2015 Annual U.S. & Global Geothermal Power Production Report

GEOTHERMAL ENERGY ASSOCIATION

GEO-ENERGY.ORG

Contents

Written and Prepared by Benjamin Matek, Geothermal Energy Association
February 2015

Acknowledgments:

GEA would like to sincerely thank its member companies, as well as other organizations and individuals, for their cooperation and assistance in gathering the information used in this report. GEA would also like to thank members of its Science and Technology Committee for reviewing this publication before release.

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

Geothermal Power Industry Highlights

International

- GEA data shows a total of 21 new power plants came online in 2014 adding about ~610 MW of new capacity to electricity grids globally. According to GEA statistics this is the most capacity to come online in one year since 1997.
- This is the third year in a row the global geothermal industry has sustained a growth rate of 5%.
- The global market is at about 12.8 GW of operating capacity as of January 2015, spread across 24 countries.
- This year the global geothermal market was developing about 11.5-12.3 GW of planned capacity spread across 80 countries.
- Based on current data the global geothermal industry is expected to reach between 14.5 GW and 17.6 GW by 2020.
- Overall if all countries follow through on their geothermal power development goals and targets the global market could reach 27-30 GW by the early 2030s.
- Flash technologies, including double and triple flash, make up a little less than two thirds of the global market (58%), while dry steam is about a quarter (26%) and binary is a remaining 15%. The last remaining 1% includes back pressure and other developing and experimental types of geothermal technologies.
- The United Nations this year formed a Global Geothermal Alliance. This alliance was signed by 23 countries. The alliance is a partnership platform among governments for working to reduce the investment risks associated with exploratory drilling, along with the associated costs, which have constituted a main obstacle to geothermal power expansion and offers.
- The World Bank estimates as many as 40 countries could meet a large proportion of their electricity demand through geothermal power.
- Communities and governments around the world have only tapped 6.5% of the total global potential for geothermal power based on current geologic knowledge and technology.
- Since 2005, over 160 geothermal power projects have been built adding an additional 4 GW to electricity grids across the globe.

United States

- The U.S. industry had about 3.5 GW of installed nameplate capacity and 2.7[1] GW of net capacity at the end of 2014.
- In total the U.S. market had about 1,250 MW of geothermal power under development with about 500 MW stalled in Phase 3 waiting for power purchase agreements (PPAs). These are projects that could be brought online in 17-33 months, or sooner with the appropriate power contracts.
- Since 2005, the United States has built over 38 geothermal power projects adding nearly 700 MW to the U.S. electricity capacity.

Methodology and Terms

To increase the accuracy and value of information presented in its annual U.S. 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: 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, GEA also asks developers to indicate 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 PPAs 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 plant's estimated installed capacity." In other words, the PCA estimate is usually the power plant's expected 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 term 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. Many definitions of 'Under Construction' do include production drilling. However, GEA looks at the projects on a case by case basis to determine if production drilling is enough to determine 'Under Construction' status. Based on the available information, sometimes a project must begin physical work on the power plant to be considered in this stage of development. 'Under Construction' is roughly equivalent to GEA's Phase 4 of a project's development but may contain elements of Phase 3 depending on the geothermal market and location of the plant.

'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.

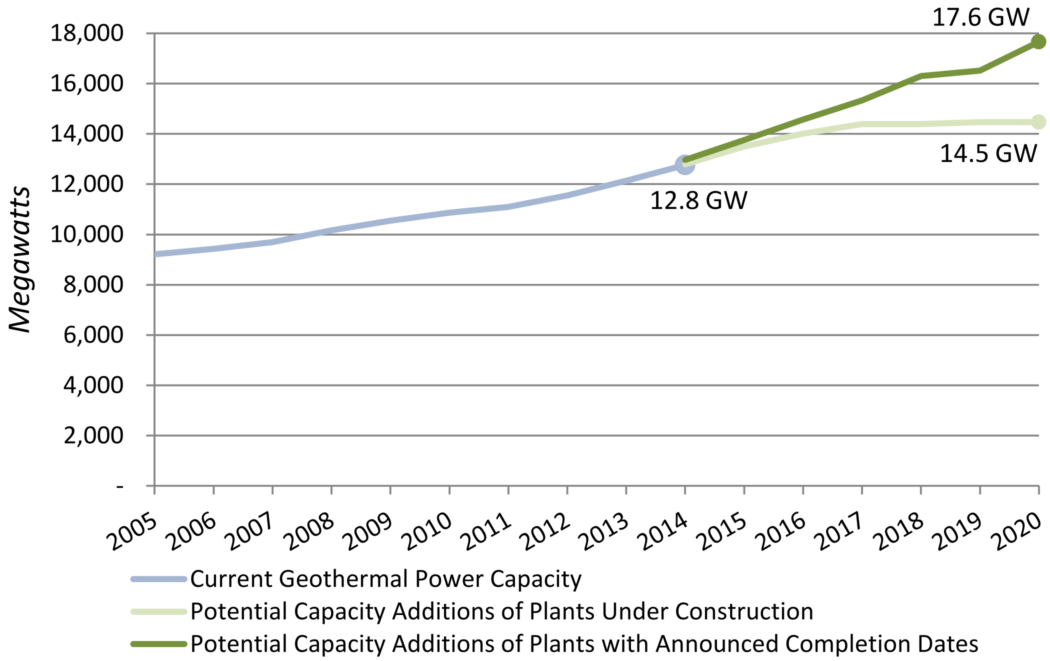
Projects **'On Hold'** are when forward progress on the projects has halted for any number of reasons not limited to land or religious disputes, loss of project funding, or an agreement that fell apart.

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 plant's 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

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.

Geothermal power industry global in 2014 sustained a 5% growth rate for the third year in a row. The world market reached upwards of 12.8 GW (gigawatts) of geothermal power operational throughout 24 countries. The majority of this new capacity became operational in Turkey, Kenya, Indonesia, and the Philippines with a total of about 610 MW of new power brought online in 2014. As of the end of 2014, there are also 11.5-12.3 GW of capacity additions in 80 countries and 630 projects. Fourteen of those 80 countries are expected to bring 2 GW of power online over the next 3-4 years based on current construction. Looking at projects in the pipeline, it is expected that the geothermal industry will continue to grow at a steady pace globally. The longer development time frames of geothermal projects make them somewhat more immune to the booms and busts of the global energy space.

GEA forecasts the global market will reach between 14.5 to 17.6 GW by 2020. The 14.5 GW forecast is comprised of announced completion dates of plants already under construction, therefore, extremely conservative. Since projects normally take about 2-3 years to construct, and the forecast goes out five years, more projects will likely announce construction over the next year or two, increasing the tail end of this forecast. The 17.6 GW forecast, is much more likely. This number is comprised of plants with announced completion dates and/or under construction. This growth will come from European, East African, and South Pacific markets as these regions lead geothermal' s growth by substantial capacity additions in the next five years.

