2014 Annual U.S. & Global Geothermal Power Production Report

GEOTHERMAL ENERGY ASSOCIATION

GEO-ENERGY.ORG

Contents

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GEA would like to thank Sam Abraham for contributing his beautiful photography for use in this publication.

Cover Page Top & Bottom Left: Menengai, Kenya courtesy of Sam Abraham
Cover Page Bottom Right: Salton Sea Geothermal Resource Area, California courtesy of CalEnergy

Executive Summary

The international geothermal power market is booming, growing at a sustained rate of 4% to 5%. Almost 700 geothermal projects are under development in 76 countries. Many countries anticipating the threats caused by climate change realize the values of geothermal power as a baseload and sometimes flexible source of renewable energy. These counties are on every continent and range from small island nations to large developed economies like China or the United States.

In contrast to the global market, in 2013 the U.S. market was a quieter place to do business. Despite lackluster growth over the past year, this trend is not expected to continue. New initiatives in Nevada, California, and Oregon could promise substantial increases in geothermal power over the next decade. For example, the Salton Sea Resource Area could be a significant source of growth for the U.S. geothermal power industry if several policy barriers are overcome in the near term. The Imperial Irrigation District has pledged to build up to 1,700 MW of geothermal power by the early 2030s at the Salton Sea. If successful, this initiative could increase the nameplate capacity of the U.S. by 50% over the next 20 years. In addition Public Utility Commissions in Nevada and Oregon recently created potentially beneficial opportunities for geothermal power while state assemblies in Washington and New Mexico have clarified confusing legislation.

International

- About 530 MW of geothermal power came online globally to bring the global installed capacity to just over 12,000 MW. That is the most megawatts to become operational in one year since 1997.
- In total there are about 12,000 MW in the pipeline and about 30,000 MW of geothermal resources under development. Of those 12,000 MW about 16% or 1,900 MW amount of planned capacity additions are under construction in 14 countries. If all geothermal power plants under construction are completed on schedule the global geothermal industry could reach about 13,450 MW of nameplate capacity by 2017.
- About 10% of global projects have drilled injection or production wells and/or are actually in the process of constructing a power plant. Another 50% of projects are in the exploration stage meaning the first exploration wells were drilled, project funds have been acquired, and/or significant knowledge of the geothermal resource has been attained.

United States

- The geothermal power industry reached about 3,442 MW at the end of 2013 (shown in Figure 5). New or refurbished power plants became operational in Utah, Nevada, California, and New Mexico. In total the U.S. industry added about 85 MW of new capacity additions in 2013.
- In 2013 there were about 1,000 MW of planned capacity additions under development and about 3,100 MW of geothermal resource under development.
- After a quiet year for geothermal power domestically, announcements in Nevada and California are likely to greatly increase the installed capacity of geothermal power in the United States over the next 20 years.
- Upcoming plans announced by Imperial Irrigation District at the Salton Sea Geothermal Resource Area could increase U.S. nameplate capacity by 50% over the next 20 years.
- Leading geothermal states, such as California, Nevada and Utah have significant amount of geothermal power potential with about 50%, 60%, and 60% of their estimated geothermal resource respectively, remain untapped.

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 for U.S. Projects

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 Co-production: 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 "Co-production" 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: is 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 to the above list of definitions, developers also indicate to GEA 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 "if the developer were to utilize the geothermal resource under its control to produce electricity via a geothermal power plant . . . would be the power plants estimated installed capacity." In other words, the PCA estimate is usually the expected 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,

Geothermal Resource Types and Their Definitions for Global Projects

While projects in the GEA's Annual U.S. Geothermal Power Production and Development Report are defined by several phases of development (Prospect and Phases 1-4) as defined by GEA's 2010 New Geothermal Terms and Definitions, this report uses much broader terms to define where a project tracks in its development because of the vastly different development models to construct geothermal power plants outside the U.S. These terms include Prospect, Early Stage, Under Construction, On Hold, Canceled, and Operational. The breadth and diversity of geothermal project tracking throughout the world makes labeling projects under a specific Phase incredibly difficult. Therefore, for the purposes of this report, projects are defined by much broader categories in order to maintain the integrity of the information regarding a project's forward progress.

Geothermal '**Prospects'** are defined to be areas in which little exploration has taken place, and the country's government has tendered the property to a private company, government agency or contractor to conduct further exploration. Although geophysical features or prior exploration might indicate the presence of a geothermal resource at the site, past exploration may not have determined the economic feasibility of a geothermal power plant at the property tendered.

'Early Stage' projects are defined to be projects where some aspects of a resource are identified and the initial stages of explorations and construction are underway. This could mean but is not limited to, the first exploration wells drilled, project funded, and/or significant knowledge of the geothermal resource attained.

Projects **'Under Construction'** are projects where physical work to build the actual power plant has begun. For the purpose of this report, this does not include production drilling. However, many definitions of 'Under Construction' do include production drilling. 'Under Construction' is roughly equivalent to GEA's Phase 4 of a project's development.

'Operational' plants are contributing electricity to a customer who agreed to purchase the power prior to the plant's construction. 'Under Construction' and 'Operational' are determined by information reported publically on company websites, press releases, government or academic reports, or media articles, interviews with company representatives, or other public sources of information.

Projects **'On Hold'** are when forward progress on the projects has halted for any number of reasons not limited to land or religious disputes, loss of project funding, or an agreement that fell apart.

Projects **'Canceled'** are projects where the government, project developer, or contractor decided to make no more forward progress on a geothermal project in the immediate future and withdrew from developing that geothermal prospect into a power plant.

For this report, GEA collected two numbers for each project in cases where both were available: 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 value of the total recoverable energy of the subsurface geothermal resource. It should not be confused with the PCA estimate, which is the portion of a geothermal resource that would be the power plants' resulting estimated installed capacity if the developer were to utilize the geothermal resource under its control to produce electricity. In other words, the PCA estimate is usually the power plant's expected installed or nameplate 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.

International Geothermal Power Update

Internationally, 2013 was a significant boom year. The geothermal power industry continued to grow steadily at a rate of 4% to 5% a year as plants came online in the United States, the Philippines, and Europe. About 530 MW of power came online around the world. That is the most geothermal megawatts to become operational in one year since 1997.

In total there are about 12,000 MW in the pipeline and about 30,000 MW of geothermal resources under development. Of those 12,000 MW about 10% of projects or 16% (≈1,900 MW) of announced planned capacity additions are already under construction in 15 countries. For comparison, in August 2013, about 8% of projects and 15% of announced planned capacity additions were under construction globally. In other words as projects advance through the pipeline there is a steady stream of new projects and opportunities replacing them.

If all geothermal power plants under construction are completed on schedule the global geothermal industry could reach about 13,450 MW of nameplate capacity by 2017. Figure 1 depicts the current installed capacity and the potential by 2017 of projects currently under construction.

Significant growth is expected in the global geothermal power industry over the next few years as countries in eastern Africa push projects toward completion. Kenya and Ethiopia are building power plants greater than 100 MW. For comparison the average size of a geothermal power plant in the United States is about 25 MW.

Steady growth continues in South Pacific despite setbacks from Typhoon Haiyan (Yolanda). Plants that were damaged were quickly repaired and reports say most normal geothermal activities resumed in the Philippines by February 2014.

