

## Geothermal Energy on Launch Trajectory in 2009

By Karl Gawell and Leslie Blodgett

In 2009, geothermal energy appeared to be on a launch trajectory. Six new geothermal plants came on line in the United States and another 144 were under development, raising the prospects of 10 GW of geothermal power in coming years. Geothermal power projects were being developed at an accelerating rate, despite the economic recession.

Power technologies for both utility-scale electric generation and decentralized self-generation both moved forward, and new applications seeking to generate power from oil and gas fields saw multiple new projects. Also, with DOE support, the U.S. took major steps to launch a research effort to develop enhanced geothermal systems technology.

Federal and state policies for renewable energy production, tax incentives, leasing and permitting and research have all been fundamental to geothermal development; and in 2009 there were major, positive new developments in all of these areas. So, it was not a surprise that GEA's 2009 Geothermal Energy Expo set record attendance and exhibitor participation figures, or that the GEA workshops and events had standing-room-only crowds.

The outlook for 2010 is for even stronger growth in the industry, continued progress with new technology, and even greater priority from federal and state policymakers as they tackle the challenge of the 21st century -- global warming. As 2009 comes to a close, these new projects, new policies and new technologies all point to dynamic growth for geothermal energy in the U.S. in coming years.

### **Total On-line Geothermal Power Grows 6% Despite Recession**

Six new geothermal projects came on line in 2009, representing growth of U.S. geothermal power capacity of about 6%. Together, these projects mean 176.68 MW placed in service in 2009. They represent an investment of roughly \$800 million, 750 full time jobs, and 2,827 jobs related to project construction, drilling and manufacturing, according to GEA research data.

GEA invited the DC energy policy and technology community to see geothermal energy projects under development in the West at the Newseum in Washington DC. Leading geothermal companies in the U.S. shared their new geothermal projects via video footage, both those near completion and those just coming on line. The videos are available at <http://www.youtube.com/geoenergyishot#p/u>.

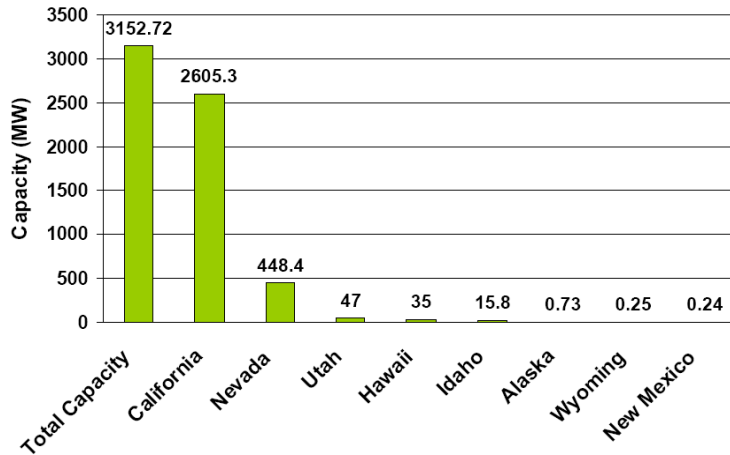
New projects in 2009:

<u>Company/Project</u>	<u>State</u>	<u>Power Capacity</u>
Ormat North Brawley	California	50 MW
Oregon Institute of Technology	Oregon	280 kw

Nevada Geothermal Blue Mtn I	Nevada	49.5 MW
Enel NA Still Water	Nevada	47.3 MW
Enel NA Salt Wells	Nevada	18.6 MW
Raser Technologies Orrin Hatch	Utah	11 MW

The total on-line capacity of geothermal power in the U.S. was 3,152.72 as of August 2009 (see graph, taken from GEA’s September 2009 Industry Update: <http://www.geo-energy.org/content/reports.aspx>).

Figure 1: August 2009 Geothermal Power Capacity On-Line (MW)



Source: GEA

### New Geothermal Projects Accelerate

The on-line geothermal power added in 2009 marks the beginning of an accelerating growth in new projects, making it a take-off year for a new era of geothermal growth. The projects underway in 2009 will make up to 140 MW of new geothermal power in fourteen states.

