What If?

Engineering the earth

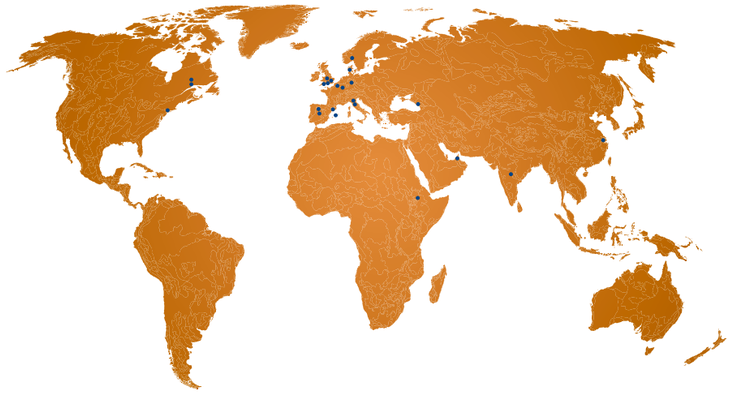
if

Generating renewable energy without sun, wind or water?

In 1989 a group of Dutch geoscientists asked the question: what if? What if we could extract and store renewable energy from deep under the ground? What if we discovered that it's not the sky that's the limit but the depths of the earth? What if we could cool buildings in summer using cold air stored from the previous winter and air-condition buildings using cold water from aquifers? Out of innovative answers to challenging question like these, IF Technology was born. Our expertise and collaborative approach is what makes IF a valuable partner for companies and governments who are determined to make sustainable use of something that we all share: the Earth.

Over 1,000 projects in the Netherlands alone

We have experience of a wide range of geothermal energy projects, mostly in the Netherlands, but also in the United Kingdom, Belgium, Spain, Norway, the United States and Canada. We are currently exploring possibilities in Asia and Africa.



IF projects around the globe

Contributing to the energy transition

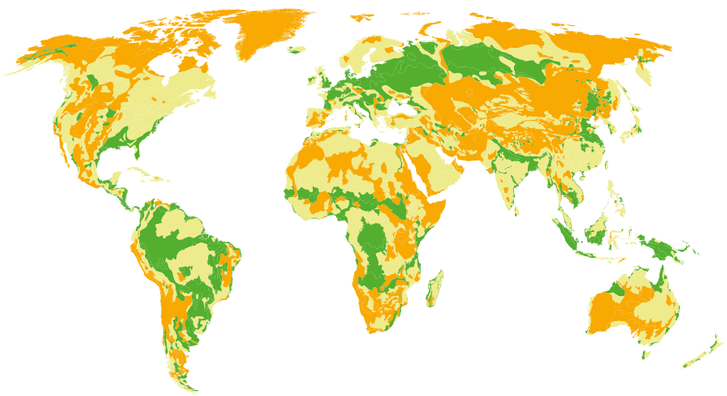
Heating entire housing estates with energy from under the ground

We are a leading geothermal energy consultancy and engineering company, based in Arnhem in the Netherlands. We take a multi-disciplinary approach to projects, bringing in our experienced geologists, hydrogeologists, civil & mechanical engineers and well engineers, as required. If you wish to explore the potential of geothermal energy, we can carry out a feasibility study. We also have all the skills in-house to provide a one-stop shop, including risk assessment, permitting, technical and financial analysis and system design. We have special expertise in Aquifer Thermal Energy Storage, Borehole Thermal Energy Storage, Deep Geothermal Energy Systems, Closed-Loop Heat Pumps Systems and Well Engineering.

Using underground sources of heat and cold

The benefits of energy independence

These are ideal solutions for local communities wishing to generate their own renewable energy, but can also be part of regional networks.