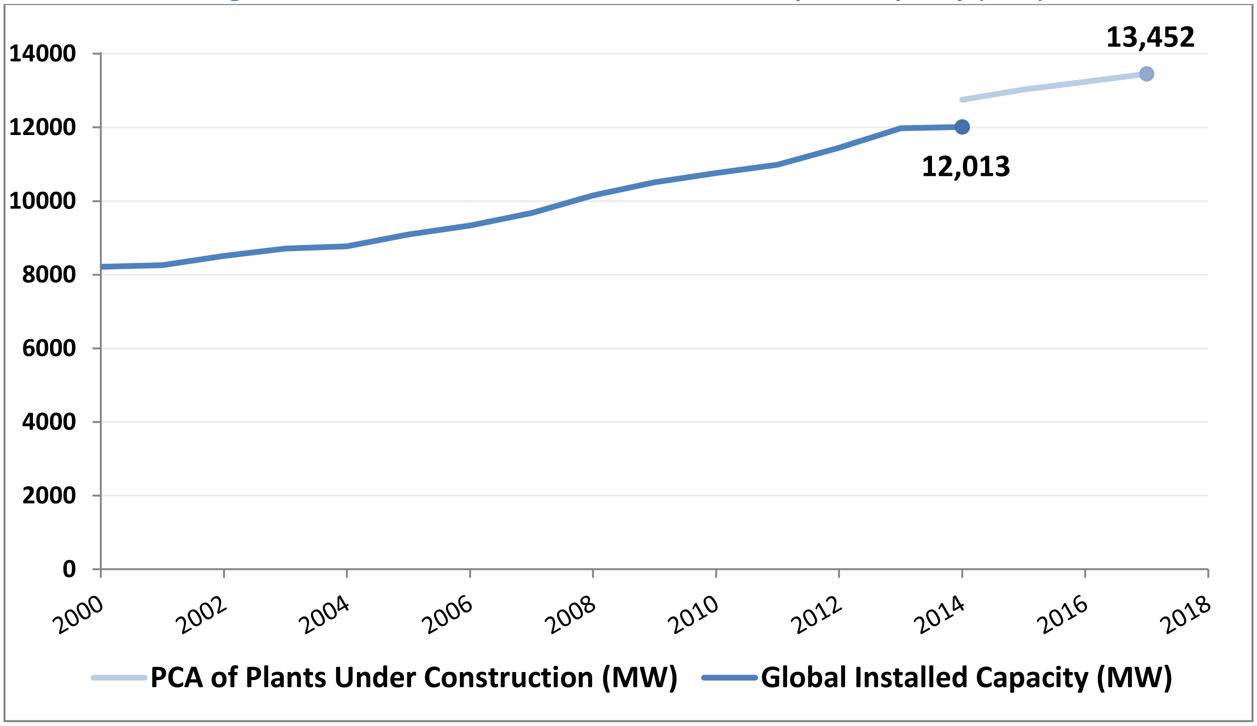
Some countries are growing so quickly there could be a time in the near future when the United States is no longer the world leader in geothermal power, despite its vast supply of geothermal resources. For example, the U.S. has about 1,000 MW in the pipeline and 3,400 MW nameplate capacity for a total of 4,400 MW. Meanwhile, Indonesia has 4,400 MW (Figure 2) of planned capacity additions announced in the pipeline alone. Although, it is unlikely all of these projects will come to fruition quickly since Indonesia is struggling with a number of bureaucratic barriers hindering development, such as permitting and land acquisition problems. There could be a time in the near future where countries passionate about geothermal power and comparable geothermal reservoirs are close competitors for the title of most nameplate capacity.

A few countries in Central and South America such as Chile, Argentina, Columbia, and Honduras, have significant amounts of geothermal potential; however, these countries are still in the early stages of exploring and identifying their resources. In the coming years, it should be expected that announcements for planned capacity additions in these countries will likely become more frequent as geothermal resources can be identified for electricity generation. Of note, GEA estimates Chile is actively developing 50 early-stage projects and prospects.

Small island nations such as Nevis and St. Lucia are dedicated to powering a substantial portion of their economies from geothermal power. However, these small island nations often go unnoticed because their economies and therefore their projects barely register on the global geothermal map. That isn't a reason to doubt the forward progress. Investment is quickly pouring into island nation projects and some are expected to complete their first power plants by 2015. Meanwhile, more experienced island nation geothermal markets like Costa Rica have found funding and are building new geothermal plants after several years of no expansion.

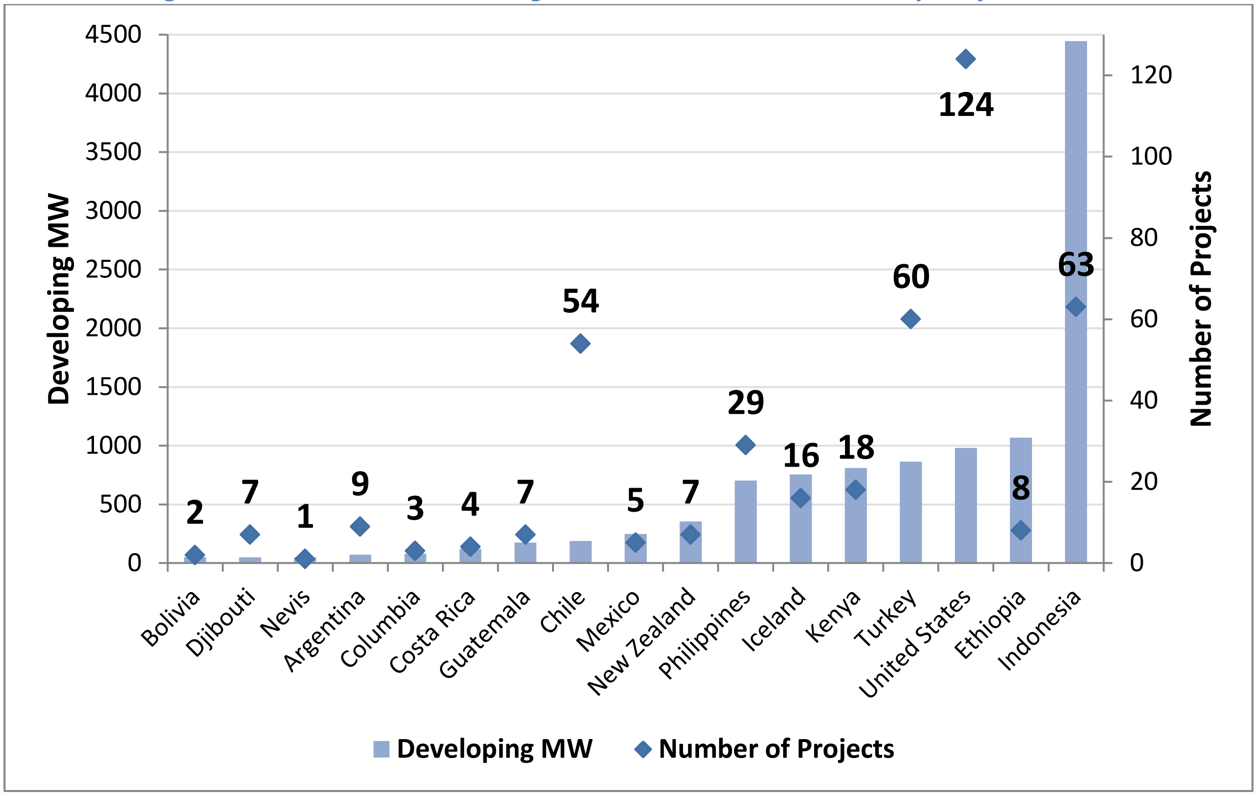
Some established geothermal markets that have not seen new growth in many years are revisiting geothermal development. For example, Mexico passed legislation at the start of 2014 opening the electricity market to private investors. In Japan, feed-in-tariffs are revitalizing the geothermal power market, particularly for small-sized projects.

Figure 1: International Geothermal Power Nameplate Capacity (MW)



Note: PCA (Planned Capacity Additions), pilot plants and utility scale geothermal plants built in the first half of the 20th century and then decommissioned are not included in the above time series.

Figure 2: Countries with 50+ Megawatts Announced Planned Capacity Additions



Figures 3 and 4 depict estimated current nameplate capacity by country. According to GEA research new power plants came online in the U.S., the Philippines, Mexico, New Zealand, Germany, Kenya, Australia, and Turkey in 2013. Kenya, Turkey, Ethiopia, Costa Rica, and Germany are quickly developing geothermal power infrastructure. In addition, it is likely within the next decade or so the Philippines or Indonesia could roughly equal the U.S. in nameplate capacity. By looking at projects in the pipeline other smaller countries are likely to become more established geothermal power markets.

Table 1 lists all countries with geothermal power projects or prospects under development in ascending order. The top five include the United States, Indonesia, Turkey Chile and Japan. While Turkey, Chile, and Japan have many projects under development many of them are in early stages and have not announced planned capacity additions.

Figure 3: Established Geothermal Power Markets Nameplate Capacity (MW)

