Geothermal Energy Association

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U.S. Geothermal Power Production and Development Update

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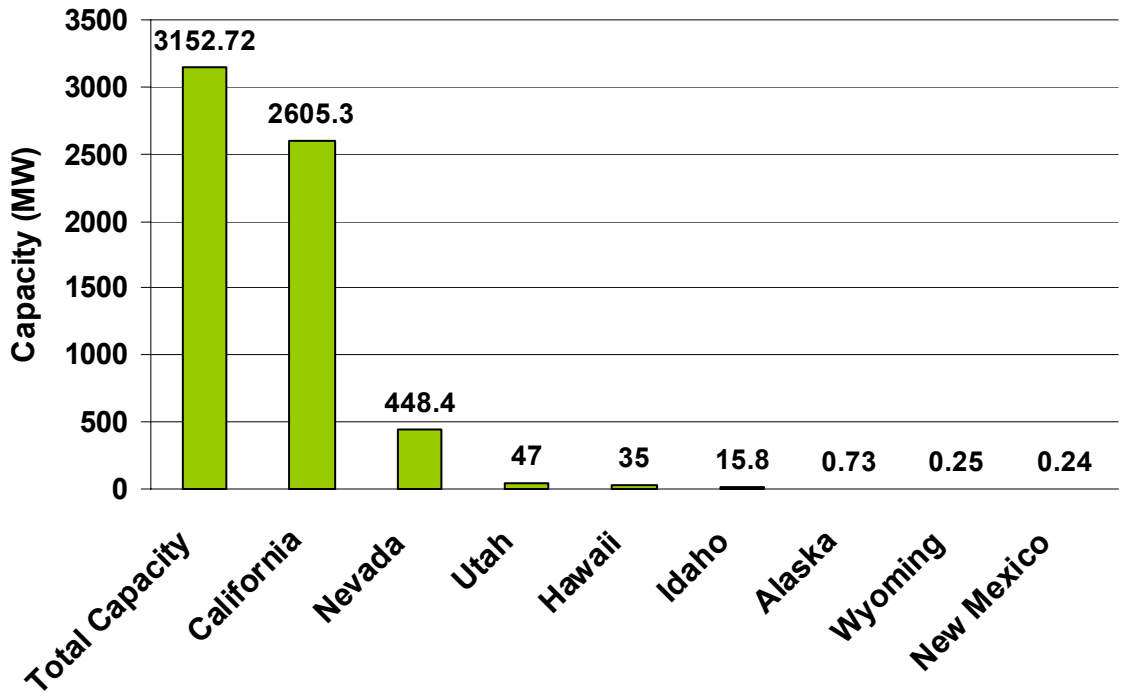
U.S. GEOTHERMAL POWER PRODUCTION AND DEVELOPMENT UPDATE: SEPTEMBER 2009

Cover Photos courtesy of Enel NA, ThermaSource, Geo-Heat Center/OIT, and Ormat.

1. Installed Geothermal Capacity and Generation

The United States continues to lead the world's countries in online geothermal energy capacity and continues to be one of the principal countries to increase its geothermal growth. In 2007 geothermal energy accounted for 4% of renewable energy-based electricity consumption in the United States.[1] As of September 2009, geothermal electric power generation is occurring in eight U.S. states: Alaska, California, Hawaii, Idaho, Nevada, New Mexico, Utah, and Wyoming. Other states, such as Oregon, Colorado, Florida, Louisiana, and Mississippi are soon to be added to the list. As of October 2009, the United States has a total installed capacity of 3152.72 MW.

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



Source: GEA

1.1 State Installed Geothermal Capacity Data

Alaska

The first geothermal power plant in Alaska was installed in 2006 at Chena Hot Springs. It is a small-scale unit, using organic rankine cycle (ORC) technology to produce 225 kW from a low-temperature resource (165°F). Subsequent 225 and 280 kW units have been installed, bringing total capacity to 730 kW[2].

[1] U.S. DOE: Geothermal Technologies Program. Geothermal Tomorrow (Sep. 2008).

[2] Previous U.S. Geothermal Industry Updates recorded total installed capacity in Alaska at 680 kW which accounted for net and not gross power generation. Installed capacity figures in this update have been altered to account for gross electricity generation, bringing Alaska's total installed capacity to 730 kW.

California
U.S. geothermal capacity remains concentrated in California. In 2005, California's geothermal capacity exceeded that of every country in the world. In 2007, 4.5 % of California's electric energy generation came from geothermal power plants, amounting to a net-total of 13,439 GWh. California currently has approximately 2605.3 MW of installed capacity.[3]

Hawaii
One geothermal power plant operates on the big island of Hawaii. This plant, Puna Geothermal Venture, delivers an average of 25–30 MW (35 MW name-plate capacity) of firm energy on a continuous basis, supplying approximately 20% of the total electricity needs of the Big Island.[4]

Idaho
In January 2008 the first geothermal power plant came online in Idaho. Raft River, a binary plant that uses a 300°F resource, has a nameplate production capacity of 15.8 MW. Currently, net electrical power output is between 10.5 and 11.5 MW. An expansion to this plant, as well as several other projects in the state, is underway.[5]

Nevada
In the last six months three new power plants have been added to Nevada's geothermal power plant portfolio. There are currently 21 operating geothermal power plants in Nevada with a total operating capacity of 448.4 MW. With more developing projects than any other state, it is expected that Nevada's installed capacity will increase significantly in the future[6].

New Mexico
In July 2008, a 0.24 MW pilot installation project went online in New Mexico.[7] The full project, Lightning Dock, is currently expected to produce 20 MW.

