

Ormat – The Growth of a Market Leader

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ABSTRACT

Ormat has grown substantially in the last 5 years, since the last World Geothermal Congress (WGC). The growth has been in markets served, innovative technological improvements, and in the amount of geothermal power plants manufactured owned and operated. The growth has strengthened our position as a market leader.

Since the last WGC we have added almost 50 new power plants, totaling approximately 1,200 MW. This brings the total geothermal plants manufactured by Ormat to over 140 plants totaling 3100 MW. Of these, 10 plants are Ormat owned, growing our portfolio to almost 950 MW. The growth in our owned power plants was mostly in the U.S. and Latin America. We contributed significantly to the growth of the Turkish geothermal power industry, the world's fastest growing geothermal market in the last decade.

This growth further established Ormat as the market leader, as Ormat's share of all new plants since the last WGC is over 50%

1. INTRODUCTION

Ormat Technologies, Inc. ("Ormat", "The Company", "We") is a leading renewable energy company with over five decades of experience. Ormat is vertically integrated – engaged in the execution of all stages of development and energy generation – at our geothermal and recovered energy power plants. These stages include exploration, development, drilling, design, manufacturing, construction, and operation. Our Ormat Energy Converter – a power generation unit that converts heat into electricity – is the basis for the solutions and services that we offer our diverse array of customers.

1.1 About Our Business

Our business is divided into three main segments:

- Electricity Segment – the power generation business, where we sell renewable energy, including geothermal, recovered energy and solar, generated to different entities.
- Product Segment – sale of our geothermal and recovered energy-based power plants that we design and manufacture.
- Other Segment - provision of energy storage, demand response and energy management-related services.

2. HISTORY

Ormat was established in 1965 for the principal purpose of developing equipment for the production of energy from clean, renewable and inherently sustainable sources. We have a total of fifty-four years of experience in the renewable energy sector pertaining to both technological development and the provision of products and services.

Our first product, developed in 1966 and installed in the African country of Mali, was a solar pump, directly coupled to a turbine that is rotated by vapor generated through solar panel heat. This pump was used to pump water from a well to provide members of the local community with access to water resources. Later, we engaged in the manufacturing, ownership and operation of solar ponds for energy generation in Israel and the United States (U.S.).

In 1983, Ormat began to set up its first geothermal power plants in the U.S. state of Nevada. We began by selling our power plants to geothermal developers, which later evolved into the development, ownership and operation of our own power plants. Today, we continue to grow our business by developing renewable energy power plants, mainly geothermal, and by selling power plants to developers worldwide and through acquisition of additional geothermal power plants worldwide, with the goal of positioning Ormat as the largest producer of geothermal power in the U.S. and a leader in the international market.

Since our establishment, Ormat has built over 180 geothermal and recovered energy power plants in 35 countries . Today, Ormat owns and operates 917 MW of mainly geothermal and recovered energy-based power plants, predominantly using equipment that we design and manufacture. With the acquisition of the Viridity business in 2017, we manage curtailable customer loads of over 875 MW across nearly 3,000 sites across the U.S. and own and operate 41MW of battery storage power plants.

Our headquarters are located in Reno, Nevada and our major manufacturing facility is located in Yavne, Israel. As of the date of this paper, Ormat operates power plants in the U.S., Honduras, Indonesia, Kenya, Guatemala and Guadeloupe (French Caribbean). The company's common stock is dually listed on the New York Stock Exchange (NYSE) under the ticker "ORA" since 2004 and the Tel Aviv Stock Exchange (TASE) since 2015.

3. GROWTH IN LAST 5 YEARS:

The years 2015-2019 have brought new heights to Ormat in many ways, based on the four pillars of growth in Ormat: improve efficiencies, organic growth, strategic M&A, and new activities.

We grow in technical, commercial and financial capabilities throughout our operation in all business segments. Our revenue grew from approx. \$595 million in 2015 to US\$XXX at the end of 2019. We grew from approximately 1100 employees in 2015 to more than 1400 in the end of 2019, and from 1900 MW in supplied power plants to 3100 MW. In the context of this paper and it being presented in the WGC 2020 we chose to focus on our leadership in the geothermal industry.

We expanded into new locations; we have new owned plants in Honduras, Guadeloupe and Indonesia and sold plants in unique locations such as the Chilean mountains. This avenue of growth is also connected to the improvement and advancement of our technologies.

