Summary

Geothermal power generation has its roots in Europe, where the first test in 1904 and the real beginning of power generation in 1913 took place, both at the Larderello dry steam field in Italy. Since then, the development of geothermal technology has been continuous and the total installed capacity currently amounts to 1.8 GWe, generating approximately 11.5 TWh of electric power every year. For a decade, thanks to the optimisation of the new binary system technology, geothermal electricity can be produced using lower temperatures than previously. Moreover, with Enhanced Geothermal Systems (EGS), a breakthrough technology proven since 2007, geothermal power can in theory be produced anywhere in Europe.

The main benefits of geothermal power plants are provision of baseload and flexible renewable energy, diversification of the energy mix, and protection against volatile and rising electricity prices. Using geothermal resources can provide economic development opportunities for countries in the form of taxes, royalties, technology export and jobs.

The potential of geothermal energy is recognised by some EU Member States in their National Renewable Energy Action Plans (NREAPs). However, the actual potential is significantly larger. In order to increase awareness, GEOELEC - an IEE project co-financed by the EU and running between 2010 and 2013- has assessed and presented for the first time the economic potential in Europe in 2020, 2030 and 2050. The figures are quite impressive, showing the large potential of geothermal and the important role it can play in the future electricity mix.

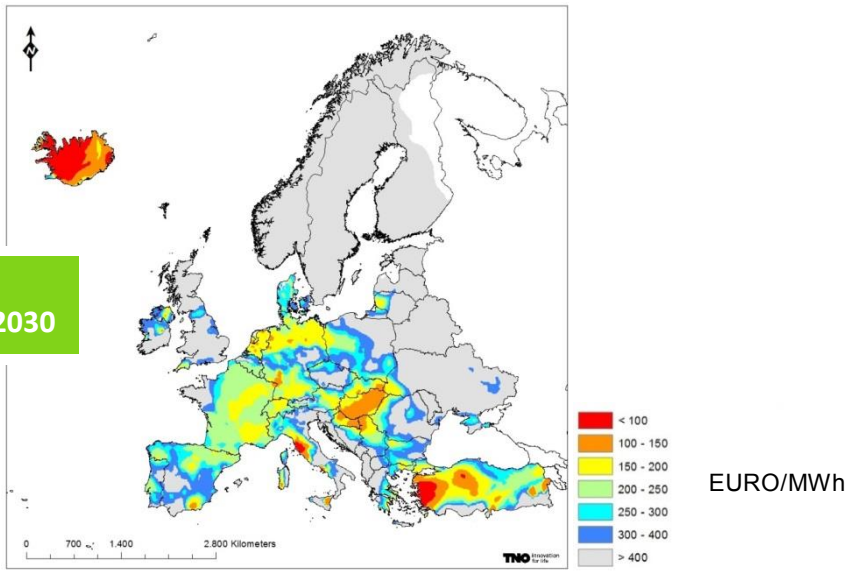
Towards more Geothermal electricity generation in Europe

Resource Assessment

The resource assessment is the product of the integration of existing data provided by the EU-28 countries and a newly defined methodology building on Canadian, Australian, and American methodology. The geological potential (heat in place) has been translated to an economical potential, using a Levelised Cost of Energy (LCoE) value of less than 150 €/MWh for the 2030 scenario and less than 100 €/MWh for the 2050 scenario:

- **The production of geothermal electricity in the EU in 2013 is 6 TWh**
- **The NREAPs forecast a production in the EU-28 of ca. 11 TWh in 2020**
- **The total European geothermal electricity potential in 2030 is 174 TWh**
- **The economic potential grows to more than 4000 TWh in 2050**

Geothermal power: economic potential in 2030



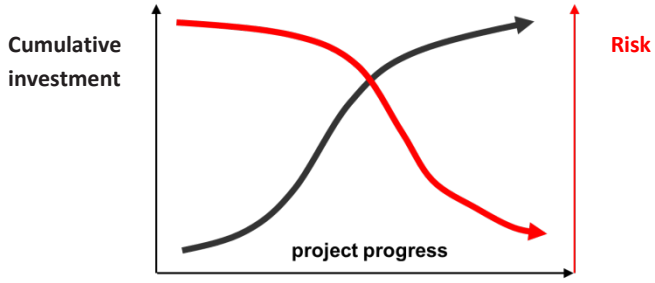
Economics and Finance

Financing a geothermal project includes two crucial elements in the initial phase of the project development: a high capital investment for drilling wells which can take up to 70% of the total project costs, and an insurance scheme to cover the geological risks.

As pre-drill assessment of geothermal performance is subject to major uncertainty and EGS (Enhanced Geothermal System) is in an embryonic development phase, the risk profile is high compared to alternative sources of renewable energy. In order to face these challenges the following financial incentives are required to facilitate growth of geothermal energy in Europe:

- Support schemes are crucial tools of public policy for geothermal to compensate for market failures and to allow the technology to progress along its learning curve;

- Innovative financing mechanisms should be adapted to the specificities of geothermal technologies and according to the level of maturity of markets and technologies;
- A European Geothermal Risk Insurance Fund (EGRIF) is seen as an appealing public support measure for overcoming the geological risk;
- While designing a support scheme, policy-makers should seek a holistic approach, which exceeds the LCoE and includes system costs and all externalities. As an alternative, there is the chance to offer a bonus to geothermal energy for the benefits it provides to the overall electricity system, balancing the grid.



In order to support the drafting of financial pre-feasibility studies for new projects, GeoElec has built and now provides online free software for the first validation of geothermal power projects.

Furthermore, GeoElec has studied issues relating to grid integration and has demonstrated how geothermal, being base load and flexible, can be integrated to the grid without technical problems and with negligible costs.

Regulations and public acceptance

The geothermal development promoted by the GeoElec project must be done in a sustainable way. A regulatory framework for licensing procedures, ownership of the resources and competition for the use of the underground is necessary, but it must be streamlined. Regulatory barriers which can cause delays and increase costs for geothermal electricity projects still exist and have to be removed. The environmental impact of all infrastructure projects should be rightly considered, and environmental regulations are important tools for the development of geothermal electricity.

Such a sustainable development of the geothermal power sector would facilitate public acceptance. Lack of social acceptance can seriously damage the progression of geothermal developments and is an important issue to consider. Best practice shows that public acceptance is higher when project developers act openly and provide clear information which helps to create trust.

A geothermal power plant in the landscape

Geothermal electricity action plan for Europe

Based on the results of the project, the following recommendations are put forward:

- Create conditions to increase awareness about the advantages of this technology and its potential. National Committees on Geothermal promoting the technology to decision-makers and engaging the civil society to favour social acceptance should be established.

- Contribute to the economic competitiveness of Europe by providing affordable electricity. In order to progress along the learning curve and deploy at large-scale a reliable renewable technology, a European EGS flagship programme should be launched, including new demonstration plants and test laboratories: it should also look at new technologies, methods and concepts.

- Establish the economic and financial conditions for geothermal development: a European Geothermal Risk Insurance Fund (EGRIF) is an innovative option tailored to the specificities of geothermal to mitigate the cost of the geological risk and is a complementary tool to operational support, still needed to compensate for the long-standing lack of a level-playing field.

- Enhance the education and training process, since multidisciplinary expertise and interaction of several disciplines are necessary. Create Networks for Geothermal Energy Education and Training involving industrial platforms, Universities and Research Centres developing a workforce for future geothermal development.

- Contribute to the development of the local economy. Create local jobs and establish a geothermal industry in Europe which will be able, by 2030, to employ more than 100,000 people (exploration, drilling, construction and manufacturing).

For more information visit www.geoelec.eu

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