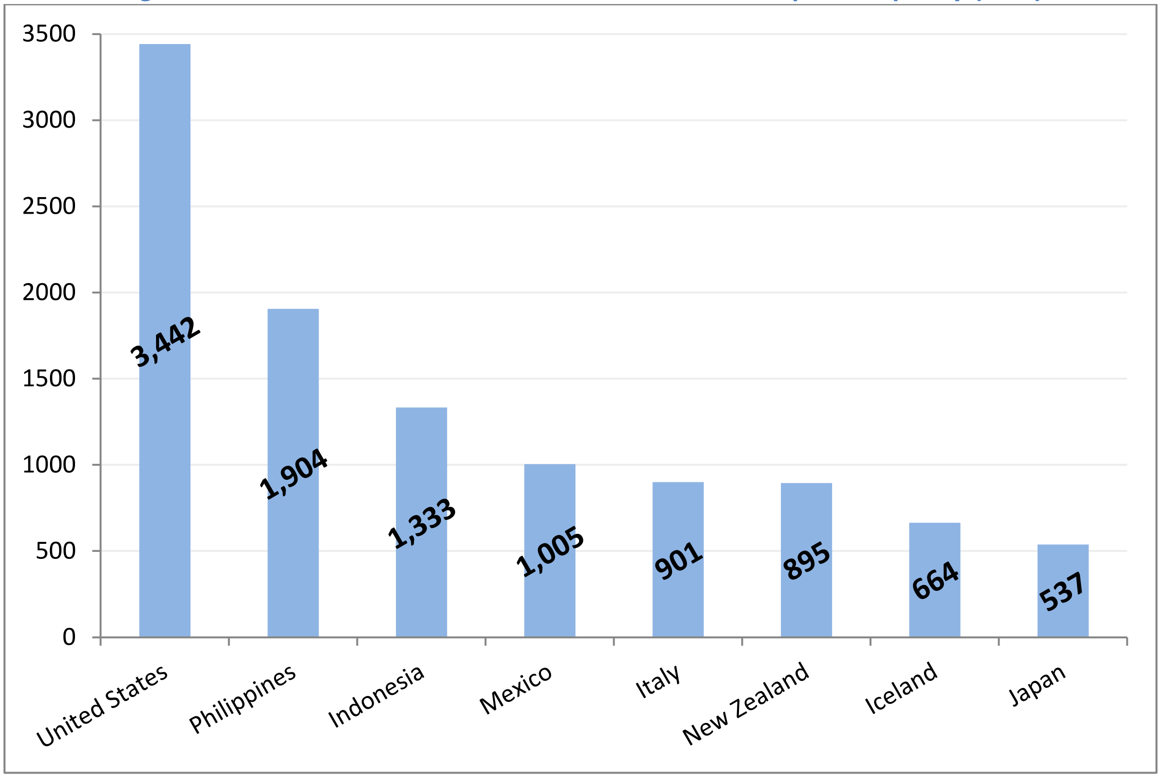


Figure 4: Developing Geothermal Power Markets Nameplate Capacity (MW)

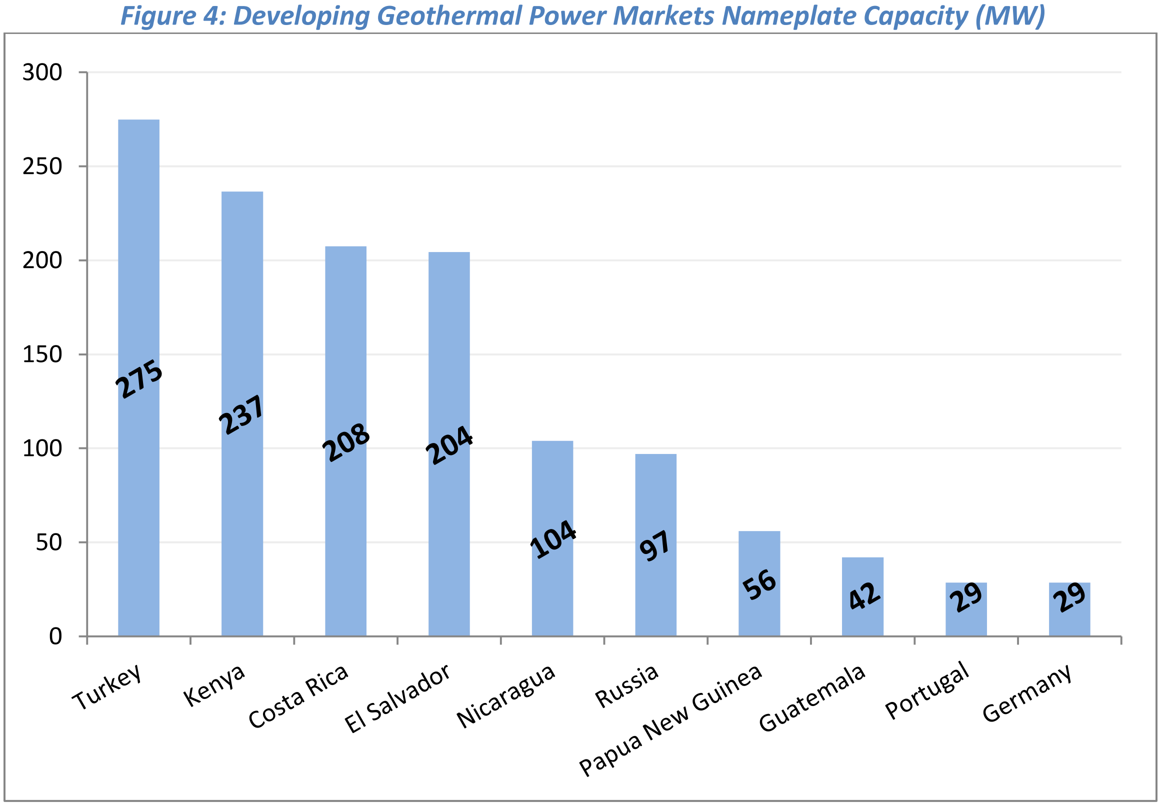
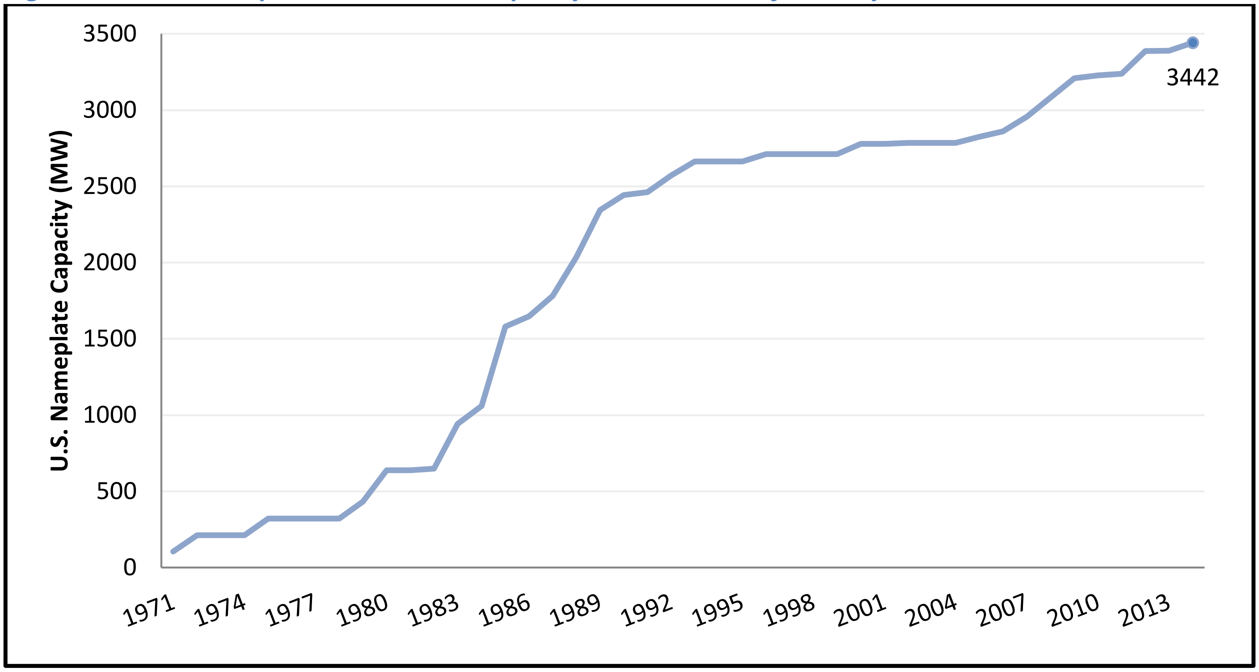


Table 1: Number of Developing Projects by Country or Territory

Country	Number of Projects
Algeria	1
American Samoa	1
Comoros Island	1
Croatia	1
Guadeloupe	1
Kyrgyzstan	1
Martinique	1
Myanmar (Burma)	1
Northern Mariana	1
Norway	1
Panama	1
Reunion	1
Saba	1
St. Lucia	1
St. Vincent and Grenadines	1
Yemen	1
Zambia	1
Montserrat	1
Latvia	1
Ireland	1
Solomon Islands	1
Vietnam	1
Malaysia	1
Nevis	1
El Salvador	2
Eritrea	2
Netherlands	2
Serbia	2
South Korea	2
Republic of Vanuatu	2
Czech Republic	2
Russia	2
Belgium	2
Portugal	2
Dominica	2
Honduras	2
Bolivia	2
Switzerland	3
France	3
Fiji	3
Slovakia	3
United Kingdom	3
Tanzania	3
Armenia	3
Columbia	3
Ecuador	4
Rwanda	4
Spain	4
Greece	4
Costa Rica	4
Hungary	5
Nicaragua	5
Italy	5
Mexico	5
China	7
Djibouti	7
Guatemala	7
New Zealand	7
India	8
Ethiopia	8
Argentina	9
Canada	10
Germany	10
Uganda	11
Jamaica	12
Iceland	16
Kenya	18
Australia	23
Peru	24
Philippines	29
Japan	47
Chile	54
Turkey	60
Indonesia	63
United States	124

Note: A full international project list is published in conjunction with this report.

Figure 5: Total Nameplate Geothermal Capacity in the U.S. as of January 2014



Note: PCA (Planned Capacity Additions), pilot plants and utility scale geothermal plants built in the first half of the 20th century and then decommissioned are not included in the above time series.

