April 2012

Annual US Geothermal Power Production and Development Report

GEA
GEOTHERMAL ENERGY ASSOCIATION

GEOTHERMAL ENERGY ASSOCIATION

209 Pennsylvania Avenue SE, Washington, D.C. 20003 USA
Phone: (202) 454-5261 Fax: (202) 454-5265 Web Site: www.geo-energy.org

ANNUAL GEOTHERMAL POWER PRODUCTION AND DEVELOPMENT REPORT: APRIL 2012

Contents

Please Note: GEA is reporting project information that is provided by developers or public sources. We do not independently verify the data provided or warrant its accuracy.

Cover photo courtesy of Gradient Resources.

1. Methodology and Terms

To increase the accuracy and value of information presented in its annual US Geothermal Power Production and Development Report, the Geothermal Energy Association (GEA) developed a reporting system, known as the Geothermal Reporting Terms and Definitions, in 2010. The Geothermal Reporting Terms and Definitions serve as a guideline to project developers in reporting geothermal project development information to the GEA. A basic understanding of the Geothermal Reporting Terms and Definitions will also aid the reader in fully understanding the information presented in this annual report.

The Geothermal Reporting Terms and Definitions serve to increase reporting clarity and accuracy by providing industry and the public with a lexicon of definitions relating to the types of different geothermal projects, and a guideline for determining which phase of development a geothermal resource is in. These two tools help to characterize resource development by type and technology. They also help to determine a geothermal project's position in the typical project development timeline.

Geothermal Resource Types and their Definitions

In reporting a project in development to the GEA, the developer of a geothermal resource is asked to indicate which of the following definitions the project falls under:

Conventional Hydrothermal (Unproduced Resource): the development of a geothermal resource where levels of geothermal reservoir temperature and reservoir flow capacity are naturally sufficient to produce electricity and where development of the geothermal reservoir **has not** previously occurred to the extent that it supported the operation of geothermal power plant(s). Such a project will be labeled as "CH Unproduced" in this report.

Conventional Hydrothermal (Produced Resource): the development of a geothermal resource where levels of geothermal reservoir temperature and reservoir flow capacity are naturally sufficient to produce electricity and where development of the geothermal reservoir **has** previously occurred to the extent that it currently supports or has supported the operation of geothermal power plant(s). Such a project will be labeled as "CH Produced" in this report.

Conventional Hydrothermal Expansion: the expansion of an existing geothermal power plant **and** its associated drilled area so as to increase the level of power that the power plant produces. Such a project will be labeled as "CH Expansion" in this report.

Geothermal Energy and Hydrocarbon Coproduction: the utilization of produced fluids resulting from oil and/or gas-field development for the production of geothermal power. Such a project will be labeled as "Coproduction" in this report.

Geopressured Systems: the utilization of kinetic energy, hydrothermal energy, and energy produced from the associated gas resulting from geopressured gas development to produce geothermal electricity. Such projects will be labeled as "Geopressure" in this report.

Enhanced Geothermal Systems: the development of a geothermal system where the natural flow capacity of the system is not sufficient to support adequate power production but where hydraulic fracturing of the system can allow production at a commercial level. Such a project will be labeled as "EGS" in this report.

Tracking Projects through the Development Timeline

In addition to defining their projects according the above list of definitions, developers also indicate to GEA their projects' current status in the project development timeline using a four-phase system. This system captures how much, and what type of, work has been performed on that particular geothermal resource up until the present time. These four phases of project development are:

Phase I: Resource Procurement and Identification
Phase II: Resource Exploration and Confirmation
Phase III: Permitting and Initial Development
Phase IV: Resource Production and Power Plant Construction

Each of the four phases of project development is comprised of three separate sections, each of which contains phase sub-criteria. The three separate sections of sub criteria are resource development, transmission development, and external development (acquiring access to land, permitting, signing PPA's and EPC contracts, securing a portion of project financing, etc.). For a project to be considered as being in any particular phase of development a combination of sub-criteria, specific to each individual project phase, must be met.

Planned Capacity Addition (PCA) and Resource Capacity

Finally, at each phase of a project's development a geothermal developer has the opportunity to report two project capacity estimates: a Resource Capacity estimate and a Planned Capacity Addition (PCA) estimate. At each project phase the geothermal resource capacity estimate may be thought of as the megawatt (MW) value of the total recoverable energy of the subsurface

geothermal resource. It should not be confused with the PCA estimate, which is defined as the portion of a geothermal resource that "the developer deems to be viable for the economic production of electricity under existing economic conditions." In other words, if the developer were to utilize the geothermal resource under its control to produce electricity via a geothermal power plant, the PCA estimate would be the power plant's estimated installed capacity. In the case of an expansion to a conventional hydrothermal geothermal plant, the PCA estimate would be the estimated capacity to be added to the plant's current installed capacity.

In each phase of development the resource and installed capacity estimates are given different titles that reflect the level of certainty of successful project completion. The different titles as they correspond to the separate phases are as follows:

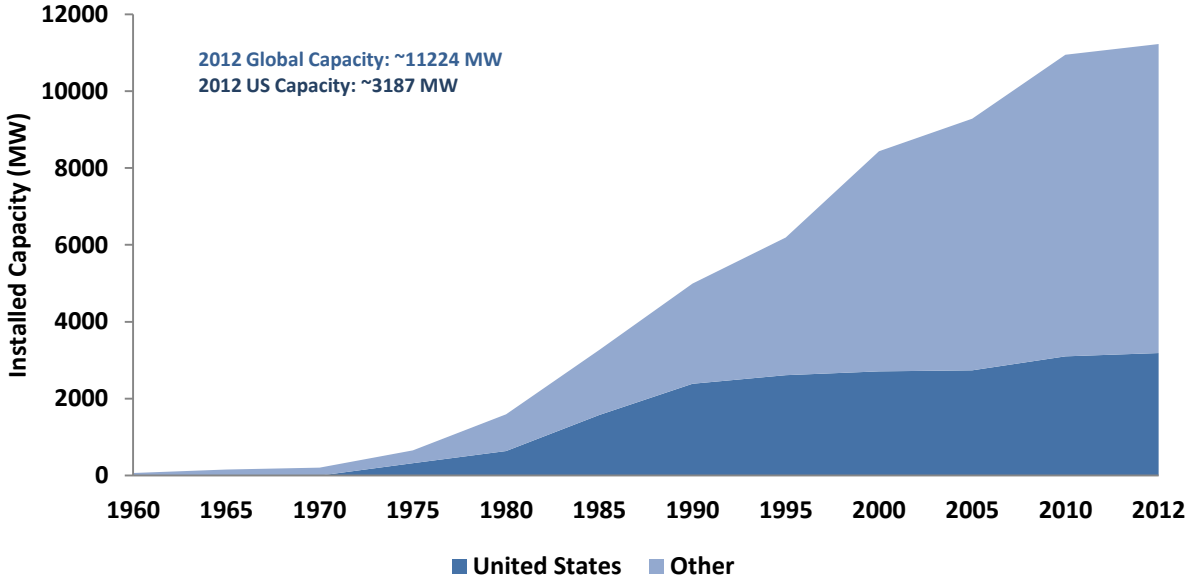
Phase I: "Possible Resource Estimate" and "Possible PCA Estimate"
Phase II: "Possible Resource Estimate" and "Possible PCA Estimate"
Phase III: "Delineated Resource Estimate" and "Delineated PCA Estimate"
Phase IV: "Confirmed Resource Estimate" and "Confirmed PCA Estimate"

This section outlines how the Geothermal Reporting Terms and Definitions influence the reporting and presentation of project in development information in this report. For a detailed explanation of each phase of development and the outline of its sub-criteria please consult GEA's Geothermal Reporting Terms and Definitions, available at http://geo-energy.org/pdf/NewGeothermalTermsandDefinitions_January2011.pdf.

2. The US Geothermal Industry

The development of geothermal energy resources for utility-scale electricity production in the United States began in the 1960's. Since that time, the continual development of geothermal resources and technology has positioned the US as a leader in the global geothermal industry. The US currently has approximately 3187 MW of installed geothermal capacity, more than any other country in the world.

