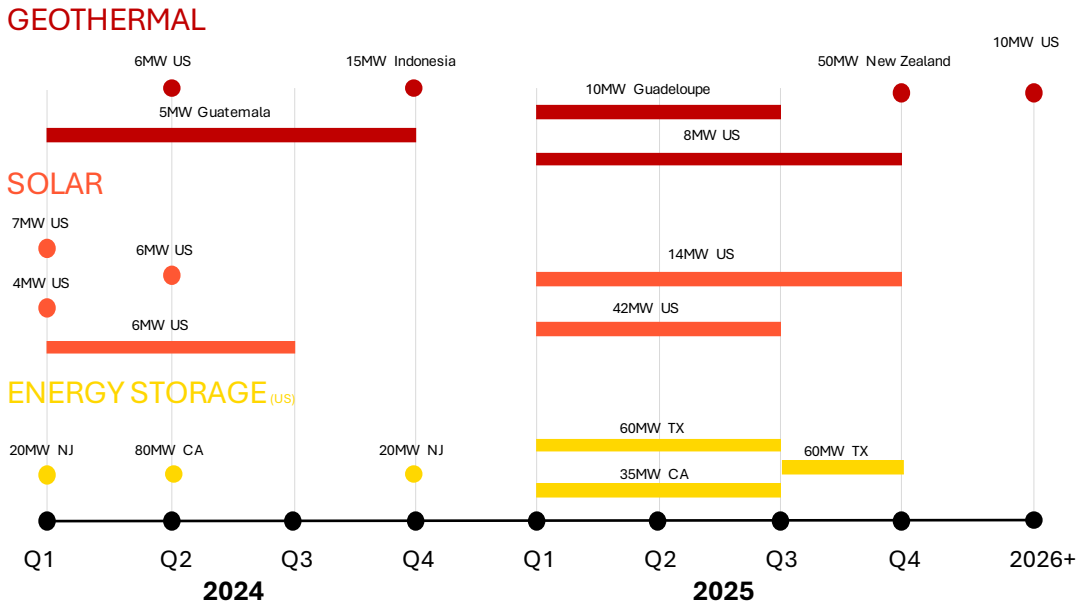
# Ormat

## Company Overview

Ormat is a geothermal energy company founded in 1965. ORA operates within 3 main segments with the most notable being energy production. 92% of their energy output comes from geothermal plants, with the rest from REG and Solar plants. In 2022, ORA announced their planned acquisition of ENEL Green Power for $271M, which includes 3 geothermal plants and 2 solar plants in the US with an expected closing date in Q1 2024. ORA serves as an EPC contractor for geothermal and REG plants. Within Energy, 2 key plants in production are the US Arrowleaf Solar plant in H12025 and the New Zealand Topp 2 Geothermal plant in Q4 2025. The current global energy output is 1,115MW and is expected to increase by 230MW-260MW by 2025. ORA's product profile consists primarily of machines and services for energy generation but they also offer cementing services for wells. One of their proprietary technologies is the GCCU power plant which uses less water and generally produces no emissions as opposed to traditional geothermal steam turbine plants. Another key product is the REG system which vapor turbine and generator that is much more efficient and has a longer lifespan than alternatives. Ormat owns 225 patents globally and 63 in the US with patent terms going out till 2039 with no specific patent cliff expected to dramatically affect profits. ORA has stated an intent to focus more on energy storage by focusing on developing and optimizing its battery energy storage system (BESS). Looking towards the future, they own 39 geothermal plant land prospects with 20 located in Nevada. A key aspect of their business model is that they use the equipment that they produce for their clients which gives them more quality control. Key customers include SCPPA (US), NV Energy (US), and KPLC (Kenya) with each accounting for 21.5%, 16.9%, and 14.4% of revenue for 2023 respectively.

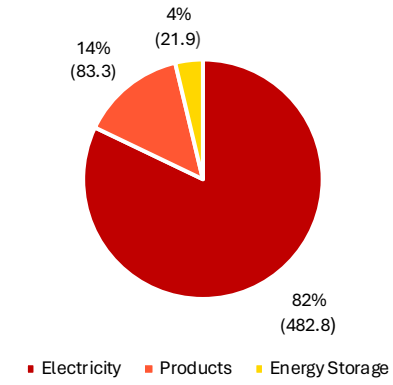
### Key Government Regulation

The Inflation Reduction Act of 2022 (IRA), signed into law in the United States, introduces various tax incentives aimed at promoting climate change mitigation, clean energy, and electric vehicles. These incentives include a new corporate alternative minimum tax, an excise tax on stock repurchases, and significant tax benefits for energy and climate initiatives such as Production Tax Credits (PTCs) and Investment Tax Credits (ITCs). Ormat Systems, under Israel's Investment Law, has received tax benefits including a reduced corporate tax rate for qualified income and an approval for reduced tax rates on certain technological income, resulting in a lower effective tax rate reflected in their net income. Recent tax regulations in Kenya have helped to boost revenues in the energy segment. The Kenyan government plans to reach 10 GW of energy by 2037 and passed the 2023 Finance Act in June lowering corporate taxes by 7.5%, leading to an income tax benefit of 9.4M for 2023.