Utah
A number of geothermal power plants operate in Utah. Unit 1 of the Blundell power plant has a gross capacity of 26 MW and Unit 2 has a capacity of 11 MW. In April 2009 the low temperature 10 MW Hatch Geothermal Power Plant in Beaver County began delivering power to Anaheim California.

Wyoming
Wyoming's first geothermal project came online in September 2008. The co-production demonstration consisted of a 250 kW organic rankine cycle power unit. For more information about the project, please see *Section 5.2: Geothermal Hydrocarbon Co-production*.

[3] California Energy Commission: http://www.energy.ca.gov/
[4] Hawaii Department of Business, Economic Development and Tourism: http://hawaii.gov/dbedt/info/energy/renewable/geothermal
[5] Idaho Office of Energy Resources: http://www.energy.idaho.gov/
[6] Nevada Commission on Mineral Resources Division of Minerals : http://minerals.state.nv.us/
[7] New Mexico Energy, Minerals, and Natural Resources Department: http://www.emnrd.state.nm.us/main/index.htm

2. New Activity

The following results identify up to 6442.9 MW of new geothermal power plant capacity under development in the United States (this includes projects in the initial development phase).* Unconfirmed projects, some of which might be developed in the next few years, increase the potential capacity to 7109.9 MW. There are 14 states with projects currently under consideration or development: Alaska, Arizona, California, Colorado, Florida, Hawaii, Idaho, Louisiana, Mississippi, Nevada, New Mexico, Oregon, Utah, and Washington. Between confirmed and unconfirmed projects there are a total of 144 developing projects.

The projects listed for each state are categorized by the following phases:

- **Phase I:** Identifying site, secured rights to resource, initial exploration drilling
- **Phase II:** Exploratory drilling and confirmation underway; PPA not secured
- **Phase III:** Securing PPA and final permits
- **Phase IV:** Production drilling underway; facility under construction
- **Unconfirmed:** Proposed projects that may or may not have secured the rights to the resource, but some exploration has been done on the site

*Only projects in Phase 1 through Phase 4 are included in the 6442.9 MW

Please Note: GEA is reporting information that is provided to us about these projects from the developer or public sources. We do not independently verify the data provided or warrant its accuracy.

2.1. Active State Geothermal Projects

Figure 2: Active Geothermal Projects Listed By State

Alaska: 70 – 115 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Pilgrim Hot Springs	Pilgrim Springs	10
	NANA Geo. Assess. Program	NW Alaska Native Assoc.	TBD
	Unalaska	City of Unalaska	10-50
Phase 2			
	Chena Hot Springs II*	Chena Hot Springs	5-10
	SW Alaska Reg. Geo. Energy Project	Naknek Electric Assoc.	25
Unconfirmed			
	Tongass**	Bell Island Hot Springs	20

*Received GRED III funding for Phase I of project
** Pending action of Volume II of the PEIS

Arizona: 2 – 20 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Clifton	Arizona Public Service	2-20

California: 1841.8 – 2435.8 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Unnamed Glass Mountain	Calpine	320
	Unnamed North Geysers	Calpine	120
	Orita 3	Ram Power	40-100
	New River	Ram Power	40-50
	NAF El Centro/Superstition Hills	Navy Geothermal Program	5-25
	MCAS Yuma Chocolate Mountains	Navy Geothermal Program	12-30
	NAWS China Lake So Range	Navy Geothermal Program	5-15
	Modoc	Western Geo. Partners*	20
	Modoc	Vulcan**	20
	El Centro CA***		50
	El Centro CA****		50
Phase 2			
	Fourmile Hill-Glass Mountain	Calpine	50
	Telephone Flat-Glass Mountain	Calpine	50
	Buckeye-North Geysers	Calpine	30
	Wildhorse-North Geysers	Calpine	30
	Mammoth Lakes	Ormat	20-30
	Imperial Valley	Ormat	50
	Project CA	Oski Energy	20-40
	KS	Oski Energy	75-100
	HV	Oski Energy	75-100
	KN	Oski Energy	75-100
	Orita 2	Ram Power	40-100
	NAF El Centro/Superstition Mts.	Navy Geothermal Program	12-35
	Marine Corps, Twenty-nine Palms	Navy Geothermal Program	5-12
	Surprise Valley	Enel NA	27-38
Phase 3			

Phase	Project Name	Developer	Capacity (MW)
	East Brawley	Ormat	30
	Orita 1	Ram Power	40-100
	Black Rock 1	CalEnergy	53
	Black Rock 2	CalEnergy	53
	Black Rock 3	CalEnergy	53
Phase 4			
	WGP Unit 1 - Geysers	Western GeoPower	35
	Hudson Ranch I	CHAR LLC	49.9
Unconfirmed			
	Salton Sea	Sierra Geothermal Power	18-38
	Military Pass	Vulcan	150-335
	Truckhaven I	Iceland America Energy	49
	San Felipe	Esmeralda Truckhaven	20-25
	Bautista - Truckhaven	Esmeralda Truckhaven	49.9

*Pending Action of Volume II of PEIS
** Pending Action of Volume II of PEIS
*** Pending Action of Volume II of PEIS
**** Pending Action of Volume II of PEIS

Colorado: 10 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 2			
	Mount Princeton Geo	Mt. Princeton Geothermal	10

Florida: 0.2 MW –1 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 4			
	Jay/Mobile ORC	Chena Hot Springs	0.2-1

Hawaii: 8 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Unspecified Hawaii Project	Ormat	TBD
Phase 3			
	Puna	Ormat	8

Idaho: 238 – 326 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Sulfur Springs	Idatherm	25-50
	Willow Springs	Idatherm	100
Phase 2			
	China Cap	Idatherm	50-100
	Preston Project	Idatherm, Shoshone	50
Phase 3			
	Raft River Expansion	US Geothermal	13-26