U.S. Geothermal Power Update

Market Summary

The geothermal power industry reached about 3,442 MW at the end of 2013 (shown in Figure 5). New or refurbished power plants became operational in Utah, Nevada, California, and New Mexico. In total the U.S. industry added about 85 MW of new capacity additions. This number is about 40% lower than the capacity additions (148 MW) of 2012 and reflective of the difficulty in building a new power plant in the U.S. right now due to a number of policy barriers, inadequate transmission infrastructure, low natural gas prices and weak demand for new renewable geothermal power projects. Simply put, the U.S. geothermal industry is trending opposite of the international market which is growing at a steady 4% to 5% per year. In different circumstances the U.S. has one of the best potentials for geo power of any nation due to strong government support, the technical knowhow, experienced developers, and vast geothermal reserves. In addition, the U.S. market is struggling to advance projects because of political gridlock and an uncertain policy environment at the federal level.

While the data shows a deceleration of the U.S. industry for 2013, it is unlikely the market will stay that way for long because of state initiatives that are driving the industry in the longer term. Many industry stakeholders and project developers are excited about numerous policy changes and initiatives that will create new opportunities at the state level. The Imperial Irrigation District (IID) has announced plans to promote development of up to 1,700 MW of new geothermal generation in the Imperial Valley as part of Salton Sea Restoration Initiative. Also, the California Public Utility Commission released a rulemaking authorizing Southern California Edison Company (SCE) to procure 400MW and may procure up to 700MW and San Diego Gas & Electric Company (SDG&E) to procure 200MW and may procure up to 800MW of preferred resources by 2022 to replace the retiring San Onofre Nuclear Generation Station.

Some of these procurements will likely go to other power sources or efficiencies however; favorable economics for geothermal power, such as low levelized costs, no fuel costs, near zero greenhouse gas emissions, and the flexibility of binary power plants will likely make geothermal power a fierce competitor for these RFPs in California. Lastly, A.B. 32 will drive demand for clean, carbon free power sources as California transitions its economy to higher levels of renewable energy integration.

Further east in Nevada, after several months of deliberation the Nevada Public Utilities Commission ruled in accordance with Nevada S.B. 123 on February 18th. Nevada S.B. 123 required the retirement of no less than 300 MW of coal-fired electric generating capacity on or before December 31, 2014, and not less than 250 MW of coal-fired electric generating capacity on or before December 31, 2017. These retiring coal generation facilities will be partially replaced with renewable resources prescribed in 100 MW RFPs in increments for three years beginning in 2014 in addition to the acquisition or construction of 50 MW facilities owned and operated by NV Energy. It's expected geothermal power will win a portion of these 100 MW RFPs, but it will be competitive process.

Lastly, Oregon Public Utilities Commission changed it current methodology for calculating standard renewable avoided cost prices to account for the capacity contribution of different renewable resources and wind integration costs for qualifying facilities of 10 MW or less. When project developers bid for RFPs, the utility company is currently instructed to pick the project that will "purchase power from [renewable facilities] at rates that are just and reasonable to the utility's customers, in the public interest, and that do not discriminate against qualifying facilities . . . that are not more than avoided costs" and "to provide maximum economic incentives for development of qualifying facilities while insuring that the costs of such development do not adversely impact utility ratepayers who ultimately pay these costs." The past methodology for calculating the avoided cost did not factor in the true cost of other renewable power sources, leaving out integration and other ancillary costs. Now the state's utilities must calculate avoided cost using a more balanced methodology.

New Mexico's the first geothermal power plant was completed by Cyrq Energy at Lightning Dock geothermal field, producing 4 MW of electricity. Also, New Mexico passed H.B. 85 that matches federal royalty rates and requires the Land Office to manage geothermal resources as renewable resources. This clarification in geothermal policy may accelerate development in the state. New text in the law states,

> *"Geothermal resources may be administered as a renewable energy resource, in which case any leases for and regulations of a geothermal resource as a renewable energy resource shall require that the geothermal resource not be diminished beneath applicable natural seasonal fluctuations in the measurable quantity, quality or temperature of any area classified as a known geothermal resources field."*

Lastly, the state of Washington's important legislation S.B. 5369 passed and created new opportunities for geothermal power and direct use by clarifying confusing legislation. The new law helps to coordinate and streamline water use permitting for geothermal development in the state. This new law, (1) created a consistent definition with federal and other states' laws; (2) allowed for resource ownership reservation or conveyance; and (3) clarified coordination between water resource regulators and geothermal programs.

In total 25 pieces of legislation were enacted in 13 states that were specific to geothermal power and heating systems. A complete list of those laws is provided here.

Developing Projects

In 2013 there were about 1,000 MW of planned capacity additions and about 3,100 MW of geothermal resource under development. These figures are a drop from the April 2013 report where in 2012, 2,500 MW of planned capacity additions and about 5,100 MW of resource were under development.

The decrease in geothermal power pipeline capacity is likely accredited to slowing demand in the U.S. for new geothermal power projects and the fact that the geothermal power industry historically goes through periods of rapid expansion and then consolidation. The year of 2013 was very much a year of consolidation. For example, Californian geothermal developers report difficulties building utility-scale plants because of weak demand, inadequate transmission, permitting delays, and a lack of coordinated policies are stymieing growth. As a result geothermal developers are dropping projects in earlier stages of development that are no longer economical in the current business environment.

In fact 37% of federal geothermal leases were returned or relinquished between 2007 and 2014.[1] This statistic is not necessarily a sign of great adversity for the domestic geothermal power industry. Geothermal property is regularly leased and traded among project developers and the federal government in order to find the most economic resources or to protect existing resources from competitors. However this statistics is a reflection that some project developers in the U.S. seem to be streamlining their portfolio and focusing on several key areas. These same developers are also focusing on specific projects in later stages of construction or moving their attention overseas, in order to wait for better opportunities at home.

Despite the decrease in the total number of projects, the ratio of projects in later stages of development versus earlier stage projects has stayed roughly the same. As seen in Figure 6, about a third (35%) of projects in the U.S. are in Phases, 2, 3, or 4 and about half (53%) of projects are in Phase 1 or Prospects. In 2013, these figures were 36% and 59% respectively again, demonstrating developers are dropping earlier stage projects and Prospects but are progressing on projects in more developed stages. Projects take four to seven years to complete from cradle to operation, so it’s not uncommon for a project to remain in the same phase for several years at a time.

Figure 6: U.S. Projects by Phase of Development

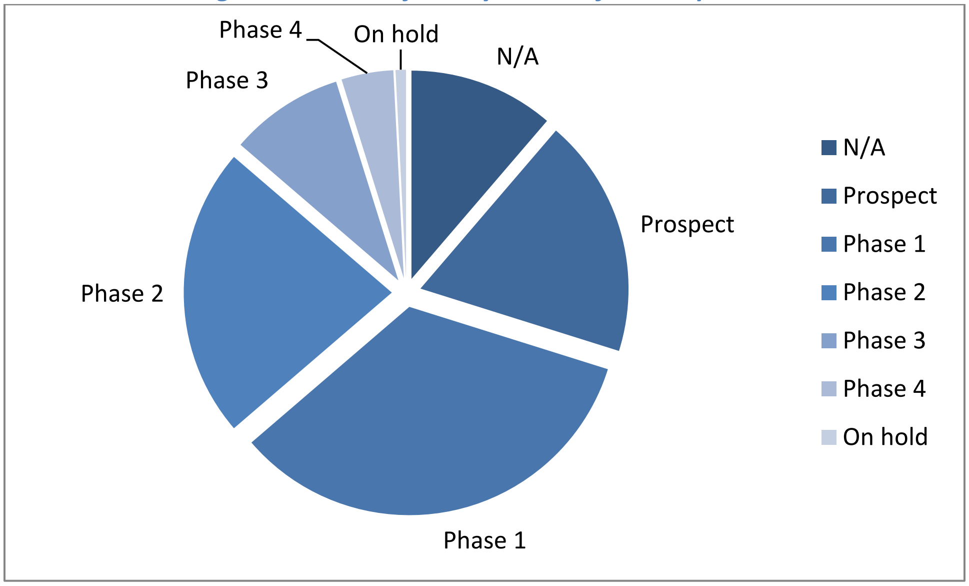
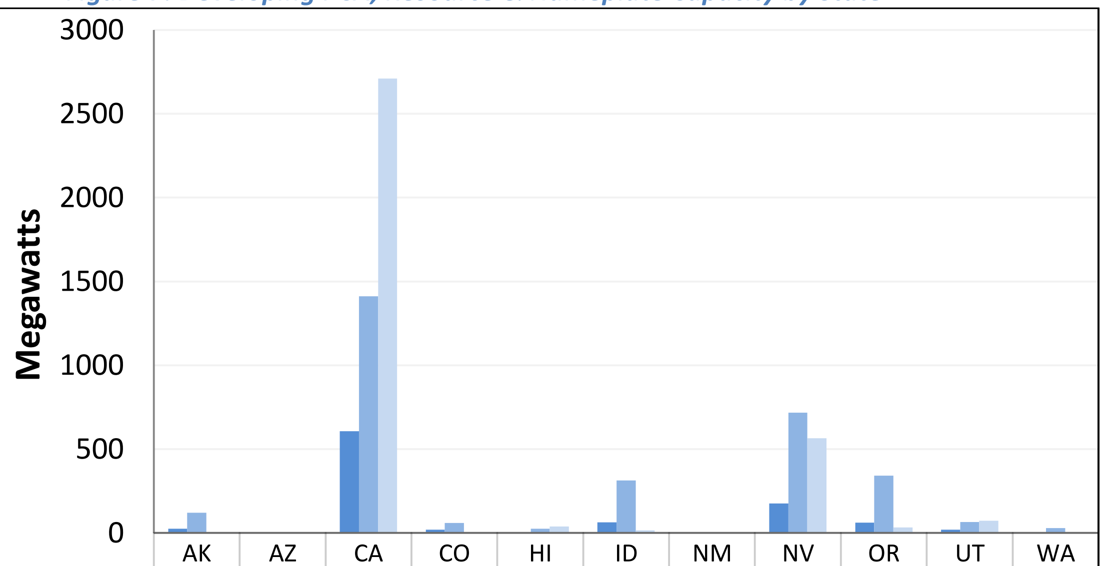


