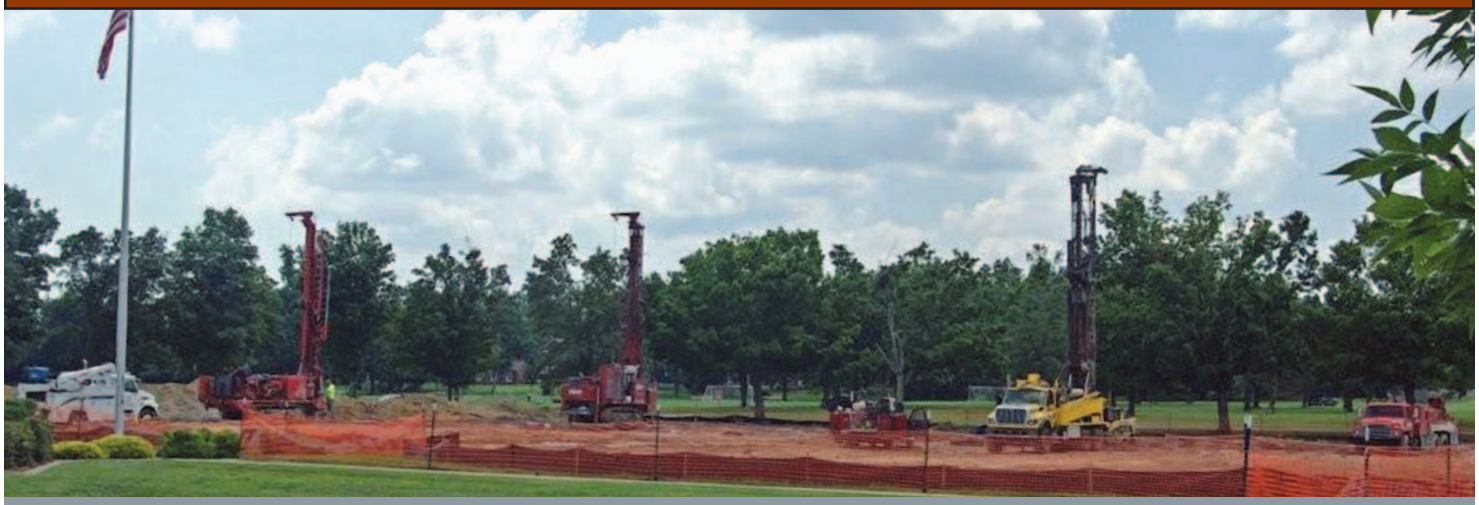
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

National Renewable Energy Laboratory



Boreholes being drilled for a ground coupled heat pump system to provide heating and cooling at the U.S. army Fort Knox Disney Barrack, completed in 2005. Fort Knox is home to one of the largest geothermal heating and cooling systems in the world.

Policymakers' Guidebook for Geothermal Heating and Cooling

This document identifies and describes five steps for implementing geothermal policies that may reduce barriers and result in deployment and implementation of geothermal heating and cooling technologies, such as ground source heat pumps (GSHP) and direct-use applications.

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

Conducting interviews and surveys with local heating, ventilation, and air conditioning (HVAC) engineers and contractors, as well as geothermal trade organizations, can help you understand local activity. Existing and recent geothermal heating and cooling installations are a sign of resource potential.

Evaluate Deployment Potential

If there is a substantial amount of geothermal heating and cooling installations, there may be significant deployment potential. However, deployment potential can be heavily

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Direct-use applications of geothermal energy, such as this greenhouse near New Castle, Utah, require a local geothermal resource. By evaluating the resource potential in your area, you'll be able to assess if direct-use applications are feasible.

impacted by system costs and other regional requirements; make sure to take these into account as you evaluate.

System costs for GSHP are dramatically affected by the local geologic and soil conditions, which can impact the cost of the required underground or underwater loop system. Evaluate the range of expected costs for drilling or excavating the underground loop system within specific areas of your state or community to assess the economic viability of GSHP.

Direct-use geothermal applications require a local geothermal resource. To head off any additional barriers, conduct an in-depth, comprehensive assessment of local direct-use resource potential to identify specific viable sites, reduce development risk, and inform the local population about opportunities for geothermal direct-use applications.