Louisiana: .05 MW

Phase	Project Name	Developer	Capacity (MW)
Unconfirmed			
	GHCP (Gas)	GCGE*, ElectraTherm	0.05

*Gulf Coast Green Energy

Mississippi: .05 MW

Phase	Project Name	Developer	Capacity (MW)
Unconfirmed			
	GHCP (Oil)	GCGE*, ElectraTherm	0.05

*Gulf Coast Green Energy

Nevada: 1876.4 – 3473.4 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Soda Lake Upgrade	Magma	16-29
	McCoy	Magma	80
	Panther	Magma	34
	Desert Queen	Magma	36
	Gabbs Valley	Ormat	30
	Desert Peak EGS	Ormat	TBD
	Dead Horse	Ormat	TBD
	Smith Creek	Ormat	TBD
	Hawthorne	Oski Energy	25-50
	Hot Pot Geo	Oski Energy	30-50

Phase	Project Name	Developer	Capacity (MW)
	Alligator Geo	Oski Energy	20-40
	Gerlach	Sierra Geothermal Power	7-15
	Salt Wells	Sierra Geothermal Power	35-76
	Howard	Sierra Geothermal Power	8-17
	Sulphur	Sierra Geothermal Power	12-27
	Wells	Sierra Geothermal Power	15-32
	Pearl Hot Springs	Sierra Geothermal Power	22-45
	Dixey Valley	Sierra Geothermal Power	14-31
	Dixey Valley North	Sierra Geothermal Power	40-90
	Hawthorne	Sierra Geothermal Power	10-22
	North Salt Wells	Sierra Geothermal Power	48-101
	Spencer	Sierra Geothermal Power	9-19
	Granite Creek	US Geothermal	TBD
	Lee Allen	Vulcan	48-115
	New York Canyon	Vulcan	27-54
	Colado	Vulcan	121-232
	Clayton Valley	Ram Power	120-200
	Delcer Butte	Ram Power	30
	Gabbs Valley	GeoGlobal Energy	5-60
	Hawthorne Army Depot	Navy Geothermal Program	10-30
	NAS Test Ranges-Fallon	Navy Geothermal Program	10-30
	Black Warrior	Nevada Geothermal	37
	Humboldt-Toayaibe*	Great American Energy	12
	Harmon Lake	Enel NA	TBD
Phase 2			
	McGinness Hills	Ormat	30
	Silver State Geo.	Oski Energy	25-50
	Alum	Sierra Geothermal Power	41-85
	Silver Peak	Sierra Geothermal Power	15-42
	Reese River	Sierra Geothermal Power	26-58
	Barren Hills	Sierra Geothermal Power	55-117
	San Emidio	US Geothermal	20-25
	Gerlach	US Geothermal	15-30
	Pyramide Lake	Pyramid Lake Paiute Tribe	TBD

Phase	Project Name	Developer	Capacity (MW)
	Sou Hills	Montara Energy Ventures	TBD
	Trail Canyon	Raser Technologies	10
	Truckee	Raser Technologies	10
	Devil's Canyon	Raser Technologies	10
	Hawthorne Army Depot SW	Navy Geothermal Program	12-25
Phase 3			
	Carson Lake	Ormat	18-30
	Salt Wells	Vulcan	117-245
	Aurora	Vulcan	132-350
	Patua Hot Springs	Vulcan	175-378
	NAS, Fallon-Mainside	Navy Geothermal Program	30
	Darrough Ranch	Great American Energy	21
	Hot Sulphur Springs	Energy Investors Fund	20-48
	Pumpernickel Valley	Nevada Geothermal	20-30
	Blue Mountain	Nevada Geothermal	24
Phase 4			
	Jersey Valley	Ormat	18-30
	San Emidio	US Geothermal	8.4
	Rye Patch	Presco Energy	13
Unconfirmed			
	Florida Canyon Mine	ElectraTherm	TBD
	Fish Lake Valley	Esmeralda Truckhaven	25
	Emigrant	Esmeralda Truckhaven	50
	Fish Lake 2	Esmeralda Truckhaven	25-75

*Pending Action of Volume II of the PEIS

New Mexico: 20 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 3			
	Lightning Dock	Raser Technologies	20

Oregon: 317.2 – 368.2 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Glass Butte	Ormat	TBD

Phase	Project Name	Developer	Capacity (MW)
	Olene Gap	Oski Energy	25-50
	City of Klamath Falls	City of Klamath Falls	1
	Klamath Falls Plant	Raser Technologies	10
	Hood River County*	Portland General Electric	20
	Willamette**	Estate of Max Millis	20
	Hood River County***	Portland General Electric	30
	Willamette****	Estate of Max Millis	30
Phase 2			
	Neal Hot Springs	US Geothermal	20-26
	Newberry	Davenport Power	120
Phase 3			
	Geoheat Center	OIT	1
	Crump Geyser	Nevada Geothermal	40-60
Phase 4			
	Geo-Heat Center	OIT	0.2

* Pending Action of Volume II of the PEIS
** Pending Action of Volume II of the PEIS
*** Pending Action of Volume II of the PEIS
**** Pending Action of Volume II of the PEIS

Utah: 272.4 – 332.4 MW

Phase	Project Name	Developer	Capacity (MW)
Phase 1			
	Thermo	Magma	20
	Drum Mountain	Ormat	TBD
	Beryl Junction/Falstaff	Verdi Energy Group	15-25
	Thermo 2	Raser Technologies	TBD
	Thermo 3	Raser Technologies	TBD
	Hill Air Force Base	Navy Geothermal Program	5-30
	Cove Fort West	Enel NA	13.4
Phase 2			
	Cove Fort	Oski Energy	50-75
	Cove Fort	Enel NA	69
Phase 3			
	Renaissance	Idatherm	100

