



Renewable Energy

Contributing Proven
Solutions to the World



It's clear that climate change is a threat that can only be tackled through the combined efforts of the international community.

The solution must be based on diverse clean, renewable, and environmentally sound sources of energy.

Geothermal power could benefit an additional 750 million people around the world.

At least 70 countries have utilizable geothermal energy potential. With today's technology, more than 140,000 MW of electric power can additionally be harnessed in the world's high-temperature geothermal fields. These areas are, for example, in the African Rift Valley and the Pacific Ring of Fire (including the archipelagos of East Asia, Central and South America and the Western United States.) Vast low-temperature areas, as can be found in China and Europe, can provide heat for district heating and other direct use. Deep drilling projects, currently underway, and the enhanced geothermal systems are likely to dramatically increase the power production.





The switch from coal to geothermal energy reduces CO₂ emission by 96%.

The total CO₂ reductions from the world's largest geothermal heating system in Reykjavik, Iceland, are between 2.5 and 4 million tons annually. The calculation is based on other possible alternatives - in the case of Reykjavik this would have been the use of fossil fuels such as gas, oil or coal. Fossil fuels have to be imported to Iceland, therefore the CO₂ saving is much higher.

Hellisheidi power plant,
Reykjavik area, Iceland.

Only 1/3 of the world's potential hydropower resources have been developed.



Hydropower projects that are developed and operated in an economically viable, environmentally sound and socially responsible manner represent sustainable development. Hydropower already produces one-sixth of the world's electrical power and is one of the world's most important sources of renewable energy. Much of the remaining potential is in countries where the need for energy is the greatest. For example, only 7% of the hydropower potential in Africa has been harnessed to date.