Figure 1: Global Context of US Geothermal Installed Capacity 1960 – 2012

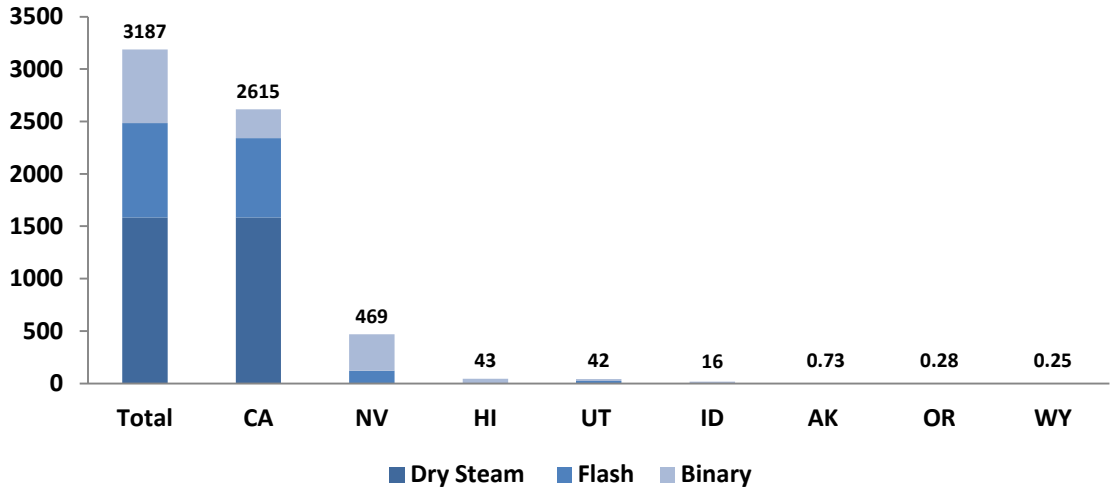


Source: GEA

Installed Capacity

Geothermal companies continue to increase the development of geothermal resources in the US. In 2010 geothermal energy accounted for 3% of renewable energy-based electricity consumption in the United States.[i] While the majority of geothermal installed capacity in the US is concentrated in California and Nevada, geothermal power plants are also operating in Alaska, Hawaii, Idaho, Oregon, Utah, and Wyoming.

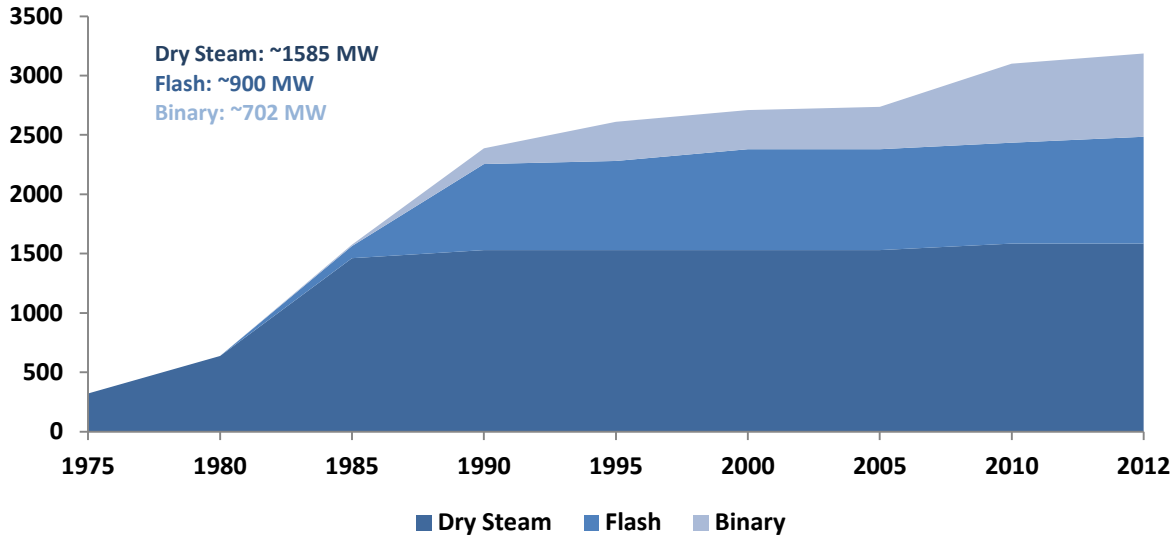
Figure 2: March 2012 US Geothermal Installed Capacity (MW)



Source: GEA

Due to the varying resource characteristics of different geothermal reservoirs, a variety of technologies are used to generate geothermal electricity in the US. Dry-steam power plants account for approximately 1585 MW (almost 50%) of installed geothermal capacity in the US, and are all located in California. Another sizeable portion of installed geothermal capacity in the US (~900 MW) is comprised of steam-flash power plants, the majority of which is also located in California. The implementation of binary geothermal technology has enabled the industry to develop lower temperature resources, which has expanded the geothermal industry's geographical footprint beyond California, especially in the last decade.

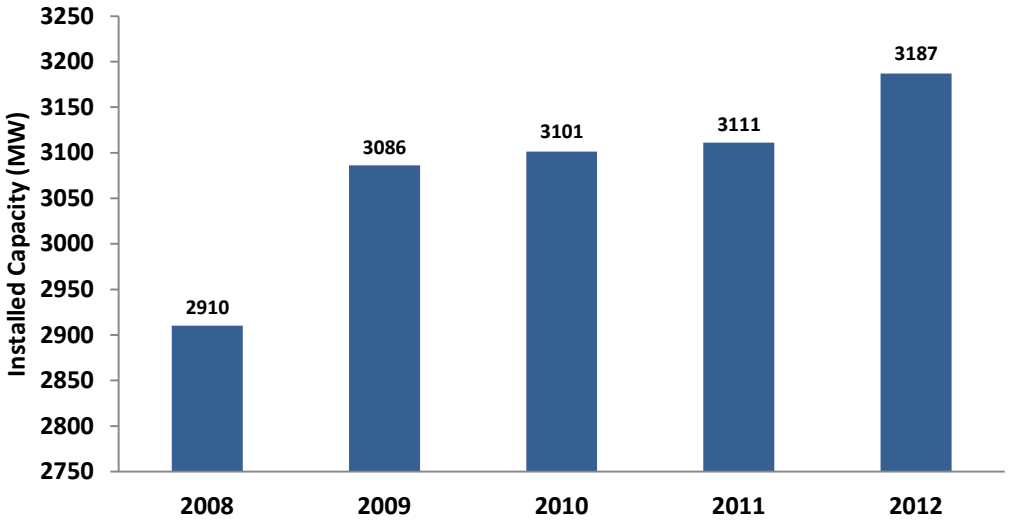
Figure 3: Total US Geothermal Installed Capacity by Technology (MW) 1975 – 2012



Source: GEA

The US geothermal industry's trend of sustained steady growth continued in 2011 and the first quarter of 2012. In that period two geothermal power plants and three expansion projects to existing power plants were completed for a total of approximately 91 MW of newly installed capacity.

Figure 4: Annual US Installed Capacity Growth 2008-2012



Source: GEA

Geothermal capacity in 2011 and 2012 was installed by four different geothermal companies. In 2011 Ormat Technologies completed an 8 MW expansion project at its Puna power plant in Hawaii, and Terra-Gen Power also expanded production at its Beowawe power plant in Nevada with a 2 MW expansion. In the first quarter of 2012 Energy Source completed the development of its 49.9 MW Hudson Ranch 1 geothermal power plant in Imperial Valley, California. Ormat Technologies also brought its 18 MW Tuscarora geothermal power plant online in Elko County, Nevada in the first quarter of 2012. Lastly, U.S. Geothermal expanded electricity generation at its San Emidio resource that replaced old generating equipment at the site with a new 12.75 MW power plant. After subtracting the capacity of the old power plant replaced at U.S. Geothermal's San Emidio site, the addition of these new power plants increase geothermal installed capacity levels in the US by approximately 85 MW to an overall total of 3187 MW.

