

# Main World Geothermal Projects

## Technology | Geothermal Energy

### 3. Main World Geothermal Project

Geothermal power plants are a unique source of renewable electricity, taking the heat generated under the earth's surface to create steam, which is then used to turn turbines to create electricity electromagnetically.

Each have turned a unique geological feature of our planet into an economical, and relatively environmentally friendly, means to power industries, homes, and modern societal infrastructure.

The top geothermal power plants in the world based on net capacity are described and illustrated in the following list:

#### **3.1 The Geysers Geothermal Complex, California, USA (1,520 MW capacity)**

The Geysers is a geothermal field located in California's Mayacamas Mountains, approximately 115km north of San Francisco.

It is the world's biggest single geothermal field, comprising of 22 geothermal power plants with an installed capacity of 1,517MW

The number of geothermal power plants currently operating within the region is 18 and the present combined generation capacity of these plants is 900MW, enough to power 900,000 homes.

The Geysers is also the area where the US's first geothermal power plant was put into commercial operation.

The complex covers an area of approximately 78km<sup>2</sup>. Production from the geothermal field commenced in 1960.



***Fig. 1 – The Geysers Geothermal Field, California (from Power Technology)***

The power generated from the Geysers helps meet the electricity needs for California's Sonoma, Mendocino, and Lake counties.

A part of the power needs of Napa and Marin counties are also met by the Geysers Complex. This is especially important, as this area of California has large numbers of people and important industries, many of whom are very ecologically conscious.

## **3.2 Larderello Geothermal Complex, Italy (770 MW capacity)**

The Larderello Geothermal Complex is found in central Italy, near Tuscany. Larderello is comprised by 34 plants with a total capacity of 770 MW of electricity generation.

The Complex is also one of the oldest in the world, with the first plant there being commissioned more than a century ago, in 1913.

Enel Green Power owns the power plants at the complex serving approximately two million families, 8,700 residential and business customers and 25 hectares of greenhouses. Reservoir depths at the geothermal field range from 700m to 4,000m below the surface. The first plant at the geothermal field was commissioned a century ago, in 1913, making it the first of its kind in the world.



*Fig. 2 – Larderello Plant in Italy (from EGP and ThinkGeoEnergy)*

## **3.3 Cerro Prieto Geothermal Power Station, Mexico (720 MW capacity)**

The Cerro Prieto Geothermal field owned by CFE (Comision

Federal de Electricidad), located in the northern part of Mexico, 30 km south of the border with the USA. It is owned and operated by the Comisión Federal de Electricidad (CFE). The power station features four plants, comprising of 13 units. The first plant was commissioned in 1973, while the fourth plant was commissioned in 2000.

A fifth plant, which will comprise of two 50MW turbines, is currently under construction.



*Fig. 3 – Cerro Prieto Geothermal Field (from ThinkGeoEnergy and Alamy pic.)*

### **3.4 Makban Geothermal Complex, Philippines (460 MW capacity)**

Makban Geothermal Power Complex, also known as Makiling-Banahaw Power Plants, is located in the municipalities of Bay and Calauan in the Laguna province and Santo Tomas, in the Batangas province, with an output capacity of 458MW.

The complex, covering an area of 700ha, commenced operations in 1979 and is owned by AP Renewables.

The complex consists of six power plants comprising of 10 units, including a binary plant.



*Fig. 4 – Makban geothermal power plant, Philippines (from: ThinkGeoEnergy)*

### **3.5 CalEnergy Generation's Salton Sea Geothermal Plants, USA(340 MW capacity)**

CalEnergy Generation's Salton Sea Geothermal Plants include a cluster of 10 generating geothermal plants in Calipatria, near the Salton Sea in Southern California's Imperial Valley, with a combined generating capacity of 340MW.

CalEnergy Generation, the operator of the field, has a 50% interest in the facilities, while the remaining 50% is held by MidAmerican Geothermal. The generated power is supplied to Southern California Edison Company.

Unit 1 with an output capacity of 10MW was the first to come online in 1982. The 10th field came online in 2000.

CalEnergy Generation is currently developing new projects in the area, including the Black Rock Project, which will consist of three new 50MW geothermal plants.



*Fig. 5 – CalEnergy Generation’s Salton Sea Geothermal Plants, USA (from PowerTechnology)*

### **3.6 Hellisheidi Geothermal Power Plant, Iceland (300 MW)**

Hellisheidi geothermal power plant is a flash steam, combined heat and power plant (CHP) located at Mount Hengill, approximately 20km east of the capital city of Reykjavik.

It serves electricity to the Icelandic city of Reykjavik, and is the largest power generating plant of any kind in Iceland.

The plant has a production capacity of 300MW of electric energy and 400MW of thermal energy.

The Hellisheidi geothermal power plant is owned by Orkuveita Reykjavíkur. It was constructed by Mannvit Engineering and Verkís Engineering and power generated from the plant is supplied primarily to the nearby aluminum refineries.

The power plant was commissioned in five phases from 2006-2011. It covers an area of approximately 13,000m<sup>2</sup>.



*Fig.6 – Hellisheidi Geothermal Power Station, Iceland*

### **3.7 Tiwi Geothermal Complex, Philippines (290 MW capacity)**

Tiwi Geothermal Complex is located at Tiwi in the province of Albay, about 300km south-east of Manila. The 289MW (net) Tiwi complex is owned by Aboitiz Power's subsidiary AP Renewables and it comprises of three power plants featuring two units each. Drilling works at the geothermal field commenced in 1972 and the power plant became operational in 1979.

The project was developed by National Power Corporation and Philippine Geothermal.



*Fig. 7 – Tiwi Geothermal Complex, Philippines*

### **3.8 Darajat Power Station, Indonesia (260 MW capacity)**

The Darajat Geothermal Power Station, has an installed capacity to generate 260 MW of electricity. It is located in Garut, Pasirwangi District, Indonesia, and is operated by Darajat GPP Amoseas Indonesia. Three power plants in the station generate electricity that serves the Bali and Java provinces of the island nation.

The power station comprises of three plants serving the provinces of Java and Bali. The plants were commissioned respectively in 1994, 2000 and 2007. Plants II and III share common facilities, including the steam gathering system.



*Fig.8 – Darajat Power Station, Indonesia*

### **3.9 Malitbog Geothermal Power Station, Philippines (230 MW capacity)**

The Malitbog Geothermal Power Station, located approximately 25km north of Ormoc City in Leyte Island, has an installed capacity to generate 230MW power capacity.



The plant was earlier owned by Visayas Geothermal Power Company (VGPC), which later transferred the ownership rights to Philippine National Oil-Energy Development Company (PNOC). The plant is currently owned by Energy Development Corporation. Power from the field is supplied to the Luzon Island.

The Malitbog geothermal power plant construction commenced in 1993 and was completed in 1996.



*Fig. 9 – Malitbog Geothermal Power Station, Philippines*

### **3.10 Wayang Windu Geothermal Power Plant, Indonesia (225 MW capacity)**

Wayang Windu Geothermal Power Plant is located in Pangalengan, approximately 40km south of Bandung City in the province of West Java. The geothermal plant, with an output capacity of 225MW.

Magma Nusantara Limited (MNL), a wholly-owned subsidiary of Star Energy, operates the field.



**Fig. 10 – Wayang Windu Geothermal Power Plant, Indonesia**

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## References

- *Power Technology:* <https://www.power-technology.com>
- *EIA:* U.S. Energy Information Administration
- *Global Energy Observatory:* <http://globalenergyobservatory.org>