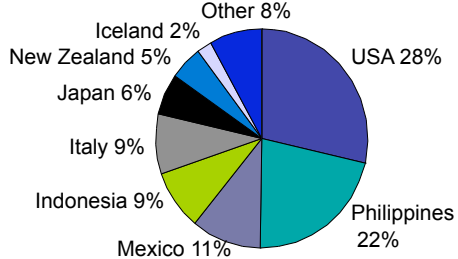


Generation and Potential

World Geothermal Electrical Generation by Country (2005)



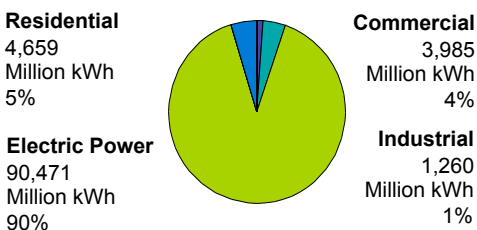
USA	2544 MWe	Japan	535 MWe
Philippines	1931 MWe	New Zealand	435 MWe
Mexico	953 MWe	Iceland	202 MWe
Indonesia	797 MWe	Other	724 MWe
Italy	790 MWe	TOTAL	9064 MWe

U.S. Current Capacity and Estimated U.S. Geothermal Potential

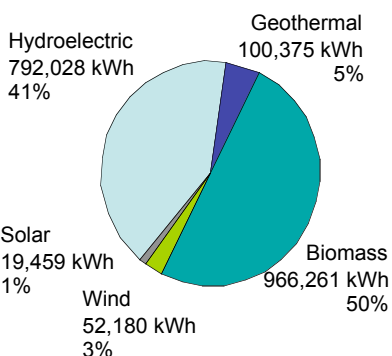
Generating Capacity	2005	2050
Shallow Hydrothermal [MWe]	2,544	30,000
Enhanced Geothermal Systems [MWe]	0	>100,000
Co-produced & Geopressured [MWe]	2	130,000
Thermal		
Direct Uses [MWt]	617	45,000
Geothermal Heat Pumps [MWt]	7,200	>1,000,000

Consumption continued

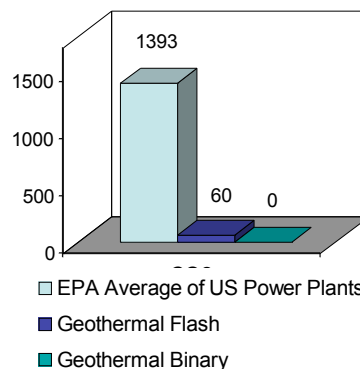
U.S. Geothermal Energy Consumption by End Use (2005)



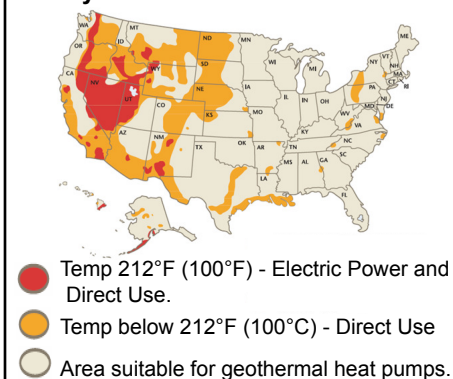
U.S. Renewable Consumption (2005)



Emissions Lbs/MWh



U.S. Hydrothermal Resource Distribution



Key Terms & Issues

Hydrothermal systems: Systems that extract or produce naturally occurring hot fluids from highly porous, permeable rock reservoirs to supply heat or to generate electricity in a power cycle.

Co-produced Fluids: Geothermal fluids produced during oil and gas production.

Geothermal Heat Pumps: Heat pumps that utilize the soil or ground water as a heat source in the winter and heat sink in the summer, taking advantage of the relatively constant ground temperature to improve thermal efficiency.

Engineered Geothermal Systems (EGS): When thermal energy is present in rock formations but other conditions of hydrothermal reservoirs are not met a geothermal system can be engineered by drilling a set of wells, hydraulically stimulating the formation to create interwell connectivity and circulating fluid through the system. EGS technology is not yet commercially feasible.

Geopressured: Geothermal resources that are found under extreme pressures and often contain dissolved methane.

Direct Use: When geothermal fluid is used directly without the aid of a turbine or a heat pump, e.g. district heating, spas and industrial processes.