Areas with a potential for Aquifer Thermal Energy Storage

High Medium Limited

The challenge of climate change

Using geothermal energy drastically reduces CO_2 emissions

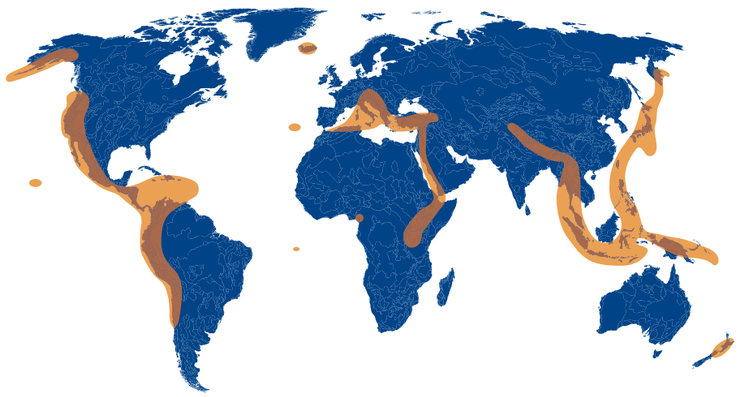
As world leaders step up to the mark on climate change, we see it as our role to present clear, viable solutions for reducing fossil fuel-based energy use and CO_2 emissions. With two decades of experience of geothermal energy, we've demonstrated that we can make a useful contribution to renewable energy programs around the globe. Although the geology varies in different parts of the world, our teams of experts can help you make the most of the potential in your region. If you wish to find out more about this promising technology, please get in touch to discuss the options and take a look at reference projects that were designed to meet similar challenges to yours.

Engineering the tectonics of the Earth

Drawing electrical power from deep under the ground

Deep geothermal energy

Energy at the Earth's core is brought to the surface using abstracted water which is then re-injected. This source is in principle inexhaustible. There are many parts of the world where it can be safely, efficiently and economically exploited.



Areas with a highest potential for deep geothermal energy

Underground thermal energy extraction and storage

Cooling a building in summer using winter cold

The system is groundwater-neutral

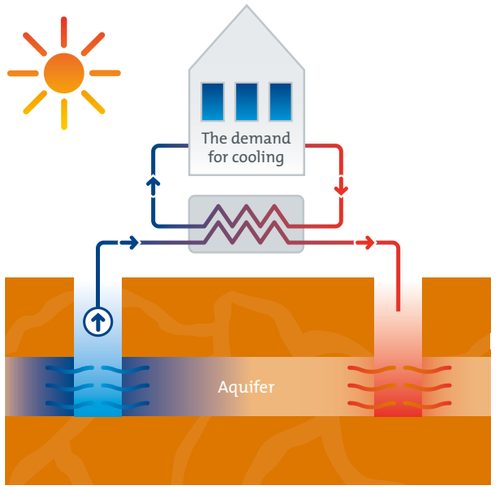
We have broad experience of Underground Thermal Energy Storage (UTES) systems, both Aquifer Thermal Energy Storage (ATES) and Borehole Thermal Energy Storage (BTES). The way ATES works is that energy is stored in aquifers 20 to 300 m below the surface. Warm water is pumped up, heat is extracted and relatively cold water is re-infiltrated. A cold groundwater zone (5 to 10° C) develops around the infiltration well, which can be used for cooling in the summer. This water then absorbs heat from the building and energy can be stored in a corresponding warm water zone (15 to 30° C) and used to heat the building in winter. In contrast, BTES systems use coolants instead of water in closed loops. Heat from industrial processes (at 45 to 90° C) can also be stored in the ground for re-use when needed.

Payback time: 1 to 10 years

The benefits of Underground Thermal Energy Storage

Compared to conventional heating boilers and cooling units UTES systems – whether in combination with heat pumps or not – make a significant contribution to reducing fossil fuel-based energy consumption and emissions of CO_2.

Savings of 50% (in heating mode) to 80% (in cooling mode) are quite feasible for residential areas and utility projects.



Deep geothermal energy

Delivering financial returns from kilometers under the ground

Drawing heat from deep below ground level

As you drill down into the Earth's core, the temperature increases by approximately 30° C per kilometer. This inexhaustible supply of energy can be extracted and used to generate electricity and/or heat for large residential areas and industry. Geothermal energy is safe and largely invisible, so there are no societal objections as for example with wind turbines. It's a proven technology and geothermal energy systems have at least a 30-year lifetime.

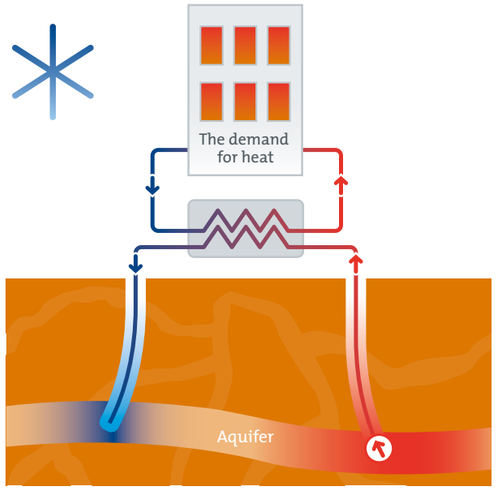
What if?