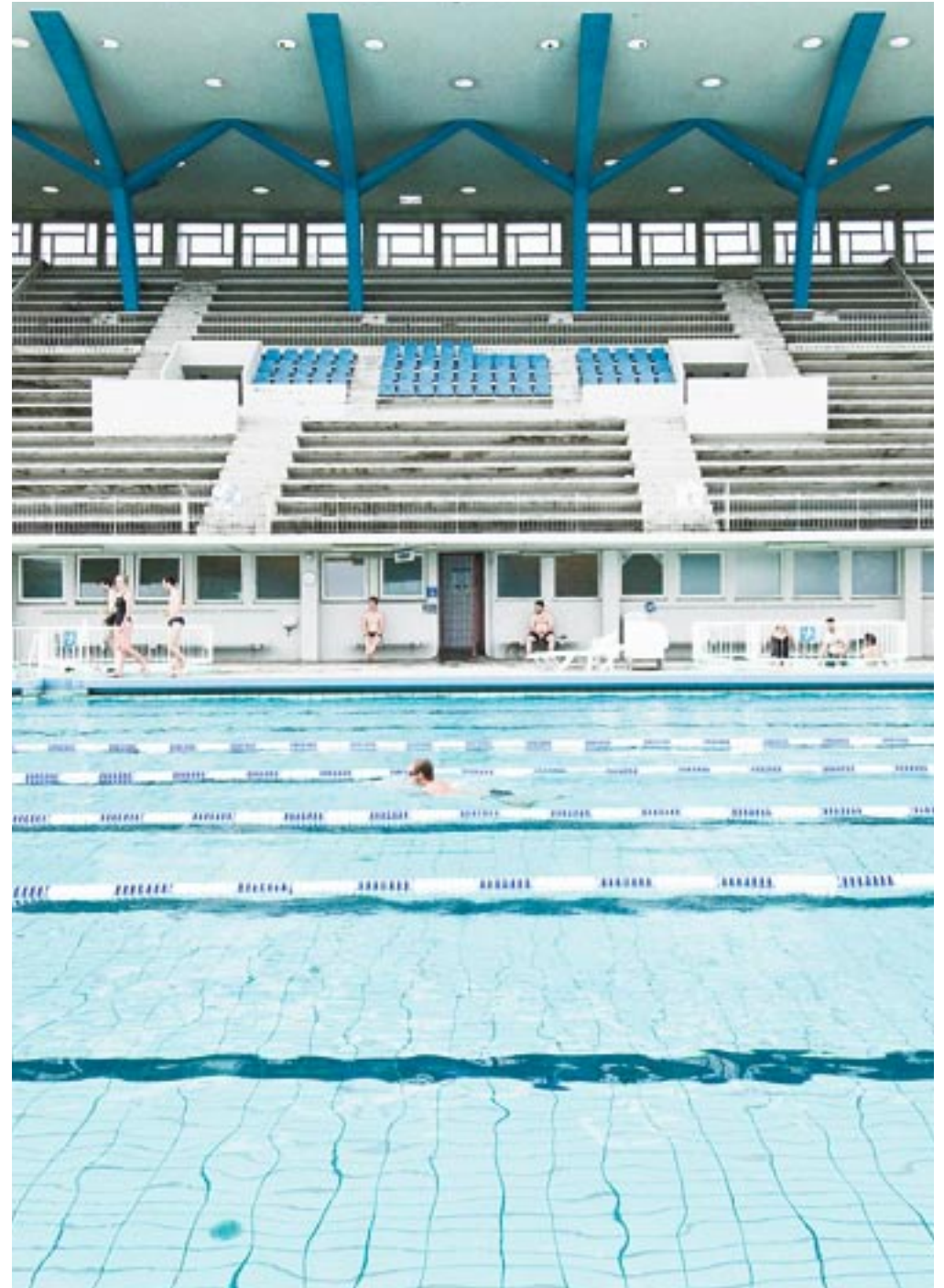


The world's daily consumption of oil is 82,5 million barrels. Hydropower already saves burning the equivalent of 4.4 million barrels of oil every day.

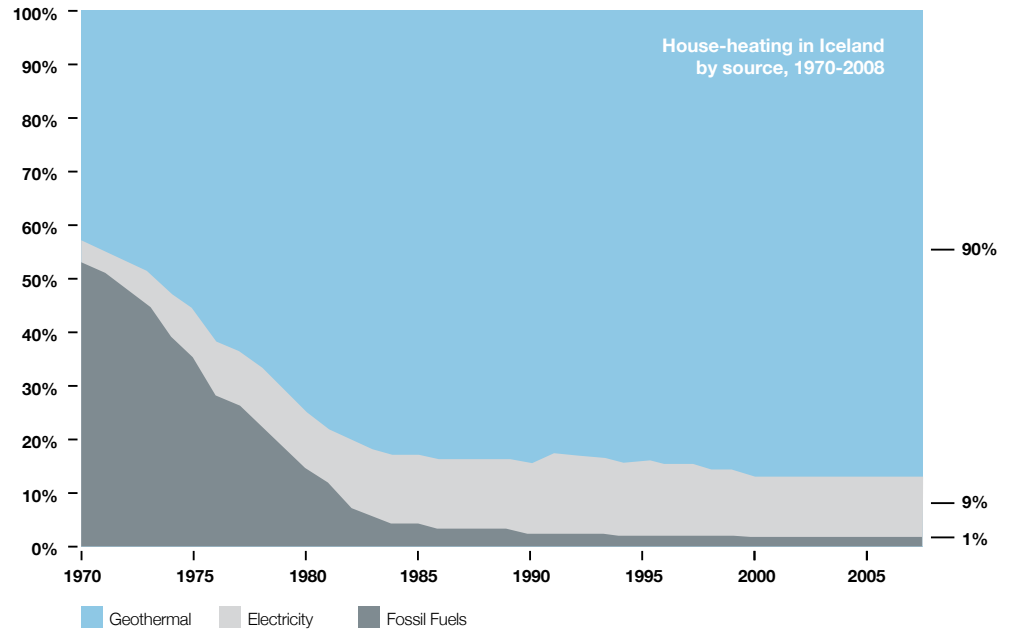
Burfell hydropower plant
in southern Iceland.

Meet Iceland. The nation which has already made the transformation to renewable energy.