Washington: Undefined

Phase	Project Name	Developer	Capacity (MW)
Unconfirmed			
	Mt. Baker	Vulcan	TBD

3. Developing Project Summaries

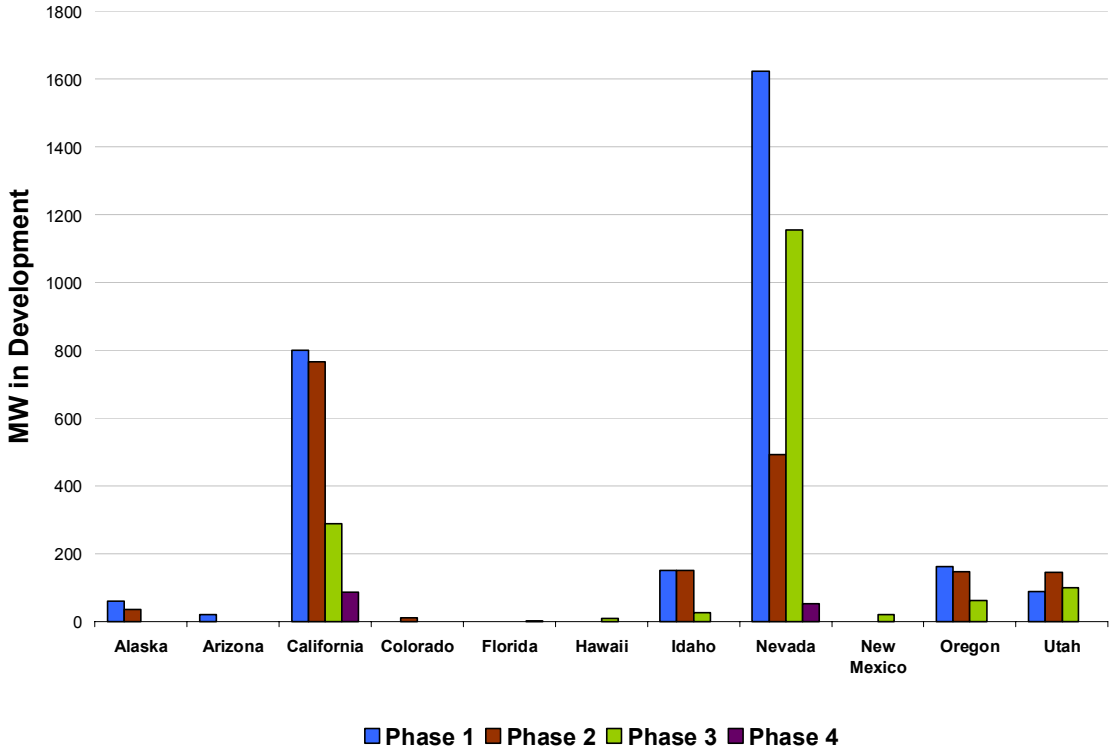
Figure 3: Developing Projects by Phase

State	Unconfirmed		Phase I		Phase II		Phase III		Phase IV	
	#	MW	#	MW	#	MW	#	MW	#	MW
Alaska	1	20	3	20 - 60	2	30–35				
Arizona			1	2–20						
California	5	286.9-496.9	11	682–800	14	559–765	5	229–289	2	84.9
Colorado					1	10				
Florida									1	0.2-1
Hawaii			1	Unspecified			1	8		
Idaho			2	125–150	2	100-150	1	13-26		
Louisiana	1	.05								
Mississippi	1	.05								
Nevada	4	100-150	34	911–1624	14	269–492	9	533–1132	3	39.4–51.4
New Mexico							1	20		
Oregon			8	136-161	2	140-146	2	41-61	1	0.2
Utah			7	53.4-88.4	2	119-144	1	100		
Washington	1	Unspecified								
Wyoming										
Totals	**13**	**407-667**	**67**	**1929.4-2903.4**	**37**	**1227-1742**	**20**	**968-1660**	**7**	**124.7-137.5**

