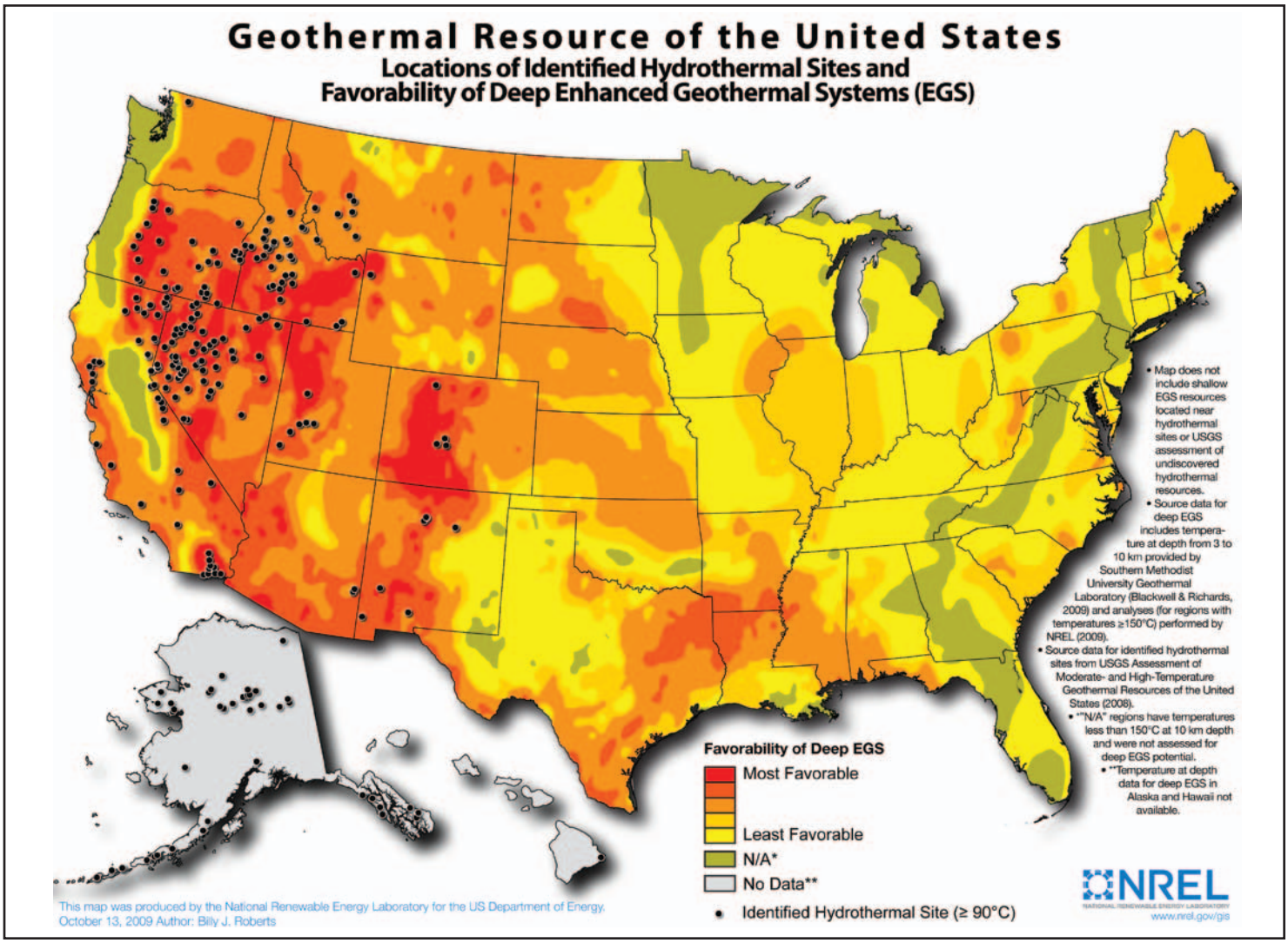
By identifying local stakeholders, you identify potential supporters and opponents of geothermal power generation and garner a sense of workforce potential and equipment vendors. To identify stakeholders, contact traditional energy developers, utilities, regulators, environmental advocacy groups, well drilling companies, state energy offices, state and federal regulators, and other geothermal power generation experts.

Step 2: Identify Challenges to Development

Identifying specific challenges associated with geothermal power generation in your area will help you recognize the point in development where new policy should be targeted. Increase your knowledge about the local geothermal market condition by determining stakeholder concerns, regulatory hurdles, competitive markets, development capital needs, and transmission availability.