Table 1: Geothermal Development Completed in 2011 and Q1 2012

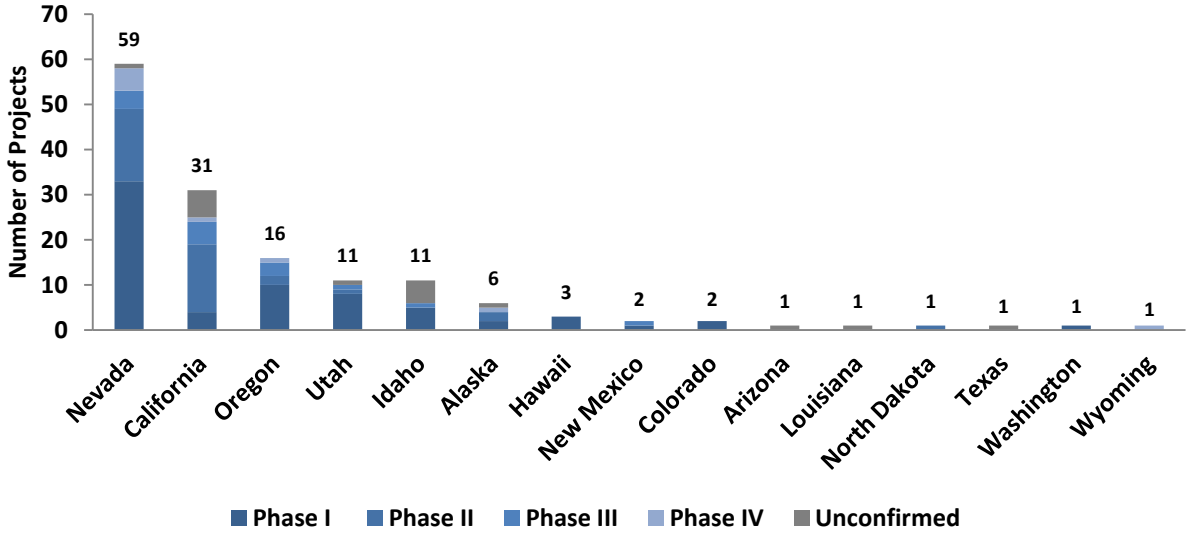
Name	Company	State	Project Type	Year Completed	Capacity (MW)
Puna Expansion	Ormat Technologies	HI	CH Expansion	2011	8
Beowawe 2	Terra-Gen	NV	CH Expansion	2011	1.9
Hudson Ranch 1	Energy Source	CA	CH Unproduced	2012	49.9
Tuscarora	Ormat Technologies	NV	CH Unproduced	2012	18
San Emidio	U.S. Geothermal	NV	CH Expansion	2012	12.75
Total:					**90.55**

Source: GEA

Capacity in Development

Geothermal companies increased installed capacity from 3102 MW to 3187 MW in 2011 and the first quarter of 2012. As the economy recovers and federal and state policy incentives driving investment in renewable energy resources remain in effect, the geothermal industry is expected to continue to bring geothermal capacity online in 2012 and subsequent years. As advanced geothermal projects enter or near the construction phase of development, geothermal companies in the US are also acquiring and developing early stage geothermal resources. In 2012 the geothermal industry is developing 130 confirmed geothermal projects. When accounting for projects not confirmed (i.e. "unconfirmed") by the developing companies this number increases to 147 projects. The geographic spread of confirmed geothermal projects alone is significant, with projects in various phases of project development located in 15 different states.

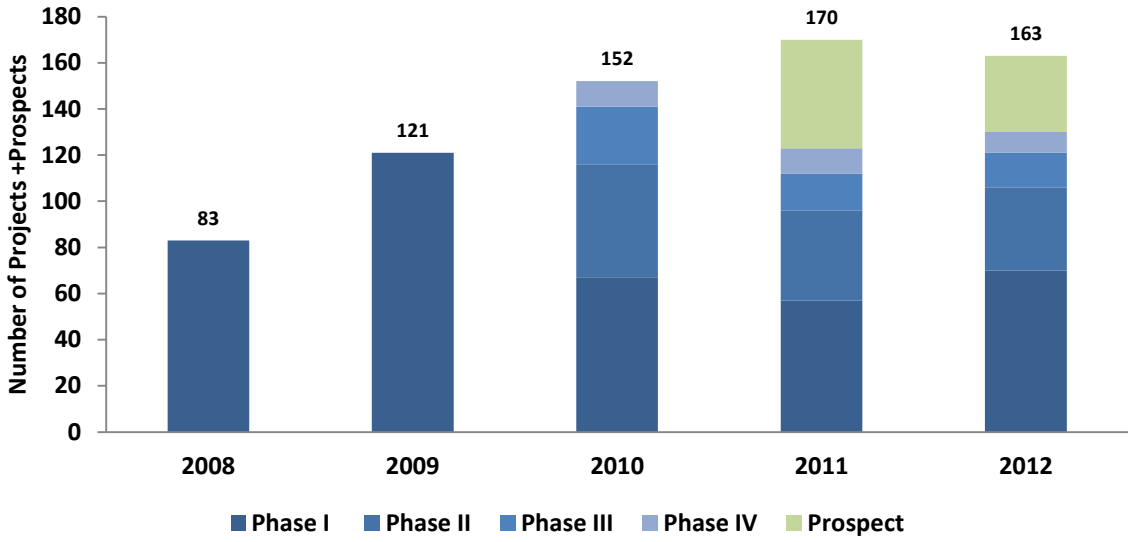
Figure 5: Number of Geothermal Projects in Development by State and Phase



Source: GEA

The number of developing geothermal projects reported to GEA in 2012 (130 projects) represents a slight increase from 2011 (123 projects). Beginning with the 2011 report, GEA allowed for the reporting of geothermal "prospects" by developers. The reporting of a prospect may occur when a geothermal developer has acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project criteria for the geothermal resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1). While not currently considered a geothermal "project," a geothermal prospect has the potential to become so. At 163, the total number of confirmed geothermal projects and prospects is down slightly from those reported in 2011 (170 projects and prospects).

Figure 6: Total Confirmed Projects +2011 and 2012 Prospects



Source: GEA

The number of confirmed geothermal projects recorded in this report account for approximately 4116 - 4525 MW of geothermal resources in development, spread among 15 states in the western US. Including unconfirmed projects in resource development totals increases these levels to 4882 - 5366 MW.

Table 2: Total Projects in Development Totals by State

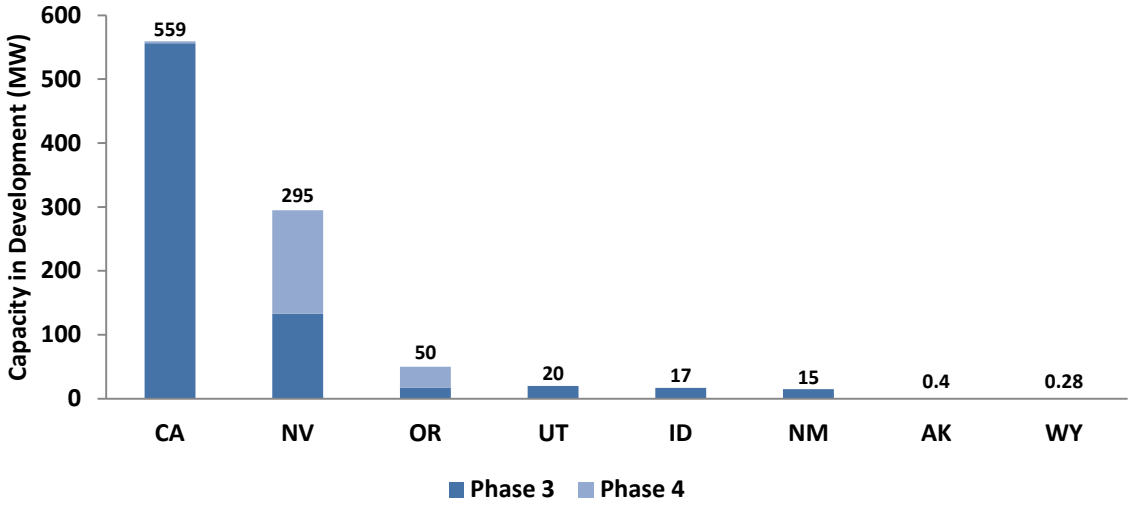
State	Total Projects	PCA (MW)	Resource (MW)	Overall Total (MW)
Alaska	6	25.4	85	90
Arizona	1	2	0	2
California	31	1065.6-1110.6	1636.7-1765.7	1859.7-2008.7
Colorado	2	20-25	0	20-25
Hawaii	3	0	0	0
Idaho	11	33.2	589-664	589-664
Louisiana	1	0.05	0	0.05
Nevada	59	631.5-641.5	1915-2125	2030.15-2250.15
New Mexico	2	15	100	115
North Dakota	1	0.25	0	0.25
Oregon	16	107.5-109.5	285-330	319.5-364.5
Texas	1	0	0.8	0.8
Utah	11	60	170-195	190-215
Washington	1	0	100	100
Wyoming	1	0.28	0	0.28
Totals*	**147**	**1961-2023**	**4882-5366**	**5317-5836**