3.1 Operational growth

The last 5 years demonstrate our continuous growth in our Product Segment and our Electricity Segment. This has been a record 5 years for Ormat, as demonstrated in the amount of MW installed in comparing different time periods

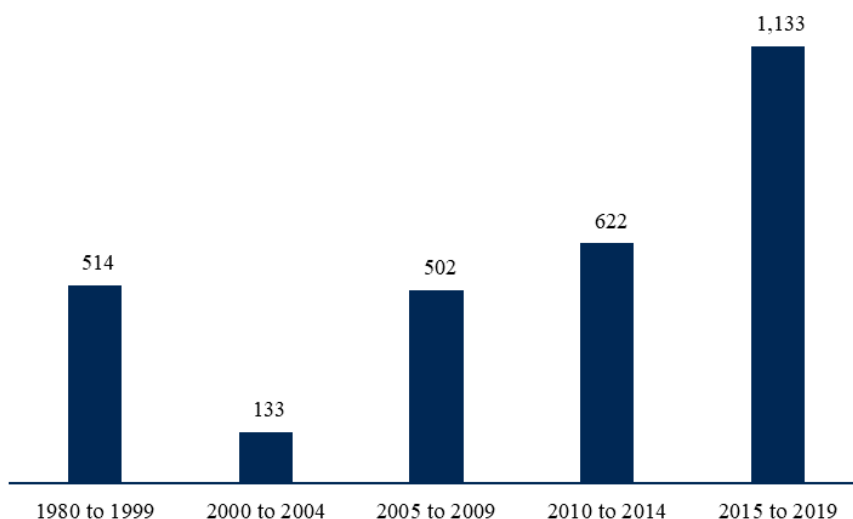


Figure 1: Ormat power plants over the years in MWs installed

Our geothermal market share also grew significantly in 2015-2019, as it is demonstrated in the figures below:

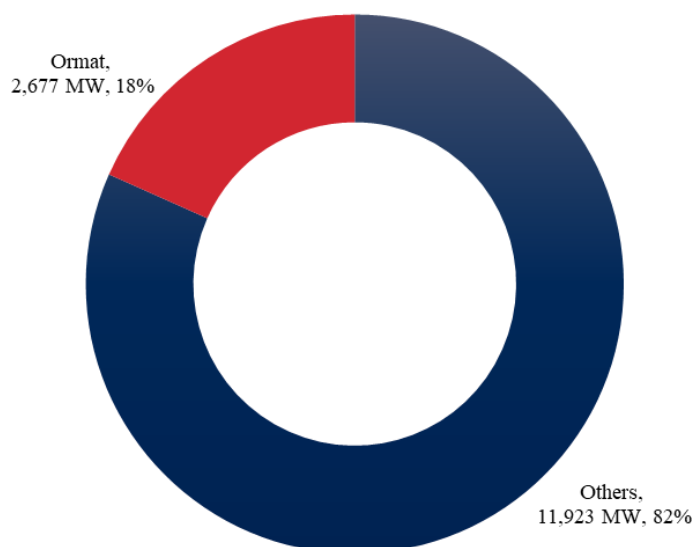


Figure 2: Ormat Overall Geothermal Market Share¹

¹ Source: Ormat analysis, IGA "World Geothermal Installed YE2018"