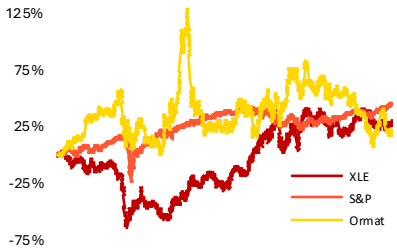



### Revenue by Segment

(In Millions USD, prev 9 months)

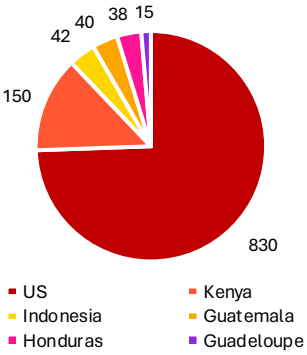



### Ormat 5Y




### Wattage Distribution by Country

(ORA MW output for 2023)




### Key Info

| | |
|---|---|
| Ticker: ORA | Price: $67.12 |
| Mkt Cap: $4.05B | Rev: $734M |
| EV/EBITDA Q3: 53.23x | R&D: $5.08M |
| P/E (TTM): 36.93x | EPS(TTM): $1.81 |

### Competitors (Mkt Cap)

| | |
|---|---|
| AboitizPower | 4.793B |
| Mercury | 9.433B |
| StarEnergy | 9.665M |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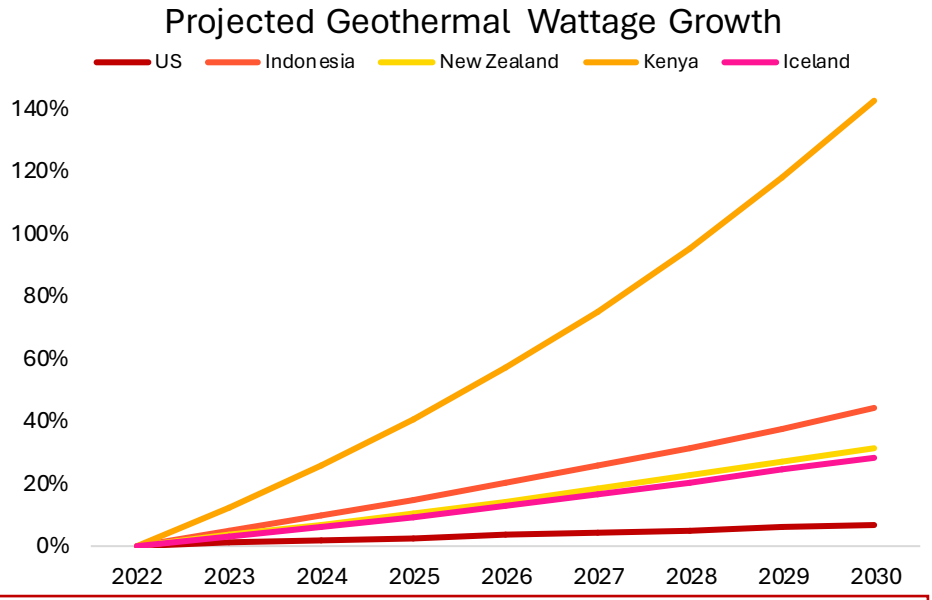
## Industry Overview

The industry is becoming more competitive as tax benefits and fluctuating commodity prices lead geothermal to become a more attractive alternative energy. Geothermal will never be an alternative to O&G globally, but it could be the main source of energy for smaller and developing countries along fault lines. Iceland currently gets around 66% of its energy from geothermal plants and countries like Kenya are rapidly expanding their geothermal production capacity. The project values on the right show an increased rate of wattage growth as opposed to previous years' linear growth trend. GeoVision sees U.S. geothermal net-summer capacity increasing from 2.5GW to 6GW by 2050 whereas the IRT projects 13GW.