This growth supported by the World Bank and other multi-lateral organizations focused on early risk mitigation. For example, the World Bank's Energy Sector Management Assistance Program (ESMAP) has mobilized $235 million through the Clean Technology Fund toward scaling up geothermal energy. This is part of their Global Geothermal Development Plan (GGDP). Projects identified in Latin America including Mexico, Chile, Nicaragua, Dominica and St. Lucia and the Caribbean are expected to or already received funding from this program to move projects forward. To date, ESMAP has identified 36 geothermal fields in 16 countries where surface exploration has been completed and additional financing is needed in the near future to confirm the commercial viability of geothermal resources. ESMAP also estimates as many as 40 countries could meet a large proportion of their electricity demand through geothermal power.[2]

Meanwhile, governments around the world implemented policies to increase renewable domestic electricity generation as part of the solution toward lowering the emissions that contribute to global warming. The result was expanded geothermal production and development across the globe, and based on the additional projects already in process, it looks like the trajectory will continue for at least another decade.

For example the United Nations this year formed a Global Geothermal Alliance signed by 23 countries. This alliance will work to reduce the investment risks associated with exploratory drilling along with the associated costs which have constituted a main obstacle to geothermal power expansion. The Alliance offers a partnership platform among governments, international financing institutions, private sector investors and other stakeholders to provide customized support in addressing key challenges.

Geothermal power has continued to heat up in Latin America and several countries have set national geothermal goals. For example, El Salvador plans 40% of energy to come from geothermal power by 2020. Mexico wants to get 35% of its energy from renewables including geothermal power. Nicaragua plans to build another 100 MW in the next 15 years. Others such as Costa Rica and Guatemala have not set a specific geothermal goal but already have several plants under construction.

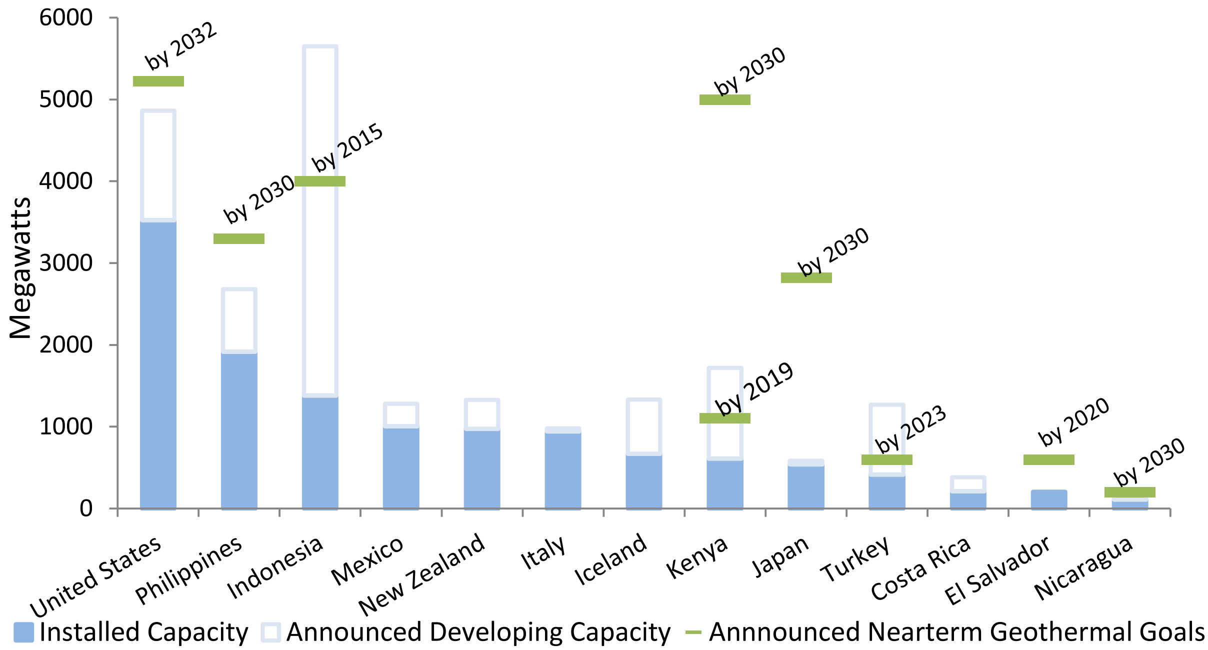
East Africa is another regional hotbed for activity. Kenya, Rwanda, Ethiopia and Tanzania all have set geothermal power goals. While not making the chart (Figure 2) below, Ethiopia plans to have an additional 1,000 MW built by the early 2020s; the country's Corbetti geothermal field, one of the largest in the world, is currently under development. Meanwhile Tanzania plans to build 180 MW over the next few years. Overall if all countries follow through on their geothermal power goals the global industry could reach 27-30 GW by the early 2030s.

Many important geothermal markets have announced development goals. Some are more realistic than others; Indonesia seems unlikely to reach the goal set several years ago due to reports of permitting delays. Still, it is likely that many of these resources will be developed by the 2030s and the increasing importance of developing clean energy sources to combat climate change globally is expected to contribute to the demand for new geothermal power plants globally through the 2030s.

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, Germany, Kenya, and Turkey in 2014. Kenya, Turkey, Ethiopia, and Germany are quickly developing geothermal power infrastructure. In addition, it is likely within the next decade or so the Philippines, Indonesia or the European Union could each roughly equal the U.S. in installed capacity. By looking at projects in the pipeline, other smaller countries are likely to become more established geothermal power markets as the percentages of their power from geothermal resources increase due to increased development.

Figure 5 depicts developing capacity of geothermal power projects by country and by amount of projects for select countries that are developing 50 MW or more according to GEA data. Several characteristics affect the amount of power or projects a country is developing, including but not limited to its climate goals, its size, discovered resources, amount of geothermal leases made available to developers and the structure of a country's power market.

Figure 2: Important Geothermal Markets Announced Planned Capacity Additions & Targets



Note: "Nearterm Goals" includes government and private sector development goals. Mexico has set a general renewable energy goal of 35% of generation from renewables by 2024; however, this goal is not geothermal specific. The U.S. goal is Imperial Irrigational District's objective of building out geothermal capacity at the Salton Sea Resource Area by 2032.