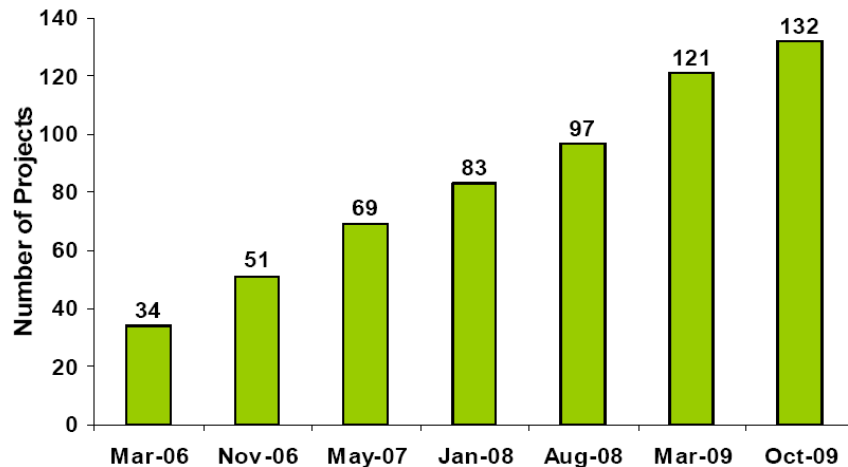
With geothermal projects taking 3–5 years to develop, the continued growth in new projects under development portended accelerating power production in years ahead. New projects could collectively surpass 7,000 MW of baseload geothermal power, bringing U.S. total geothermal power capacity to 10 GW. That would be enough geothermal capacity to supply about 25% of California’s total electric power needs in 2008 —enough generating capacity to supply the power needs of about 10 million people!

GEA’s market reports identified new projects in:

<u>State</u>	<u>Number of Projects</u>	<u>Potential MW</u>
Alaska,	6	70–115
Arizona	1	2–20
California,	37	1841.8–2435.8
Colorado,	1	10

Florida	1	0.2–1
Hawaii,	2	8
Idaho	5	238–326
Louisiana	1	.05
Mississippi	1	.05
Nevada,	64	1876.4–3473.4
New Mexico,	1	20
Oregon,	13	317.2–368.2
Utah,	10	272.4–332.4
Washington	1	Unspecified

There were 132 new geothermal projects under development at the end of 2009, twice as many as GEA identified two years before (see graph).



### **Geothermal Energy’s Range of Technology Options Grows**

Geothermal energy has historically been used for electricity production and commercial, industrial, and residential direct heating purposes. Recent years have seen growth in efficient home heating and cooling through geothermal heat pumps. In 2009, the U.S. also took major steps towards the lead in advanced geothermal technology through investment in Enhanced Geothermal Systems (EGS). Additionally, inaugurated this year were two projects that would utilize hot water produced by oil and gas wells to produce geothermal power — located in Louisiana and Mississippi, these are the first geothermal power production projects for these states.

These oil field co-production projects are two of the five projects now underway in the U.S. utilizing geothermal hydrocarbon co-production: Jay Oil Field in Florida, expected to generate between 200 kW and 1 MW; Rocky Mountain Oil Test Center in Wyoming; GCGE Oil Co-production in Mississippi, expected to generate 50 kWh; GCGE Natural Gas Co-production in Louisiana, 50 kWh; and Florida Canyon Mine in Nevada. Researchers at Southern Methodist University believe that oil field co-production can

become an important source of power. They have identified potential areas for similar development that could bring thousands of megawatts of new power on line.

The U.S. Department of Energy (DOE) has invested more than \$5 million in a demonstration project for EGS at Desert Peak, Nevada. This first commercial EGS operation will increase the plant's capacity by 5 MW. Other EGS projects have now been selected by DOE for federal funding as well (see section on DOE initiatives below).