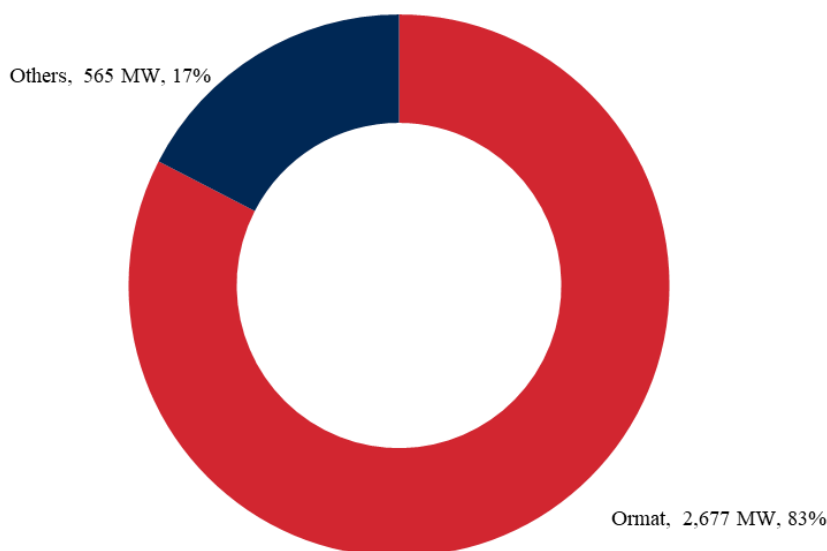


Figure 3: Ormat Overall Geothermal Binary Market Share²

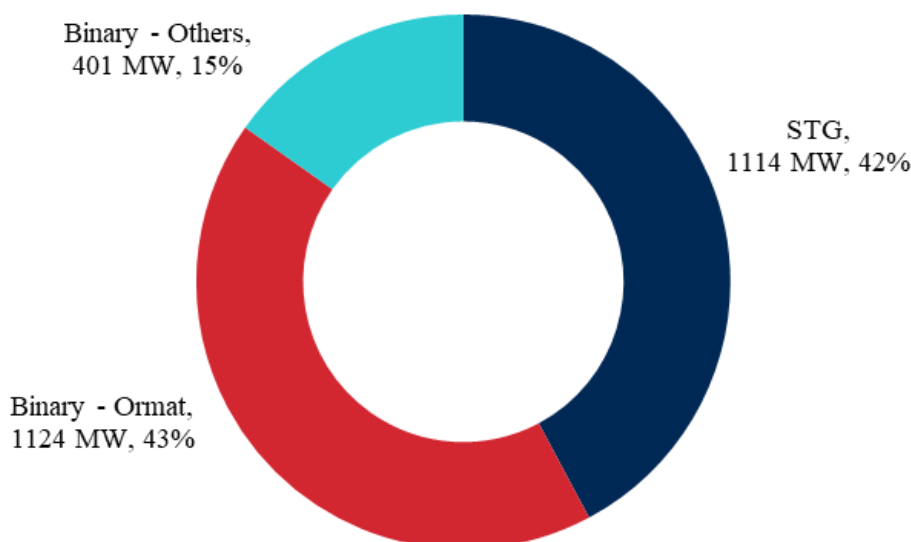


Figure 4: Ormat Overall Geothermal Market Share 2015-2019³

Behind this growth there are many stories, below we chose to give some more details on the most important in 2015-2019.

Our growth in Turkey - Ormat is the leading player in the strong geothermal market in Turkey. We actively supply equipment in Turkey, and have been doing so for over 10 years, supplying our first plant in 2006 and a total of over 760 MW so far – of which 550 MW are in the years 2015-2019 – and over 70 MW are expected in the future. The binary equipment we supplied in just over a decade represents over 50% of Turkey’s current installed binary capacity and we intend to increase and reinforce our position with the strong and growing installed base and support team. In 2016 we set up a manufacturing facility in Turkey, the sole full manufacturing facility among the geothermal equipment suppliers in Turkey. The progress and improvements we made, and continue to work on, demonstrate our commitment to this market. We see Turkey as a key market to Ormat as well as to the entire geothermal industry, and we will continue to share our experience and contribute our share with our clients towards their success in Turkey and elsewhere.

High Altitude Power Plant in Chile – Ormat was the EPC contractor for the 48 MW Cerro Pabellon geothermal power plant in Chile, a project with extreme conditions and professional challenges to overcome: the project is located in a remote location, high altitude area (over 4500m), and bears cold and extremely windy weather. The first challenge was the to overcome the effect of these conditions on the power plant. In such altitude, we needed to design and choose, together with our client, the right equipment and

² Source: Ormat analysis, IGA “World Geothermal Installed YE2018”

³ Source: Ormat analysis, IGA “World Geothermal Installed YE2018”

materials that fit all the extreme conditions. The air is very thin which directly effects the plant's air cooling abilities and the efficiency of the electrical equipment drops in high altitude. In order to mitigate these challenges, Ormat conducted meticulous calculations for the condenser and other electrical equipment and adjusted its configuration to fit these extreme conditions. In dealing with the weather, Ormat also has vast experience in designing power plants for harsh conditions, as we have many power plants that work in Canada and the Midwest part of the USA. The second challenge was the effect of these conditions on the work force. Such high altitude requires an adjustment period and even once adjusted people cannot stay up at 4500m for a long period of time. The project's goal is to minimize the time for site construction; Ormat has an advantage as its binary power plants are built modularly with prefabricated components that are faster to construct. The plant was successfully commissioned in 2017. In 2019, after the plant proved its high performance, Ormat signed an additional contract for the next 30 MW stage in the Cerro Pabellon geothermal complex.