Figure 4: Developing Projects by State

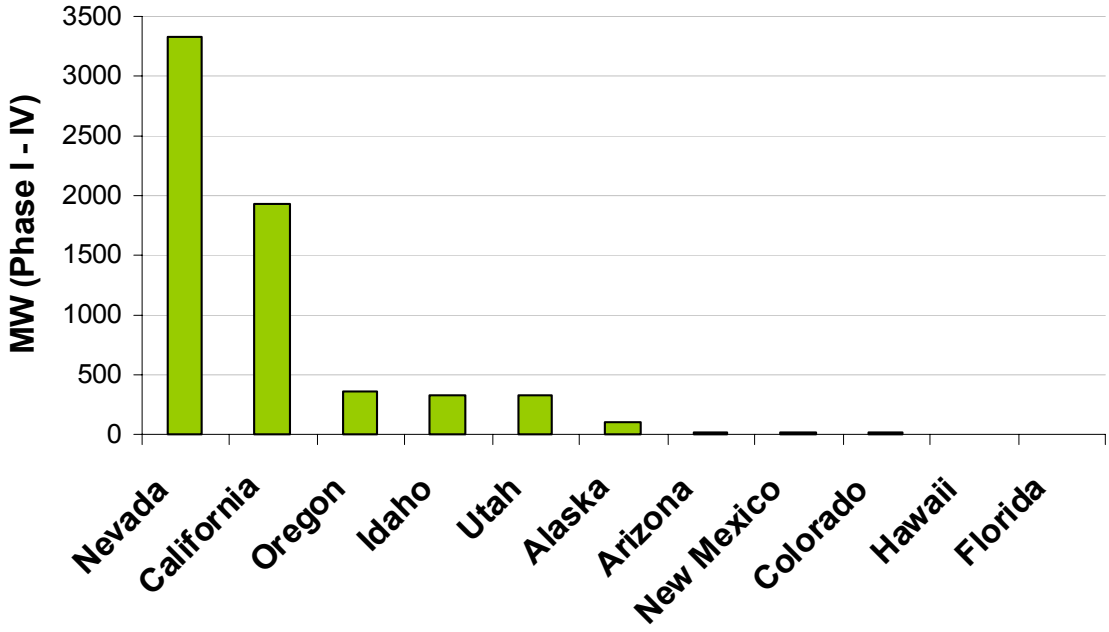
State	Phase 1 to Phase 4	TOTAL (with unconfirmed)
Alaska	5/50 – 95 MW	6/70 – 115 MW
Arizona	1/2 – 20 MW	1/2 – 20 MW
California	32/1554.9 – 1938.9 MW	37/1841.8 – 2435.8 MW
Colorado	1/10 MW	1/10 MW
Florida	1/0.2 – 1 MW	1/0.2 – 1 MW
Hawaii	2/8 MW	2/8 MW
Idaho	5/238 – 326 MW	5/238 – 326 MW
Louisiana	0	1/.05 MW
Mississippi	0	1/.05 MW
Nevada	60/1776.4 – 3323.4 MW	64/1876.4 – 3473.4 MW
New Mexico	1/20 MW	1/20 MW
Oregon	13/317.2 – 368.2 MW	13/317.2 – 368.2 MW
Utah	10/272.4 – 332.4 MW	10/272.4 – 332.4 MW
Washington	1/Unspecified	1/Unspecified
Total	**132 Projects 4249.1 – 6442.9 MW**	**144 Projects 4699.9 – 7109.9 MW**

Figure 5: Developing Projects by State and Phase



Source: GEA

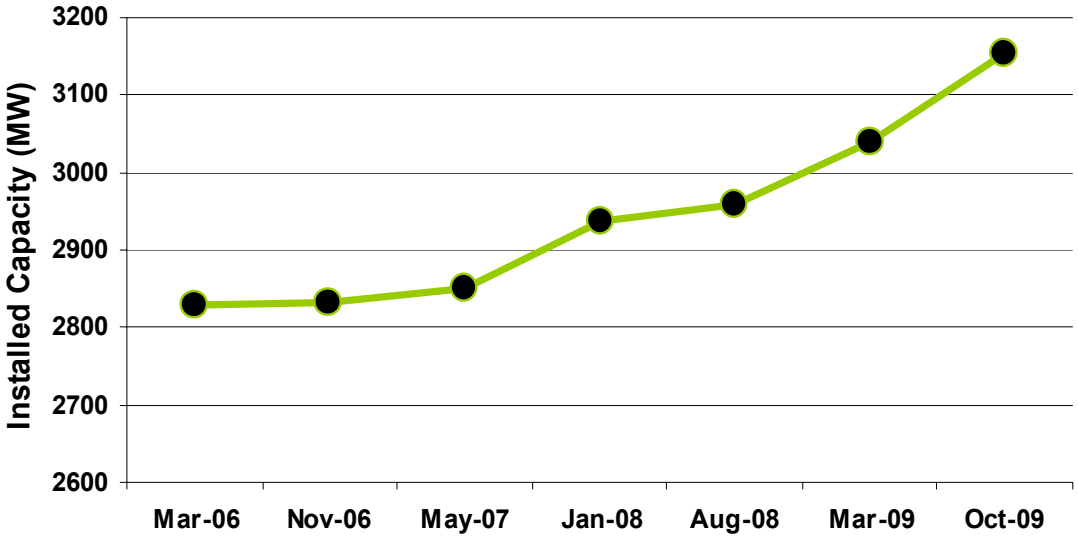
Figure 6: Total Capacity in Development by State



Source: GEA

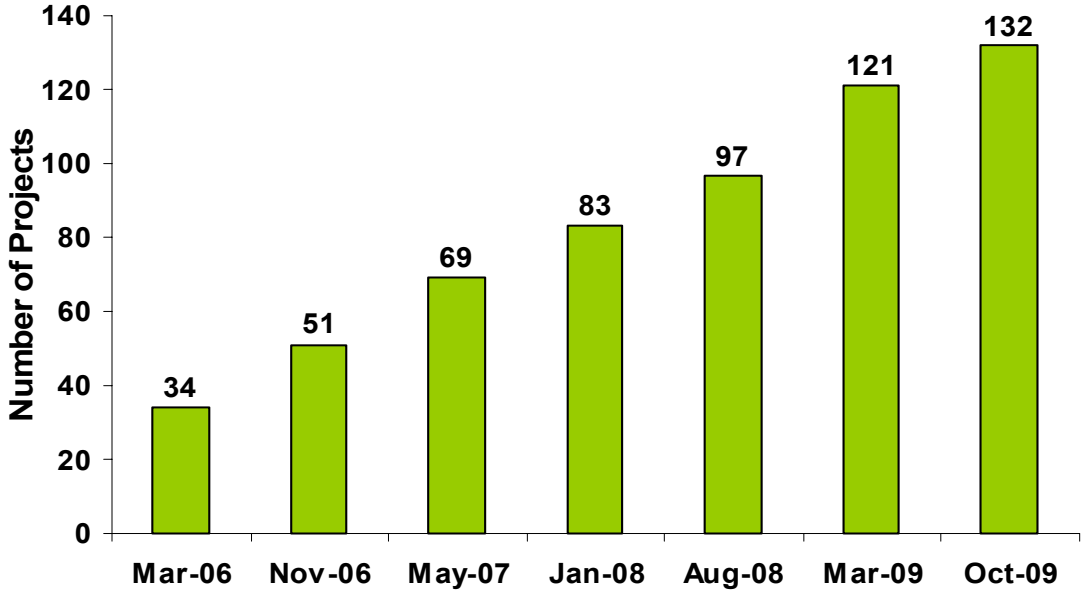
4. Comparison of Results from GEA Surveys: March 2006 – March 2009

Figure 7: Total Installed Capacity 2006 – 2009



Source: GEA

Figure 8: Total Confirmed Projects 2006 – 2009



Source: GEA

5. Emerging Technologies

As geothermal Technology progresses, resources that were once non-commercial are now being actively examined as feasible possibilities. The following are some of the more commonly discussed areas of future development.