Identify Stakeholders

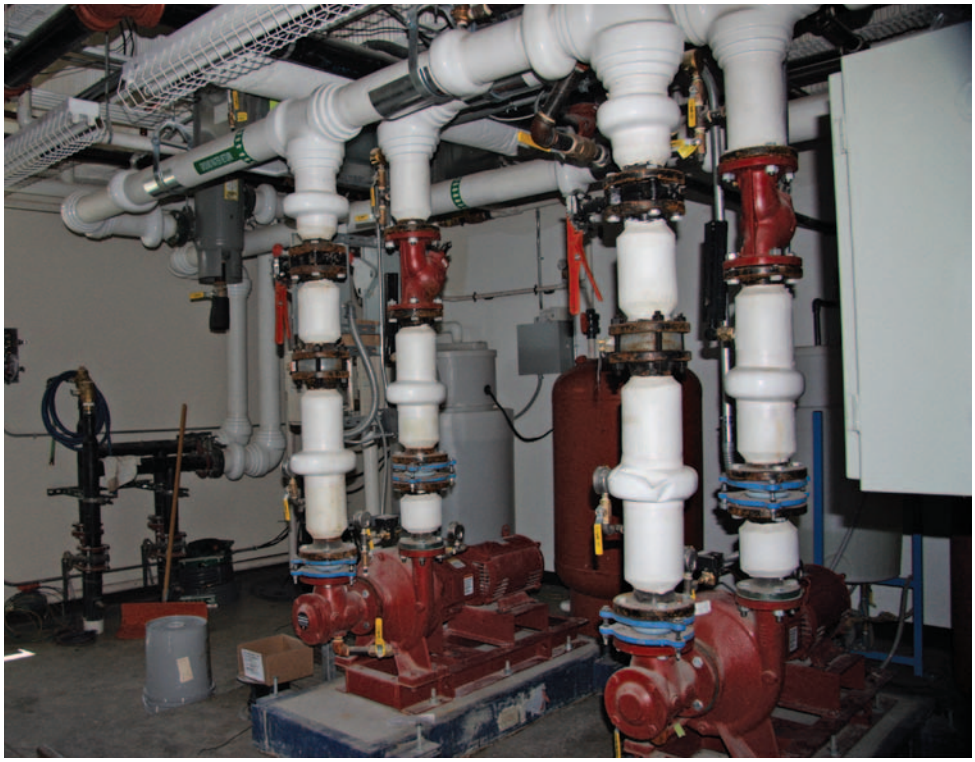
By identifying possible stakeholders you'll find information on existing or potential workforce personnel, equipment vendors, regulatory players, and potential champions or opponents of geothermal development in your area. To identify stakeholders, contact state and federal environmental agencies, your state energy office, or university experts.

Step 2: Identify Challenges to Development

Identifying specific challenges associated with geothermal heating and cooling development in your area will help you recognize the point in development where new policy should be targeted. Understanding development barriers, stakeholder concerns, and development capital needs will help boost your knowledge about the local geothermal market condition and further increase the likelihood of effective policy.

Development Barriers

Geothermal heating and cooling technologies must be able to compete with other clean energy technologies to ensure successful deployment. However, numerous barriers must be overcome to make geothermal heating and cooling technologies a viable option. A lack of specific machinery, equipment, financing, knowledge, and the personnel needed to develop geothermal heating and cooling technologies are some of the most common barriers to successful development. Direct-use applications



New and existing GSHP systems, like this one in Greensburg, Kansas, are a sign of resource potential in your area.

A lack of qualified workers to install and maintain geothermal equipment is one barrier to development that should be addressed when designing policy.

One way to address stakeholder and public concerns is to provide information on geothermal technologies by giving a system demonstration.

face additional barriers, such as leasing backlogs, regulatory and permitting roadblocks, and insufficient resource access. GSHP barriers also include high installation costs and varying system designs.

Stakeholder Concerns

Conducting surveys and interviews, networking at conferences or meetings, and holding formal public comment opportunities with stakeholders on specific local and industry needs can increase the value of your geothermal heating and cooling policy by revealing barriers to development. These types of activities will be most effective if a clear distinction is drawn between GSHP and direct-use applications.