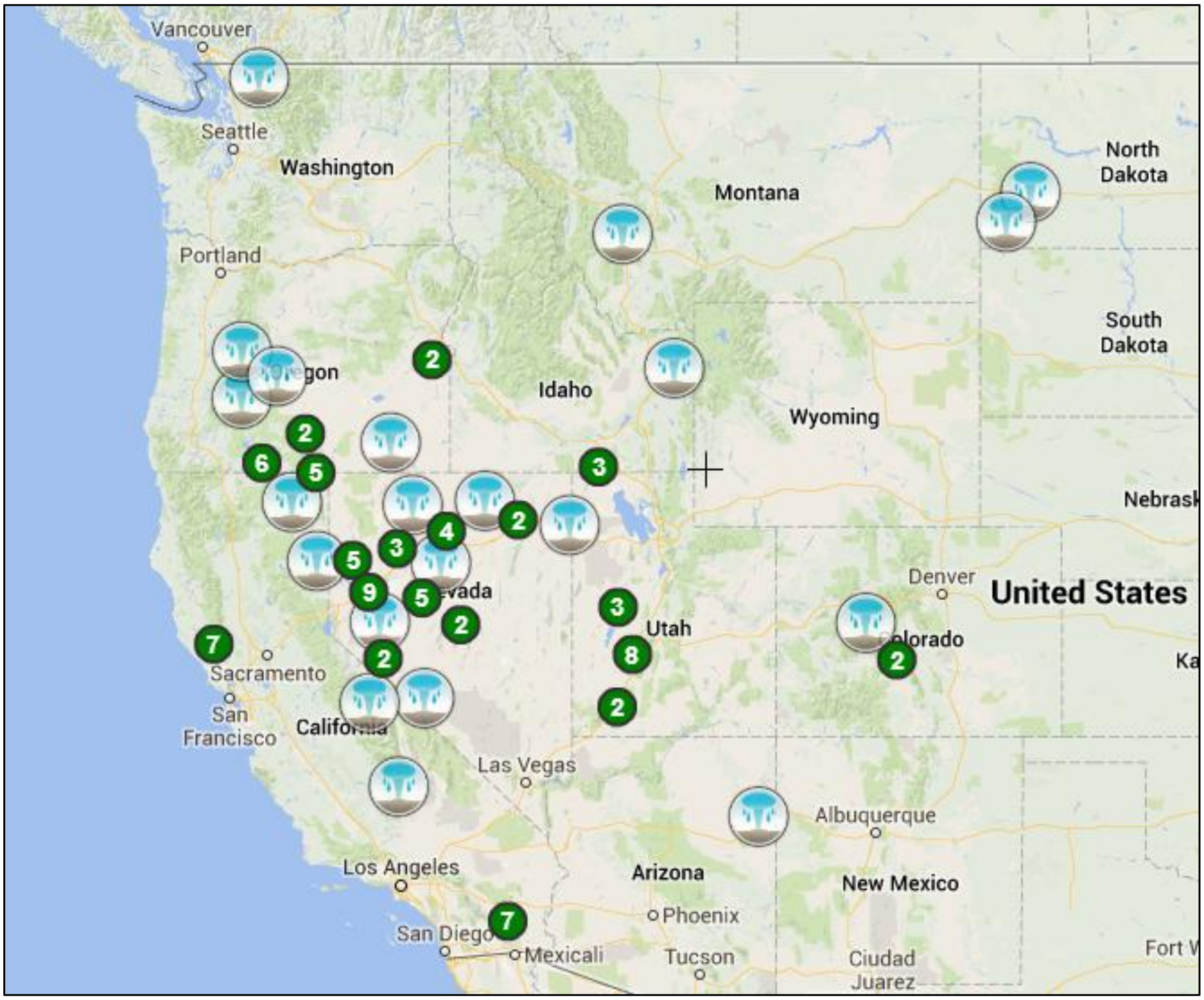
Figure 7 lists the planned capacity additions, developing resource, and the current nameplate capacity divided by state. California is by far the leader in all three categories despite the fact they have fewer developing projects. This is mainly due to the fact that geothermal resources in California are on average of higher temperature, quality, and volume allowing for larger power plants to be built on the same field. While in contrast a state like Nevada hosts nearly double the projects but they tend to be smaller binary power projects of 10-30 MW.

Figure 7: Developing PCA, Resource & Nameplate Capacity by State



	AK	AZ	CA	CO	HI	ID	NM	NV	OR	UT	WA
Developing PCA	25	5	607	20	0	63	0	176	61	20	0
Developing Resource	120	5	1413	60	25	314	0	718	342	65	30
Nameplate Capacity	1	0	2711	0	38	16	4	566	33	73	0

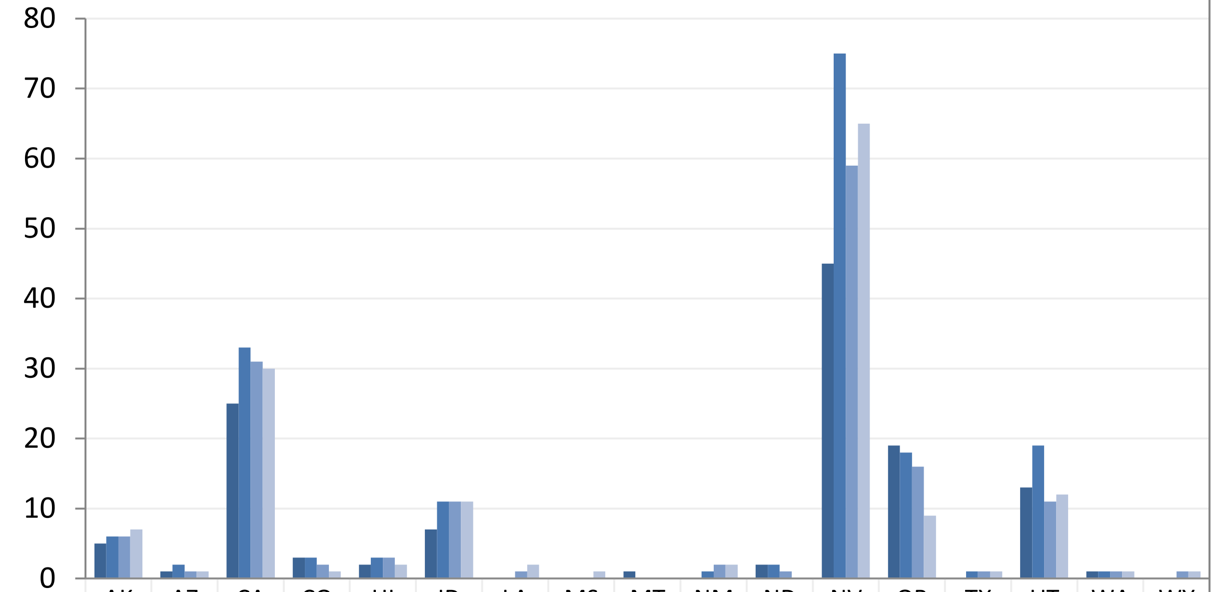
Figure 8: Lower 48 States Developing Geothermal Power Projects



A Green Circle indicates multiple projects at the same location or in very close proximity to one another. The geyser indicates a single project.

Figure 8, places developing projects on a map of the lower 48 states. Projects in Hawaii and Alaska are not included. The green circles indicate multiple projects that are at the same location or in very close proximity to one another while the geyser icon indicates a single project at that location. Notice the clusters of projects in western Nevada, the Salton Sea, the Geysers resource area and Southern Oregon/ Northern California. These projects all fall in highly desirable areas that geothermal developers are actively pursuing to develop geothermal power projects.