Iceland's story is a showcase of the success which can be achieved in clean energy development. The country has succeeded in doing what many consider impossible: transforming its energy systems from fossil fuels to renewable energy. The use of geothermal energy in Iceland is highly cost-effective, reliable, clean, and socially important. It has also dramatically increased the quality of life for the inhabitants.



An outdoor geothermal swimming pool in central Reykjavik.



Heating houses without a carbon footprint.

A large part of global CO₂ emissions comes from burning fuels for heating houses. Iceland enjoys one of the most advanced geothermal district heating systems in the world. The fact that CO₂ emissions from the total house heating in the cool Icelandic climate are almost zero demonstrates exciting opportunities for the world.

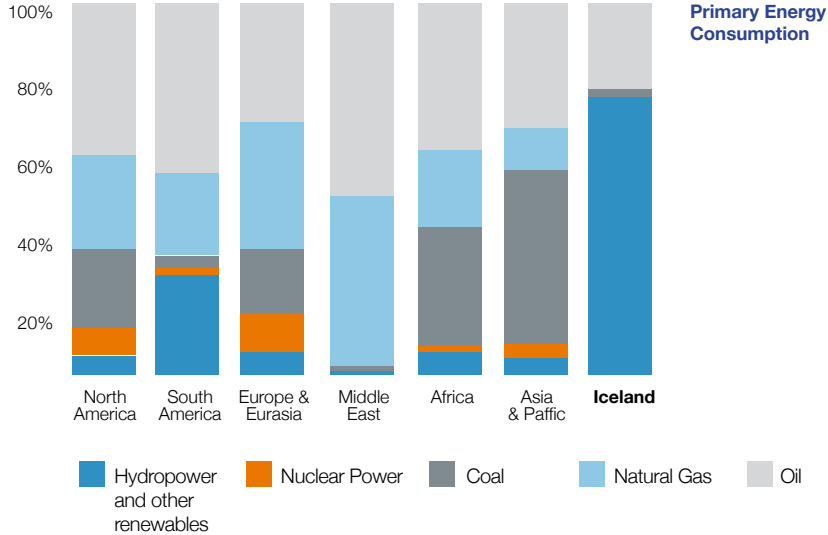
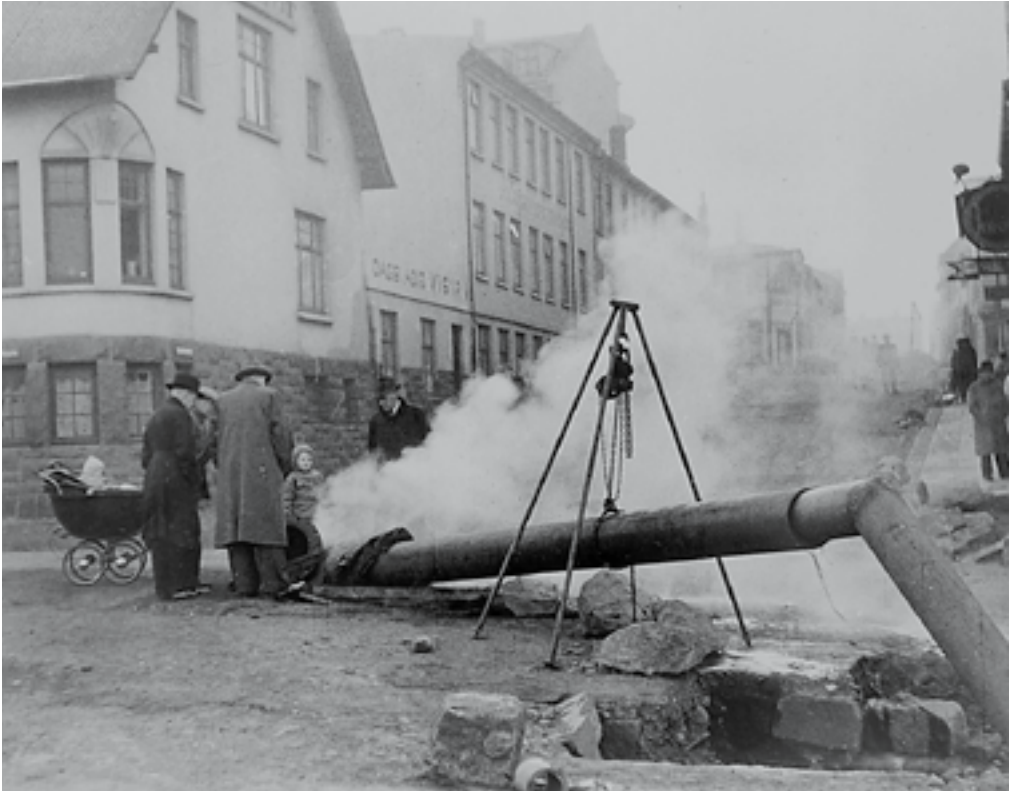
Icelandic families enjoy life in geothermally heated houses at a low cost.