Development Capital

Geothermal heating and cooling technologies require specific equipment, personnel, and financing or development capital. Find out the level of financial and industry support needed to make GSHP or direct-use technologies competitive in your area by contacting existing or potential geothermal heating and cooling consumers. Involving the HVAC industry will allow you to make direct comparisons between the economics of geothermal heating and cooling technologies and current heating and cooling technologies, such as HVAC loads, local climate variations, utility prices, and required funding.

Step 3: Evaluate Current Policy

Review current state and federal policy and major provisions that impact the development of geothermal heating and cooling technologies to create a coordinated plan that will enhance new policy effectiveness by addressing current policy gaps and leveraging existing policy.

Some states already have policies in place that apply to direct-use applications and GSHP. Additionally, federal, state, and local policies can interact to create or correct market failures.

Learn more about current federal policies in the table on the next page and view current state policies already in place by visiting the Policymakers' Guidebook for Geothermal Heating and Cooling website at *www.nrel.gov/geothermal/guidebooks/heating_cooling/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 renewable energies like geothermal.

Step 4: Consider Policy Options

Developing geothermal heating and cooling policy involves considering different types of policy options that can help expand the deployment of geothermal heating and cooling technologies. Options may be directed to both GSHP and direct-use applications depending on your area's goals, resources, and needs. Options include:

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

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

Policy Options for Geothermal Heating and Cooling

Policy	Definition	Example
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.	Grants Rebates
Lead-By-Example Policies	Used to increase awareness and test or demonstrate geothermal technologies.	Attain Green-Building Certification Meet Energy-Reduction Goals Procure Energy-Efficient Equipment
Tax Incentives	Used to offset purchasing, installation, and ownership costs. Easy to administer and do not require special funding or annual appropriations.	Property Tax Incentives Sales Tax Incentives Tax Credits
Financing	Allows projects to become more feasible by spreading costs over time.	Loan Guarantees Loans
Regulatory Provisions	Used to address deployment barriers such as permitting, leasing, and access requirements.	Delineated Resource Ownership Single-Agency Permitting Standardized Leasing Practices Standardized Permitting Processes
Outreach and Training	Used to increase knowledge and facilitate development of geothermal heating and cooling technologies.	Outreach and Education Resource Assessment Technical Assistance Workforce Development
Utility Mandates and Standards	Used to enhance local energy diversity and security by promoting economic development and mitigating climate change.	Energy Efficiency Portfolio Standards Geothermal Infrastructure Access Renewables Portfolio Standards

Step 5: Implement Policies

Implementing policies that will achieve increased deployment of GSHP and direct-use technologies will require different sets of policies to facilitate deployment because each technology is different. Weigh the options for developing new policies or changing existing policies to include geothermal heating and cooling technologies as you move forward.

New Policies

New policies may be most effective if targeted to market barriers that are not already addressed by existing local, state, or federal policy. For example, if the existing federal ITC can provide the necessary financial incentive to make direct-use projects economically feasible, new policy is likely to be most effective when designed to address resource access, ownership, local expertise, and knowledge barriers that can halt development.

Changes to Existing Policies

Some existing policies can be expanded to explicitly include GSHP and direct-use technologies. In other cases, clarifying eligibility restrictions so that the statutory language is clear about which technologies are eligible for a given incentive or program may be the most appropriate approach.

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 energy efficiency and renewable energy.