A 2006 report by the Massachusetts Institute of Technology, *The Future of Geothermal Energy*, was enthusiastic about the potential of EGS technology. According to MIT, "A comprehensive new MIT-led study of the potential for geothermal energy within the United States has found that mining the huge amounts of heat that reside as stored thermal energy in the Earth's hard rock crust could supply a substantial portion of the electricity the United States will need in the future, probably at competitive prices and with minimal environmental impact."

For information about oil and gas co-production, visit the SMU Geothermal Program web site at: <http://smu.edu/geothermal/>

To download a copy of the MIT Report on Enhanced Geothermal Systems, go to: <http://www.geo-energy.org/content/reports.aspx>

### **Expanded Federal and State Policies Fuel Geothermal Growth**

The stunning progress of the geothermal industry this year has been propelled by state and federal policies. The keys to geothermal development established over past years have been (1) state renewable energy standards which provide growing markets for renewable power, (2) federal tax credits and incentives which attract investors and bring down the upfront costs of projects, (3) federal and state land availability, which means active and timely leasing and permitting programs, and (4) research, development, and deployment support from the DOE. Key policy developments in 2009 that underpin geothermal progress addressed all four of these areas.

On the state level, the two largest markets for geothermal energy are California and Nevada. In 2009, California increased its renewable standard to 33% by 2020. Nevada has extended its renewable energy standard to 25% by 2025. Utilities are looking to geothermal energy to fill these needs. In California, one new project came on line in 2009 with a 50 MW capacity, and 37 geothermal projects are underway with a combined capacity of 1841.8–2435.8 MW. In Nevada, three new power plants with a total on-line capacity of 115.4 MW were added; 64 projects are underway for another 1876.4–3473.4 MW. Developments in these states are an example that others are following.

Early 2009 saw a move by Congress to extend the Production Tax Credit for new geothermal plants until 2013, extended to certain geothermal projects a 30% Investment Tax Credit, and made available to certain geothermal projects a cash grant in lieu of the 30% ITC. Together these are powerful financial incentives whose impact will be felt

over the next few years, reminiscent of trends after a 2005 decision to extend the production tax credit to geothermal energy (it was previously only available to wind projects).

In addition, the DOE this year opened its loan program for innovative technologies to geothermal technology and Congress created a new DOE loan guarantee program for renewable projects using commercial technology. These loan guarantee programs are particularly valuable and needed given the tight financial markets in the U.S. and around the world.

In July of this year, the BLM held a sale involving lands in Nevada, California and Utah which resulted in the sale of 255,355 acres of land and total revenue of approximately \$9 million. The geothermal lease sales held by the BLM over the past year were made possible by a major Programmatic EIS for Geothermal Leasing in the Western United States completed in October 2008 by the Department of the Interior and the U.S. Forest Service. Prior to that EIS, 190 million acres of potential lands had been unavailable simply because BLM had not conducted the necessary reviews; by the end of 2009, BLM had over 1.2 million acres under lease for geothermal power development!

Research, development, and deployment support at DOE is managed through their Geothermal Technologies Program, a program crucial to the industry that had been a matter of concern since the Bush Administration proposed to terminate the program in 2006. Congress kept the program alive and authorized a new program in the 2007 Energy Bill, but funding and direction were still limited. In 2009, as part of the stimulus legislation (The American Recovery and Reinvestment Act of 2009), Congress appropriated \$400 million for the DOE Geothermal Technologies Program. Just last month, the DOE announced pending awards of \$338 million to over 123 geothermal projects in 39 states, including the first demonstration projects in the U.S. for EGS technology.

### **In an Historic Shift, DOE Ramps Up Geothermal Efforts**

While all of the federal and state policy developments in 2009 were important to the industry, the changes at the DOE marked an historic shift. One of the uniquely geothermal initiatives in 2009 was the DOE's initiative which infused major new resources to spur geothermal technology across the board. For the first time in over 25 years, the DOE was putting significant resources behind its geothermal efforts.

In October, DOE Secretary Steven Chu announced up to \$338 million in Recovery Act funding for the exploration and development of new geothermal fields and research into advanced geothermal technologies. These grants will support 123 projects in 39 states, with recipients including private industry, academic institutions, tribal entities, local governments, and DOE's National Laboratories.