Geothermal water has been used for hygienic purposes for centuries. The picture shows women washing clothes in Reykjavik in the early 20th century.

More than 80% of Iceland's primary energy consumption comes from renewable resources.

Over 80% of Iceland's energy demands are met with local sustainable energy resources. This record breaking achievement consists of geothermal energy and hydroelectric sources. Iceland's first geothermal district heating system was started 100 years ago. Around the same time, the country's first hydropower plant was built. The systems were built gradually over the decades. When global interest in clean energy resources peaked after the oil crisis in the 1970s, Iceland was continuing its development. When other countries fell back to using fossil fuels after the crisis, Iceland fortunately kept its pace of developing indigenous geothermal and hydroelectric energy resources.



Over the decades, Iceland has gradually built its geothermal district heating system.





Iceland generates almost 100% of its electricity with clean energy.

In many countries, the most difficult energy challenge is to change electricity systems from fossil fuels to clean energy. Iceland has achieved this. The benefits are clear: low production cost, 24-hour base load power and reliable peak hours availability. Iceland now benefits from having generated electricity commercially by hydroplants and geothermal steam for decades.

Ljosafoss hydropower plant
in southern Iceland.



Since 1975, many of the world's leading experts, from countries with vast geothermal potential, have been educated in Iceland. The geothermal training programs offer 6-month courses as well as MSc programmes. The UNU Geothermal Training Programme has held regular seminars in Asia, Africa, and Latin America for regional experts and authorities. The aim is to contribute technology and tested energy solutions to developing countries, towards a better future for the people as well as a cleaner energy future for the world. See www.os.is/page/unugtp for more information.

Hundreds of experts from 43 countries have graduated from the UN University Geothermal Training Program in Reykjavik.



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The University of Iceland
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Reykjavik Energy Graduate School of Sustainable Systems
www.reyst.is

Icelandic universities – Centers of excellence in renewable energy.

Renewable energy has become an important field of study in Iceland. The Icelandic universities have taken the lead, founding graduate and post-graduate courses in the many fields of expertise in clean energy, collaborating with some of the world's leading institutions.

Icelandic experts and investors participate in geothermal projects worldwide.



From a geothermal project in Nicaragua where Icelandic experts are participating.

Ever since the first overseas geothermal project, in Kenya in 1975, Icelandic experts have contributed to the world's best known geothermal projects. Geothermal experts from Iceland are currently at work in the United States, China, Indonesia, the Philippines, Germany, Hungary, Djibouti, Eritrea, Nicaragua, and El Salvador to name but a few examples.

