

*Cool the Earth  
Stay Hot with*

***GEO THERMAL***

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***QUICK GUIDE***

*Explore the Treasure  
under your Feet*

*International Geothermal Association Inc.*

[www.lovegeothermal.org](http://www.lovegeothermal.org)

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# What is Geothermal?

## *Pure treasure*



Geothermal is the natural heat of the Earth, which is estimated to be 5,500 °C at the Earth's centre – almost as hot as the surface of the Sun. This heat is derived from the original formation of the planet and from the decay of the radioactive elements in the Earth's crust. It is transferred to the subsurface by conduction and convection. With depth the rate of temperature increases, this is what we call geothermal gradient.

People learnt to use different temperatures and apply them for various purposes. For centuries, geothermal springs have been used for bathing, heating and cooking. But only in the early 20th Century did people start to consider the heat from inside the Earth as a practical source of energy with huge potential. Geothermal energy is now used to produce electricity, to heat and cool buildings as well as for other industrial purposes like grain and lumber drying, pulp and paper processing, fruit and vegetable cultivation, soil warming and many others.

Geothermal has become established as a reliable and environmentally benign source of power. Proven high availability and load factors with no dependence on outer sources, makes geothermal energy one of the key resources in a sustainable energy future. Only a small fraction of the world's geothermal potential has been developed so far, which leaves enough room for growth and development in both electricity and direct use sectors.



# Geothermal 4 Health

## *Back to nature*



Since ancient times geothermal resources have played a significant role in human societies. Probably the most ancient one is the use of the geothermal hot springs. Nothing can compare to thermal bathing and geothermal waters have been long known for their healing properties. According to the most reliable records, the use of thermal waters dates straight back to 3000 BC when the Indus Valley civilisations used natural hot and mineral springs.

Geothermal waters are highly beneficial, especially if you want to improve your health and well-being, treat arthritis, skin diseases (e.g. eczema and psoriasis) and get rid of your high blood pressure. Thermal waters contain a lot of minerals, such as calcium, sulfate, magnesium, iron, chloride, potassium, zinc—to name just a few. Nowadays, a lot of wellness centres offer a variety of geothermal by-products such as soaps, shampoos, bath powders and facial creams with thermal water.

You can find out more about the best geothermal health destinations on our Website.





# Hot & Cool Sides of Geothermal

## *Multitask with geothermal*

Geothermal water has been used for decades for space heating and cooling, which is the largest direct use type of geothermal. Geothermal Heat Pumps (GHP, also referred to as GSHP) make use of stable ground temperatures of 10-20°C in moderate climates. When the underground temperatures are too low to be used directly for space heating, heat pumps can still be used and make geothermal usage practicable for much smaller scale operations down to individual dwellings. Virtually any temperature level in the underground is suitable for heat pumps usage, but the range of 5-30°C is a common practice. Reversible heat pumps are being used on an increasing scale for space cooling during summer and space heating during winter.



### CASE-STUDY

In 1995 a geothermal district heating scheme was launched in Balçova, a suburb of Izmir, Turkey. Up to 30 wells have been drilled into the geothermal resource at 140°C of which 14 remain online (including two deep injectors). As of year 2006, the Balçova district heating system enjoyed a 90 MWth installed capacity, sustaining a 250 GWh production of geothermal heat. The heat load consists of residential dwellings (60%) as well as university buildings, hospital, offices, hotels, shopping centre, thermal baths, and 10 ha of heated greenhouses.

Reservoir depletion and premature cooling have been mastered thanks to deep peripheral injection wells, achieving, as of year 2006, the disposal of 60% of the peak discharge. Calcite scale abatement is achieved by scaling inhibitors injected into the wells. It is estimated that the system avoids the emission of 18,000 tonnes of carbon dioxide per year.