Figure 9: Number of Developing Projects by State



	AK	AZ	CA	CO	HI	ID	LA	MS	MT	NM	ND	NV	OR	TX	UT	WA	WY
2014	5	1	25	3	2	7	0	0	1	0	2	45	19	0	13	1	0
2013	6	2	33	3	3	11	0	0	0	1	2	75	18	1	19	1	0
2012	6	1	31	2	3	11	1	0	0	2	1	59	16	1	11	1	1
2011	7	1	30	1	2	11	2	1	0	2	0	65	9	1	12	1	1

Nevada still leads as one of the most business-friendly environments for geothermal power in the U.S. and globally. Project developers report the legislative framework of Nevada makes it an easy place to explore for resources, explaining the proportionally high amount of exploration and geothermal activity in the state. If Nevada was an independent country it would rank 8th for nameplate capacity. While many earlier stage exploration projects were dropped this year due to falling demand, projects in later stages of construction still progressed forward. Some projects in California were also dropped due to a difficult business environment and inadequate transmission infrastructure for geothermal power projects.

New Mexico's only power project that had been listed in previous reports as "under development" was completed this year by Cyrq Energy. Meanwhile projects in Alaska, Utah, and Idaho continued to move forward. Promising drilling results at City of Akutan's project could mean it won't be long before Alaska has its first utility-scale power plant.

U.S. 2014 Developing Project List

Table 2: U.S. Developing Geothermal Power Projects 2014

Project Name	Developer	Estimated Installed Capacity (MW)	Estimated Resource Capacity (MW)	Project Type	Location (State, County)	Project Phase
Abraham	Cyrq Energy			CH Unproduced	UT, Millard	Prospect
Agua Quieta	Ormat Nevada Inc.			CH Unproduced	NV, Churchill	Phase 1
Akutan Geothermal Project	City of Akutan	10	10	CH Unproduced	AK, Aleutians East Borough	Phase 2
Alligator Geothermal	Oski Energy			CH Unproduced	NV,	N/A
Alvord	Cyrq Energy			CH Unproduced	OR, Harney	Phase 1
Apache County Project	GreenFire Energy	5	5	Enhanced Geothermal Systems	AZ, Apache	Phase 1
Argenta	Ormat Nevada Inc.			CH Unproduced	NV, Lander	Phase 1
Aurora	Gradient Resources		60	CH Unproduced	NV, Mineral	Phase 2
Bald Mountain (Project CA)	Oski Energy			CH Unproduced	CA, Sonoma & Napa	N/A
Black Rock 1-2	CalEnergy	159	235	CH Produced	CA, Imperial	Phase 3
Black Rock 5-6	CalEnergy	235	235	CH Produced	CA, Imperial	Phase 3
Bottle Rock Expansion*	Bottle Rock Power*	55	55	CH Expansion	CA, Lake	N/A
Brady EGS	Ormat Technologies			Enhanced Geothermal Systems	NV, Churchill	Phase 4
BuckEye North Geysers*	Calpine*		30	CH Produced	CA, Sonoma	Prospect
Canby Cascaded Geothermal Development Project	Canby Geothermal, LLC	0.25	5	CH Unproduced	CA, Modoc	Phase 3
Carson Lake	Ormat Nevada Inc.		10	CH Unproduced	NV, Churchill	Phase 2
CD4 (Mammoth Complex)	Ormat Nevada Inc.		25	CH Unproduced	CA, Mono	Phase 2
Chena Hot Springs 2*	Chena Hot Springs 2*	0.4	5	CH Produced	AK, Fairbanks North Star Burrough	Phase 4
City of Aspen Geothermal Project*	City of Aspen*			CH Unproduced	CO, Pitkin	Phase 2
Colado	Gradient Resources		60	CH Unproduced	NV, Pershing	Phase 2
Cove Fort	Oski Energy			CH Produced	UT, Beaver & Millard	N/A
Cove Fort 2	Enel North America	20	65	CH Unproduced	UT, Beaver & Millard	Phase 1
Cricket	Cyrq Energy			CH Unproduced	UT, Millard	Prospect
Crump Geyser JV of Ormat/AER	Crump Geothermal Company, LLC (AER)	10	80	CH Unproduced	OR, Lake	Phase 2
Crump Geyser JV of Ormat/AER	Crump Geothermal Company, LLC (Ormat)		15	CH Unproduced	OR, Lake	Phase 2
DeArmand	Cyrq Energy			CH Unproduced	UT, Iron	Prospect
Desert Queen	Magma Energy (U.S.) Corp			CH Unproduced	NV, Churchill	Phase 1

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Devils Canyon	Cyrq Energy			CH Unproduced	NV, Nye	Prospect
Dixie Meadows	Ormat Nevada Inc.		30	CH Unproduced	NV, Churchill	Phase 2
Drum Mountain	Cyrq Energy			CH Unproduced	UT, Millard	Prospect
Drum Mountain	Standard Steam Trust			CH Unproduced	UT, Juab & Millard	Phase 1
Fallon	Gradient Resources		50	CH Unproduced	NV, Churchill	Phase 2
Foley Hot Springs	Ormat Nevada Inc.			CH Unproduced	OR, Lane	Phase 1
Four Mile Hill*	Calpine*		50	CH Unproduced	CA, Siskiyou	Prospect
GeoHeat Center 2*	Oregon Institute of Technology*		1.75	CH Expansion	OR, Klamath	Phase 4
Gerlach	U.S. Geothermal	18	25	CH Unproduced	NV, Washoe	Phase 2
Gerlach Power	Kodali, INC.		60	CH Unproduced	NV, Washoe	Phase 1
Geysers Project	Ram Power	26	26	CH Produced	CA, Sonoma	Phase 3
Glass Mountain*	Calpine*		320	CH Unproduced	CA, Siskiyou	Prospect
Goose Lake	Ormat Nevada Inc.		15	CH Unproduced	OR, Lake	Phase 1
Granite Creek	U.S. Geothermal			CH Unproduced	NV, Washoe	Phase 1
Granite Springs	Magma Energy (U.S.) Corp			CH Unproduced	NV, Pershing	Phase 1
Harmon Lake	Enel North America	15	15	CH Unproduced	NV, Churchill	Phase 1
Hawthorne	Oski Energy			CH Unproduced	NV, Mineral	N/A
Hawthorne Army Depot	Navy Geothermal Program		10	CH Unproduced	NV, Mineral	Phase 2
Hot Pot	Oski Energy			CH Unproduced	NV, Humboldt	N/A
Hot Springs Point	Earth Power Resources			CH Unproduced	NV, Eureka	On hold
Hudson Ranch Power II	EnergySource	49.9	50	CH Unproduced	CA, Imperial	Phase 2
HV	Oski Energy		75	CH Unproduced	CA,	N/A
Klamath Hills	Entiv Organic Energy	8	8	CH Unproduced	OR, Klamath	Phase 2
Klamath Plant	Cyrq Energy			CH Unproduced	OR, Klamath	Phase 2
KN	Oski Energy			CH Unproduced	CA	N/A
Kodali Dixie Valley 1	Kodali, INC.		25	CH Produced	NV, Churchill	Prospect
Kodali Dixie Valley 2	Kodali, INC.		60	CH Produced	NV, Churchill	Prospect
Kodali Raft River	Kodali, INC.		50	CH Produced	ID, Cassia	Prospect
Ks	Oski Energy		75	CH Unproduced	CA,	N/A
Kula	Ormat Nevada Inc.		25	CH Unproduced	HI, Big Island	Phase 1
Lee Hot Springs	Earth Power Resources	16	32	CH Unproduced	NV, Churchill	Phase 3
Lower Klamath Wildlife Refuge	Entiv Organic Energy	5	5	CH Unproduced	CA, Siskiyou	Phase 2
Marys River	Standard Steam Trust			CH Unproduced	NV, Elko	Phase 1
Marys River SW	Standard Steam Trust			CH Unproduced	NV, Elko	Phase 1
MCAS Yuma Chocolate Mountains/Glamis	Navy Geothermal Program		15	CH Unproduced	CA, Imperial	Phase 1
McCoy	Magma Energy (U.S.) Corp			CH Unproduced	NV, Churchill & Lander	Phase 1
Midnight Point	Ormat Nevada Inc.		25	CH Unproduced	OR, Lake	Phase 1