According to estimates from the Intergovernmental Panel on Climate Change reflecting current geologic knowledge, there are 200 GW of traditional hydrothermal geothermal resources identified globally. Therefore, communities and governments around the world have only tapped 6.5% of the total global potential for geothermal power based on current geologic knowledge.[3]

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

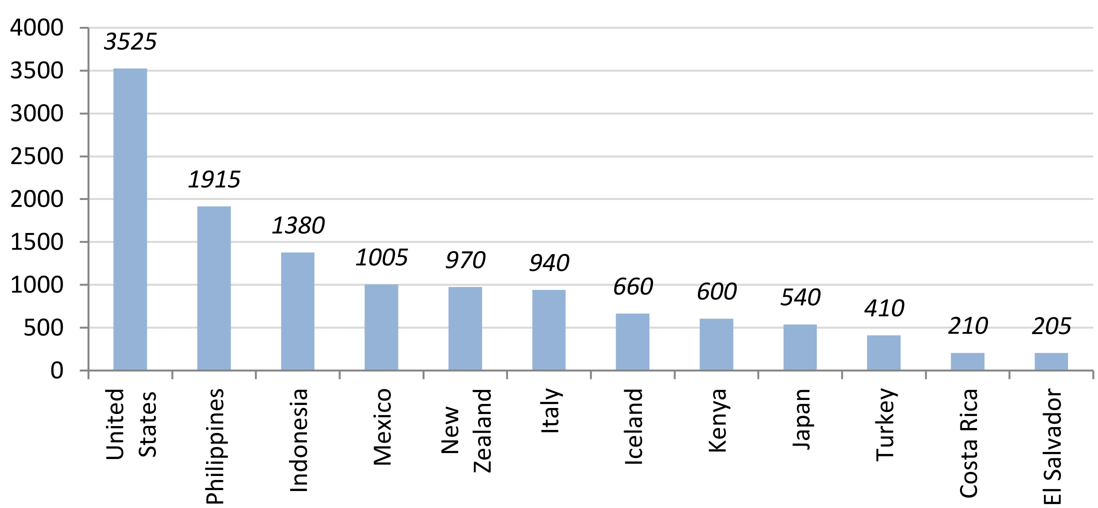
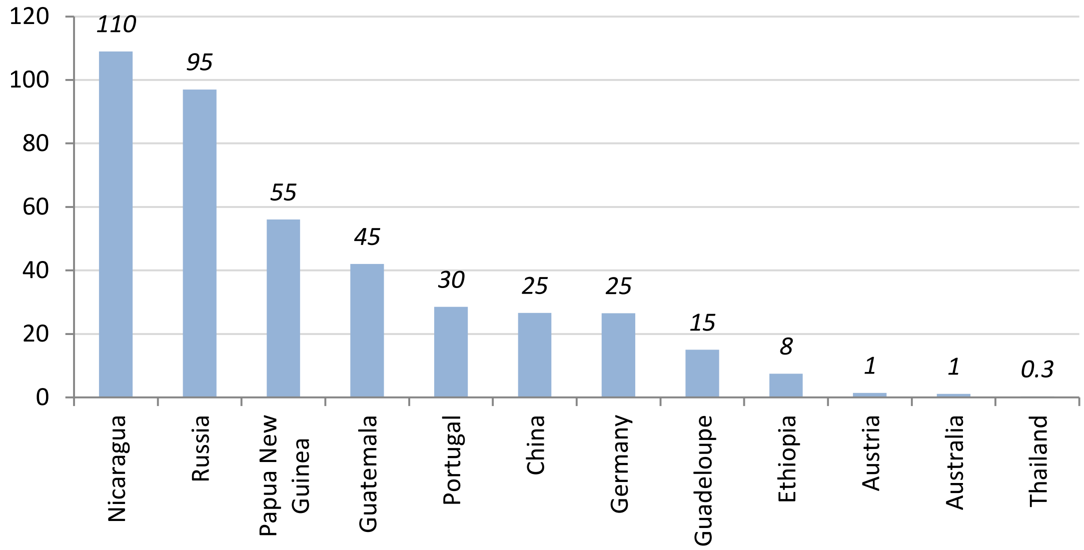
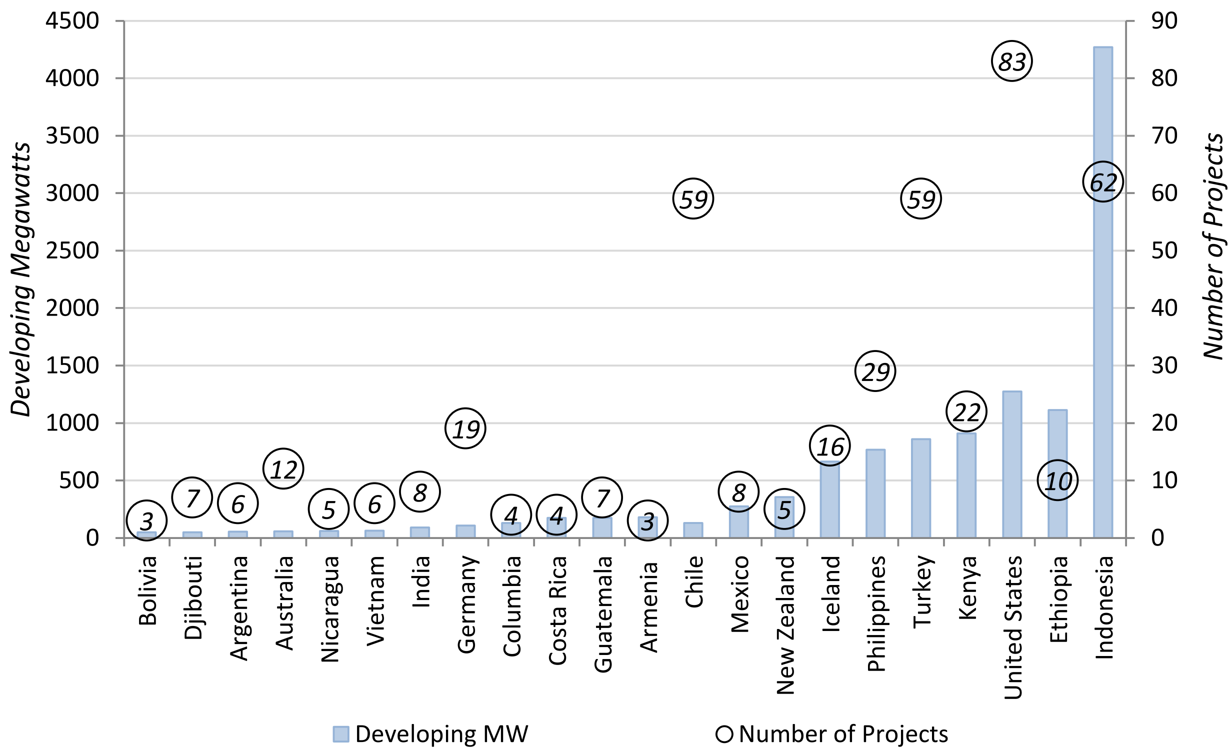


Figure 4: Developing Geothermal Power Markets Installed Nameplate Capacity (MW)



Note: Estimates on data labels for Figure 3 & 4 are rounded to the nearest '5' MWs and 'nameplate capacity' is often used to derive these estimates but also 'net capacity' is used when nameplate is not available.