While traditionally it was thought that the "best" spots for geothermal drilling were already taken, Binary-Cycle plants and ESG lead to more suitable spots and potential plants off a fault line. Binary-cycle plants are set to overtake flash steam plants as the primary geothermal plant type in the future due to a lower required temperature and longer use life. The potential for geothermal energy to be used in the US to directly heat housing could cause increased demand.




| | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| US | 3.7488 | 3.7796 | 3.81055 | 3.84175 | 3.8731 | 3.90465 | 3.93645 | 3.96845 | 4.00065 |
| Indonesia | 2.32965 | 2.4379 | 2.5534 | 2.67225 | 2.79615 | 2.92545 | 3.0604 | 3.20145 | 3.34885 |
| New Zealand | 1.0899 | 1.1261 | 1.16395 | 1.20355 | 1.24495 | 1.28835 | 1.3338 | 1.38135 | 1.4312 |
| Kenya | 1.0999 | 1.23475 | 1.38255 | 1.5452 | 1.7249 | 1.92405 | 2.14545 | 2.3924 | 2.6685 |
| Iceland | 0.84505 | 0.8699 | 0.896 | 0.9235 | 0.95245 | 0.9829 | 1.015 | 1.04875 | 1.08425 |

**Data Disclaimer:**
The data is from a study by Oakland University using a mathematical model to predict wattage for the top 10 countries utilizing geothermal countries. The study had 2 models for which I took the average of the 2 models' projected wattage and graphed the growth. Turkey had high growth but was excluded due to a high error percentage. Link to study: https://doi.org/10.3390/thermo2040023

The global market size for geothermal was $59.2B for 2021 and at a CAGR of 6.3%, it is expected to grow to $95.82B by 2029. Production was halted due to COVID-19 but has since been rising back to normal levels.

### Sustainability

Geothermal produces virtually no emissions by design since they have to pump the fluid back into the earth to maintain pressure. The major caveat to this revolves around ESG which is basically "better fracking." Cool water is pumped into the ground to break up the hot rock but this doesn't use geologically harmful chemicals and the water pressure isn't as strong as fracking. ESG has been known to cause early earthquakes due to geothermal energy's required proximity to fault lines, like the magnitude 7 Kumamoto earthquake in Japan.

## Ormat Future Outlook

Ormat has a strong business model and global positioning but risks around Kenya and cost cause concern for future profits. They are the largest publicly traded producer of geothermal energy, and they manufacture and sell the equipment that they use to other plants. Relying on internal equipment production gives the company more control over the timing and delivery of required equipment and its related costs. They also have a strong patent portfolio that furthers their competitive edge with 2 main products, the GCCU and REG systems. The GCCU (depicted on the next page) is the proprietary technology is the second vapor chamber that uses a low boiling point fluid to create steam. The REG system can harness heat from an external heat source such as exhaust gases from a Brayton cycle gas turbine, low-pressure steam, or medium-temperature liquid found in process industries such as oil refining and cement manufacturing. ORA sells both of these products to other plants along with using them for their energy segment. Moving into the future, the key markets to focus on will be Kenya and New Zealand. ORA is already in the process of developing one of their largest geothermal plants in New Zealand with an estimated 50MW of production capabilities. New Zealand currently accounts for 73% of their total $192M product backlog. The two largest projects from ORA are in Kenya and account for 27.6% of total generating capacity in 2022. Olkaria is the largest geothermal plant currently in operation from Ormat and it is located in Kenya with a production capacity of 150MW. The Olkaria is cooling at 2F per year and is currently at 73% production capacity which is below their average geothermal plant capacity of 83%. Geothermal plants can last for over 20 years but as the temperature decreases, efficacy decreases. While this plant will continue to operate for a while since it is a binary plant and can work at a lower temperature and they have plants operating at 63% capacity, their lack of future expansion in Kenya is worrying. Of their future projects, none are slated to take place in Kenya and any future projects will require a large capital investment or third-party funding. Overall personal outlook is mixed for Ormat.


VIRGINIA TECH SEED

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# Geothermal Overview

Geothermal energy revolves around harvesting heat energy from the earth and thus works best around tectonic plate lines where the heat is closer to the surface. The "Ring of Fire" encircles the Pacific Ocean and shows where the magma is close to the surface with Chile being the country with the most untapped geothermal potential. Major growing markets will be the US, Indonesia, Philippines, Turkey, and New Zealand. 3 types of plants exist, Dry Steam, Flash Steam, and Binary-Cycle.