Stakeholder Concerns

Conducting informal interviews with stakeholders on specific industry needs can reveal barriers that may not be obvious at first glance. Hosting



Locate geothermal resources in your area by using maps like this one featuring identified hydrothermal sites as well as the favorability of deep enhanced geothermal systems throughout the United States.

outreach meetings and participating in industry research group meetings with stakeholders can help you gain specific knowledge of your area's geothermal electricity market in order to build relevant policy and successful development in your area.

Regulatory Hurdles

To ensure successful geothermal power deployment, geothermal technology must be able to compete with other clean energy and traditional power technologies. Contact the primary regulators of wholesale power markets (e.g., the Federal Energy Regulatory Commission or your public utilities commission) or your regional transmission/system operator to get detailed information on existing regulatory or market design policies that are likely to impact geothermal development.

Additionally, geothermal projects can require an extensive permitting process that can hinder development. The permitting process varies significantly by state and locality.

Consult relevant agencies such as the local Bureau of Land Management (BLM) office and your State Energy Office to determine regulatory and permitting requirements in your location and to find out whether or not an established geothermal permitting process exists.

Competitive Markets

Understanding existing power generation costs, as well as the costs and ability to develop alternative renewable energy resources in your area, will help you identify the potential value of geothermal energy and the required policy measures you

Current transmission availability and capacity will determine your transmission policy and investment needs.

Evaluate the development capital in your area, including equipment and manpower capable of digging deep wells, to address any possible barriers to development.

need to implement in order to increase the competitiveness of geothermal power generation.

Development Capital

Geothermal power generation requires specific machinery, equipment, and financing or development capital. Learn about available financing for geothermal power projects by evaluating the prevalence of heavy industry in the region and its ability to dig deep wells. This will help you assess the ability of local businesses and laborers to participate in future geothermal power generation development, which will provide insight into the potential economic impacts from new policy within your area.

Transmission Availability

Identifying the proximity of existing transmission lines to specific sites and the available capacity on these lines will inform your transmission policy and investment needs. Check with your regional transmission operator, public utilities commission, or utility to get existing transmission maps and available capacity information.

Step 3: Evaluate Current Policy

A plan coordinated across federal, state, and local agencies that addresses current policy gaps and leverages existing policy will enhance your ability to develop new policy.

Depending on land ownership, regulations, and other factors, current policies may or may not apply to your needs. Furthermore, states use a variety of policy tools to support clean energy development; some states already have policies in place that apply to geothermal energy while others do not. In light of this discrepancy, federal, state, and local policies can interact to create or correct barriers.

Learn more about current federal policies in the table below and view current state policies already in place by visiting the Policymakers' Guidebook for Geothermal Electricity Generation website at *www.nrel.gov/*

Current Federal Policies for Geothermal Electricity Generation

Federal Policy	Description
Auction Regulations	Energy Policy Act (EPAct) of 2005. Amended leasing regulations for geothermal resources located on federal lands, opening the resource nomination process to the market.
Grants/Loans/ Loan Guarantees	Geothermal projects can receive DOE Tribal Energy Program grants and U.S. Department of Agriculture Rural Energy for America Program grants. Federal government has been authorized to provide loan guarantees through DOE for geothermal energy projects under Title XVII of EPAct 2005.
Investment Tax Credit (ITC)/ Production Tax Credit (PTC)	Geothermal facilities placed in service 2009 through 2013 are eligible for their choice of either a PTC of 2.1 cents per kilowatt hour for 10 years or a 30% ITC on qualifying expenditures on geothermal equipment. After 2013, a 10% ITC policy that currently has no expiration date is available.
Modified Accelerated Cost Recovery System (MACRS)	An IRS-implemented incentive that allows for accelerated depreciation on a 5-year tax schedule.
Section 1603 Cash Grant Program	Section 1603 of the Recovery Act allows taxable entities developing geothermal projects to take the respective PTC or ITC as a cash grant.
Public Utility Regulatory Policies Act	Implemented in 1978. Requires utilities to purchase electricity from qualifying facilities at avoided costs. Still drives some geothermal development.
Research and Development	DOE's Geothermal Technologies Program funds research, development, and technical assistance for geothermal exploration and development.
Resource Assessment	In 2008, the USGS conducted a study of moderate- and high-temperature geothermal resources in 13 states, as authorized in EPAct 2005. This study focused on the western United States, including Alaska, and Hawaii, and identified all known geothermal resource areas and analyzed geologic features that facilitate the formation of geothermal systems. It also sought to identify regions that may be viable for enhanced geothermal power development specifically in the western United States. Such work demonstrates a large resource and identifies potentially high-value areas where geothermal energy production is likely to be viable.
Unitization	Allows multiple landowners or federal leaseholders to develop a vast reservoir as one unit rather than limiting individuals to the specific property rights assigned by a lease or deed. Generally allows for the most-efficient development of the resource and reduces the required investments in equipment. Procedures outlined in EPAct 2005.

geothermal/guidebooks/electricity_generation/current_policy.html.