Figure 5: Developing Projects and Capacity by Country or Territory



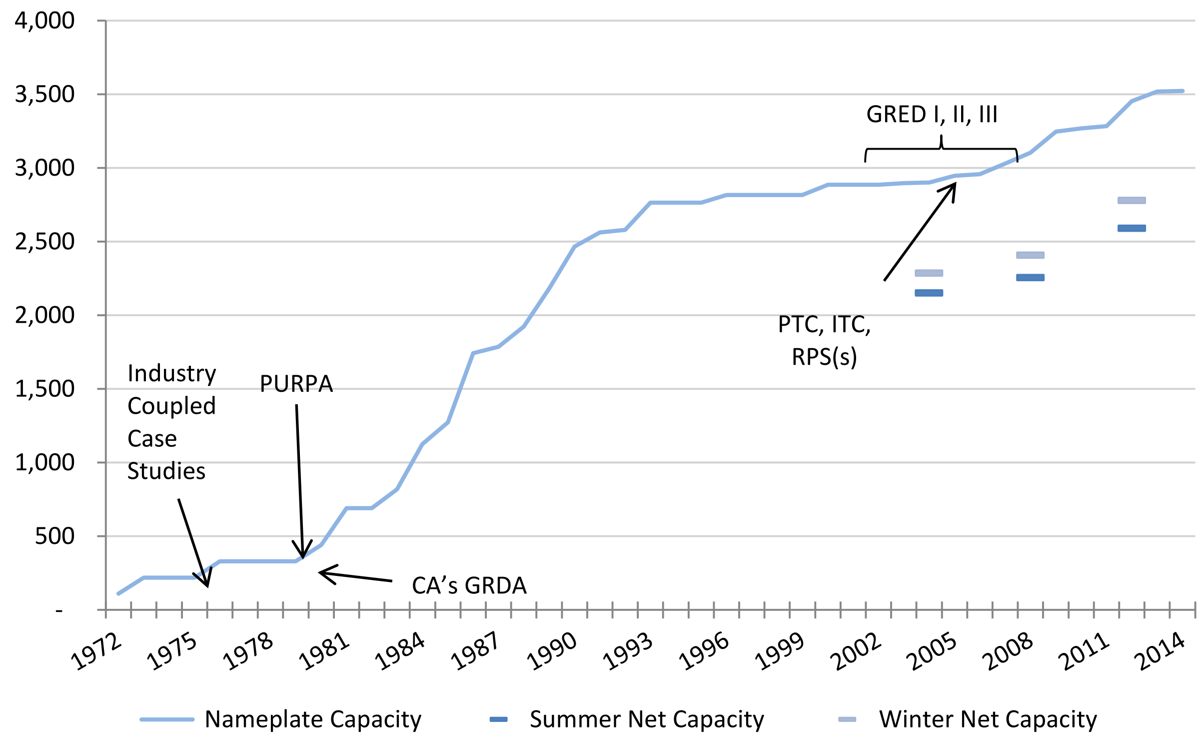
Note: A full international project list is published in conjunction with this report. The extraordinary amount of developing capacity for Indonesia could possibly be the result of the backlog of projects in the country stalled by prolonged PPA negotiations, delayed permits related to the usage of conservation or protected areas and resistance from local residents.

U.S. Geothermal Power Update

Market Summary

Overall the U.S. market hovers just over 3.5 GW of operating nameplate capacity and just over 2.7 GW of net capacity. While this number is higher than previous year estimates, only a couple MW of new geothermal power came online in 2014. The revised upward estimate is a reflection of GEA's efforts to synchronize old data with government and international sources such as the International Energy Agency and the U.S. Energy Information Administration, in addition to new data from several of our member companies. Previous operating capacity data in GEA's database proved to be out of date and was revised.

Figure 6: U.S. Industry Geothermal Nameplate & Net Capacity



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.
Source: GEA & EIA[4]

In total the U.S. market had about 1,250 MW of geothermal power under development with about 500 MW stuck in Phase 3 waiting for PPAs. These are projects that could be brought online in 17-33 months, or sooner with the appropriate power contracts. The expansion of the U.S. geothermal sector was hindered by little growth in demand for new power, legislative uncertainty about the Production Tax Credit (PTC) and Investment Tax Credit (ITC) and unbalanced mechanisms for valuing baseload power and integration costs in California (where a significant amount of U.S. geothermal resources are located). As a result, the U.S. market did not expand or grow in 2014 with the exception of a small plant in California.

In 2014, some speculate projects paused as developers waited to see the results of the PTC/ITC debates in Washington D.C. Unfortunately, the legislation that did pass created more adversity for the industry than did it relieve any financial burdens as Congress only extended the PTC tax credit for several weeks until the end of 2014. What did happen this year was a significant amount of consolidating and restructuring in the U.S. geothermal market as companies wait for better times or restructure themselves in stronger positions. Several smaller geothermal developers were purchased by larger geothermal power companies as companies sought to better position themselves. For example, U.S. Geothermal (HTM) purchased Earth Power Resources, and Ormat (ORA) purchased the remaining American geothermal projects from Alternative Earth Resources. Other companies began to sell off their remaining U.S. assets and focus efforts on overseas projects, where the geothermal market is booming. Alterra (MGMXF) sold its operating Soda Lake plant to Cyrq Energy and Ram Power (RPG) sold its developing geothermal field at The Geysers to U.S. Geothermal (HTM).

Despite the flat growth, there are policies that could create new opportunities for geothermal power in the western states, for example if enacted, Governor Jerry Brown's announcement of a 50% RPS goal for California. Governor Brown also signed into law A.B. 2363 earlier in 2014 which will require the California Public Utilities Commission to establish the appropriate adders (integration cost) for each technology that must be used when evaluating bids for long term wholesale power contracts. The geothermal industry is hopeful this bill will add the appropriate costs to intermittent power sources due to their variable deliverability, so baseload renewables like geothermal and biomass power can compete for PPAs with Investor Owned Utilities on a more accurate comparison of the full cost for power. Some believed this to be one reason why geothermal companies were not winning as many contracts in California in the past.

At the federal level, the geothermal industry will be closely watching the results of the EPA Clean Power Plant rule final result. If this rule is successfully implemented, states which contain geothermal resources but have not developed them yet may consider developing their geothermal resources to meet carbon reduction requirements.