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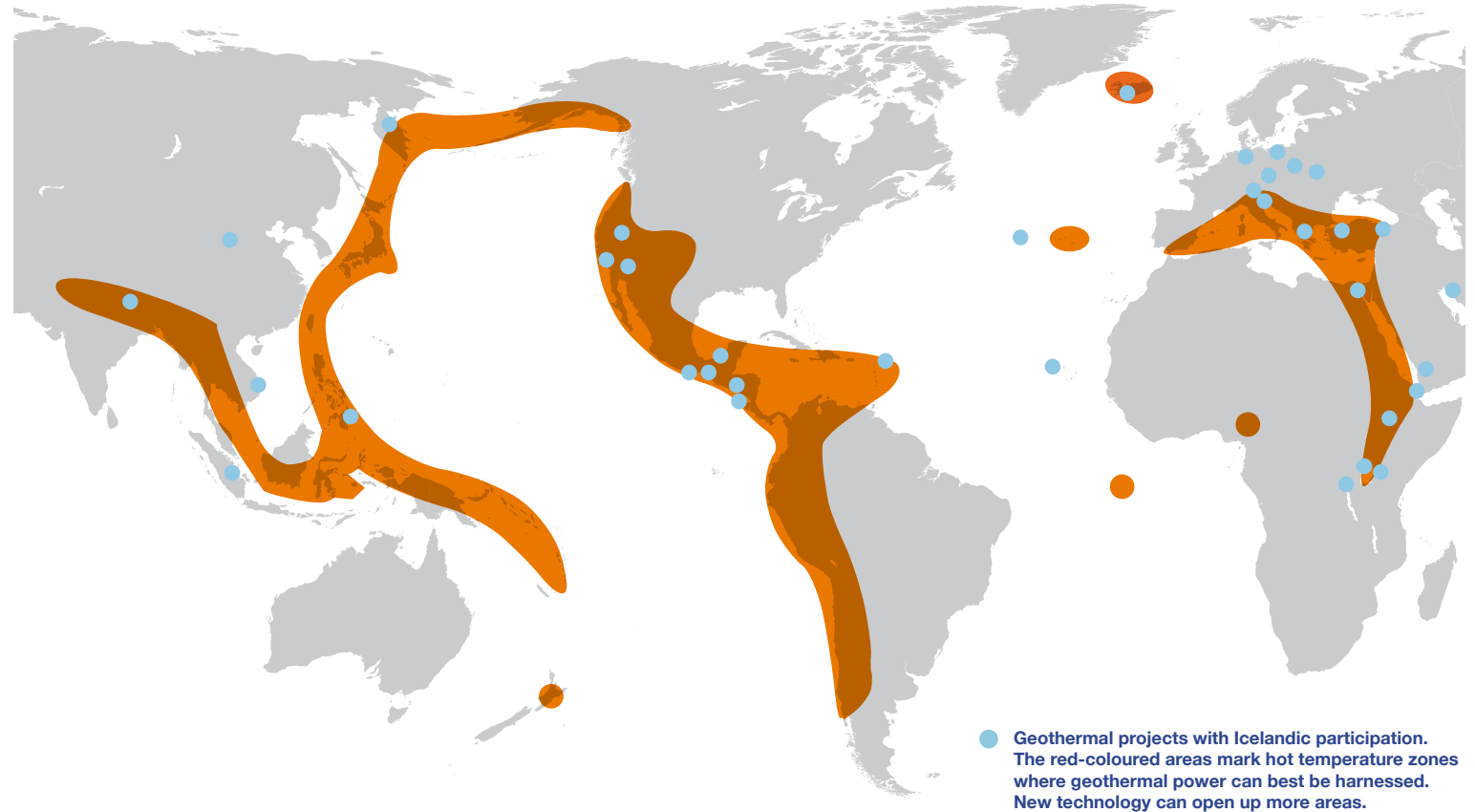
Verkis Engineering Consultants
www.verkis.is

Mannvit Engineering Consultants
www.mannvit.is

Efla Engineering Consultants
www.efla.is

Innovative technology to utilize geothermal power can open up many new opportunities.

Geothermal heat can be used to cool buildings in a warmer climate. Projects are under way to use geothermal energy to drive district cooling systems and thus combat the CO₂ emissions from air conditioning which is in some countries the largest source of emissions of greenhouse gasses. Innovative technologies may also be used to generate electricity from low-temperature geothermal areas. Recently, advancement has also been made in Hot Rock technology.







New drilling technology can open access to 5-10 times more energy.