**Ring of Fire**


## Exploring and Evaluating Sites

Initial evaluations of potential sites require expenditures ranging from $10,000 in the U.S. to $50,000 internationally, covering travel, chemical analyses, and data acquisition. After promising initial assessments, acquiring land rights introduces additional costs, dependent on market conditions and specific agreements. The exploratory drilling phase, a crucial step in confirming the geothermal resource's viability, represents a substantial financial commitment, with expenses averaging between $1.0 million and $3.0 million per site, excluding land acquisition costs. These figures do not account for the potentially higher exploration costs outside the U.S. This financial outline underscores the resource-intensive nature of geothermal exploration, with decisions to proceed heavily influenced by the anticipated commercial viability and geological assessments.

**Estimated Drilling Costs**

| | |
|---|---|
| 1000m | 2M – 3M |
| 1500m | 2.5M – 4M |
| 2000m | 3M – 5M |
| 2500m | 3.75M – 5.75M |
| 3000m | 5.75M – 8.25M |
| 3500m | 6M – 9M |
| 4000m | 7M – 10.25M |

## Costs & Drilling

In geothermal projects, drilling can represent up to 50% of total capital costs for conventional plants and over 75% for Enhanced Geothermal Systems (EGS) due to the need to drill through harder rock formations and achieve greater depths. Cost estimation is difficult compared to O&G due to additional factors affecting geothermal energy, such as harsh downhole environments, larger diameter boreholes, and lack of similarity from well to well. PDC bits are common for O&G but tri-cone bits are more common in geo drilling, though when correctly applied PDC makes up for its higher cost with a greater ROP. While more expensive initially, geothermal plants have lower operational costs and are not affected by volatile commodity prices making it a competitive option.

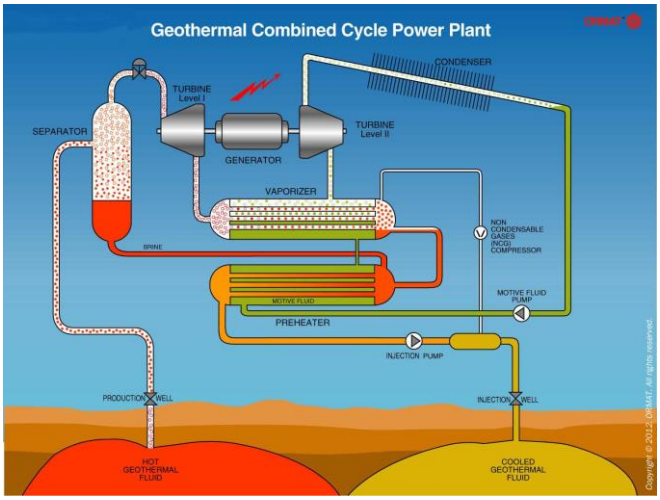
## How it Works

**1. Extraction of Geothermal Fluids:** The process begins with drilling wells deep into the Earth's crust to access hot water and steam stored in geothermal reservoirs. These geothermal fluids are then pumped to the surface under high pressure.

**2. Separation and Steam Generation:** Once the geothermal fluid reaches the surface, it is separated into steam and water. The steam, which is often superheated, is directed towards the turbine in the first cycle of the plant. Any water that is separated can be reinjected back into the Earth to sustain the reservoir.

**3. First Power Generation Cycle:** The high-pressure steam spins a turbine connected to a generator, producing electricity. This initial step is part of the steam cycle, which is highly efficient at converting the thermal energy of the steam into electrical energy.

**4. Utilizing Lower-Temperature Steam:** After the steam has passed through the first turbine, it still holds significant thermal energy, although at a lower temperature. This steam is then directed into a secondary system, where it heats a secondary fluid with a lower boiling point than water, in a process known as a binary cycle.




**5. Second Power Generation Cycle:** The heated secondary fluid, now vaporized, spins another turbine connected to a generator, producing additional electricity. This binary cycle allows the plant to extract even more energy from the geothermal steam by utilizing the heat that would otherwise be wasted.

**6. Cooling and Recondensation:** After the secondary fluid has passed through its turbine, it is cooled and condensed back into a liquid by a cooling system, often using air or water. This liquid is then recirculated back to be heated again, continuing the cycle.