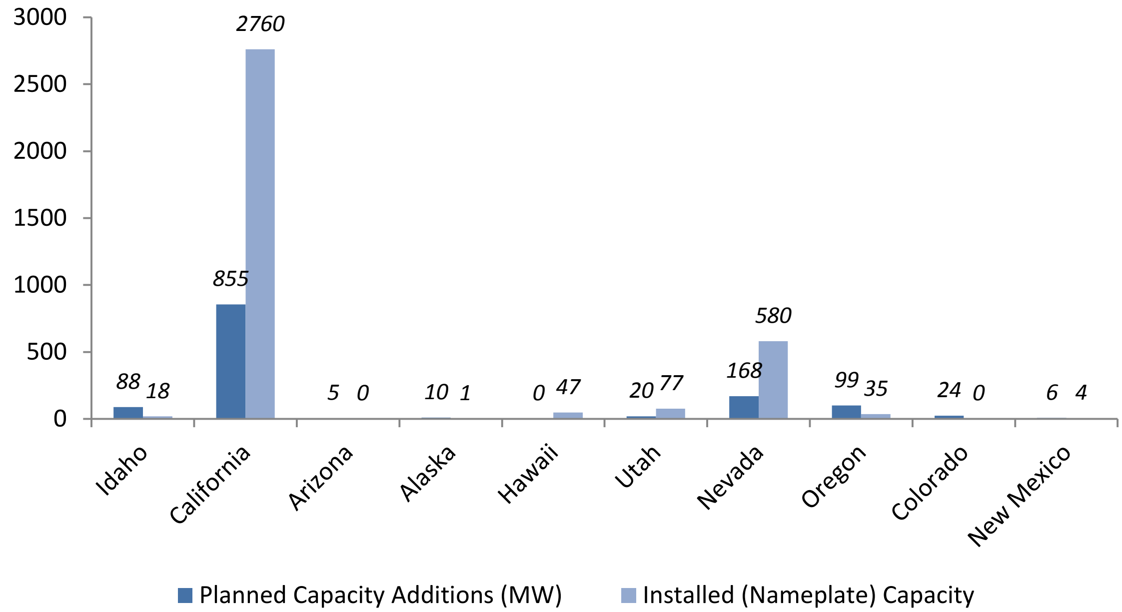
Despite the slow growth development-wise, in terms of new geothermal technologies, the U.S. continued to be a world leader and innovator. Department of Energy's Geothermal Technologies Office (GTO) continues to make advancements on mineral extraction and recovery from geothermal power plants. GTO spent $4 million in 2014 to assist in developing technologies for mineral recovery from low- to moderate-temperature geothermal resources. Geothermal brine has the potential to contain relatively high concentrations of rare earths and other valuable materials.

GTO also launched its The Frontier Observatory for Research in Geothermal Energy (FORGE). The Observatory will be a research site in the United States that allows scientists and engineers to develop and test new technologies for Enhanced Geothermal Systems (EGS).The purpose of FORGE is to accelerate cutting-edge geothermal research that, by the conclusion of the project, could lead to replicable, commercial pathways to EGS and the growth of geothermal energy in more regions of the United States.

Developing Projects

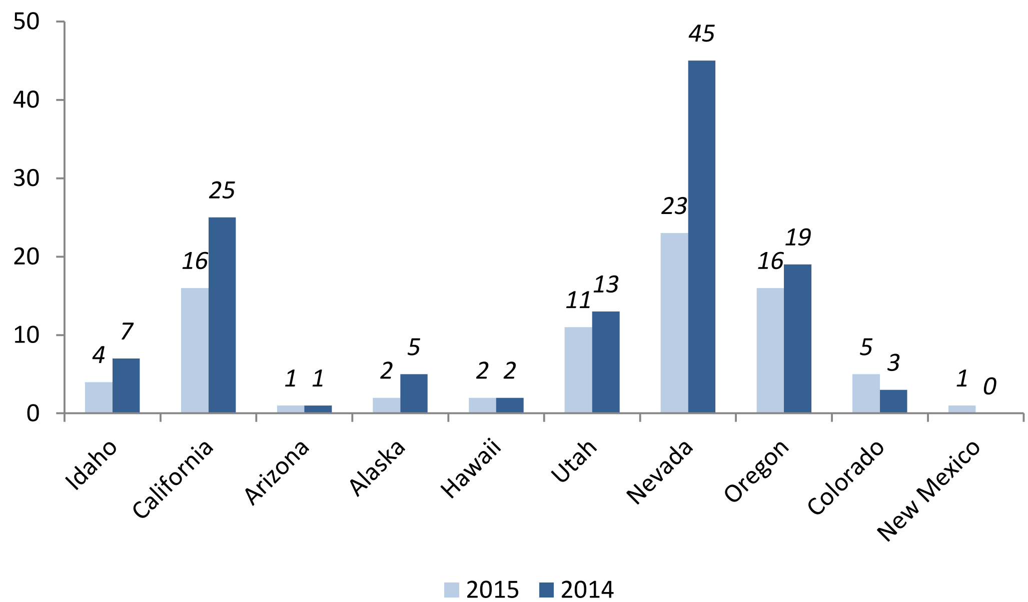
As shown in Figure 8, the amount of developing geothermal projects fell in recent years partly due to projects reaching completion and to the industry consolidation discussed in earlier section. Some companies reported to GEA they are returning federal or state leases on sites they have deemed uneconomical to develop at this time, though they may be revisited in the future when market conditions change. The economics of a geothermal power project resemble that of mining or an oil and gas project more closely than other renewables such as wind and solar. Geothermal resources need to be discovered, drilled for, and extracted. Therefore, when leases are returned it doesn't necessarily mean the industry is shrinking. Purchasing and returning leases is a normal exploration cycle that geothermal developers go through as they search for prime geothermal resources. Holding onto geothermal leases costs money. It may be more economical in the long return to return a lease and revisit that property at a later date when market conditions change.

Figure 7: Developing Planned Capacity Additions & Nameplate Capacity by State



Note: Planned Capacity Additions (PCA) is the power plants estimated installed capacity.

Figure 8: Number of Developing Projects by State

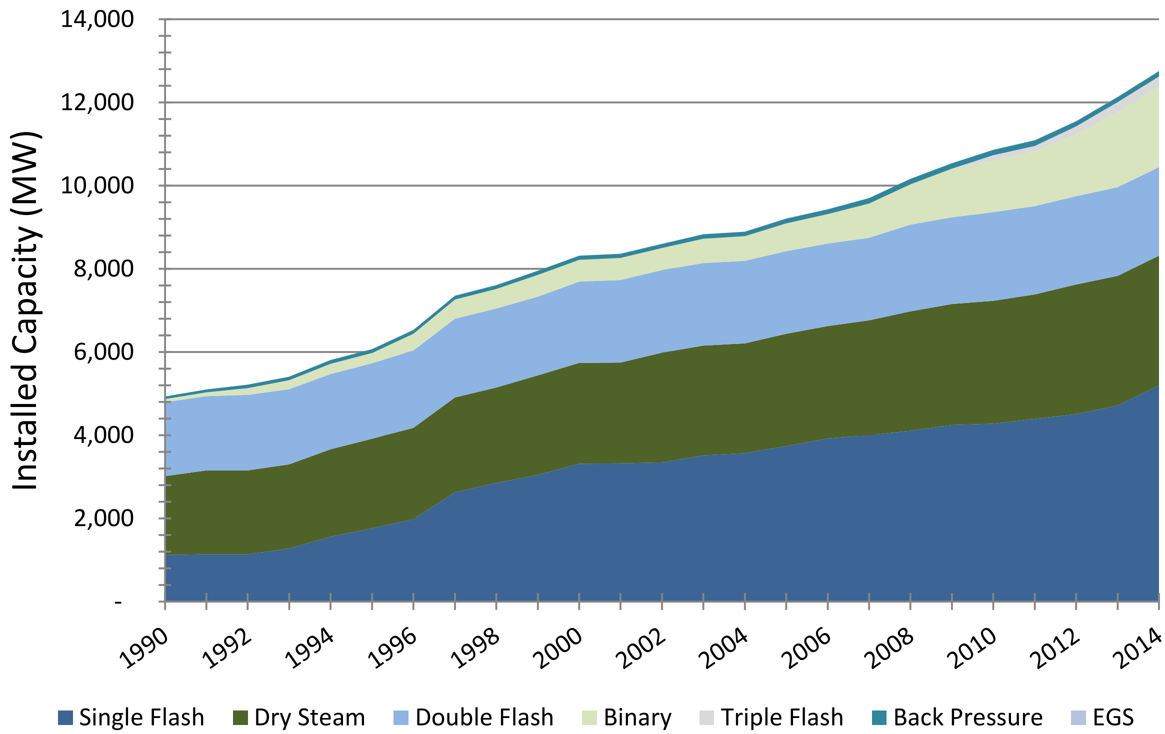


Note: In the past few years, demonstration and exploration projects have occurred in additional states such as Washington, Texas, North Dakota, Louisiana, Montana, Mississippi, and Wyoming.