5.1 Enhanced Geothermal Systems (EGS) – The term EGS commonly refers to any resource that requires artificial stimulation and includes resources that have to be fully engineered, or ones that produce hydrothermal fluid, but sub-commercially. In certain respects EGS is still a young and not fully proven technology. However, several EGS R&D and demonstration projects are underway in the United States. If EGS technology proves to be successful, it is expected to allow significantly increased extension and production from existing fields, as well as utilization of geothermal energy in previously implausible locations.

Desert Peak, Nevada: The U.S. Department of Energy has invested more than $5 million in a project that is currently in development and is designed to be the first geothermal operation to commercially produce geothermal energy via EGS in the United States. Ormat Technologies Inc. and GeothermEx Inc. are among some of the other stakeholders in the project. It is estimated that the completion of the project could add approximately 5 MW to the Desert Peak geothermal power plant, showing the potential of Enhanced Geothermal System development.

DOE has selected other EGS R&D and demonstration projects for federal funding. The agency hopes to have the technology ready for commercial production by 2015.[8] Additional details on the DOE's Geothermal Technologies Program (GTP) and how it supports the geothermal industry are provided in section 6.1 (DOE Geothermal Technologies Program Funding and Projects) below.

5.2 Geothermal Hydrocarbon Co-production – Usable geothermal fluids are often found in oil and gas production fields as well as certain mining operations. The Southern Methodist University Geothermal Energy Program has estimated that geothermal hydrocarbon co-production (GHCP) operations in the Texas Gulf Plains has the capability of providing 1000 – 5000 MW of power.[9] Currently there is no geothermal production in that region. The GEA has gathered information on five GHCP operations.

> **Jay Oil Field (Florida)**: Chena Energy LLC and Quantum Resources Management LLC are partnering to co-produce geothermal energy with fossil fuels at the Jay Oilfield in Florida. The GHCP operation is planned to utilize 120,000 barrels of co-produced water with Pratt & Whitney Power Systems Pure Cycle Power System. The expected capacity of the project is 200 kW but has potential for 1 MW. If successful, a full project could follow at the Florida oilfield and provide about 5% of the field's total electrical demand. The demo project is expected to become operational in 2009.[10]

[8] DOE, *DOE Funds 21 Research, Development and Demonstration Projects for up to $78 Million to Promote Enhanced Geothermal Systems*, (October 6, 2008), http://www.energy.gov/news/6624.htm
[9] McKenna, et al, SMU, *Oil and Gas Journal*, (September 5, 2005).
[10] Allan Jelacic, DOE, *The Geothermal Technology Program: A Renaissance,* (November 20, 2008)

Rocky Mountain Oil Test Center (Wyoming): RMOTC is another GHCP demonstration project near Casper, Wyoming. In August 2008, a 250 kW Ormat organic Rankine cycle (ORC) power unit was installed and a month later it began operating. Through February 2009, the unit produced more than 586 MWh of power from 3.0 million barrels of hot water with an on line percentage of 97.[11] The unit was shut-down for maintenance and repair and has been down while the field network of wells are being modified to produce a more consistent volume of water. The demonstration project will continue to operate past the original September 2009 date as part of a project with the DOE Geothermal Technologies Program (GTP). The GTP collaboration will include the addition of a UTC 280kW liquid cooled unit. Also to be included is a testing facility for smaller generation systems. For more information please visit (http://www.rmotc.doe.gov)

GCGE Oil Co-production (Mississippi): Gulf Coast Green Energy and Denbury Resources are planning on generating co-produced geothermal electricity from a producing oil well in the state of Mississippi. The test project will employ one of ElectraTherm's modular and mobile waste heat generators to use hot produced water from the oil well to generate 50 kWh of electricity. The project has received a federal research grant as well as technical support from the Southern Methodist University's Geothermal Lab.

GCGE Natural Gas Co-production (Louisiana): Gulf Coast Green Energy, Louisiana Power Company, and an unnamed Houston based oil and gas company are working together to generate co-produced geothermal electricity from natural gas production operations in the State of Louisiana. An ElectraTherm modular and mobile waste heat generator unit will be employed to generate 50 kWh of electricity from produced water from a producing natural gas well.

Florida Canyon Mine (Nevada): ElectraTherm Inc. is planning on deploying two "green machine" units at the Florida Canyon Mine in Nevada. The two modular units will utilize groundwater from mining operations to generate electricity while cooling the water used in mining operations. Premier Technology is to install the piping interface between ElectraTherm's modular units and the heated groundwater. The project was scheduled to be commissioned in September, 2009.