**7. Reinjection of Geothermal Fluids:** Any remaining geothermal fluid, primarily water at this point, is reinjected back into the Earth to replenish the geothermal reservoir, ensuring the sustainability of the resource. Fluids must be reinjected to maintain pressure.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# Appendix

## Types of Geothermal Plants

**Dry Steam Plants:**

Dry steam plants utilize high-pressure steam directly from geothermal reservoirs to drive turbines, which in turn generate electricity. Dry steam plants require high-temperature reservoirs typically above 300°C (572°F) to produce the steam necessary for power generation. Steam is extracted from underground reservoirs through production wells. The steam is then piped to the surface and directed through a turbine to generate electricity. After passing through the turbine, the steam is condensed back into water and reinjected into the reservoir to maintain pressure.

**Flash Steam Plants:**

Flash steam plants are the most common type of geothermal power plants. They utilize high-pressure hot water from the reservoir, which is flashed into steam to drive turbines. Flash steam plants operate at slightly lower temperatures compared to dry steam plants, typically between 180°C to 370°C (356°F to 698°F). Hot water is brought up from the reservoir through production wells. As the high-pressure water flows up to the surface, it is sprayed into a flash tank where the sudden drop in pressure causes it to "flash" into steam. The steam then drives turbines to generate electricity. After passing through the turbine, the steam is condensed back into water and reinjected into the reservoir.

**Binary Cycle Plants:**

Binary cycle plants are used when the temperature of the geothermal resource is too low to directly produce steam. They utilize a secondary fluid with a lower boiling point than water to transfer heat from the geothermal reservoir to a heat exchanger. Binary cycle plants can operate at lower temperatures compared to dry steam and flash steam plants, typically between 50°C to 150°C (122°F to 302°F). Hot water from the geothermal reservoir is pumped through a heat exchanger, where it transfers its heat to a secondary working fluid with a lower boiling point, such as isobutane or isopentane. The secondary fluid vaporizes and drives a turbine to generate electricity. The vaporized secondary fluid is then condensed back into liquid form using cooling water and recycled through the system.

## Key Countries

**Guatemala:**

- Implemented the General Electricity Law of 1996 to establish a wholesale electricity market and regulatory framework.
- Provided incentives for renewable energy development, such as tax exemptions and customs duty benefits.

**Kenya:**

- Regulated by the Kenyan Energy Act, allowing licensing for power producers and distributors, with KPLC as the major supplier.
- Encourages renewable energy through feed-in tariff policies.
- Manages transmission and geothermal drilling through government-owned entities.

**Indonesia:**

- Governed by the Electricity Law of 2009 and Job Creation Act No. 11 of 2020, dividing the industry and allowing private sector participation.
- Encourages private sector involvement in power generation, especially for geothermal, through the IPP scheme.
- Enacted regulations to accelerate renewable energy adoption with a focus on negotiated tariffs.

**Guadeloupe:**

- EDF operates transmission, distribution, and fossil fuel generation, while IPPs focus on renewable electricity.
- Regulated by the Commission Regulation of Energy, with laws encouraging renewable energy generation.
- Aims for energy independence by 2030, focusing on solar, wind, and geothermal growth.

**Honduras:**

- The Law of Electrical Industry of 2014 establishes auctions for renewable energy and supervisory bodies.
- Mandates utilities to buy excess power from renewables and credit it towards bills.
- Offers incentives for renewable energy projects, including tax exemptions and payment guarantees.

## BLM Contracts

BLM geothermal leases authorize lessees to utilize geothermal resources on U.S. federal lands, with terms allowing for development while maintaining federal ownership of underground minerals. Lease durations and financial terms vary, including initial ten-year terms with potential extensions based on production, alongside annual rental fees and royalties on the geothermal resources produced. Non-competitive leases cost $1 per acre for the first ten years, then increase to $5 per acre annually, while competitive leases are priced at $2 per acre for the first year, $3 per acre for the second through tenth years, and then $5 per acre annually thereafter. Royalty rates during the first ten years of production are between 1.0% and 2.5% of gross proceeds from electricity sales. After the first ten years, the rates for resources used for electricity but not sold in an arm's length transaction increase to 1.75% for the first ten years and 3.5% thereafter. For arm's length transactions, the rate is 10.0% of gross proceeds.

## New Technologies

**AltaRock Energy** has developed a technology that uses a beam of microwaves to drill small holes and then clogs the cracks made in the process with a biodegradable substance. This prevents water leakage into the cracks when drilling and is currently being tested in Newberry Oregon.

**HydroValve** already launched the GeoVolve HAMMER which is a drill that both rotates and vibrates into the rock (percussive drilling) which is said to lower drill times by 10 times and half costs.

**Orchyd** researchers are developing a water-based drill that is predicted to lower cost by 60% and will have its first viable prototype in 2024.

**Petre** is testing a “plasma gas torch” to drill through rocks thermally.