Growth through mergers and acquisitions (M&A) – acquiring US Geothermal - In 2018 Ormat completed the acquisition of U.S. Geothermal, a renewable energy company focused on the development, production and sale of electricity from geothermal energy. This acquisition contributed to our portfolio three operating geothermal power plants including Neal Hot Springs in Oregon, San Emidio in Nevada and Raft River in Idaho that currently generate approximately 41MW. This acquisition significantly broadens and diversifies our operations in the U.S., expanding our presence into Idaho and Oregon. With this transaction, we demonstrate again the implementation of our business strategy to grow our business with both accretive M&A transactions and organic growth.

Hybrid solar-geothermal power plant - the Tungsten Solar power plant, which commenced commercial operation in July 2019, is our first-ever geothermal and solar hybrid project, a 7MW AC solar expansion of our Tungsten Mountain geothermal power plant in Nevada, U.S.. The electricity generated from Tungsten Solar will be used to offset the equipment's auxiliary power at the Tungsten geothermal facility, thus increasing the renewable energy delivered by the project under the Southern California Public Power Authority (SCPPA) portfolio contract.

Sarulla, the biggest geothermal power plant - The 330 MW Sarulla complex located in North Sumatra, Indonesia, is one of the world's largest geothermal power plants and it includes three generating units of approximately 110 MW each, utilizing both steam and brine extracted from the geothermal field to increase the power plant's efficiency. In addition to being one of the sponsors of the project, Ormat also provided the conceptual design of the Geothermal Combined Cycle Unit (GCCU) power plant and supplied its Ormat Energy Converter (OEC). The OECs are producing over 40% of the total power by utilizing low pressure steam and the separated brine, and as such maximizing resource exploitation for maximum power output. SIL, the first unit of the power plant, commenced commercial operation in March 2017; NIL 1, the second unit, commenced commercial operation in October 2017; NIL 2, the third unit, commenced commercial operation in April 2018.

Olkaria III – growing in stages – since 2015 Ormat's Olkaria III geothermal complex in Kenya has grown from 110 MW to 150 MW, continuing Ormat's gradual expansion of this complex since we started with a 13 MW plant in 2000. In January 2016 we reached commercial operation of the 29 MW Plant 4. The 11 MW Plant 1 expansion project commenced commercial operation in June 2018. The scope of the project included drilling of new wells, adding a new OEC unit and optimizing other existing units. The Plant 1 expansion project demonstrates once again the creativity of our engineering group that analyzed the Olkaria III complex operation, equipment and PPA and came up with a plan that enabled us to increase the Olkaria III complex capacity in a short timeframe and in a cost-effective manner. The expansions support the Government of Kenya's 2030 vision to increase generation capacity and we are proud to be part of Kenya's efforts.

3.2 Technological growth:

Ormat has always been at the forefront of binary geothermal technology. In the last five years Ormat excelled in its OEC size and efficiency. The size of a single OEC grew from 25 MW to 50 MW while also being able to utilize efficiently any possible geothermal heat source. The main improvements were:

- Turbine efficiency grew up by 2.5%. On top of our well-established overhang turbine, we developed a "between bearing" turbine that allows more stages and higher capacity, up to 25 MW per turbine. New blades geometry was implemented for better turbine efficiency.
- Heat exchangers design improvement resulted in increased efficiency of 1.25%
- Air cooled condenser design improvement resulted in increased efficiency of 1.25%

We chose to show these advantages in examples of plants with similar heat sources that were commissioned in the approximate span of the last five years.