5.3. Geopressured Geothermal Resources – There is also renewed interest in the energy potential of geopressured-geothermal resources. While located in a number of states, the most significant resources are said to be located in the northern Gulf of Mexico, particularly Texas and Louisiana (offshore and onshore). The USGS has estimated that in addition to thousands of megawatts of geothermal energy, these resources hold as much as 1,000 TCF of potentially recoverable gas. Also, it is estimated that in Texas alone, there exists a total geopressured resource of 5,100 EJ.[12] Although Congress authorized new technology demonstrations for

[11] Lyle Johnson and Dan Lee Simon, DOE and Ormat Technologies, *Electrical Power from an Oil Production Waste Stream,* (February 2009)
[12] Texas State Energy Conservation Office, *Texas Renewable Energy Resource Assessment,* (December 2008)

geopressured-geothermal systems in 2007, no new projects or demonstrations have been identified for this report.

For more information on these technologies, see *The State of Geothermal Technology: Parts I & II,* recently released by the Geothermal Energy Association (for electronic copies, please visit: http://www.geo-energy.org/publications/reports.asp).

5.4. Geothermal Heat Pumps - In the United States, the Geothermal Heat Pump industry has seen continuous growth over the last four years. A February 2009 Energy Information Administration (EIA) report shows that geothermal heat pump shipments increased by 36 percent to 86,396 units in 2007. That same year capacity shipped rose 19 percent to 291,300 tons. Although geothermal heat pumps tend to cost more initially than traditional heating and cooling systems, the high efficiency and ongoing cost-saving potential of geothermal heat pumps has resulted in them becoming more appealing to many consumers. For more information on the EIA report, please visit (http://www.eia.doe.gov/cneaf/solar.renewables/page/ghpsurvey/geothermalrpt.pdf)

6. Federal Programs and Funding

6.1 DOE Geothermal Technologies Program Funding and Projects

In addition to the tax and loan incentives, the American Recovery and Reinvestment Act (ARRA) of 2009 provided up to $400m in new funding for the U.S. Department of Energy's (DOE) Geothermal Technologies Program (GTP) to implement a wide range of research, development, demonstration, and deployment activities. The amount of Federal funding provided to the geothermal industry through ARRA is unprecedented and provides resources necessary to spur the continued development of domestic geothermal resources. With ARRA funding the DOE GTP initiatives will spur not only new jobs but also the development and deployment of new technology as well as growth in new applications for the geothermal marketplace.

The ARRA funding to DOE is expected to support up to 100 new projects in various sub-sectors of geothermal industry research and development. Approximately $90m of DOE ARRA funding will support up to 10 new EGS demonstration projects with each project aiming to generate 50 MW for five to seven. Another $50m of DOE ARRA funding will be provided to up to 20 new application demonstration projects. New application projects will include geothermal electricity generation from geothermal hydrocarbon co-production, geopressured, and low-temperature resources and it is planned that these projects will bring 20 MW in new applications on-line. A total of $100m in ARRA funding is allocated for up to 40 projects that employ innovative exploration technologies. It is expected that projects selected for "innovative exploration technology" funding will result in the generation of up to 400 MW of electricity. Additionally, up to 30 EGS R&D or analysis projects will be selected to receive $56m in ARRA funding. Lastly, $20m of ARRA funding has been provided for the development of a National Geothermal Data Sysem (NGDS) and another $50m has been selected to accelerate the deployment of geothermal heat pumps.[13]

Figure 9: ARRA Funding Provided Through DOE GTP

Funding Application	Amount	Number of Projects	Generation Goal (MW)
EGS Demonstration*	$90m	10	500**
New Application Demonstration	$50m	20	20
EGS R&D/Analysis	$56m	30	NA
Innovative Exploration Technologies	$100m	40	400
Geothermal Heat Pumps	$50m	NA	NA
National Geothermal Data System	$20m	NA	NA
Total	**$366m**	**100**	**920**

Source: DOE *EGS demonstration projects are planned to generate up to 50 MWe each. **500 MW is the maximum amount of electricity that would be generated should each EGS demonstration project reach its 50 MWe goal.

[13] DOE, EERE. *Geothermal Technologies Program Recovery Act Funding Opportunities*. June, 2009. It should be noted that funding amounts provided here represent ARRA funding provided via DOE only in the near term. Application for the near-term funding opportunity announcements were in late July of 2009.

In addition to supporting geothermal research and development through ARRA funds the DOE chose 21 recipients to receive federal funding for projects engaged in the research, development, and demonstration of EGS. Subject to annual appropriations the DOE will award $43.1m to the recipients over a period of four years. With cost-share by the recipients, the public-private investments total around $78m.

Among the 21 projects chosen to receive DOE funding are four EGS cooperative projects which aim to achieve EGS technology readiness by 2015. Figure 9 below provides further details on the four projects. [14]

Figure 10: EGS Systems Demonstration

Awardees	Location	Project Description	Funding
- Alta Rock - Northern California Power Agency - University of Utah - Texas A&M University - SAIC - Temple University	WA	Demonstrate stimulation process to create EGS reservoir that drills below permeable zone	$6,014,351
- Geysers Power Co.	CA	Demonstrate deepening of wells into high-temperature zones	$5,697,700
- ORMAT Nevada, Inc. and GeothermEx - Lawrence Berkeley National Laboratory - University of Utah - Pinnacle Technologies - GeoMechanics International - University of Nevada Reno - TerraTek/ Schlumberger	NV	Demonstration ability to stimulate multiple wells at Brady Field	$3,374,430
- University of Utah and U.S. Geothermal - APEX Petroleum Engineering Services - HiPoint Reservoir Imaging - Chevron	UT	Demonstrate monitored hydraulic stimulation of existing injection well	$8,928,999
Systems Demonstration Total			**$24,015,480**