Global Technology and Manufacturing Update

The types of conventional geothermal power technologies are: dry steam, flash and binary. The technology of choice for a geothermal power plant depends on the characteristics of the geothermal resources. Binary plants are used with lower temperature resources while flash and dry steam plants are used with higher temperature resources. Flash and dry steam technologies continue to be the more prevalent and the most developed. Flash technologies, including double and triple flash, make up a little less than two thirds of the global market (58%), while dry steam is about a quarter (26%) and binary is a remaining 15%. The last remaining 1% includes back pressure and other developing types of geothermal technologies. Figure 9 shows the change in the geothermal power market by turbine technology over time.

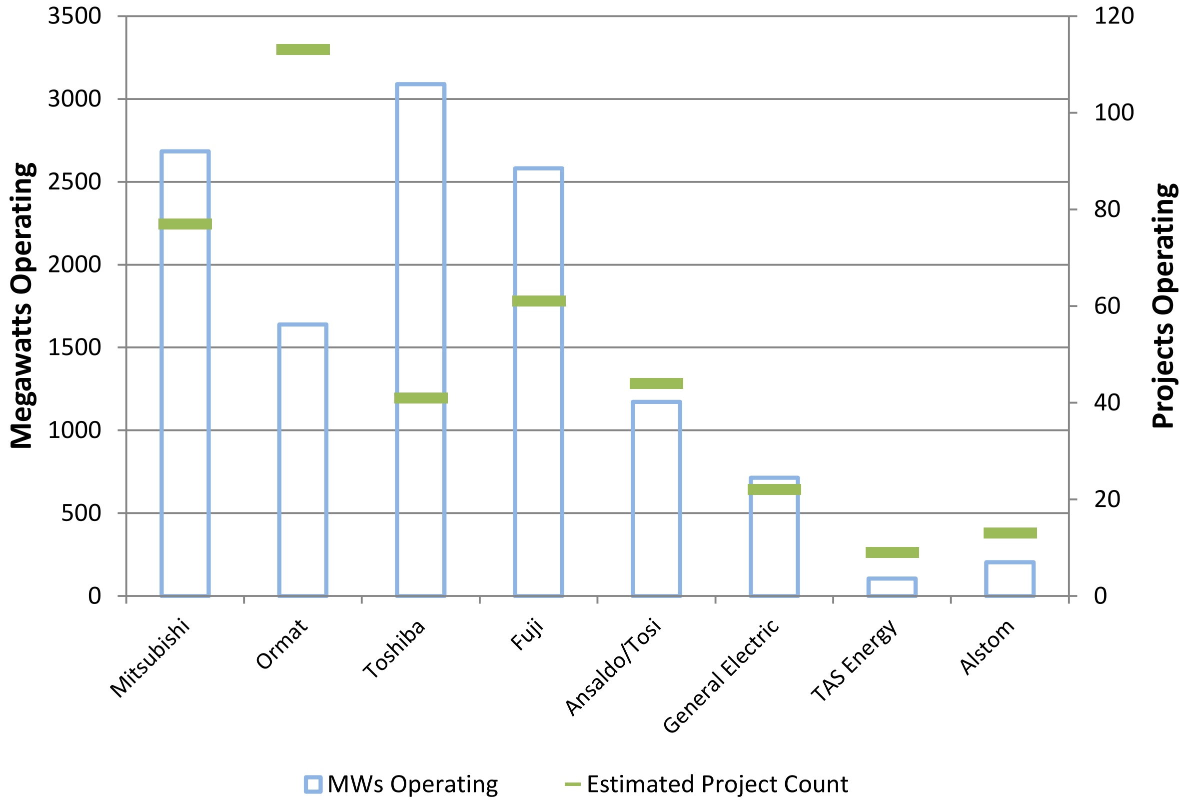
Figure 9: Operating Capacity by Technology Type



In general, the geothermal turbine market has several companies who provide equipment for higher temperature projects; these companies include Toshiba, Mitsubishi, and Fuji. The lower temperature Organic Rankine Cycle (ORC) market is mostly accounted for by one manufacturer, Ormat Technologies Inc. (ORA). Several smaller manufactures of ORC technologies just began to enter the geothermal market recently or are capitalizing on specific niches. For example, Ormat has provided the turbines for about 85% of the ORC market. Meanwhile, Exergy has recently entered the geothermal ORC market signing nearly a dozen turbine deals over the last few years. Lastly in the niche geothermal market, ElectraTherm continues to be one of the leaders in designs for co-produced fluids geothermal facilities.

Figures 10, 11, and 12 display some of the latest GEA data on the geothermal equipment suppliers market by project and by MW. Toshiba provided nearly a quarter of the global equipment in MWs. Ormat has provided equipment to substantially more projects than nearly any other company but these are often smaller binary projects; thus their MW count is smaller. In total when looking at the global turbine market by MWs, the leaders are Toshiba (24%), Mitsubishi (21%), Fuji (20%) and Ormat (13%).

Figure 10: Major Geothermal Equipment Suppliers Megawatts Operating and Project Count



Other geothermal equipment providers who don't have enough capacity to fit onto this chart or have only just entered the geothermal market include but are not limited to: Kaluga Turbine, Turboden, Atlas Copco/Mafi Trench, ElectraTherm, Elliot Turbomachinery, Exergy, Pratt & Whitney and Siemens.

In general, GEA expects that the binary market will continue to grow substantially in tandem with the flash and dry steam markets. In Europe and the U.S., binary projects are the main power plant type under construction while regions such as East Africa and the South Pacific have numerous flash and dry steam plants under development. Other countries in places such as South and Central America have only started exploring and studying their geothermal resources, but it is expected these regions will develop a diverse mix of binary, flash and dry steam projects. In conclusion, there are significant geothermal resources under development across the temperature spectrum in many regions around the world.