Source: GEA

***PCA, Resource, and Overall totals have been rounded to the nearest megawatt. Also, PCA and Resource totals do not add up to Overall totals because they have been adjusted to avoid double counting. In cases where respondents gave both a PCA value and resource value, it was assumed that the PCA was already included in the stated resource total. In projects where PCA values but no Resource values were given the PCA value (being the planned capacity of the geothermal power plant) was used as the Resource value and added to the latter to get the Overall Total. As a result, the overall total is less than the sum of PCA and resource values.**

Note that while a project's resource capacity value provides an estimate of the amount of recoverable electricity (MW) from an underground reservoir, a project's PCA estimate is the portion of that geothermal resource which a developer plans to develop for electricity production via a geothermal power plant (see Section 1 explaining the Geothermal Reporting Terms and Definitions used in this report). Currently, geothermal companies are developing 1779 - 1821 MW of confirmed PCA projects in the US. When accounting for unconfirmed projects, the range of PCA in development is approximately 1961 – 2023 MW. Of this, 949 – 956 MW are advanced-stage (Phase 3 – 4) geothermal projects.

Figure 7: Advanced-Stage Planned Capacity Additions by State



Note: With the exception of Alaska and Wyoming state PCA values (Phase 3 and 4) have been rounded to the nearest megawatt.
Source: GEA

While the majority of advanced-stage projects are currently located in Nevada and California, utility-scale projects are also nearing construction and production in Oregon, Utah, Idaho, and New Mexico. Smaller capacity projects (< 1 MW) are also nearing completion in Alaska and Wyoming.

The total amount of PCA and Resource Capacity (MW) in development in the US in respect to location and project status (phase) is outlined in Table 3 below.

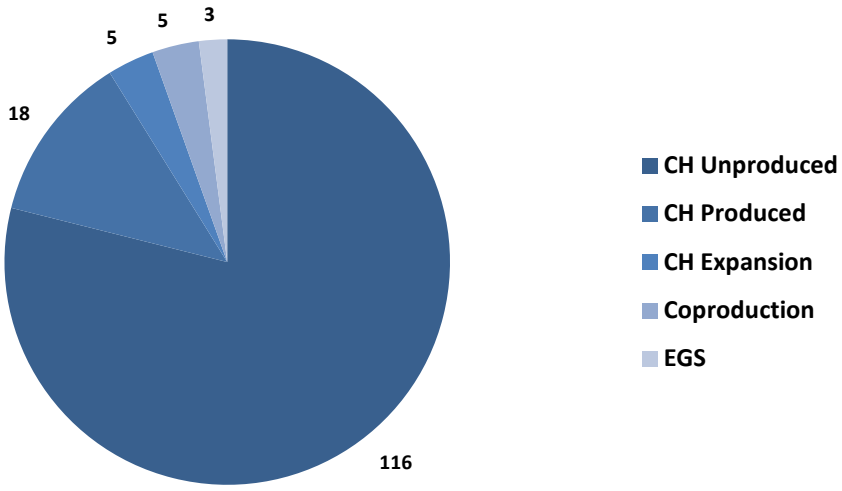
Table 3: Developing Geothermal Capacity (MW) by State and Phase

State	Phase 1 Capacity		Phase 2 Capacity		Phase 3 Capacity		Phase 4 Capacity		Unconfirmed Capacity	
	PCA	Resource	PCA	Resource	PCA	Resource	PCA	Resource	PCA	Resource
Alaska	15	50	10	10	0	0	0.4	5	0	20
Arizona	0	0	0	0	0	0	0	0	2	0
California	99.8	104.8-124.8	246.8-271.8	615.9-724.9	556	496	3	0	160-180	420
Colorado	20-25	0	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	16.6	150	0	0	16.6	114	0	0	0	325-400
Louisiana	0	0	0	0	0	0	0	0	0.05	0
Nevada	124.6-129.6	1059-1224	217	512-557	127.75-132.75	144	162.15	200	0	0
New Mexico	0	100	0	0	15	0	0	0	0	0
North Dakota	0	0	0.25	0	0	0	0	0	0	0
Oregon	30	165-210	30	80	14.5-16.5	40	33	0	0	0
Texas	0	0	0	0	0	0	0	0	0	0.8
Utah	20	60	0	50-75	20	60	0	0	20	0
Washington	0	100	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0.28	0	0	0
Totals*	326-336	1789-2019	504-529	1268-1447	750-757	854	199	205	182-202	766-841

***PCA and Resource Estimate totals have been rounded to the nearest megawatt.**
Source: GEA

As the geographical reach of the geothermal industry expands, developers are increasingly exploring for and developing conventional hydrothermal geothermal resources in areas where little or no previous development has taken place. Of the 147 projects surveyed, 116 (approximately 80%) are developing conventional hydrothermal resources in "unproduced" areas (CH Unproduced) where the geothermal resource has not been developed to support electricity generation via a power plant. Additionally, 18 are developing conventional hydrothermal projects in "produced" (CH Produced) areas, and five are expansions to existing conventional hydrothermal power plants (CH Expansion). The remaining projects are five geothermal and hydrocarbon coproduction (Coproduction) and three enhanced geothermal systems (EGS) projects.

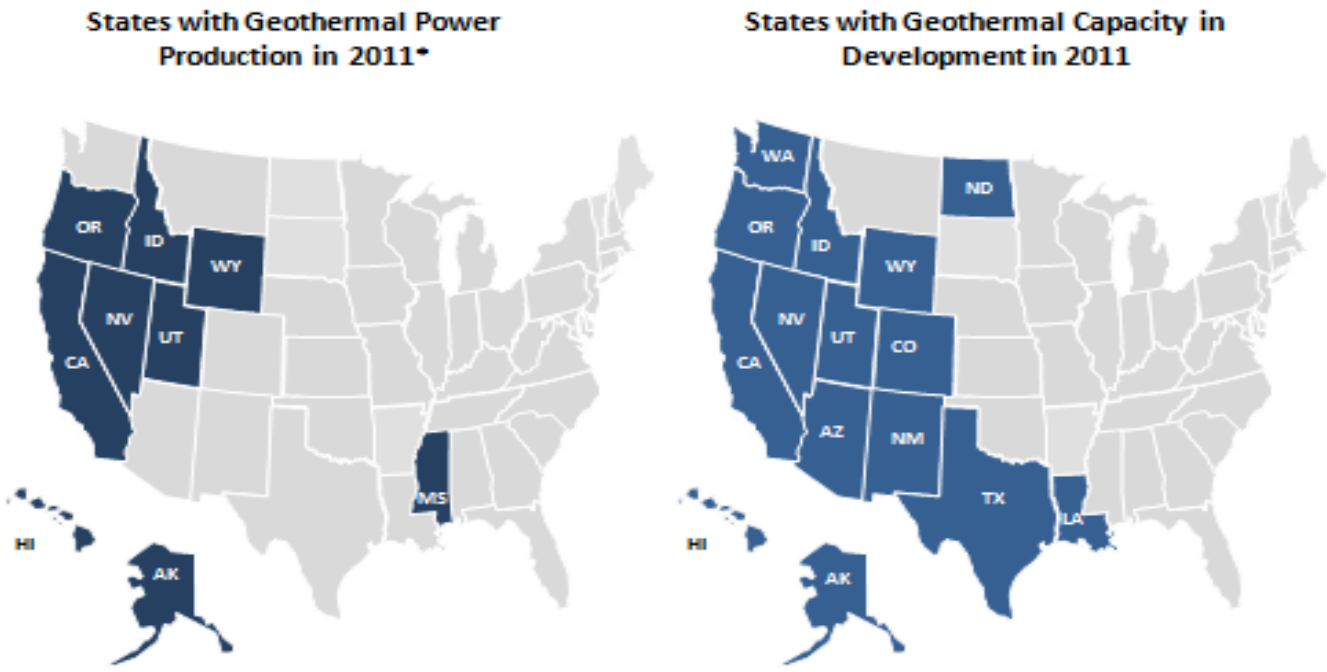
Figure 8: Number of Projects Under Development by Project Type



Source: GEA

The exploration for and development of new resources, as well as the application of new technologies, has the potential to expand the geographic extent of the industry. Projects featuring the development of conventional hydrothermal resources as well as EGS pilot projects are increasing in the western US. At the same time, the potential to generate geothermal electricity from low-temperature fluids left over as a byproduct from oil and gas production is being explored through demonstration scale projects in states along the Gulf of Mexico and in North Dakota.

