Power Generation

Geothermal energy is heat from the Earth. It’s clean and sustainable. Resources of geothermal energy range from the shallow ground to steam, hot water, and hot rock accessed by drilling wells up to thousands of feet beneath the Earth’s surface. The extremely high temperatures in the deeper geothermal reservoirs are used for the generation of electricity.

Most power plants use steam to generate electricity. The high-pressure steam spins a turbine that rotates a generator, producing electricity. The largest source of carbon emissions in the U.S. are the many power plants still burning fossil fuels to boil water for steam. Geothermal power plants, however, do not burn fuels to heat water to steam. Instead, they use natural heat found below the Earth’s surface to generate electricity.

New geothermal power plants produce near-zero CO₂ and emit very little air pollution.

And unlike solar or wind energy, geothermal energy is available around the clock.

BENEFITS

Jobs Boost. Geothermal power plants employ about 1.17 persons per MW. Adding related governmental, administrative, and technical jobs, the number increases to 2.13.

Economy Boost. Over the course of 30 to 50 years an average 20 MW facility will pay nearly $6.3 to $11 million dollars in property taxes plus $12 to $22 million in annual royalties. Seventy-five percent of these royalties ($9.2 to $16.6M) go directly back to the state and county.

Locally Produced. Geothermal power can offset electricity currently imported into the state, keeping jobs and benefits in state and local communities.

Near-Zero Carbon Emissions. Geothermal flash plants emit about 5% of the carbon dioxide, 1% of the sulfur dioxide, and less than 1% of the nitrous oxide emitted by a coal-fired plant of equal size, and binary geothermal plants – the most common – produce near-zero emissions.

Small Footprint. Geothermal has among the smallest surface land footprint per kilowatt (kW) of any power generation technology.

Reliable. Geothermal power can provide consistent electricity throughout the day and year - continuous baseload power and flexible power to support the needs of variable renewable energy resources, such as wind and solar.

Sustainable Investment. Energy resource decisions made now for sources of electric power have 40-50 year consequences, or longer. Using renewables like geothermal resources avoids “price spikes” inherent in fossil fuel resource markets. Geothermal energy is an investment in stable, predictable costs. Investing in geothermal power now pays off for decades to come.
**Idaho Geothermal Power Benefits**

**Reliable, baseload power:**
2,200 MWe of geothermal potential

Total annual power consumption in Idaho in 2013 was 39,000 GWh. Geothermal potential in the state is as much as 17,000 GWh – 44% of the state’s power consumption, providing reliable baseload power.

**Water use reduction**

Geothermal power has substantially lower life-cycle water consumption than other types of baseload generation. In addition, geothermal plants normally use brackish water for cooling (when necessary) that would not be fit for human consumption or use.

**Locally produced power:**
In-state electricity production

Geothermal plants can operate for many decades providing stable jobs to local communities and revenue to state and municipal treasuries.

**Job Creation:**
Construction: 7,000 person-years
Operation: 2,400 full-time jobs

**Policies & Incentives**
Federal and state policies and incentives helped catapult renewable energy technologies, such as wind and solar, into the billion dollar industries they are today.

State incentive programs that help developers reduce upfront risk and secure power purchase agreements can help to incentivize geothermal power development in the state.

**Geothermal Projects Under Development in Idaho**
- Walker Ranch, Cassia County
- Raft River Expansion, Cassia County

**Idaho’s most promising Geothermal Resource Areas**

Calculations in this flyer were based on the USGS 2008 Resource Assessment. Sources for other information in this flyer can be obtained by contacting the Geothermal Energy Association.

January 2016
Direct Use

Geothermal energy is heat from the Earth. It’s clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock accessed by drilling wells up to thousands of feet beneath the Earth’s surface. The hottest reservoirs are used to produce electricity, and the more common moderately hot reservoirs are a ready source of natural heat, without burning fossil fuels.

Direct, or non-electric, use of geothermal energy refers to the use of the energy for both heating and cooling applications. Fluids with temperatures of <300°F, adequate for direct use, are available throughout much of the United States.

Direct use of geothermal energy in homes and commercial operations is much less expensive than using traditional fuels; savings can be as much as 80%! Furthermore, direct-use applications such as fish farms, greenhouses, microbreweries, fruit and vegetable drying, spas, pulp and paper processing, and lumber drying offer attractive and innovative opportunities for local businesses and entrepreneurs.

Benefits

Jobs Boost. Direct-use geothermal energy projects leverage existing workforces and companies within the state. Their simple design and construction from off-the-shelf parts can utilize local engineering firms, geologists, drilling operators, construction trades, pipefitters, technicians, and welders. A rough prediction of potential job opportunities created by installing direct-use systems may be 3 temporary jobs per MWth during construction, with 1 full-time job per MWth for ongoing operation.

Economy Boost. Geothermal heated facilities have the potential to stimulate economies through increased tax revenues, the creation of new businesses and local jobs, tourism, agriculture, and enhanced community involvement.