# Other Direct Uses of Geothermal

## *Grow your own geothermal food*



Geothermal energy can be used in a wide variety of applications, ranging from agriculture and aquaculture to the production of consumer goods. Food processing, fruit and vegetable cultivation, grain and lumber drying, pulp and paper processing are just a few possibilities to use geothermal in industry. A lot of countries report the use of geothermal energy for direct uses. Since the temperature range used in direct geothermal is much lower comparing to the electricity production this is one of the most promising area of geothermal application.



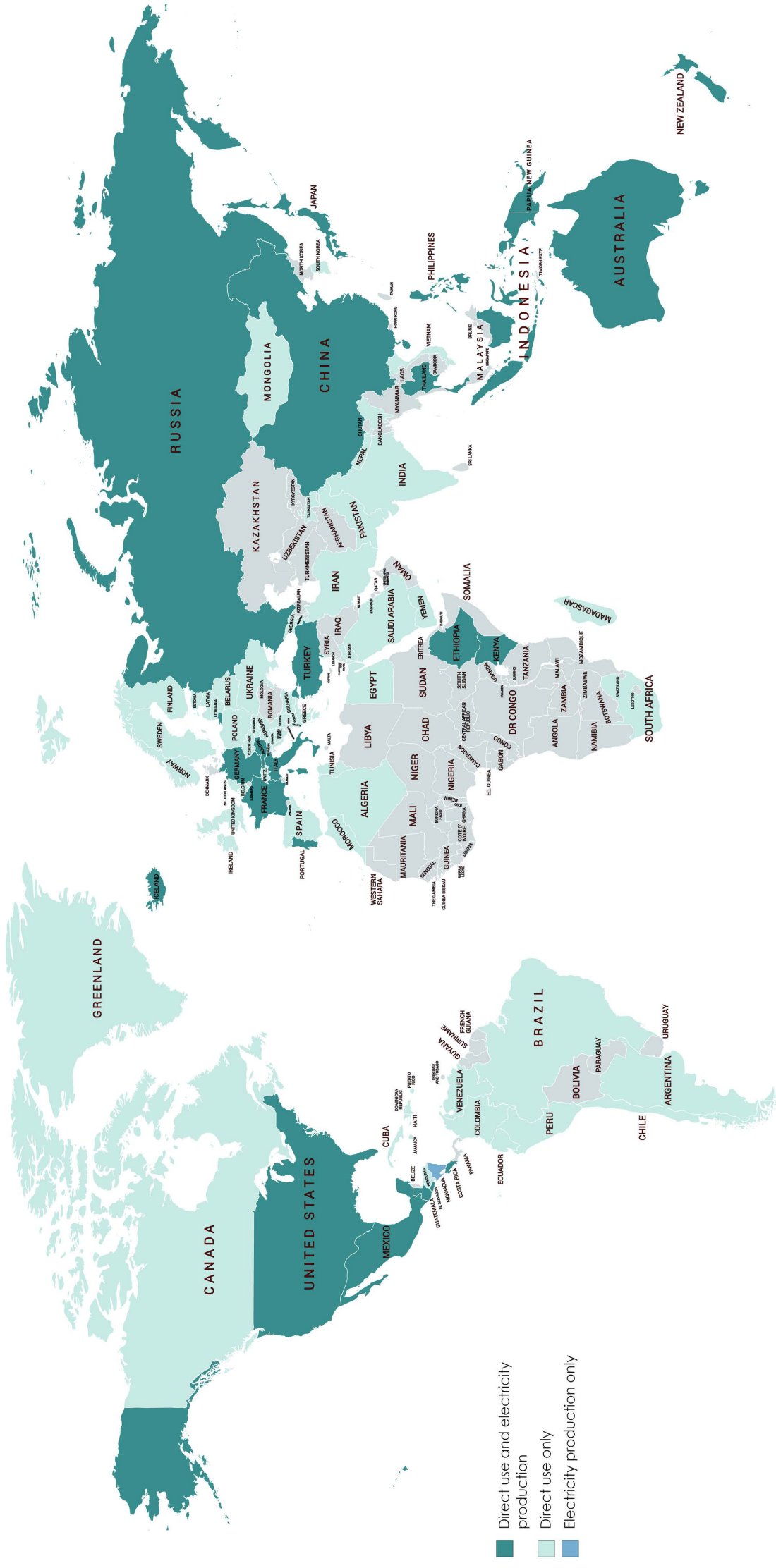
# Electricity Generation

## *Powerful source of stable energy*

Existing power plant technologies enable generation of electricity either directly from high temperature steam, from steam-water mixtures using flash technology, or from geothermal water with intermediate temperature (70-170°C) using binary technology. In a binary cycle plant of Organic Rankine Cycle (ORC) type the geothermal fluid (water, steam or both) passes a heat exchanger heating another working fluid i.e. isopentane or isobutane with a low boiling point, which vaporizes and drives a turbine. The working fluid can be air-cooled or condensed with water. Binary plants are often constructed as linked modular units of a few MWe. Combined or hybrid plants comprise two or more of the above basic plant types to improve versatility, increase overall thermal efficiency, and improve load-following capability. Cogeneration plants, or Combined Heat and Power plants (CHP), produce both electricity and hot water for district heating at significantly higher efficiency than can be achieved by just generating electricity or supplying heat.