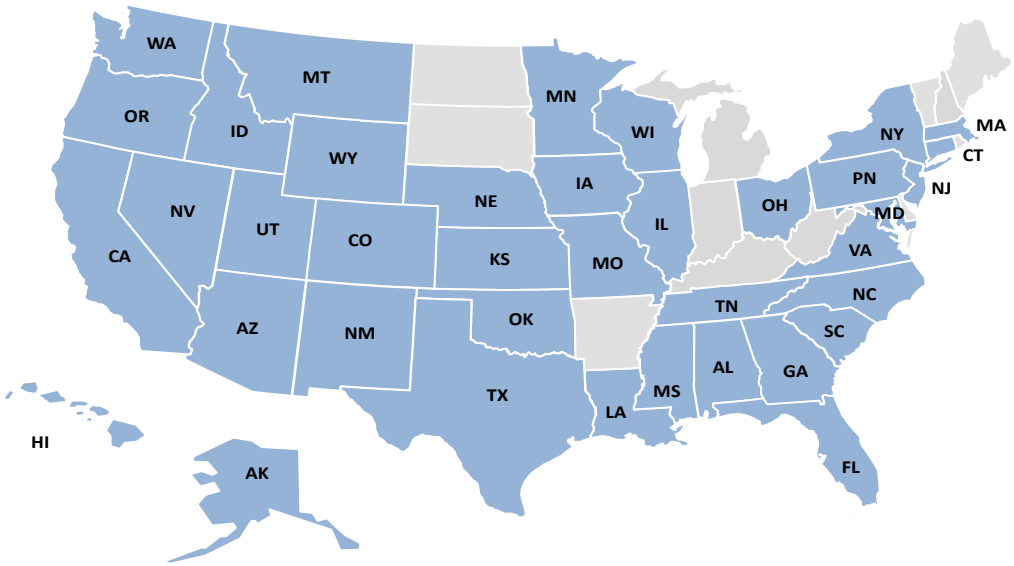
Figure 9: Maps of Geothermal Capacity Online and Under Development in US States



* This figure shows where geothermal power produced in 2011 – nine states. This includes Mississippi where geothermal power was produced for only part of the year. See the state summary for Mississippi in Section 3 of this report for additional information.
Source: GEA

While the number of states with geothermal installed capacity and projects in development is significant, the reach of the geothermal industry is still more extensive. Companies offering various products, services, and expertise in both the industrial and service sectors are needed to support additional geothermal development. Vendors supporting the development of geothermal resources abound throughout the US as shown in Figure 10.

Figure 10: Map of States with Vendors Supporting Geothermal Development



Source: GEA

A variety of companies provide goods and services to geothermal projects in development from a number of states in the US. In 2012 companies developing geothermal resources have identified vendors in 39 different states (including the District of Columbia) supplying goods and services for the development of geothermal resources. This compares to 2011 when geothermal companies reported that vendors from 43 states were supplying goods and services to geothermal resource development.

3. State Tables: Capacity in Development

The following results identify 4116 – 4525 MW of confirmed geothermal resource capacity under development in the United States. Unconfirmed projects increase the resource capacity estimate to 4882 – 5366 MW. There are 15 states with projects currently in various stages of development: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Louisiana, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, Washington, and Wyoming. Between confirmed and unconfirmed projects there are a total of 147 geothermal projects in development.

Per GEA's Geothermal Reporting Terms and Definitions (outlined in Section 1 of this report) the projects listed for each state are categorized by the following phases:

- **Phase I:** Resource Procurement and Identification (i.e. identifying resource, secured rights to resource, pre-drilling exploration, internal transmission analysis complete).
- **Phase II:** Resource Exploration and Confirmation (i.e. exploration and/or drilling permits approved, exploration drilling conducted/in progress, transmission feasibility studies underway).
- **Phase III:** Permitting and Initial Development(i.e. securing PPA and final permits, full size wells drilled, financing secured for portion of project construction, interconnection feasibility study complete).
- **Phase IV:** Resource Production and Power Plant Construction (i.e. plant permit approved, facility in construction, production and injection drilling underway, interconnection agreement signed).
- **Unconfirmed:** Project information obtained by GEA from publicly available sources but not verified by the project developer

To properly identify a project's "project type" please refer to the following key:

- **CH Unproduced:** Conventional Hydrothermal Unproduced Resource
- **CH Produced:** Conventional Hydrothermal Produced Resource
- **CH Expansion:** Conventional Hydrothermal Expansion
- **Coproduction:** Geothermal Energy and Hydrocarbon Coproduction
- **Geopressured:** Geopressured System
- **EGS:** Enhanced Geothermal System

The following sections list 15 states with geothermal projects in various stages of development. It should be noted that "NA" (i.e. "not available") is provided in the place of resource capacity or planned capacity addition (PCA) estimates where none was provided by the developer when the project was reported to GEA.

Alaska

Installed Capacity: 0.73 MW
Estimated Resource Capacity in Development: 85 MW
Estimated PCA in Development: 25.4 MW
Number of Projects in Development: 6

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. Subsequent units have been installed, bringing total capacity to 730 kW.

The State of Alaska has adopted a renewable energy goal, which aims to generate 50% of the state's electricity from renewable energy resources by 2025. Also, in 2010 the State of Alaska enacted legislation to significantly reduce royalty payments from geothermal projects on state lands and streamline geothermal permitting and regulatory processes with state agencies. Additionally, in 2012 the State of Alaska allocated $250M for spending on renewable energy projects throughout the state over the next five years.

AK Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Pilgrim Hot Springs	Unaatuq	NA	5	CH Unproduced
	Unalaska	City of Unalaska	50	10	CH Unproduced
Phase 2					
	Akutan	City of Akutan	10	10	CH Unproduced
	Mount Spurr	Ormat Technologies	NA	NA	CH Unproduced
Phase 4					
	Chena II	Chena Hot Springs	5	0.4	CH Expansion
Unconfirmed					
	Tongass	Bell Island Hot Springs	20	NA	CH Unproduced

Source: GEA

Arizona

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: 2 MW
Number of Projects in Development: 1

Arizona currently has one EGS project under development.

AZ Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Unconfirmed					
	Apache County Project	GreenFire Energy	NA	2	EGS

Source: GEA

California

Installed Capacity: 2615.4 MW
Estimated Resource Capacity in Development: 1636.7– 1765.7 MW
Estimated PCA in Development: 1065.6 – 1110.6 MW
Number of Projects in Development: 31

Geothermal capacity online in the US remains concentrated in California, which has approximately 2615 MW of installed geothermal capacity. In 2010 geothermal energy provided approximately 42% of California's commercial in-state renewable electricity generation.[ii]

With the support of an ambitious Renewable Portfolio Standard (RPS),[iii] the development of geothermal resources continues to move forward in California. The following table identifies 31 projects being developed by 11 different companies. These projects account for up to 1766 MW of geothermal resource development.