As the DOE explained, “the projects selected for negotiation of awards fall in six categories”:

- 24 Innovative Exploration and Drilling Projects to be awarded up to \$98.1 million: “focusing on the development of new geothermal fields using innovative sensing, exploration, and well-drilling technologies.”
- 11 Coproduced, Geopressed, and Low Temperature Projects to be awarded up to \$20.7 million: “for the development of new low-temperature geothermal fields, a vast but currently untapped set of geothermal resources. This includes geothermal heat found in the hundreds of thousands of oil and gas wells around the U.S., where up to ten barrels of hot water are produced for every barrel of oil.”
- 3 Enhanced Geothermal Systems Demonstration Projects to be awarded up to \$51.4 million: “to validate power production from deep hot rock resources using innovative technologies and approaches.”
- 45 Enhanced Geothermal Systems Components Research and Development Projects to be awarded up to \$81.5 million: “to focus on research and development of new technologies to find and drill into deep hot rock formations, stimulate enhanced geothermal reservoirs, and convert the heat to power.”
- 3 Geothermal Data Development, Collection and Maintenance Projects to be awarded up to \$24.6 million: “for the population of a comprehensive nationwide geothermal resource database to help identify and assess new fields.”
- 37 Ground Source Heat Pump Demonstration Projects to be awarded up to \$61.9 million: “to demonstrate the deployment of ground source heat pumps for heating and cooling of a variety of buildings for a variety of customer types, including academic institutions, local governments and commercial buildings.”



“The United States is blessed with vast geothermal energy resources, which hold enormous potential to heat our homes and power our economy,” said Secretary Chu.

When completed, these projects will represent a federal-private total of \$691 million invested in new geothermal technology and applications.

For more information on DOE’s Geothermal Technology Program, go to: <http://www1.eere.energy.gov/geothermal>

### **GEA Holds Record Trade Show, Successful Workshops**

The 2009 Geothermal Energy Expo, held in Reno, Nevada in October, saw 120 exhibitors, 40 more than in 2008. Individuals, new start-ups, and well-established companies are learning about geothermal energy and are willing to develop it in record numbers. GEA estimates show roughly 2,300 walked the 2009 Expo floor, up from 1,700 in 2008. Visitors came from across the U.S., Iceland, France, Germany, Italy, Turkey, Indonesia, Canada, Australia, New Zealand, the Philippines, and Chile.

As the national trade association for the geothermal industry, GEA provides events to educate participants and to provide a setting for networking. Beyond the annual expo, three GEA workshops in 2009 catered to sold-out audiences. A multimedia showcase of geothermal projects brought field developments to the energy community in Washington, DC in May. Developers and financiers converged for a finance workshop in Seattle in June, and a third workshop in Klamath Falls, Oregon in August explored small power and direct use capacities of geothermal development.

For information about GEA activities and events, go to: <http://www.geo-energy.org/content/events.aspx>

### **Outlook for 2010 and Beyond**

GEA's staff consulted its crystal ball which said that in 2010:

- The number of states with geothermal power will reach double digits, with new power projects coming on line in four to eight states.
- Climate change will increase the pressure for policy support by federal and state governments; geothermal power will become more widely viewed as one of the key energy sources to provide baseload power, now largely supplied by coal.
- New technology advances will continue to expand the recognized power potential of geothermal resources; DOE will officially recognize a near-term potential of at least 20 GW, or 5% of U.S. power needs, with longer-term possibilities well over 100 GW.
- The GEA Expo in 2010 will set new attendance records and attract exhibitors and visitors from around the world.

### **Stay Tuned**

Stay tuned to all of the developments in the geothermal field by reading GEA's newsletter, the Geothermal Energy Weekly. To sign up for the geothermal community's leading news source, email [research@geo-energy.org](mailto:research@geo-energy.org). Visit GEA's web site for new reports, news about events, and more information at <http://www.geo-energy.org/content/default.aspx>.