Mount Spurr	Ormat Nevada Inc.		50	CH Unproduced	AK	Phase 1
Mt Princeton	Mt Princeton Geothermal LLC	10	50	CH Unproduced	CO, Chaffee	Phase 2
Mt. Baker	Gradient Resources		30	CH Unproduced	WA, Whatcom	Phase 1
NAF El Centro/Superstition Hills	Navy Geothermal Program		25	CH Unproduced	CA, Imperial	Phase 1
NAF El Centro/Superstition Mountain	Navy Geothermal Program			CH Unproduced	CA, Imperial	Phase 1
Naval Air Station Fallon: Dixie Valley	Navy Geothermal Program		10	CH Unproduced	NV, Churchill	Phase 1
Naval Air Station Fallon-Main	Navy Geothermal Program		10	CH Unproduced	NV, Churchill	Phase 2
Neal Hot Springs II	U.S. Geothermal			CH Unproduced	OR, Malheur	Phase 2
Newberry	Davenport Newberry Holdings/AltaRock Energy		120	Enhanced Geothermal Systems	OR, Deschutes	Phase 2
Newdale	Standard Steam Trust			CH Unproduced	ID, Freemont & Madison	Phase 1
North Valley	Alternative Earth Resources	55	120	CH Unproduced	NV, Washoe & Churchill	Phase 2
NVN092478*	Presco Energy*			CH Unproduced	NV,	Prospect
Olene Gap	Kodali, INC.	17	17	CH Produced	OR, Klamath	Phase 2
Olene Gap (Project Oregon)	Oski Energy			CH Unproduced	OR, Klamath	N/A
Olene KBG	Klamath Basin Geopower	12	20	CH Unproduced	OR, Klamath	Phase 2
OM Power	Kodali Inc (OM Power 1, LLC.)	11	30	CH Unproduced	OR,	Phase 3
Paisley Geothermal	Surprise Valley Electric Corp.	3	10	CH Unproduced	OR, Lake	Phase 4
Parma	Standard Steam Trust			CH Unproduced	ID, Canyon	Phase 1
Pavant	Cyrq Energy			CH Unproduced	UT, Millard	Prospect
Pilgrim Hot Springs Geothermal Exploration Project	Alaska Center for Energy and Power (Research); Unaatuq (Land Owner)	5	5	CH Unproduced	AK, Nome	Phase 3
Pilot Peak	Oski energy			CH Unproduced	NV, Elko	N/A
Poncah Hot Springs	Mt Princeton Geothermal LLC	10	10	CH Unproduced	CO, Chaffee	Phase 2
Pumpernickel	Alternative Earth Resources (AER)	30	33	CH Unproduced	NV, Humboldt	Phase 2
Pyramid Lake	Paiute Tribe	0	2	CH Unproduced	NV, Pyramid Lake Paiute Tribe Reservation	N/A
Raft River Unit II	U.S. Geothermal	16.6	114	CH Produced	ID, Cassia	Phase 3
Raft River Unit III	U.S. Geothermal	16.6		CH Produced	ID, Cassia	Phase 1
Rye Patch*	Presco Energy*		13	CH Unproduced	NV, Pershing	Prospect
San Emidio Phase II	U.S. Geothermal	12.75	44	CH Produced	NV, Washoe	Phase 3
San Emidio Phase III	U.S. Geothermal	24.6	44	CH Produced	NV, Washoe	Phase 1
Silver Lake	Ormat Nevada Inc.			CH Unproduced	OR, Lake	Prospect
Silver Peak	Rockwood Lithium Inc. sponsored by U.S. DOE	5	5	CH Unproduced	NV, Esmeralda	Phase 4

Silver State Valley	Oski Energy			CH Unproduced	NV, Humboldt	N/A
Soda Lake East	Magma Energy (U.S.) Corp			CH Unproduced	NV, Churchill	Prospect
Soda Lake South	Magma Energy (U.S.) Corp			CH Unproduced	NV, Churchill	Phase 1
Summer Lake	Ormat Nevada Inc.			CH Unproduced	OR, Lake	Phase 1
Surprise Valley	Enel North America	15	15	CH Unproduced	CA, Modoc	Phase 2
Surprise Valley Hot Springs*	Cornerstone Sustainable Energy/ Warner Mountain Energy Corp.*	1.5	1.5	CH Unproduced	CA, Modoc	Phase 1
Telephone Fiat*	Calpine*		50	CH Unproduced	CA, Siskiyou	Prospect
Thermo 3	Cyrq Energy			CH Produced	UT, Beaver	Phase 1
Thermo 4	Cyrq Energy			CH Produced	UT, Beaver	Phase 1
Thermo Central	Cyrq Energy			CH Produced	UT, Beaver	Prospect
Thermo Greater	Cyrq Energy			CH Produced	UT, Beaver	Prospect
Trail Canyon	Cyrq Energy			CH Unproduced	NV, Nye	Prospect
Truckee	Cyrq Energy			CH Unproduced	NV, Nye	Prospect
Truckhaven	Alternative Earth Resources (AER)	30	60	CH Unproduced	CA, Imperial	Phase 2
Tungsten Mountain	Ormat Nevada Inc.			CH Unproduced	NV, Churchill	Phase 2
Tuscarora - Phase II	Ormat Technologies			CH Unproduced	NV, Elko	Phase 1
Twilight	Ormat Nevada Inc.			CH Unproduced	OR, Deschutes	Phase 1
Ulupalakua (Maui)	Ormat Nevada Inc.			CH Unproduced	HI, Maui	Phase 1
Unalaska Geothermal Project	City of Unalaska	10	50	CH Unproduced	AK, Aleutians West County	Phase 1
UND Coproduction	University of North Dakota	0.25	0.25	Hydrocarbon Coproduction	ND, Slope	Phase 1
UND Low Temperature Project	University of North Dakota	0.35	0.35	Hydrocarbon Coproduction	ND, Stark	Phase 1
Upsal Hogback	Magma Energy (U.S.) Corp			CH Expansion	NV, Churchill	Phase 1
Walker Ranch	Agua Caliente, LLC	30	150	CH Unproduced	ID, Cassia	Phase 3
Warm Springs	Dewhurst Group/ State of Montana			Geopressured Systems	MT, Silver Bow	Phase 1
Weiser	Standard Steam Trust			CH Unproduced	ID, Washington	Phase 1
Wendel	Oski Energy			CH Produced	CA, Lassen	N/A
Wildhorse North Geysers*	Calpine*		30	CH Produced	CA, Sonoma	Prospect
Wister - Phase I	Ormat Technologies	30	30	CH Unproduced	CA, Imperial	Phase 3
Wood Ranch	Cyrq Energy			CH Unproduced	UT, Iron	Prospect

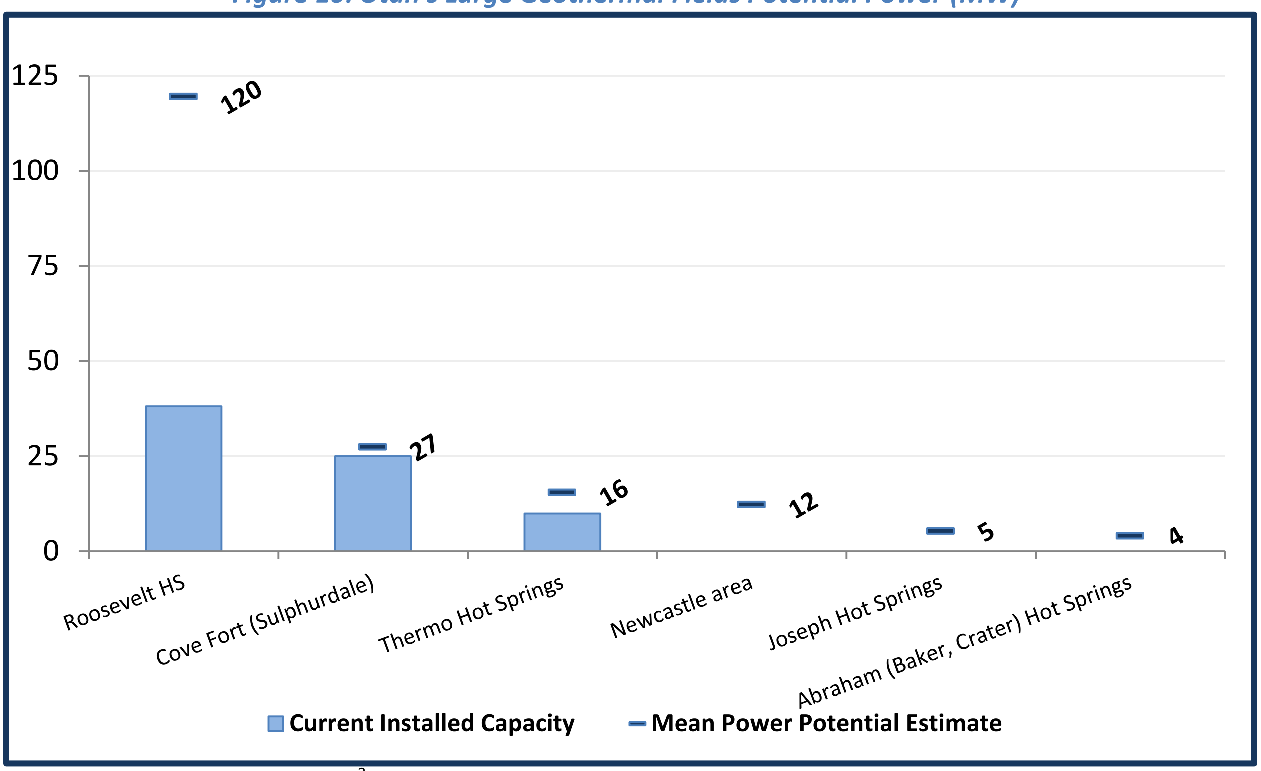
Note: “*” Indicate a project that was not able to be verified by GEA.