CA Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Northern California	Gradient Resources	NA	NA	CH Unproduced
	El Centro/Superstition Hills	Navy Geothermal Program	5-25	NA	CH Unproduced
	Orita 2	Ram Power	49.9	49.9	CH Produced
	Orita 3	Ram Power	49.9	49.9	CH Produced
Phase 2					
	Canby Cascaded Project	Canby Geothermal	5	2	CH Unproduced
	Surprise Valley	Enel NA	15-20	15-20	CH Unproduced
	Hudson Ranch 2	Energy Source	50	49.9	CH Produced

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
	El Centro/Superstition Mt.	Navy Geothermal Program	12-35	NA	CH Unproduced
	Chocolate Mt-Glamis	Navy Geothermal Program	12-15	NA	CH Unproduced
	Chocolate Mt-Hot Mineral	Navy Geothermal Program	12-15	NA	CH Unproduced
	Truckhaven	Nevada Geothermal Power	60	30-50	CH Unproduced
	Bald Mountain	Oski Energy	20	NA	CH Unproduced
	HV	Oski Energy	75-100	NA	CH Unproduced
	KN	Oski Energy	75-100	NA	CH Unproduced
	KS	Oski Energy	75-100	NA	CH Unproduced
	Wendel	Oski Energy	5	NA	CH Expansion
	Keystone	Ram Power	100	50	CH Unproduced
	New River	Ram Power	50	50	CH Unproduced
	Orita 1	Ram Power	49.9	49.9	CH Unproduced
Phase 3					
	Black Rock 1-2	CalEnergy	235	235	CH Unproduced
	Black Rock 5-6	CalEnergy	235	235	CH Unproduced
	CD4	Ormat Technologies	NA	30	CH Unproduced
	Wister I	Ormat Technologies	NA	30	CH Unproduced
	Geysers Project	Ram Power	26	26	CH Produced
Phase 4					
	Mammoth Repower	Ormat Technologies	NA	3	CH Expansion
Unconfirmed					
	Buckeye	Calpine	NA	30	CH Produced
	Four Mile Hill	Calpine	50	NA	CH Unproduced
	Telephone Flat	Calpine	50	NA	CH Unproduced
	Unnamed Glass Mountain	Calpine	320	NA	CH Unproduced
	Unnamed North Geysers	Calpine	NA	100	CH Produced
	Wildhorse – North Geysers	Calpine	NA	30-50	CH Produced

Source: GEA

In addition to the 31 geothermal projects in development, one geothermal prospect with potential for power production has been identified in the State of California. Geothermal developers may have acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project milestones for the geothermal

resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1).

CA Geothermal Prospects

Prospect Name	Developer/Owner
Salton Sea	Ram Power

Source: GEA

Colorado

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: 20 – 25 MW
Number of Projects in Development: 2

A robust state RPS supports geothermal resource development in Colorado.[iv] Currently, two conventional hydrothermal geothermal projects are in early stages of development in the state.

CO Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Mt. Princeton	Mt. Princeton Geothermal	NA	10-15	CH Unproduced
	Poncha Hot Springs	Mt. Princeton Geothermal	NA	10	CH Unproduced

Source: GEA

Hawaii

Installed Capacity: 43 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: NA
Number of Projects in Development: 3

One geothermal power plant operates on the big island of Hawaii. This plant, the Puna Geothermal Venture, has a generating capacity of 38 MW, supplying approximately 20% of the total electricity needs of the Big Island.[v]

The state of Hawaii has set ambitious goals to increase the generation of electricity from renewable resources, including geothermal energy.[vi] In 2012, Hawaii Electric Light Company (HELCO) announced its intentions to seek Geothermal Requests for Proposals for up to 50 MW

of additional geothermal energy supply.[vii] Three additional projects are currently being developed on Maui and the Big Island by Ormat Technologies.

HI Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Kona	Ormat Technologies	NA	NA	CH Unproduced
	Kula	Ormat Technologies	NA	NA	CH Unproduced
	Ulupalakua (Maui)	Ormat Technologies	NA	NA	CH Unproduced

Source: GEA

Idaho

Installed Capacity: 15.8 MW
Estimated Resource Capacity in Development: 589 – 664 MW
Estimated PCA in Development: 33.2 MW
Number of Projects in Development: 11

In January 2008 the first geothermal power plant came online in Idaho. The Raft River binary plant uses a 300°F resource, and has a nameplate production capacity of 15.8 MW. Currently, net electrical power output is approximately 11.5 MW. Expansions to this plant, as well as 9 other projects, are under development.[viii]

ID Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	White Mountain	Eureka Green Systems	150	NA	CH Unproduced
	Newdale	Standard Steam Trust	NA	NA	CH Unproduced
	Parma	Standard Steam Trust	NA	NA	CH Unproduced
	Weiser	Standard Steam Trust	NA	NA	CH Unproduced
	Raft River 3	U.S. Geothermal	114*	16.6	CH Produced
Phase 3					
	Raft River 2	U.S. Geothermal	114*	16.6	CH Produced
Unconfirmed					
	China Cap	Idatherm	50-100	NA	CH Unproduced

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
	Preston	Idatherm	50	NA	CH Unproduced
	Renaissance Geothermal	Idatherm	100	NA	CH Unproduced
	Sulfur Springs	Idatherm	25-50	NA	CH Unproduced
	Willow Springs	Idatherm	100	NA	CH Unproduced

***Raft River 2 and 3 are reported as being developed at the same geothermal resource. As such, when counting state resource capacity estimates for projects, the resource capacity estimate for Raft River 2 and Raft River 3 (114 MW) should only be counted once.**
Source: GEA

In addition to the 11 geothermal projects in development, five geothermal prospects with potential for power production have been identified by developers in Idaho. Geothermal developers may have acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project milestones for the geothermal resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1). While not currently considered a geothermal "project", a geothermal prospect has the potential to become so.

ID Geothermal Prospects

Prospect Name	Developer/Owner
Grays Lake	Eureka Green Systems
Oakley	Eureka Green Systems
Thatcher	Eureka Green Systems
Twin Falls	Eureka Green Systems
Kodali Raft River	Kodali, Inc.

Source: GEA

Louisiana

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: 0.05 MW
Number of Projects in Development: 1

The potential to utilize the hot water byproduct of oil and gas production to generate electricity using geothermal technology is being evaluated in a number of demonstration projects in the Gulf of Mexico. Louisiana hosts one geothermal and hydrocarbon coproduction project.

LA Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Unconfirmed					
	Natural Gas Coproduction	Gulf Coast Green Energy	NA	0.05	Coproduction

Source: ES DOE, GEA

Mississippi

In 2011 a 0.05 MW geothermal coproduction demonstration project that was being developed in Mississippi was completed and began to generate electricity from water produced as a byproduct of oil production in Mississippi. The project was demonstration scale and was concluded within the year, but highlighted the potential for geothermal energy to be produced via a variety of resources.[ix]

Nevada

Installed Capacity: 469 MW
Estimated Resource Capacity in Development: 1915 – 2125 MW
Estimated PCA in Development: 631.5 – 641.5 MW
Number of Projects in Development: 59

There are currently 22 geothermal power plants in Nevada with a total operating capacity of 469 MW. In the first quarter of 2012 Ormat Technologies brought its 18 MW Tuscarora power plant online, and U.S. Geothermal completed the first 12.75 MW phase of expansion at its San Emidio power plant.

With a strong state RPS,[x] and more developing projects than any other state, it is expected that the development of geothermal resources will continue in Nevada into the foreseeable future.[xi]

NV Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Desert Queen	Alterra Power Corp.	NA	NA	CH Unproduced
	McCoy	Alterra Power Corp.	NA	NA	CH Unproduced
	Soda Lake South	Alterra Power Corp.	NA	NA	CH Unproduced

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
	Upsal Hogback	Alterra Power Corp.	NA	NA	CH Unproduced
	Lee Hot Springs	Earth Power Resources	32	NA	CH Unproduced
	Lovelock	Earth Power Resources	32	NA	CH Unproduced
	Harmon Lake	Enel NA	NA	15-20	CH Unproduced
	Aurora	Gradient Resources	190	NA	CH Unproduced
	Colado	Gradient Resources	350	NA	CH Unproduced
	Lee Allen	Gradient Resources	145	NA	CH Unproduced
	Darrough Hot Springs	Great American Energy	30-100	NA	CH Unproduced
	Gerlach Power	Kodali, Inc.	60	NA	CH Unproduced
	Sou Hills	Montara Energy	NA	NA	CH Unproduced
	Naval Air Station-Fallon	Navy Geothermal Program	5-15	NA	CH Unproduced
	Blue Mountain 2	Nevada Geothermal Power	NA	NA	CH Produced
	North Valley	Nevada Geothermal Power	120	55	CH Unproduced
	Argenta	Ormat Technologies	NA	NA	CH Unproduced
	Brady EGS	Ormat Technologies	NA	NA	EGS
	Dixie Meadows	Ormat Technologies	NA	30	CH Unproduced
	Hycroft	Ormat Technologies	NA	NA	CH Unproduced
	Mustang	Ormat Technologies	NA	NA	CH Unproduced
	Quieta	Ormat Technologies	NA	NA	CH Unproduced
	Smith Creek	Ormat Technologies	NA	NA	CH Unproduced
	Tuscarora 2	Ormat Technologies	NA	NA	CH Produced
	Walker River Paiute	Ormat Technologies	NA	NA	CH Unproduced
	Alligator Geothermal	Oski Energy	20-40	NA	CH Unproduced
	Hawthorne	Oski Energy	25-50	NA	CH Unproduced
	Hot Pot	Oski Energy	30-50	NA	CH Unproduced
	Pilot Peak	Oski Energy	20-40	NA	CH Unproduced
	Marys River	Standard Steam Trust	NA	NA	CH Unproduced
	Marys River SW	Standard Steam Trust	NA	NA	CH Unproduced
	Granite Creek	U.S. Geothermal	NA	NA	CH Unproduced
	San Emidio 3	U.S. Geothermal	44*	24.6	CH Produced
Phase 2					
	Fireball	Earth Power Resources	32	NA	CH Unproduced