- McGinness Hills, Plant 2 (2015) compared to McGinness Hills, Plant 3 (2018) – both plants utilize the same resource. Implementation of several design changes resulted in 5% increased efficiency
- TAOM (2019) compared to Ngatamariki (2013) - both plants are in the same area in New Zealand. The heat source temperature is in the same range although steam and brine ratio is different, yet the motive fluid evaporation is identical and therefore we are able to compare the two plants. The implementation of Ormat's technological improvements resulted in 4% higher efficiency



The McGinness Hills Complex

4. A LOOK AT THE FUTURE & CONCLUSION

Looking forward, Ormat sees many avenues of growth potential in the geothermal market as a whole, and specifically for Ormat, who is the only geothermal vertically integrated company in the world. Still most of the world's geothermal potential has not been tapped and we believe that as the fight against climate change grows worldwide, there will be still a greater move to renewable energy, and that will include geothermal. Geothermal is able to stay competitive with other renewables, as geothermal's operational flexibility further enhances geothermal's value. In Ormat's binary geothermal technology, the geothermal reservoir and well field are decoupled from the power generating equipment through the use of a working fluid, which allows binary geothermal facilities to operate in both a baseload or an operationally flexible mode that provides 100 percent dispatchability at unparalleled ramp rates—up to 30 percent of generator nameplate per minute—and can even be controlled by the system operator using Automatic Generation Control (AGC). Geothermal power plants offer additional benefits to grid stability like voltage support and inertia. Beyond theory we can see an actual example of geothermal's competitive pricing in California, where in 2017, for the first time, the combined energy and capacity values of geothermal energy significantly exceeded the value of solar photovoltaic (PV) resources when you account for geothermal's ancillary services and operational flexibility. Geothermal can, and will, continue to obtain higher energy and capacity values because it can produce outside the solar PV production hours during the new peak load hours. As a result, after years of solar dominating new renewable energy contracts in California, utilities are starting to appropriately value renewable resources that provide energy and capacity value while also being operationally flexible.

APPENDIX –**ORMAT GEOTHERMAL POWER PLANTS SINCE 2015 AND IN THE FUTURE****1. OWNED BY ORMAT**

Project	Location	Utility	Capacity (MW)⁴	Operational Since⁵
Steamboat Hills Enhancement	Nevada, U.S.	Southern California Public Power Authority (SCPPA)	19	under construction
Heber Complex Repowering	California, U.S.	Southern California Public Power Authority (SCPPA)	11	under construction
Tungsten Solar ⁶	Nevada, U.S.	Southern California Public Power Authority (SCPPA)	7 (AC)	2019
Olkaria III Complex	Kenya	Kenya Power and Light Co. (KPLC)	150	2000, 2008, 2013, 2014, 2016, 2018
McGinness Hills Complex	Nevada, U.S.	NV Energy (phase 1&2) and Southern California Public Power Authority (SCPPA) (phase 3)	140	2012, 2015, 2018
Brady	Nevada, U.S.	NV Energy	26	1992, 2004, 2007, 2018
Sarulla – NIL 2 ³	Indonesia	PT Perusahaan Listrik Negara (PLN)	110 (14 owned by Ormat)	2018
Sarulla – NIL 1 ³	Indonesia	PT Perusahaan Listrik Negara (PLN)	110 (14 owned by Ormat)	2017
Sarulla – SIL ⁷	Indonesia	PT Perusahaan Listrik Negara (PLN)	110 (14 owned by Ormat)	2017
Tungsten Mountain	Nevada, U.S.	Southern California Public Power Authority (SCPPA)	27	2017
Platanares ⁸	Honduras	Empresa Nacional de Energía Eléctrica (ENEE)	38	2017
Don A. Campbell – Complex ⁹	Nevada, U.S.	Southern California Public Power Authority (SCPPA)	39	2013, 2015

2. SUPPLIED BY ORMAT TO THIRD PARTIES

Project	Location	Customer	Capacity (MW)¹⁰	Operational Since	Ormat's Scope
Emirler JES 1	Turkey	Pekdemir	7	under construction	Supply of Equipment, Supervision of Installation and Start Up

⁴ In power plant owned by Ormat the capacity figure given is the net to the grid generating capacity, which is defined in Ormat's 10K reports. In solar power plants the MWdc is indicated

⁵ In power plants that were built in phases, the year of each new phase is indicated

⁶ Solar PV as part of a hybrid plant with geothermal

⁷ Ormat owns 12.75% interest in the Sarulla Complex

⁸ Ormat holds the assets under a Build, Operate and Transfer (BOT) structure for approximately 15 years

⁹ Ormat owns a 63.3% stake in Don A. Campbell complex.