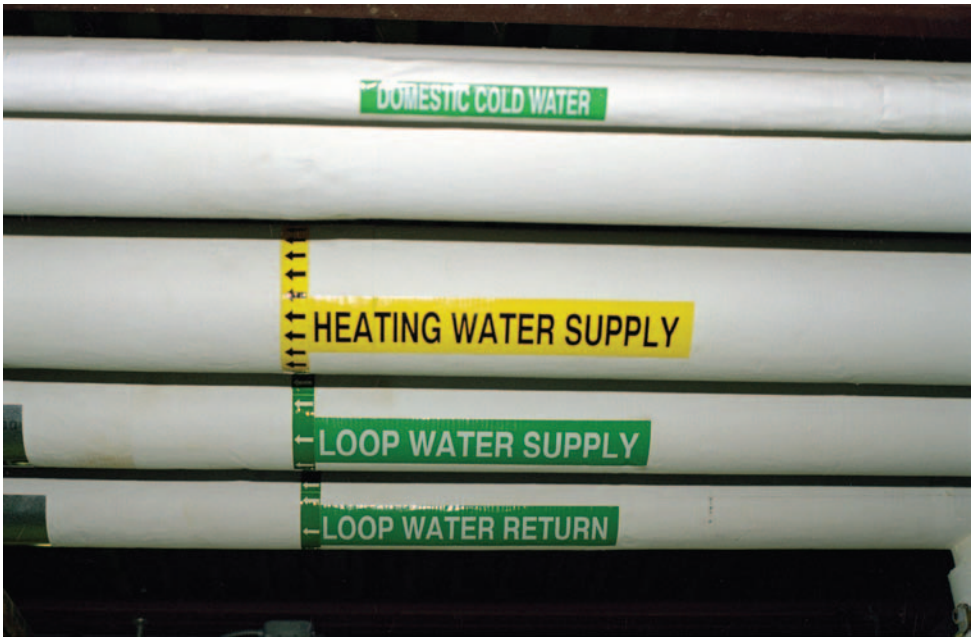
After implementing your geothermal heating and cooling policy, it is critical to track and monitor its success. If results are not in accord with your goals, you may need to change or modify your policy.

Current Federal Policies for Geothermal Heating and Cooling

Federal Policy	Definition	Applicable Technology
Auction Regulations	Energy Policy Act of 2005 (EPAct 2005). Amended leasing regulations for geothermal resources located on federal lands, opening the resource nomination process to the market.	Direct-use
EPAct 2005 Residential Renewable Energy Tax Credit	30% residential renewable energy tax credit applies to residential GSHP. Effective January 1, 2008 – December 31, 2016.	GSHP
Grants/Loans/Loan Guarantees	Geothermal projects can receive U.S. Department of Energy 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 for geothermal energy projects under Title XVII of EPAct 2005.	Direct-use, GSHP
Investment Tax Credit (ITC)	10% ITC for all expenditures on geothermal equipment except those required for transmission. No expiration date.	Direct-use, GSHP
ITC/Cash Grant Program	Section 1603 of Recovery Act allows taxable entities developing geothermal projects to take the 10% corporate investment tax credit as a cash grant.	Direct-use, GSHP
Modified Accelerated Cost Recovery System (MACRS)	An IRS-implemented incentive that allows for accelerated depreciation on a 5-year tax schedule.	Direct-use, GSHP
Recovery Act R&D	Recovery Act provides $350 million for geothermal research and demonstration. $50 million available for GSHP demonstration projects.	Direct-use, GSHP
Resource Assessment	In 2008, U.S. Geological Survey conducted a study of moderate- and high- temperature geothermal resources in 13 states, as authorized in EPAct 2005. 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. Also sought to identify regions that may be viable for enhanced geothermal power development specifically in the western United States. Work demonstrates a large resource and identifies potentially high-value areas where geothermal energy production is likely to be viable.	Direct-use
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 the EPAct 2005.	Direct-use

Well core drilling at the IKEA construction site in Denver, Colorado, where 130 GSHP wells, 500-feet-deep each, were dug in August 2010, showcasing how a GSHP system can be used in a commercial setting.

Successful geothermal policy implementation means more use of geothermal energy, like this geothermal district heating system that keeps sidewalks clear after snowfall in Klamath Falls, Oregon.



Thanks to effective geothermal policy, this elementary school in Lincoln, Nebraska, uses loop water piping as part of the school's GSHP system, shown here, to save energy and money.

Additional Resources

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

You may also find the following websites useful.

American Reinvestment and Recovery Act of 2009
www.recovery.gov

Association of Energy Engineers
www.aeecenter.org

ENERGY STAR
www.energystar.gov

Geothermal Energy Association
www.geo-energy.org

Geothermal Resource Council
www.geothermal.org

International Ground Source Heat Pump Association – Training
www.igshpa.okstate.edu/training/training.htm

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

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

National Renewable Energy Laboratory
1617 Cole Boulevard, Golden, Colorado 80401
303-275-3000 • www.nrel.gov

NREL/BR-6A20-49477 • Revised February 2011

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.

Photo credits: PIX 17125, PIX 13981, PIX 17555, PIX 04133, PIX 07290, PIX 17887, PIX 08829, PIX 07414.