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
	Hot Springs Point	Earth Power Resources	32	NA	CH Unproduced
	Fallon	Gradient Resources	70	NA	CH Unproduced
	Salt Wells	Gradient Resources	60	NA	CH Unproduced
	Hawthorne Army Depot	Navy Geothermal Program	5-15	NA	CH Unproduced
	Fallon-Main	Navy Geothermal Program	30	NA	CH Unproduced
	Pumpernickel	Nevada Geothermal Power	33	15	CH Unproduced
	Dixie Hope	Ormat Technologies	NA	NA	CH Unproduced
	Desert Peak EGS	Ormat Technologies	NA	NA	EGS
	Edwards Creek	Ormat Technologies	NA	NA	CH Unproduced
	Leach Hot Springs	Ormat Technologies	NA	NA	CH Unproduced
	Tungsten Mountain	Ormat Technologies	NA	NA	CH Unproduced
	Silver State	Oski Energy	25-50	NA	CH Unproduced
	Clayton Valley	Ram Power	160	160	CH Unproduced
	Reese River	Ram Power	40	24	CH Unproduced
	Gerlach	U.S. Geothermal	25-35	18	CH Unproduced
Phase 3					
	Carson Lake	Ormat Technologies	NA	20	CH Unproduced
	Wild Rose	Ormat Technologies	NA	15-20	CH Unproduced
	New York Canyon	Terra-Gen	100	80	CH Unproduced
	San Emidio 2	U.S. Geothermal	44*	12.75	CH Produced
Phase 4					
	Florida Canyon Mine	ElectraTherm	NA	0.05	Coproduction
	Patua	Gradient Resources	120	60	CH Unproduced
	McGinness Hills	Ormat Technologies	NA	30	CH Unproduced
	Coyote Canyon	Terra-Gen	80	67	CH Unproduced
	Dixie Valley 2	Terra-Gen	NA	5.1	CH Expansion
Unconfirmed					
	Pyramid Lake	Pyramid Lake Paiute Tribe	NA	NA	CH Unproduced

*San Emidio 2 and 3 are being developed at the same geothermal resource. As such, when counting state resource capacity estimates for these projects, the resource capacity estimate for San Emidio 2 and San Emidio 3 (44 MW) should only be counted once.
Source: GEA

In addition to the 59 geothermal projects in development, 17 geothermal prospects with potential for power production have been identified by developers in Nevada. Geothermal

developers may have acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project milestones for the geothermal resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1).

NV Geothermal Prospects

Prospect Name	Developer/Owner
Granite Springs	Alterra Power Corp.
Soda Lake East	Alterra Power Corp.
Kodali Dixie Valley	Kodali, Inc.
Kodali Dixie Valley 2	Kodali, Inc.
Edna Mountain	Nevada Geothermal Power
Barren Hills	Ram Power
Delcer Butte	Ram Power
Dixie Valley	Ram Power
Dixie Valley North	Ram Power
Gerlach	Ram Power
Hawthorne	Ram Power
Howard	Ram Power
North Salt Wells	Ram Power
Salt Wells	Ram Power
Spencer	Ram Power
Sulphur	Ram Power
Wells	Ram Power

Source: GEA

New Mexico

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: 100
Estimated PCA in Development: 15 MW
Number of Projects in Development: 2

In July 2008, a 0.24 MW pilot installation project went online in New Mexico.[xii] Since then, the pilot installation has been brought offline, but a full utility-scale project, Lightning Dock, is being developed at the location by Utah-based Cyrq Energy. It is currently expected to have installed capacity is 15 MW. Supported by strong state renewable energy incentives,[xiii] geothermal energy could play an increasingly important role in New Mexico in the future.

NM Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	South New Mexico	Gradient Resources	100	NA	CH Unproduced
Phase 3					
	Lightning Dock I	Cyrq Energy	NA	15	CH Unproduced

Source: GEA

North Dakota

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: 0.25
Number of Projects in Development: 1

The University of North Dakota is working with a number of energy companies to implement a geothermal energy and hydrocarbon coproduction demonstration project at an oilfield in North Dakota. The project will demonstrate the use of binary, Organic Rankine Cycle (ORC) technology to produce electricity from low temperature fluids.[xiv]

ND Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 2					
	ND Coproduction	University of North Dakota	NA	0.25	Coproduction

Source: GEA

Oregon

Installed Capacity: 0.28 MW
Estimated Resource Capacity in Development: 285 – 330 MW
Estimated PCA in Development: 107.5 – 109.5 MW
Number of Projects in Development: 16

In August 2009, a 0.28 MW geothermal unit began producing electricity at the Oregon Institute of Technology's Klamath Falls campus. Currently, 15 known geothermal projects are in development with the potential of providing up to 300 MW to Oregon's electricity grid.

OR Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Newberry I	Davenport Newberry	120	30	CH Unproduced
	Olene KBG	Klamath Basin Geopower	20	NA	CH Unproduced
	Foley Hot Springs	Ormat Technologies	NA	NA	CH Unproduced
	Goose Lake	Ormat Technologies	NA	NA	CH Unproduced
	Mahogany	Ormat Technologies	NA	NA	CH Unproduced
	Midnight Point	Ormat Technologies	NA	NA	CH Unproduced
	Silver Lake	Ormat Technologies	NA	NA	CH Unproduced
	Summer Lake	Ormat Technologies	NA	NA	CH Unproduced
	Twilight	Ormat Technologies	NA	NA	CH Unproduced
	Olene Gap	Oski Energy	25-50	NA	CH Unproduced
Phase 2					
	Crump Geyser	Nevada Geo. Power/Ormat	80	30	CH Unproduced
	Neal Hot Springs 2	U.S. Geothermal	NA	NA	CH Unproduced
Phase 3					
	OM Power	Kodali, Inc.	30	11	CH Unproduced
	GeoHeat Center 2	OIT	NA	1.5	CH Expansion
	Paisley	Surprise Valley Electric	10	2-4	CH Unproduced
Phase 4					
	Neal Hot Springs	U.S. Geothermal	NA	33	CH Unproduced

Source: GEA

In addition to the eleven geothermal projects in development, two geothermal prospects with potential for power production have been identified by developers in Oregon. Geothermal developers may have acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project milestones for the geothermal resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1).

OR Geothermal Prospects

Prospect Name	Developer/Owner
Alvord	Cyrq Energy
Klamath Falls Plant	Cyrq Energy

Source: GEA

Texas

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: 0.8 MW
Estimated PCA in Development: NA MW
Number of Projects in Development: 1

The potential to utilize the hot water byproduct of oil and gas production to generate electricity using geothermal technology is being evaluated in a number of demonstration scale projects in the Gulf of Mexico. Texas currently hosts one geothermal and hydrocarbon coproduction project in Goliad County.

TX Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Unconfirmed					
	Goliad Co. Coproduction	Universal GeoPower	0.8	NA	Coproduction

Source: GEA

Utah

Installed Capacity: 42 MW
Estimated Resource Capacity in Development: 170 – 195 MW
Estimated PCA in Development: 60 MW
Number of Projects in Development: 11

A number of geothermal power plants operate in Utah. Unit 1 of the Blundell power plant has an installed capacity of 23 MW and Unit 2 has a capacity of 9 MW. In April 2009 the low-temperature 10-MW Hatch Geothermal Power Plant in Beaver County began delivering power to Anaheim California.