Various scientific investigations are under way to make geothermal energy a potential major contributor in the quest for clean, sustainable, and economically viable energy solutions. The Iceland Deep Drilling Project (IDDP) examines the technical and economic viability of using deep, unconventional geothermal resources. The technique is expected to produce much more energy from a geothermal source than has been possible in the past by drilling far deeper down into the earth in order to reach temperatures of 400-600°C and a pressure up to tenfold the pressure found in conventional wells. Enhanced Geothermal Systems (EGS) are expected to open up an additional 100,000 MW of cost-competitive base-load electricity in the United States as soon as 2050. Experts are optimistic about achieving commercial viability of EGS over the next 10–15 years.



An electric moped

Driving Sustainability, is an exclusive international platform for sustainable energy solutions for transport. It is an annual conference in Iceland where visionaries, policy makers and leading companies gather to confer on the present and future trends in sustainable mobility.



Iceland as a laboratory for the clean technology revolution.



At work. Marorka's award winning experts in energy efficiency systems.

Even though only 20% of Iceland's energy needs, mostly in the transport and fisheries sectors, are met by fossil fuel, Icelandic authorities and local companies already have several innovative programs up and running to create a totally clean energy future. The government of Iceland supports innovative companies in clean energy, energy efficiency, and clean technology and offers Iceland as a laboratory for solutions aiming at a clean energy future. These are a few of the examples.

Marorka is a leading producer of energy management systems for ocean vessels. The aim of the company is to enable its customers to maximize operating results by minimizing fuel consumption and harmful emissions. Marorka won the Nature and Environment Prize awarded by the Nordic Council in 2008.

Carbon Recycling International captures carbon dioxide from industrial emissions and converts carbon dioxide to fuel. The sources of emissions are basic infrastructure industrial processes, including aluminum smelting, ferro silicon manufacturing, cement production and coal-fired power generation.

Electric cars. In 2008 Mitsubishi Motors Corporation (MMC) and Iceland's Ministry of Industry, Energy, and Tourism signed a Memorandum of Understanding regarding fleet testing of the zero-emissions MiEV electric vehicle. Iceland has ambitious plans to reduce its dependency on fossil fuels and proposed that the testing of the MMC electric car would begin in 2009.

Iceland is home to the **Hydrogen project**, where the first commercial hydrogen filling station was built in cooperation with Shell Hydrogen, Norsk Hydro, and DaimlerChrysler. Iceland New Energy has been in the forefront of promoting the hydrogen economy, and Iceland is a founding member of the International Project for the Hydrogen Economy. An innovative company, Iceland Hydrogen, has built a machine to drive energy systems on an ocean vessel.

The Ministry of Industry has announced a plan to work with local communities and around Iceland to build multi-fuel power stations to provide different types of fuel for cars. This would be a major contribution to the clean energy infrastructure. The filling stations could provide alongside traditional petroleum: biodiesel, ethanol, methanol-mixed fuel, methane, and be charging stations for electric cars.



A hydrogen fuelling station in Reykjavik.