Additionally, visit the Database of State Incentives for Renewables and Efficiency, *www.dsireusa.org/*, to find information on state, local, utility, and federal incentives and policies that support geothermal.

Step 4: Consider Policy Options

Developing geothermal electricity generation policy involves different types of policy options that can help expand the deployment of geothermal electricity power generation by taking the risk of initial costs off the end-user. Options include:

- Utility mandates and standards
- Direct cash incentives
- Regulatory provisions
- Tax incentives
- Financing
- Outreach and training
- Lead-by-example policies

Learn more about these policy options in the table to the right and get specific details on each at *www.nrel.gov/geothermal/guidebooks/electricity_generation/policy_options.html*.

Step 5: Implement Policies

Choosing and implementing the right policies for your area will help move it toward geothermal power generation goals. The policies you choose should address any legal and regulatory challenges as well as your state's geothermal resources and barriers.

Legal and Regulatory Challenges

Geothermal power generation technologies have some exclusive attributes that suggest new policies, rather than updating current policies, may be more successful in supporting development.

In some respects, geothermal power generation challenges are similar to those of other renewable energy

Policy Options for Geothermal Electricity Generation

Policy	Definition	Example
Utility Mandates and Standards	Used to enhance energy diversity and security, promote economic development, and mitigate climate change.	Interconnection Standards Renewables Portfolio Standards
Direct Cash Incentives	Used to fund a portion of initial equipment and installation costs, which are often high, or to offset resource assessments, feasibility studies, or other pre-development costs.	Feed-in Tariffs Grants
Regulatory Provisions	Used to address non-standard application processes or lack of clarity regarding permitting requirements.	Delineated Resource Ownership Expanded Transmission Infrastructure Single Agency Permitting Standardized Leasing Practices Standardized Permitting Processes
Tax Incentives	Can be used to offset costs of developing a geothermal power project, or to assist in project economics by providing additional incentives based on power production rates. States often use tax incentives to provide an incremental motivation for development.	Property Tax Incentives Sales Tax Incentives Tax Credits
Financing	Can be used to lower the cost of capital or reallocate investor and lender risk.	Direct Government Loans Loan Guarantees
Outreach and Training	Helps provide key infrastructure elements necessary for geothermal development, including technology knowledge, workforce training, and technical assistance.	Outreach and Education Resource Assessment Technical Assistance Workforce Development
Lead-By-Example Policies	Used to promote increased use of geothermal energy or directly invest in emerging technology demonstration or research.	Green Power Purchasing for Public Buildings Public Private Partnerships and Cost Sharing Agreements

Implementing effective policies that address common barriers to geothermal electricity generation will result in clean, efficient geothermal power plants, such as The Geysers in California, shown here.

technologies in that widespread deployment will require improved transmission access. However, legal and regulatory challenges regarding geothermal energy generation are somewhat unique. Consider these specific issues when determining new policy:

- Technological maturity—EGS are still in a research, development, and demonstration phase. Supporting EGS will require different policies than those that support co-production or hydrothermal development.

The best approach for effective geothermal electricity generation policy in your area will be influenced by the available geothermal resource, barriers, and goals.

- Project timeline—Hydrothermal projects take longer than most other renewable energy technologies, approximately 4-7 years, to develop and get online.
- Development risk profile—even conventional geothermal energy production systems, such as hydrothermal, have relatively high risk early in the development process, but low risk during operations.

State Resources

Because the knowledge about geothermal resources, available transmission, and existing regulatory landscape varies widely between states, it will be very likely that state and local policy measures developed in one state may not be applicable in neighboring states.

The most appropriate policy approach will be dictated by your state's available geothermal resources; current barriers to, and opportunities for, geothermal development; and existing priorities and goals for renewable energy. Ultimately, policies should be designed to address the geothermal barriers that are most prominent in your jurisdiction.

After implementing your geothermal energy generation policy, it is critical to track and monitor its success. If results are not in accord with your goals, you may need to change or modify your policy.

Additional Resources

Make sure to visit the Policymakers' Guidebook for Geothermal Electricity Generation website to learn more and get in-depth details and examples. *www.nrel.gov/geothermal/guidebooks/electricity_generation/electricity_generation.html*

You may also find the following websites useful.

Federal Energy Regulatory Commission
www.ferc.gov

Geothermal Energy Association
www.geo-energy.org

Geothermal Resource Council
www.geothermal.org

Interstate Renewable Energy Council
http://irecusa.org

National Renewable Energy Laboratory, Geothermal Energy Basics
www.nrel.gov/learning/re_geothermal.html

U.S. Department of Energy, Geothermal Technologies Program
www.geothermal.energy.gov

U.S. Geological Survey
www.usgs.gov

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