¹⁰ In power plant supplied by Ormat the capacity figure given is gross at design point. In solar power plants the MWdc is indicated.

Project	Location	Customer	Capacity (MW) ¹⁰	Operational Since	Ormat's Scope
Cerro Pabellon 3	Chile	Geotérmica del Norte (GDN)	32	under construction	EPC <u>Repeat Order</u>
Nezih Beren	Turkey	Maren	20	under construction	Supply of Equipment, Supervision of Installation and Start Up <u>Repeat Order</u>
Ching-Shui	Taiwan	Chingshuei Geothermal Power Corporation	5	under construction	Supply of Equipment, Supervision of Installation and Start Up
Pamukoren 7	Turkey	Celikler	32	under construction	Supply of Equipment, Supervision of Installation and Start Up <u>Repeat Order</u>
Laguna Colorada	Bolivia	Empresa Nacional de Electricidad (ENDE)	5	under construction	Supply of Equipment, Supervision of Installation and Start Up
Ngawha 4	New Zealand	Top Energy	34	under construction	EPC <u>Repeat Order</u>
EFE 8 U2	Turkey	Gurmat	no30	under construction	Supply of Equipment, Supervision of Installation and Start Up. Repeat Order
Tuzla West	Turkey	Yerka Yilsan	12	under construction	Supply of Equipment, Supervision of Installation and Start Up
EFE 8 U1	Turkey	Gurmat	30	under construction	Supply of Equipment, Supervision of Installation and Start Up. Repeat Order
Soda Lake 3	U.S.	Cyrq Energy	24	2019	EPC <u>Repeat Order</u>
Salihli JES 3	Turkey	Sanko	30	2019	Supply of Equipment, Supervision of Installation and Start Up <u>Repeat Order</u>
Salihli JES 2	Turkey	Sanko	25	2019	Supply of Equipment, Supervision of Installation and Start Up <u>Repeat Order</u>
Ala 2	Turkey	Maspo	34	2019	Supply of Equipment, Supervision of Installation and Start Up
Akkecili Mis 3	Turkey	Soyak	24	2019	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Akkecili Mis 2	Turkey	Soyak	24	2019	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
TAOM	New Zealand	Eastland Group	28	2018	EPC
TR3	Turkey	Turkerler	27	2018	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Pamukoren 6	Turkey	Celikler	32	2018	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Incirliova JES 1	Turkey	3S Kale	27	2018	Supply of Equipment, Supervision of Installation and Start Up.

Project	Location	Customer	Capacity (MW) ¹⁰	Operational Since	Ormat's Scope
EFE 7	Turkey	Gurmat	27	2018	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Akkecili Mis 1	Turkey	Soyak	15	2018	Supply of Equipment, Supervision of Installation and Start Up
Sultanhisar 2	Turkey	Celikler	23	2018	Supply of Equipment, Supervision of Installation and Start Up
Baklaci	Turkey	Akca	20	2018	Supply of Equipment, Supervision of Installation and Start Up
Kizildere 3 Unit 2	Turkey	Zorlu	16	2018	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Melih	Turkey	Maren	32	2017	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Caferbay Salihli JES 1	Turkey	Sanko	16	2017	Supply of Equipment, Supervision of Installation and Start Up
Kizildere 3 Unit 1	Turkey	Zorlu	22	2017	Supply of Equipment, Supervision of Installation and Start Up
EFE 6	Turkey	Gurmat	27	2017	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Ala 1	Turkey	Maspo	11	2017	Supply of Equipment, Supervision of Installation and Start Up
Cerro Pabellon	Chile	Geotérmica del Norte (GDN)	53	2017	EPC
TR2	Turkey	Turkerler	24	2016	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
DORA 4	Turkey	MEGE	21	2016	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
Gumuskoy 1, 2	Turkey	Turcao - BM	9	2015	Repowering non-working older units of another provider. Design and supply Equipment
Tsuchiyu	Japan	Genki-Up Tsuchiyu Co.	1	2015	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
KEN	Turkey	Kipas - Ken	22	2015	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
EFE 4	Turkey	Gurmat	26	2015	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>
EFE 3	Turkey	Gurmat	26	2015	Supply of Equipment, Supervision of Installation and Start Up. <u>Repeat Order</u>