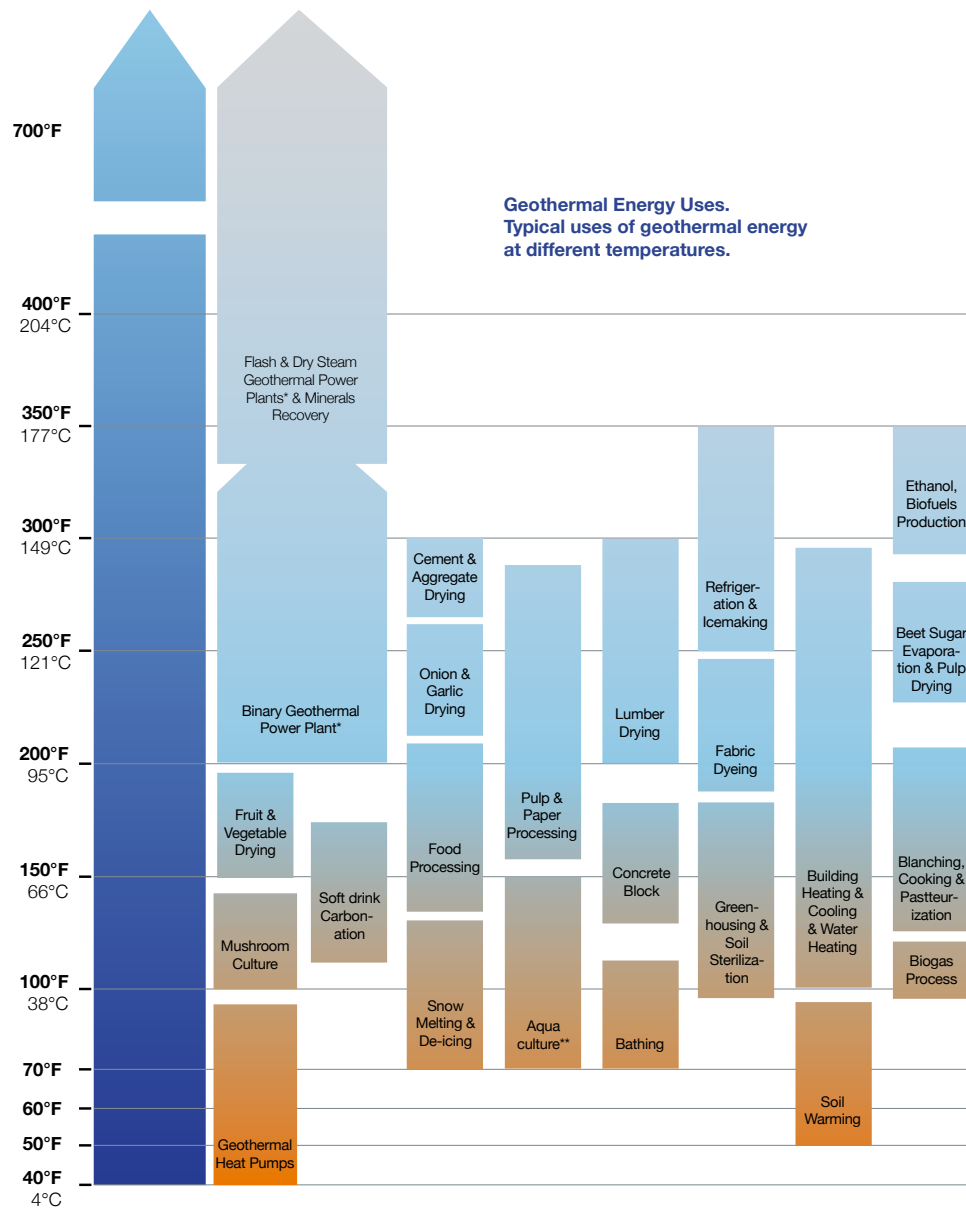


From the Blue Lagoon, the world famous geothermal spa in Iceland.

International partners work with Iceland towards global solutions.

Many leading technology and industrial companies now base their energy needs on fossil fuels that will add a huge cost to their business in the coming years as the world seeks ways to combat CO₂ emissions. These companies see many opportunities in driving their operations on clean energy wherever they can get access to it. They realize that the technology revolution and the clean energy transformation go hand in hand, giving them an advantage in the competitive global marketplace. Aluminium and computer companies and solar cell producers, among others, are looking for reliable partners to develop the clean energy solutions of the future.

A single geothermal resource can create up to 12 different streams of revenue.



Geothermal energy calls for a broad view of opportunities. Even though the use of geothermal energy in Iceland has focused on house heating and electricity generation for the power grid and industry, the spin-off benefits are even greater. Greenhouses and warm swimming pools are widespread as are spas, skincare- and beauty producers, and various other job-creating processes and spin offs in industry and tourism. There are, in addition, a wide variety of applications for geothermal energy use, including fish farming, soil warming, industrial heating and industrial processing.



These diverse outputs of a single geothermal resource make its development economically feasible, distinguishing geothermal energy from other energy resources.





**A global solution
waiting to happen!**

Renewable Energy.

Contributing Proven Solutions to the World

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For further information on energy matters:
www.os.is



Printed matter

**Clean energy gives us hope
that the threat of climate
change can be averted.**

**Iceland has a proven record
as a laboratory demonstrating
the benefits of a clean energy
future.**



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