Transmission: Geothermal resources are often located far from population centers, so it is critical to geothermal energy growth that new transmission capacity be added to the U.S. grid.

Production Tax Credit (PTC): There is a federal 2.0 cents/kWh tax credit in place for geothermal electricity production. It will expire December 31, 2008.

Renewable Portfolio Standards (RPS): 26 states now have a mandatory RPS which designates that a certain amount of the energy supply come from renewable resources.

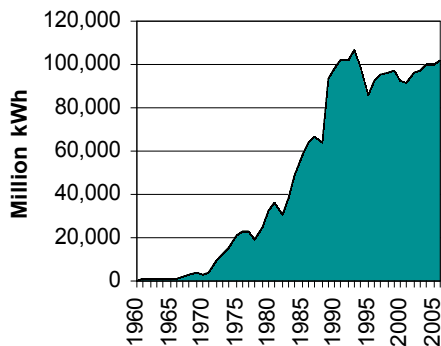
Baseload Power: Geothermal has a very high capacity factor of over 90%.

Cost: 4.5-7.8 cents/kWh or about \$2800/MW installed.

Risk: Drilling and exploration risk are some of the major challenges to geothermal development.

Consumption

U.S. Geothermal Energy Consumption 1960-2006



Key References

Data was primarily taken from:
 EIA Renewable Energy Annual
 2005

EIA website: www.eia.doe.gov
 For references of specific figures, see
 Electricity Fact Sheet reference page.

Generation & Potential

World Geothermal Electrical Generation by Country (2005)

- Installed Generating Capacity
- Data from International Geothermal Association
<http://iga.igg.cnr.it/geoworld/geoworld.php?sub=elgen> Accessed Dec. 15, 2006

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J. W. Lund, R. G. Bloomquist, T. L. Boyd, and J. Renner, "The United States of America Country Update," in World Geothermal Congress 2005, Antalya, Turkey, 2005.

Data from Green, B.D. and R.G. Nix, *Geothermal - The Energy Under Our Feet*, U.S.D.o. Energy, 2006, National Renewable Energy Laboratory.

U.S. Geothermal Energy Consumption 1960-2006

Geothermal electricity net generation converted to Btu using the geothermal energy plants heat rate), geothermal heat pump and direct use energy.

Data from table 10.1, *Renewable Energy Production and Consumption by Primary Energy Source, 1949-2006*, Annual Energy Review 2006

Consumption continued

U.S. Geothermal Energy Consumption by End Use (2005)

Data from table 2, *Renewable Energy Consumption by Energy Use Sector and Energy Source, 2001-2005*, EIA Renewable Energy Annual 2005

U.S. Renewable Consumption (2005)

Data from table 2, *Renewable Energy Consumption by Energy Use Sector and Energy Source, 2001-2005*, EIA Renewable Energy Annual 2005

Emissions Lbs/MWh

- Coal, oil, and geothermal reported as average existing system emissions Natural gas reported as average existing steam cycle, simple gas turbine, and combined cycle system emissions.
- Data from Kagel, A., D. Bates, and K. Gawell, *Clearing the Air, Air Emissions from Geothermal Electric Power Facilities Compared to Fossil-Fuel Power Plants in the United States*, in *GRG Bulletin*. 2005

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Key Terms & Issues

Hydrothermal systems, Co-produced fluids, Geothermal heat pumps and Geopressured:

Tester, J.W., et al., *Sustainable Energy, Choosing Among Options*. 2005, Cambridge, MA. The MIT Press

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Massachusetts Institute of Technology. (2006). *The future of geothermal energy: impact of enhanced geothermal systems (EGS) on the United States in the 21st century: an assessment by an MIT-led interdisciplinary panel*. Cambridge, MA, MIT

Production Tax Credit (PTC):

26 USC § 45

Renewable Portfolio Standards:

U.S. Department of Energy. (June 2007). States with Renewable Portfolio Standards. Retrieved March 20, 2008, from <http://www.eere.energy.gov/states/>

Baseload Power and Cost (¢/kWh):

Badr, M., & Benjamin, R. (2003). *Comparative Cost of California Central Station Electricity Generation Technologies*: California Energy Commission.

Cost (\$/MW installed):

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<http://www.geo-energy.org/gea/aboutGE.asp>

EIA AER 2005 = EIA Annual Energy Review 2005

<http://www.eia.doe.gov/emeu/aer/contents.html>