Locally Produced. Directly using geothermal energy in homes and commercial operations, such as food production from local agriculture, can offset imported energy, keeping jobs, dollars, and other benefits in local communities.

Carbon Emission Reduction. Geothermal direct-use projects produce near-zero emissions. Depending on the existing heating fuels being offset, this may result in annual emissions reductions of anywhere between 1,700 tons (if offsetting natural gas) to 9,300 tons (if offsetting electricity) of CO₂ saved per MWth of installed geothermal direct-use capacity.

Flexible Heating Systems. Applications of geothermal direct use may include district heating, snow melting, spas and pools, agriculture, food processing, and other uses. Within a single system these diverse applications can be “cascaded” and work together in the most efficient way possible to ensure the maximum benefit and lowest costs possible from direct-use systems.

Reliable and Sustainable Heat Source. Geothermal heating projects last for decades—typically 25 years or more—providing reliable energy at a low, stable price. This can provide price certainty and insulate consumers (and the economy) from often unpredictable fluctuations in fossil fuel prices.

Discover the geothermal direct-use potential in your state.
Idaho Geothermal Direct Use Benefits

**Carbon emissions reduction:**
3.8 Million metric tons (MMtCO₂)

The total estimated annual heat consumption in Idaho is 61 Trillion BTU. Developing the hydrothermal direct-use resources in Idaho — as much as 81 Trillion BTU — could supply all of Idaho’s heating needs with clean, renewable geothermal heat.

Idaho’s CO₂ emissions from heating are nearly 3.8 MMtCO₂ per year. Developing only three-fourths of the geothermal direct-use in the state can offset most of the emissions released by the heating sector in Idaho, while providing reliable energy at a low, stable price.

**Direct-Use Hydrothermal Sites in Idaho**

Low-temperature hydrothermal potential exists throughout most of the state of Idaho with several hundred locations identified by the USGS as having potential for development.

**Geothermal Direct-Use Projects in Idaho**

Boise’s district heating system is the largest direct use geothermal system in the United States, supplying heat to over 65 businesses and municipal buildings, including the Ada County Courthouse. The system displaces an estimated 19.40 GWh of electricity production annually.

**Policies & Incentives**

Federal and state policies and incentives helped catapult renewable energy technologies, such as wind and solar, into the billion dollar industries they are today.

State incentive programs that help developers reduce upfront risk can help to incentivize geothermal direct-use development in the state.

**Direct Use Locations**

- **Current Direct Use**
- **Co-located Sites**
- **Wells and Springs**

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January 2016
Heat Pumps

Geothermal energy is heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock accessed by drilling wells up to thousands of feet beneath the Earth's surface. Geothermal heat pumps use the natural insulating properties of the earth from just a few feet underground to as much as several hundred feet deep, offering a unique and highly efficient renewable energy technology for heating and cooling.

Most work by circulating water in a closed system through a “loop field” installed horizontally or vertically in the ground adjacent to or even beneath a building. Heat is taken from the building and transferred to the ground in the summer. The system is reversible, and heat is taken from the ground and used in the building in the winter. The system only moves heat, which is much more efficient than using a fuel or electricity to create heat.

Geothermal heat pumps can support space heating and cooling needs in almost any part of the country.

BENEFITS

Economic. On average, a typical home of 2000 square feet will require 4 tons of heating and cooling capacity with an average system installation cost between $5,000 and $7,500 per ton.

Energy Efficient. Geothermal heat pumps use 25% to 50% less energy than conventional heating or cooling systems.

Carbon Emissions Reduction. One ton (12,000 BTU/hr) of GHP capacity over a 20 year operating cycle avoids 21 metric tons of CO₂ emissions. So a typical home system can avoid 80-100 metric tons of CO₂ emissions.

Improved Indoor Air Quality & Safety. There is no combustion in a geothermal heat pump; therefore there is no chance of carbon-monoxide poisoning. By adding high-efficiency air cleaners with geothermal, these systems can improve inside air quality.

Locally Produced. Everywhere. Unlike other geothermal technologies, heat pumps are not limited by geography or geology. They can be installed in most locations in any of the 50 states or territories of the U.S.

Sustainable Investment. The lifespan of a geothermal system is usually greater than 24 years. A conventional furnace will last 7-10 years with regular maintenance. The ground loop of the geothermal system has a warranty of 50 years. These loops are made up of high-density polyethylene pipe, the same pipe which is used in city gas lines.

Quiet Operation. Unlike air conditioners, there is no outdoor unit. Geothermal units are very smooth and quiet in operation.

Discover the geothermal heat pump potential in your state.
Policies & Incentives
Federal and state policies and incentives helped catapult renewable energy technologies, such as wind and solar, into the billion dollar industries they are today.

States can use tax incentives, including property and sales tax incentives, and tax credits to provide an incremental motivation for geothermal development.

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