Geothermal fluids are piped directly to the power plant where steam is used to drive turbines for power generation. Spent geothermal fluids are commonly injected back into the ground to help sustain reservoir pressure, taking with them the majority of potential contaminants. Geothermal power plants easily meet the most stringent clean air standards. The comparatively minute quantities of gases such as CO<sub>2</sub> that may be emitted from geothermal power plants are not created during power production but are natural trace constituents of all geothermal systems. During the industrial exploitation of a geothermal field, when the geothermal wells and gathering systems collect and convey the deep geothermal fluids to the power plants, the natural emissions are concentrated at the plants, which facilitates disposal. Natural surface manifestations, including soil degassing, are usually reduced.

# Global Geothermal Use, 2015



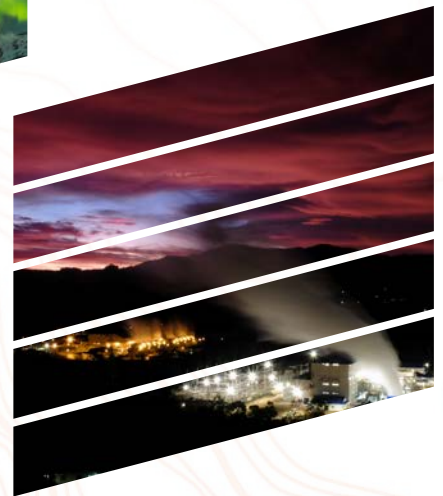


# Geothermal A, B, C...

*There is something good for every letter*



- A - Available
- B - Baseload
- C - Cozy
- D - Domestic
- E - Environmentally friendly
- F - Future-oriented
- G - simply Great
- H - Homemade
- I - Independent
- J - Joyous
- K - Known
- L - #Lovegeothermal
- M - Majestic
- N - Natural
- O - Observable
- P - Promising
- Q - Qualified to meet future energy needs
- R - Reliable
- S - Safe
- T - Tremendous
- U - Universal
- V - Valuable
- W - Weather unrelated
- X - Xenial
- Y - Young
- Z - Zero emissions







*International Geothermal Association Inc.*

IGA is a global geothermal organization uniting the geothermal sector around the globe. It aims at being the leading world authority in matters concerning the research and development of geothermal energy by setting educational standards and offering world-wide energy solutions and in-house technical support, with special support for countries in early stages of geothermal development.

IGA connects the Global Geothermal Community, serving as a platform for networking opportunities aimed at promoting and supporting global geothermal development.

More information on the IGA website: [www.lovegeothermal.org](http://www.lovegeothermal.org)

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