Figure 11: Geothermal Equipment Suppliers as Percent of Global Market by Projects

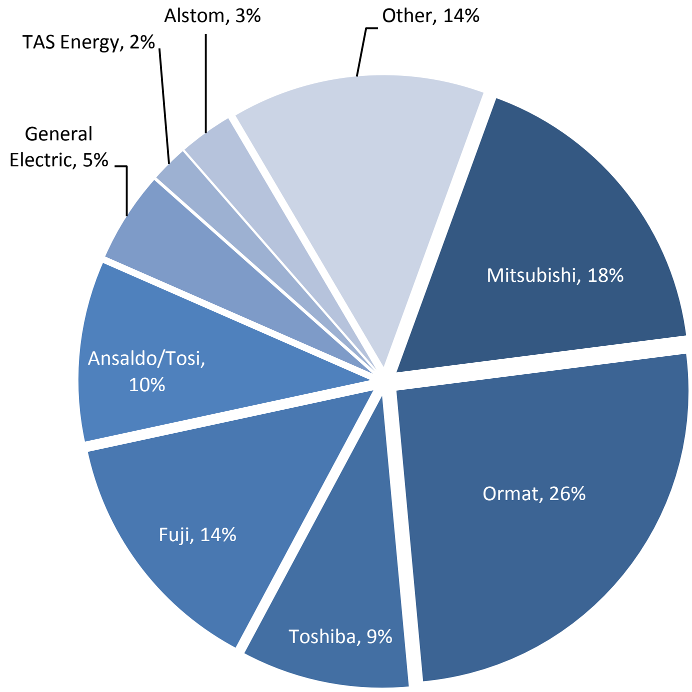
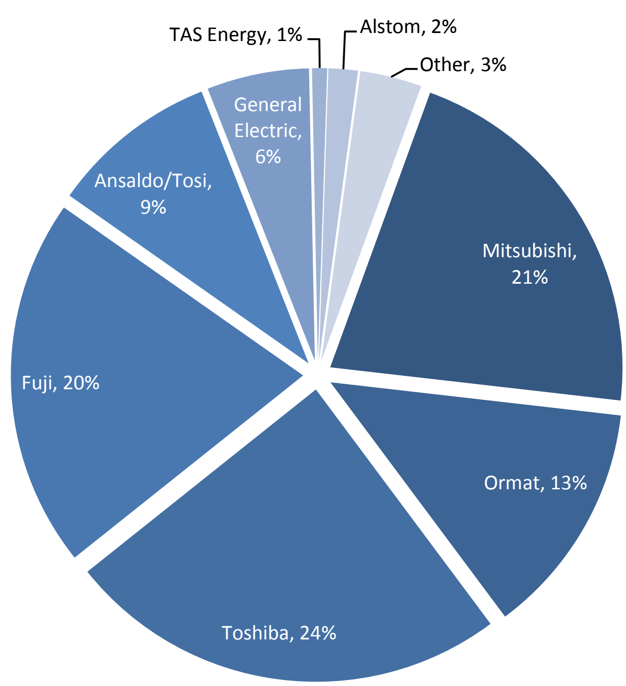


Figure 12: Geothermal Equipment Suppliers as Percent of Global Market by MW



Appendix 1: U.S. Developing Project List

Project Name	Developer	Estimated Capacity (MW)	Location (State, County)	Project Phase
Walker Ranch	Agua Caliente, LLC	30	ID, Cassia	Phase 3
Bottle Rock Expansion	Bottle Rock Power	55	CA, Lake	Phase 1
Black Rock 1-2	CalEnergy	159	CA, Imperial	Phase 3
Black Rock 5-6	CalEnergy	235	CA, Imperial	Phase 3
Wildhorse	Calpine	48	CA, Sonoma	Phase 1
Four Mile Hill	Calpine	55	CA, Siskiyou	N/A
Telephone Fiat	Calpine	55	CA, Siskiyou	N/A
Buckeye North Geysers	Calpine	57	CA, Lake	N/A
Glass Mountain	Calpine	-	CA	Phase 1
Akutan Geothermal Project	City of Akutan	10	AK, Aleutians East Borough	Phase 2
City of Aspen Geothermal Project	City of Aspen	-	CO, Pitkin	Phase 2
Lightning Doc 2	Cyrq Energy	6	NM, Hidalgo	Phase 2
Abraham	Cyrq Energy	-	UT, Millard	Prospect
Alvord	Cyrq Energy	-	OR, Harney	phase 1
Cricket	Cyrq Energy	-	UT, Millard	prospect
DeArmand	Cyrq Energy	-	UT, Iron	Prospect
Drum Mountain	Cyrq Energy	-	UT, Millard	Prospect
Klamath Plant	Cyrq Energy	-	OR, Klamath	Phase 2
Pavant	Cyrq Energy	-	UT, Millard	Prospect
Thermo 2	Cyrq Energy	-	UT, Beaver	Phase 1
Thermo 3	Cyrq Energy	-	UT, Beaver	Phase 1
Thermo 4	Cyrq Energy	-	UT, Beaver	Phase 1
Thermo Central	Cyrq Energy	-	UT, Beaver	Prospect
Thermo Greater	Cyrq Energy	-	UT, Beaver	Prospect
Newberry	Davenport Newberry Holdings/AltaRock Energy	-	OR, Deschutes	Phase 2
Harmon Lake	Enel North America	15	NV, Churchill	Phase 1
Surprise Valley	Enel North America	15	CA, Modoc	Phase 2
Cove Fort 2	Enel North America	20	UT, Beaver, Millard	Phase 1
Imperial Wells Power	EnergySource	85	CA, Imperial	Phase 1
Lower Klamath Wildlife Refuge	Entiv Organic Energy	5	CA, Siskiyou	Phase 2
Klamath Hills	Entiv Organic Energy	8	OR, Klamath	Phase 2
Apache County Project	GreenFire Energy	5	AZ, Apache	Phase 1
Olene KBG	Klamath Basin Geopower	25	OR, Klamath	Phase 3
Olene Gap	Kodali, Inc.	17	OR, Klamath	Phase 2
Kodali Raft River	Kodali, Inc.	-	ID, Cassia	Prospect
Gerlach Power	Kodali, Inc.	-	NV, Washoe	Phase 1
Kodali Dixie Valley 2	Kodali, Inc.	-	NV, Churchill	Prospect
Kodali Dixie Valley 1	Kodali, Inc.	-	NV, Churchill	Prospect
Desert Queen	Magma Energy (U.S.) Corp	-	NV, Churchill	Phase 1
Granite Springs	Magma Energy (U.S.) Corp	-	NV, Pershing	Phase 1
McCoy	Magma Energy (U.S.) Corp	-	NV, Churchill, Lander	Phase 1
Soda Lake East	Magma Energy (U.S.) Corp	-	NV, Churchill	Prospect
Soda Lake South	Magma Energy (U.S.) Corp	-	NV, Churchill	Phase 1
Poncha Hot Springs	Mt Princeton Geothermal LLC	10	CO, Chaffee	Phase 2
Mt Princeton	Mt Princeton Geothermal LLC	10	CO, Chaffee	Phase 2
OM Power	OM Power 1, LLC.	11	OR, Klamath	Phase 3
Goose Lake	Ormat Nevada Inc.	-	OR, Lake	Prospect
Carson Lake	Ormat Nevada Inc.	-	NV, Churchill	Phase 2
CD4 (Mammoth Complex)	Ormat Nevada Inc.	-	CA, Mono	Phase 2
Kula	Ormat Nevada Inc.	-	HI, Big Island	Prospect
Midnight Point	Ormat Nevada Inc.	-	OR, Lake	Phase 2