Leading Geothermal Power States' Potential

Some myths have surfaced that geothermal power is reaching its potential capacity in states like California and Nevada. These states still have a significant amount of geothermal power that could be used domestically or exported to surrounding states. Figures 10, 11 and 12 demonstrate the untapped potential of selected large fields in three states, California, Nevada, and Utah. Notice some fields in Figures 11 and 12 already exceed their estimated mean certainty. Since these estimates were derived from probabilistic heat-in-place estimates it is possible to exceed the estimated reserves. Overall about 50% of California's estimated resources, 60% of Nevada's, and 60% of Utah's are still untapped.

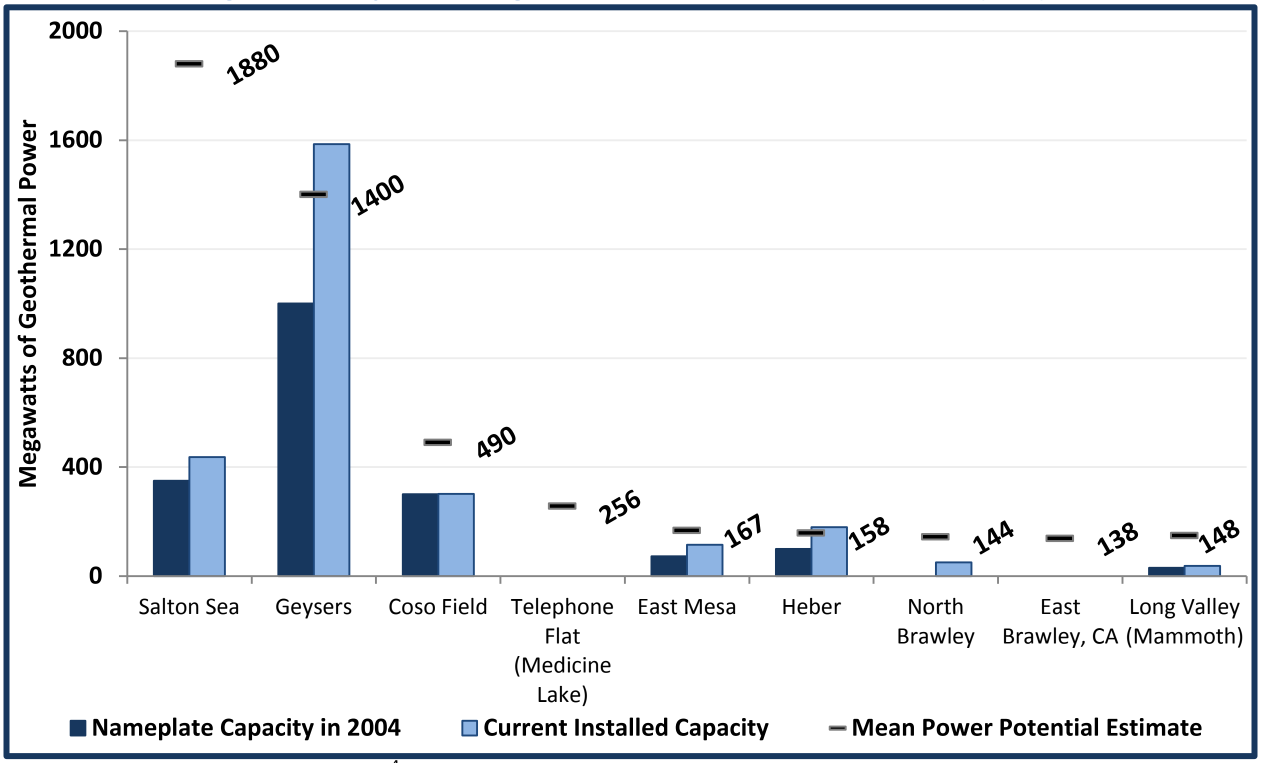
Note that Figures 10, 11, and 12 are derived from probabilistic Monte Carlo heat-in-place estimates. Therefore it's always possible for the true reservoir to be much larger or smaller depending on the accuracy and detail of the input parameters used to make the estimate. Geothermal reservoir exploration and assessment should be thought of as a continuing process as project developers learn about the resource. For example, in Figure 11 the current installed capacity far exceeds the estimated power potential capacity at the Steamboat resource. However, Steamboat is something of a mystery to geothermal resource experts. Based on what is known about the size of the reservoir and the rate of hot water inflow, the productivity of the reservoir is much higher than it should be. Possible reasons are (1) the reservoir is larger than commonly believed or (2) there is a much more rapid influx of hot water than documented. So to conclude, the charts depict only probabilistic estimates that are good approximations but it's not uncommon for the actual size of that field to be much larger or smaller than heat-in-place estimates can predict.[2]

Figure 10: Utah's Large Geothermal Fields Potential Power (MW)



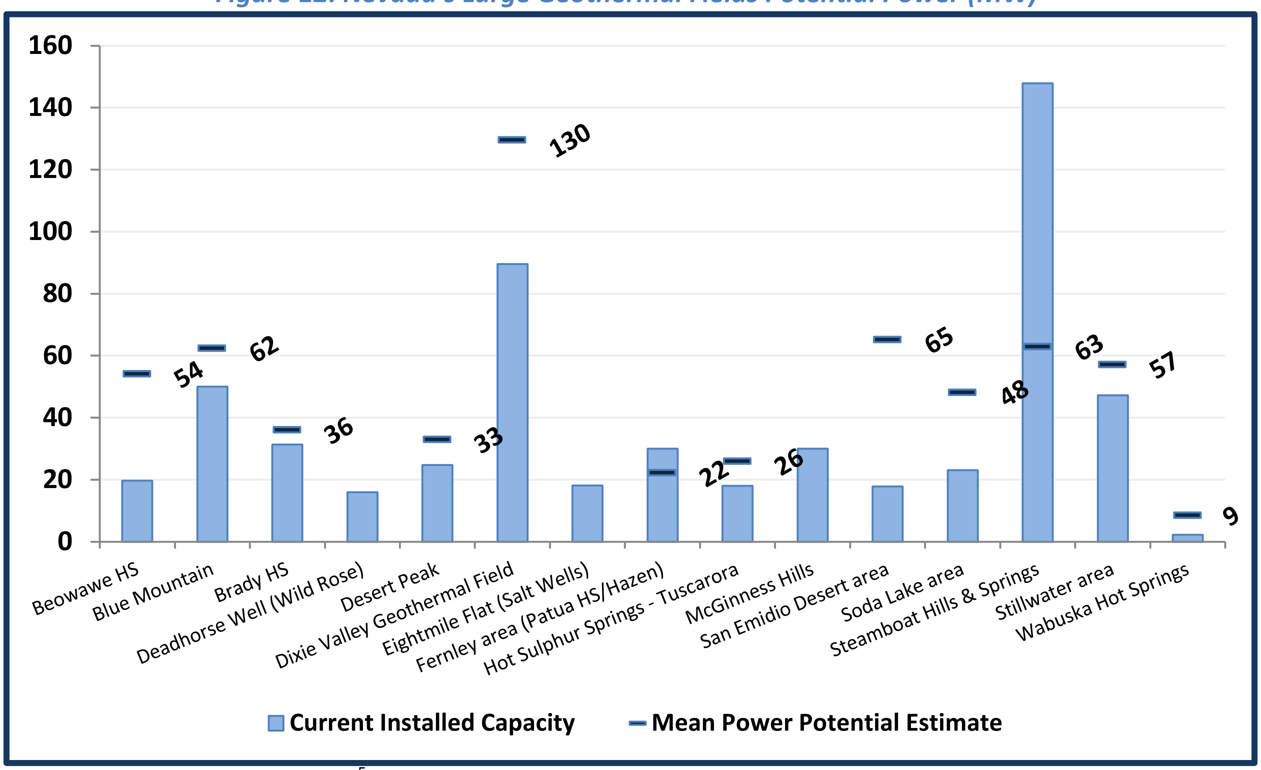
Source: USGS Factsheet and GEA[3]

Figure 11: California's Large Geothermal Fields Potential Power (MW)



Source: Lovekin et al. 2004 and GEA[4]

Figure 12: Nevada's Large Geothermal Fields Potential Power (MW)



Source: USGS Factsheet and GEA[5]

Works Cited

[1] Communication with Kermit Witherbee, NREL
[2] Communication with Colin Williams, USGS
[3] See "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States" by U.S. Geological Survey, 2008.
[4] See "New Geothermal Site Identification and Qualification" by Christopher Klein, James Lovekin, Subir Sanyal, 2004.
[5] See "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States" by U.S. Geological Survey, 2008.