Source: DOE, Geothermal Technologies Program

6.2 Bureau of Land Management Lease Sales

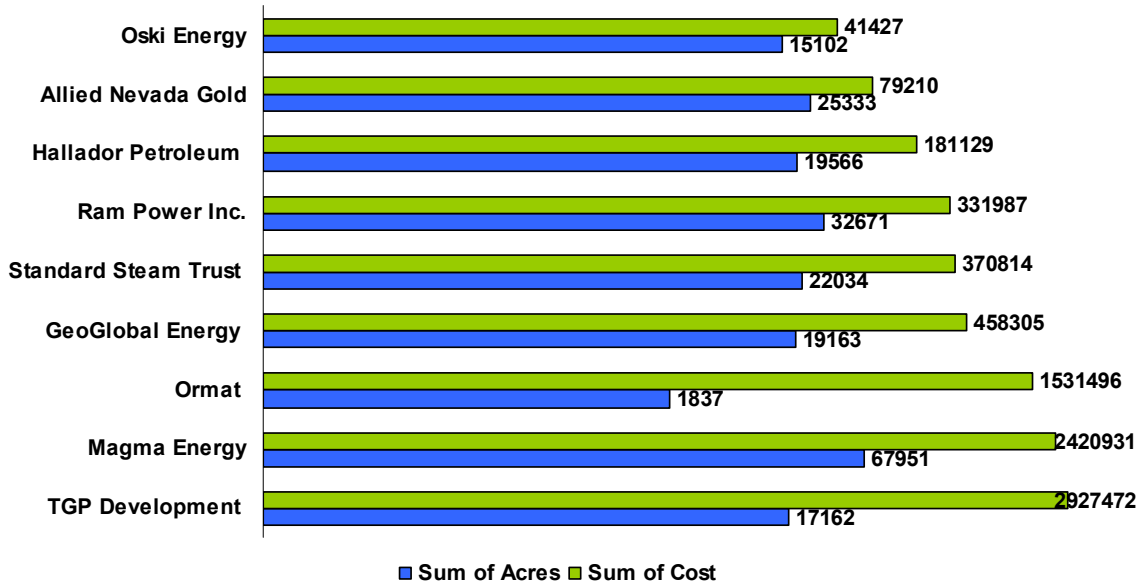
The U.S. Bureau of Land Management (BLM) held geothermal lease sales in July 2009 which resulted in the sale of 255,355 acres of land and total revenue of approximately $9 million. The total amount of dollars generated by bonus bids as well as the average price per acre was higher than those of the previous geothermal lease sale in December 2008. Still, half of the parcels in Nevada were sold for the minimum $2/acre minimum and approximately 25% of the parcels offered did not draw any bids.

According to the BLM 50% of revenues from the lease sale is distributed to the state in which leased land is located, and 25% is distributed to the counties in which leased land is located. The

[14] DOE, EERE, GTP. *National Geothermal Action Plan (Draft).* 2009. Page 28.

remaining 25% is distributed to the BLM for the processing of geothermal leases and geothermal use authorizations.

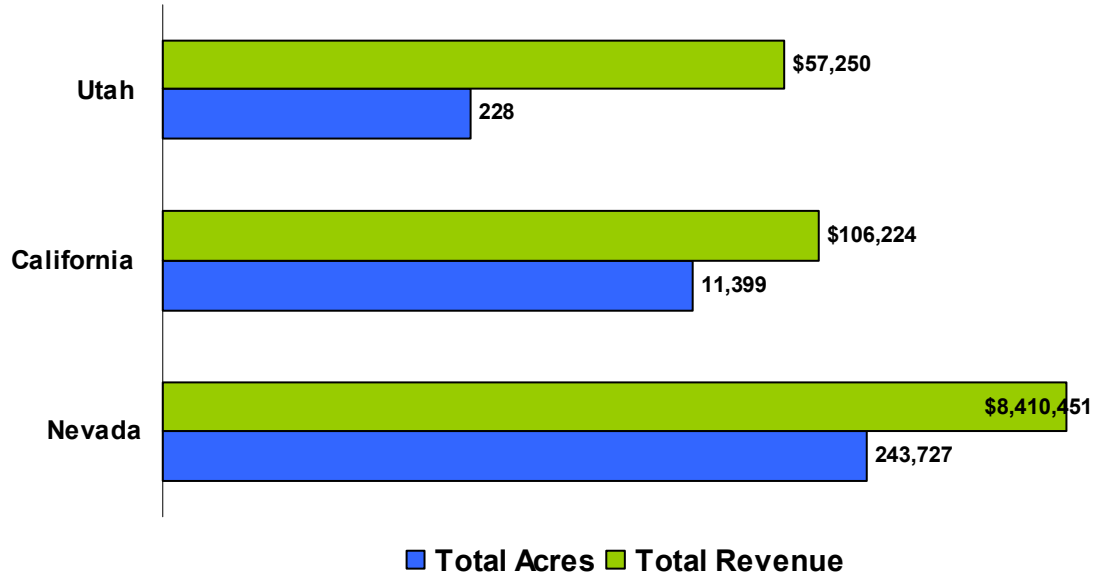
Figure 11: July 2009 BLM Lease Sale



Source: BLM, GEA. The chart shows the top ten purchasers of geothermal leases, in terms of dollars spent, in the BLM's July 2009 geothermal lease sale.

A breakdown of the lease sale by state, total acreage sold, and total bonus bid dollar amount can be found in the table below.

Figure 12: July 2009 BLM Geothermal Lease Sale Results by State



Source: BLM, GEA

BLM has also published an amended plan for geothermal leasing in the Western states. The plan allocates approximately 111 million acres of BLM lands and 79 million acres of National Forest System lands open for leasing. In addition to this, the plan allows pre-existing studies on specific lands to be used along with best management practices. The change will reduce the processing time of future geothermal power development. For more information on BLM's plan, please visit http://www.blm.gov/wo/st/en/info/newsroom/2008/december/NR_12_18_2008.html

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