Dixie Meadows	Ormat Nevada Inc.	-	NV, Churchill	Phase 2
Truckhaven	Ormat Nevada Inc.	30	CA, Imperial	Phase 1
Mount Spurr	Ormat Nevada Inc.	-	AK	Phase 1
McGinness Hills Expansion	Ormat Nevada Inc.	24	NV	Phase 4
North Valley	Ormat Nevada Inc.	55	NV, Washoe, Churchill	Prospect
Agua Quieta	Ormat Nevada Inc.	-	NV, Churchill	Phase 1
Argenta	Ormat Nevada Inc.	-	NV, Lander	Prospect
Silver Lake	Ormat Nevada Inc.	-	OR, Lake	Prospect
Twilight	Ormat Nevada Inc.	-	OR, Deschutes	Phase 2
Ulupalakua (Maui)	Ormat Nevada Inc.	-	HI, Maui	Phase 1
Foley Hot Springs	Ormat Nevada Inc.	-	OR, Lane	Phase 1
Summer Lake	Ormat Nevada Inc.	-	OR, Lake	Phase 1
Tungsten Mountain	Ormat Nevada Inc.	-	NV, Churchill	Phase 2
Crump Geyser	Ormat Nevada Inc. (Crump Geothermal Company, LLC)	10	OR, Lake	Phase 2
Wister - Phase I	Ormat Nevada Inc.	30	CA, Imperial	Phase 2
Tuscarora - Phase 2	Ormat Nevada Inc.	-	NV, Elko	Phase 2
Pagosa Waters	Pagisa Verde	4	CO, Archuleta	Phase 2
Calipatria: Mineral Extraction Facility	Simbol Materials	-	CA, Imperial	Phase 4
Town of Rico Project	Town of Rico	-	CO, Dolores	Prospect
Geysers Project (aka WGP Geysers)	U.S. Geothermal	26	CA, Sonoma	Phase 3
Lee Hot Springs	U.S. Geothermal	-	NV, Churchill	Phase 1
Raft River Unit II	U.S. Geothermal	26	ID, Cassia	Phase 2
Hot Springs Point (Crescent Valley)	U.S. Geothermal	-	NV, Eureka	Phase 1
San Emidio Phase III	U.S. Geothermal	17	NV, Washoe	Phase 1
Vale Butte	U.S. Geothermal	-	OR, Malheur	Prospect
Neal Hot Springs II	U.S. Geothermal	28	OR	Phase 2
Gerlach	U.S. Geothermal	18	NV, Washoe	Phase 2
San Emidio Phase II	U.S. Geothermal	11	NV, Washoe	Phase 3
Raft River Unit III	U.S. Geothermal	32	ID, Cassia	Phase 1
Granite Creek	U.S. Geothermal	-	NV, Washoe	Phase 1
UND Coproduction	University of North Dakota	0.25	CA, Imperial	Phase 1
UND Low Temp Project	University of North Dakota	0.35	ND, Stark	Phase 1

Note: This list is accurate as of January 2015. Some of the Phase 4 projects may have come online in early 2015

Appendix 2: New Power Plants to Come Online in 2014

Country	Region	Field	Plant	Nameplate Capacity (MW)	Primary Plant Type	Plant Owner or Operator
United States	North America	OR - Klamath Falls	OIT	1.5	Binary	Oregon Institute of Technology
Japan	Asia	Oguni Town, Kumamoto	Oguni Town	2.0	Single Flash	Waita Geothermal Power Plant, Chuo Electric Power Co
Japan	Asia	Ibusuki	Ibusuki	1.5	Binary	Geonext Corporation
Indonesia	South Pacific	West Java - Pengalengan	Cibuni	2.0	N/A	PLTP
**United States	North America	CA - Surprise Valley	Paisley Geothermal	2.0	Binary	Surprise Valley Electric Corp.
Germany	Europe	Taufkirchen/ Oberhaching	Taufkirchen/ Oberhaching Plant	4.3	Binary	Daldrup & Söhne AG
Germany	Europe	Sauerlach	Sauerlach	5.0	Binary	SWM – Stadtwerke München
Indonesia	South Pacific	West Java	Ulumbu	5.0	Single Flash	PLN
Turkey	Europe	Aydin-Gumuskoy	Gumuskoy 1	6.6	Binary	BM Enerji
Turkey	Europe	Aydin-Gumuskoy	Gumuskoy 2	6.6	Binary	BM Enerji
Turkey	Europe	Aydin-Salavatil	Dora 3U2	20.0	Binary	Menderes A.S.
Kenya	Middle East/Africa	Olkaria	Olkaria 3 Plant 3	22.0	Binary	Ormat
Turkey	Europe	Manisa-Alesehir	TR1	24.0	Binary	Zorlu Enerji
Turkey	Europe	Aydin-Germencik	Kerem 3	24.0	Binary	Maren Enerji
Turkey	Europe	Aydin-Germencik	Germencik 3	26.0	Binary	Guris Holdings
Italy	Europe	Mt. Amiata-Bagnore	Bagnore 4	40.0	Single Flash	Enel Green Power
Kenya	Middle East/Africa	Olkaria	Olkaria 2 Plant 3	35.6	Single Flash	KenGen
*Philippines	South Pacific	Southern Negros	Nasulo	49.4	Single Flash	Energy Development Corporation
Indonesia	South Pacific	Patuha	Unit 1	55.0	Single Flash	PT. Geo Dipa Energy
Kenya	Middle East/Africa	Olkaria	Olkaria I Unit 4	70.0	Single Flash	KenGen
Kenya	Middle East/Africa	Olkaria	Olkaria I Unit 5	70.0	Single Flash	KenGen
Kenya	Middle East/Africa	Olkaria	Olkaria IV	140.0	Single Flash	KenGen

Note: Net Capacity is used when Nameplate or Installed Capacity is not available.
**This plant was built from equipment salvaged from the North Negros geothermal plant. GEA data was adjusted to reflect the decommissioning of the older plant.*
***The Paisley project began commissioning but is not fully commercially operational yet.*

References

[1] Energy Information Administration (EIA). "Form EIA-860 detailed data." October 10, 2013. http://www.eia.gov/electricity/data/eia860/ (Accessed January 28th, 2015).
[2] The World Bank. "Geothermal Energy: Expansion Well Underway in Developing Countries" December 3, 2014. http://www.worldbank.org/en/news/feature/2014/12/03/geothermal-energy-expansion-well-underway-in-developing-countries (Accessed February 9th, 2015).
[3] Goldstein, B., et al. 2011*: Geothermal Energy*. "Special Report on Renewable Energy Sources and Climate Change Mitigation." Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf
[4] Energy Information Administration (EIA). "Form EIA-860 detailed data." October 10, 2013. http://www.eia.gov/electricity/data/eia860/ (Accessed January 28th, 2015).