UT Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Thermo 2	Cyrq Energy	NA	NA	CH Produced
	Thermo 3	Cyrq Energy	NA	NA	CH Produced
	Thermo 4	Cyrq Energy	NA	NA	CH Produced
	Cove Fort 2	Enel NA	60	20	CH Produced

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
	Hill Air Force Base	Navy Geothermal Program	NA	NA	CH Unproduced
	Drum Mountain	Ormat Technologies	NA	NA	CH Unproduced
	Whirlwind Valley	Ormat Technologies	NA	NA	CH Unproduced
	Drum Mountain	Standard Steam Trust	NA	NA	CH Unproduced
Phase 2					
	Cove Fort	Oski Energy	50-75	NA	CH Produced
Phase 3					
	Cove Fort	Enel NA	60	20	CH Unproduced
Unconfirmed					
	Falstaff	Verdi Energy	NA	20	CH Unproduced

Source: GEA

In addition to the 11 geothermal projects in development, eight geothermal prospects with potential for power production have been identified by developers in Utah. Geothermal developers may have acquired access to a geothermal resource which has the potential for electricity production, but which has not yet met enough project milestones for the geothermal resource to be considered a Phase I project under the Geothermal Reporting Terms and Definitions (see Section 1).

UT Geothermal Prospects

Prospect Name	Developer/Owner
Thermo	Alterra Power Corp.
Abraham	Cyrq Energy
DeArmand	Cyrq Energy
Drum Mountain	Cyrq Energy
Thermo Central	Cyrq Energy
Thermo Greater	Cyrq Energy
Wood Ranch	Cyrq Energy
Millard	Kodali, Inc.

Source: GEA

Washington

Installed Capacity: 0 MW
Estimated Resource Capacity in Development: 100 MW
Estimated PCA in Development: NA
Number of Projects in Development: 1

While there are no geothermal power plants currently operating in the State of Washington, one company, Gradient Resources, is in the early stages of developing its Mt. Baker project there. Washington does have and RPS supporting the development of renewable resources.[xv]

WA Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 1					
	Mt. Baker	Gradient Resources	100	NA	CH Unproduced

Source: GEA

Wyoming

Installed Capacity: 0.25 MW
Estimated Resource Capacity in Development: NA
Estimated PCA in Development: 0.28 MW
Number of Projects in Development: 1

In August 2008, a 0.25 MW geothermal and hydrothermal coproduction unit was installed at the Department of Energy's Rocky Mountain Oil Test Center (RMOTC) near Casper, Wyoming. The unit, built by Ormat Technologies, Inc., was operated for approximately one year when it was shut down for maintenance. The unit has since resumed operation and RMOTC is developing another site for the installation of a 0.28 MW unit.

WY Projects in Development

Phase	Project	Developer	Capacity Estimate (MW)		Project Type
			Resource	PCA	
Phase 4					
	RMOTC Co-production	RMOTC	NA	0.28	Coproduction

Source: GEA

4. Emerging Technology Demonstration Projects

Through the American Recovery and Reinvestment Act (ARRA) of 2008, as well as annual Department of Energy (DOE) Appropriations, the DOE Geothermal Technologies Program is funding a number projects demonstrating new geothermal technologies throughout the US (as well as additional R&D projects). In previous Annual US Geothermal Power Production and Development Reports GEA outlined the progress of projects receiving ARRA and DOE Annual Appropriations funding. Given the large extent of information on geothermal R&D and demonstrations projects receiving federal funding, GEA decided to withhold this information from the 2012 Report in order to maintain its primary focus; the development of geothermal resources in the US by geothermal companies. At the same time, this section provides a brief outline of some of the innovative geothermal technologies that the industry is developing with federal support.

One of the fields of technological innovation where development is occurring is Enhanced Geothermal Systems (EGS). The DOE is working to demonstrate the technical feasibility of EGS through seven demonstration projects in five western states. DOE has also set a target to reduce the levelized cost of electricity (LCOE) from EGS to 6 cents/kWh by 2030.[xvi]

Table 4: DOE Funded EGS Demonstration Projects

Demo Performer	Demo Site
AltaRock Energy, Inc.	Newberry Volcano, Oregon
Geysers Power Company, LLC	The Geysers, California
Naknek Electric	Naknek, Alaska
Ormat Technologies, Inc.	Brady Hot Springs, Nevada
Ormat Technologies, Inc.	Desert Peak, Nevada
TGP Development Co.	New York Canyon, Nevada
University of Utah	Raft River, Idaho

Source: DOE Geothermal Technologies Program

Another developing area of technological innovation in geothermal energy is the production of geothermal energy from fluids produced in oil and natural gas development (Coproduction), the production of geothermal energy from geopressure resources, and the development of low temperature technology. DOE is currently funding 17 projects demonstrating a mix of coproduction, geopressure, and low temperature projects, and has set a target to reduce the LCOE from such technologies to 6 cents/kWh by 2020.[xvii]

Table 5: DOE Funded Coproduction and Geopressure Demonstration Projects

Demo Performer	Technology Focus	Demo Site
ElectraTherm	Coproduction	Nevada
Universal GeoPower	Coproduction	Texas
University of North Dakota	Coproduction	North Dakota
Louisiana Tank	Geopressure	Louisiana

Terra-Gen	Low Temp.	Nevada
Terra-Gen	Low Temp.	Nevada
University of North Dakota	Low Temp.	North Dakota
Oski Energy	Low Temp.	Idaho
City of Klamath Falls	Low Temp.	Oregon
Johnson Controls	Low Temp.	Oregon
Oasys Water	Low Temp.	California
Surprise Valley Electrification Corp.	Low Temp.	California
Energent Corp.	Low Temp.	California
GreenFire Energy	Low Temp.	Arizona
Modoc Contracting	Low Temp.	California
National Renewable Energy Lab	Low Temp.	Colorado
National Renewable Energy Lab	Low Temp.	Colorado

Source: DOE

5. Appendix: Glossary of Terms Used in this Report

CH Unproduced	Conventional Hydrothermal (Unproduced Resource)
CH Produced	Conventional Hydrothermal (Produced Resource)
CH Expansion	Conventional Hydrothermal (Expansion)
EGS	Enhanced Geothermal System
Coproduction	Geothermal Energy and Hydrocarbon Coproduction
PCA	Planned Capacity Addition
NA	Not Available

6. References

[i] US Energy Information Administration. Renewable Energy Consumption and Electricity Statistics 2010.
[ii] California Energy Commission. *Renewable Power in California: Status and Issues*, Lead Commissioner Report. December 2011.
[iii] In 2005, California's Energy Action Plan recommended a state RPS goal of 33% of electricity generation from renewable sources by 2020. In April 2011California's 33% by 2020 RPS goal was codified by Governor Edmund Brown. California Energy Commission.
[iv] Colorado's RPS requires investor owned utilities, municipal utilities, and rural electric cooperatives to derive 30%, 10%, and 10%, of their electricity from renewable resources (respectively) by 2020. DSIRE.org
[v] Puna Geothermal Venture.
[vi] Hawaii passed legislation in 2009 that expanded its RPS goals to require 40% of electricity generation from renewable resources by 2030. DSIRE.org
[vii] Hawaii Electric Light Company
[viii] Idaho Office of Energy Resources
[ix] ElectraTherm. Mississippi Oilfield is Home to Innovative Lower-Temp Geothermal Energy Production.
[x] In 2009 the State of Nevada revised its RPS to require 25% of electricity generation from renewable resources by 2025. DSIRE.org
[xi] Nevada Commission on Mineral Resources Division of Minerals
[xii] New Mexico Energy, Minerals, and Natural Resources Department: http://www.emnrd.state.nm.us/main/index.htm
[xiii] The State of New Mexico has established an RPS that requires investor owned utilities and rural electric cooperatives to derive 20% and 10% of their electricity mix respectively from renewable resources by 2020. DSIRE.org
[xiv] US Department of Energy Geothermal Technologies Program.
[xv] The State of Washington has established an RPS requiring 15% of its electricity to be derived from renewable resources by 2020. DSIRE.org
[xvi] DOE Geothermal Technologies Program. Fiscal Year 2013 Budget Request Briefing.
[xvii] DOE Geothermal Technologies Program. Fiscal Year 2013 Budget Request Briefing.