If just 1% of the total available geothermal energy under the Netherlands was extracted, it could heat 10 million homes for 30 years.

Payback time: 5 to 20 years

The benefits of geothermal energy

Geothermal energy can be used to generate heat and green electricity. Forward-looking industries are already benefiting from both, while residential projects use the heat, with the electricity going to the grid. Greenhouses are also being heated with this inexhaustible supply of energy.



It can even provide air conditioning

Consultant engineers in green technology

We advise local authorities, developers and installation consultants on a broad range of geothermal energy solutions, including energy extract ion and storage projects as well as energy master plans. We also advise policymakers on underground storage of compressed energy, CO_2 and water.

Preparatory phase

- Quick scans
- Feasibility studies
- Total energy concepts
- Hydrogeological studies
- Test drilling consultancy
- Licensing
- Tendering
- Permitting
- Process Control & Risk Management

Execution phase

- Project Management
- Reservoir Engineering
- Well Engineering
- Mechanical & Electrical Engineering
- Construction Supervision
- Commissioning
- Operation & Maintenance
- Monitoring
- Second Opinion
- Data Management

Intriguing innovations

Keeping roads free of snow and ice .... with heat captured in asphalt

The heat generated in asphalt in summer can be stored under roads and used in winter to keep them ice-free. What if this technology was applied on a large scale?

Surplus electricity need never be wasted again

With Compressed Air Energy Storage (CAES), surplus electricity (e.g. from wind power generation) is converted into compressed air and stored underground. Advanced Adiabetic CAES captures and stores heat as well. Could this part of a flexible solution involving smart grids based on hybrid power generation?

Large-scale users can produce their own drinking water

Don't let rainwater disappear down the drain. We've developed an infiltration system that's similar to natural filtration in the soil, but much more efficient. Our solution prevents water accumulating on the surface and causing flooding.

Literally dissolving CO_2 ...in water

What if carbon emissions could be dissolved in water and stored in underground aquifers?

Groundwater remediation that generates income instead of costing the earth

The groundwater in inner-city sites is often polluted. What if it could be treated biologically, while at the same time being used for heat and cold storage?

Case study:
Richard Stockton College,
New Jersey

Aquifer Thermal Energy Storage

First of its kind in the USA

Ground coupled heat pumps are widely used in North America. However, in 2005, we developed the first ATES system. The main advantage compared to traditional closed systems is that cooling is provided directly, as a result of which energy economy is substantially increased. We installed three warm and three cold wells (total capacity 1,000 kW). We overcame initial skepticism about the feasibility of such a large project. The client was impressed with our technical, theoretical and practical knowledge, highly efficient planning and project management, and the fact that we were prepared to get our hands dirty working on-site.

What we did

- We took the client to visit some completed projects
- We provided technical input for permit applications
- We carried out technical and financial calculations and made a pre-design, including interviews with all those involved
- We drew up a detailed design in US format and assisted the contractor with technical drawings
- We assessed and approved the components and carried out civil engineering activities related to the wells on location
- We supervised the work, engaged in troubleshooting, and established a test protocol and system measurements for quality control
- We represented the client on completion of the project and set up monitoring procedures.

Steps in a typical project

- Although no two projects are ever the same, we usually begin by carrying out a quick scan (free of charge) to assess the technical possibilities and potential risks of a project.
- The risks are reduced incrementally in the following steps, starting with a feasibility study to explore the technical, legal & financial aspects.
- In some cases there are further investigations on-site to further reduce the risks and, where necessary, we recommend drilling test boreholes.
- Then we make a design and present this to the client.
- We make an impact assessment of the hydraulic and thermal effects of the groundwater system. This is part of the information required for permits, applications for which we also help draw up.
- The next stage is to make detailed specifications and select local drilling and installation firms.
- We are present on site during the execution phase to make sure that critical activities are carried out correctly.
- We perform tests at various stages and, once the project is complete, we continue to provide remote online care, monitoring as well as give advice on how to get the most out of the system.

Up to our ankles in mud, delivering clean energy.

Next steps

We believe in sharing knowledge rather than keeping it to ourselves and we have extensive experience of removing both technical and legal barriers. We are good problem solvers, flexible, and we're used to adapting to local conditions. And we listen to our customers. If you'd like to engage in serious discussions about moving towards energy independence by exploiting the potential for geothermal energy, please don't hesitate to get in touch.

We can engineer the Earth, together.

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Engineering the earth

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