HORIZON RESULTS BOOSTER

HRB-GeoDrill Policy Brief

A Multi-disciplined Approach to Optimising Geothermal Utilisation and Energy Economics

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Executive Summary

The increasing need for energy and setting new regulations in the transition to clean energy calls for the adoption of renewable energy on a much larger scale than today.

Geothermal is a clean source of energy that generates baseload or dispatchable electricity, which offers high flexibility and is always available. However, the high operational and maintenance costs and the lack of European and global regulations make geothermal energy the most under-utilised renewable source.

GeoDrill is a project group composed of five EU-funded initiatives (GeoDrill, Geo-Coat, GeoSmart, GeoHex and OptiDrill) that are developing methods and solutions for resilient and long-lasting materials which can reduce the costs needed to exploit geothermal energy. The GeoDrill project group has come together under the umbrella of the Horizon Results Booster programme (HRB) of the European Commission to jointly disseminate results that help tackle key challenges in increasing the adoption of geothermal energy.

1 Topic Overview

Geothermal energy is a clean homegrown energy source with low emissions that generates baseload or dispatchable electricity, heat or the combination of both and that is always and fully available. The planet's potential for geothermal energy could provide clean energy for 4000 years[1]. European research can help tackle these challenges to ensure the wider adoption of geothermal energy.

In a quest to accelerate the energy transition, the Global Geothermal Alliance[2] was established after the 2015 Conference of Parties (COP21) with a mission to fast-track this renewable energy source. In 2016, the UN's 2030 Agenda and Sustainable Development Goals (SDGs) were put in place, four of which are relevant to this context: affordable and clean energy (SDG7); industry, innovation and infrastructure (SDG9); sustainable cities and communities (SDG11) and decarbonisation by 2050 (SDG13).

Geothermal energy offers high flexibility, but is still the most under-utilised renewable source due to its inherently harsh environments which corrode materials and cause scaling issues resulting in high capital, operational and maintenance costs.

European research can help tackle these challenges to ensure the wider adoption of geothermal energy.

1 https://www.enelgreenpower.com/learning-hub/renewable-energies/geothermal-energy

2 https://www.globalgeothermalalliance.org/

1.1 Topic Context

There is a recognised need for more research to tackle challenges such as improving plant efficiency, reducing costs for developing resilient geothermal materials, and extending the knowledge base to test novel materials and drilling techniques, among other advances in the field. GeoDrill, GeoSmart, GeoHex, Geo-Coat and OptiDrill are five Horizon 2020 projects that aim to drive innovations forward.

Technological Challenges

While geothermal power plants are a flexible source of energy, they often operate in harsh environments with components subject to corrosion and scaling issues in power plants. This drives a need to develop enhanced drill monitoring systems based on automated machine learning analysis that help predict drilling parameters using sensor-based data-driven models. The technological advanced systems can contribute to optimise the system and create a unified one that combines existing data with the newly developed methods.

These challenges have to be met throughout the entire lifecycle of many geothermal projects, from drilling through final decommissioning.

Industrial Challenges

The frequent failures of geothermal plant materials and the relatively small size of the geothermal industry results in higher capital, operational and maintenance costs. This drives a need to improve plant capabilities to withstand the harsh geothermal environment, to maintain the equipment longevity and generate efficiency. This also highlights the need to produce better geothermal power plant equipment protection design concepts through virtual prototyping to meet the increasing requirements for lifecycle costs, environmental impacts and end-of-life considerations.

European research can help tackle these challenges to ensure the wider adoption of geothermal energy. A good case in point is the GeoDrill multi-disciplined cluster of projects, which is tackling these technological and industrial issues, in an innovative and sustainable way.

1.2 Policy challenges

On top of the technological challenge come diverse policy challenges.

Lack of standards in the geothermal community:
All geothermal plants need to follow strict local and national environmental standards and rules to meet specific goals that help reduce CO2 in the atmosphere. National rules are country-specific and are not homogeneous around Europe, mainly because there are different sources of geothermal energy across Europe (from volcanic in Iceland to hot granites in Cornwall). This scenario creates legal barriers that do not allow to build new plants in a standardised way in different areas in Europe. Therefore, the lack of common standards reduces plant efficiency and increases the cost of planning, manufacturing, and monitoring geothermal plants.

Lack of recommendations for heating / cooling and energy production:
Most government policies focus on electricity production, whereas in Europe a very large percentage of energy consumption is used for the heating of buildings and often for cooling. Geothermal resources can serve to produce electricity, where source temperatures permit, but they can also provide direct heat to buildings with high efficiencies and of course to abstract heat and recycle it back into the source. Currently, the regulations issued for this renewable energy are often combined and do not highlight the double nature of this energy.

2 Recommendations

Based on the landscape and gap analysis overview, the GeoDrill project group has defined four actionable recommendations for policy makers at national and European level, with the aim of optimising the efficiency of geothermal power plants, while improving monitoring systems and designing resilient, long-lasting materials that can reduce production and maintenance costs.

2.1 Recommendation 1
Fund research and innovation on geothermal energy

Building new geothermal power plants takes between 4 and 5 years, which is much longer compared to other renewable energy sources. For example, wind plants are built between 8 and 10 months and solar in as little as 4. Longer times required does not make geothermal energy attractive to potential private investors and leads to lower numbers of geothermal stations in Europe and worldwide. Both wind and solar have benefitted greatly from governmental incentives, whereas deep geothermal has lagged behind, often related to the reasons already discussed above. Investing in research and innovation plays a crucial role in reducing the time needed to build new plants, sharing new ideas among the key actors in the field, and contributing to economies of scale, which cannot be reached in the current scenario, given the high front-end costs the plants require in the first years of the building new geothermal plants.

2.2 Recommendation 2
Implement standards for the geothermal community

Introducing standards for the geothermal community at European level incentivises the adoption of common rules that optimise the phases of planning, manufacturing and monitoring of geothermal sites. Issuing standards lowers the risk profile of this renewable energy, and, thanks to this, becomes more attractive to potential investors while helping to reduce the development costs associated with designing and engineering geothermal materials.

2.3

Recommendation 3

Make specific recommendations for heating/cooling and energy production

A clear distinction between the different purposes served by the geothermal energy is needed to optimise its consumption at local and national level. The recommendations need to clarify how geothermal energy can be used for electricity production and heating/cooling purposes and not for both of them in parallel. This clear separation helps optimise the final market demand and contributes to improving the energy requirements as a wider acceptance of geothermal power will help reduce the energy demand for electricity.

2.4

Recommendation 4

Raise awareness and educate society to foster trust in geothermal energy

Dissemination actions are needed to inform all interested stakeholders (industries, researchers, geothermal operators, policy makers, citizens and young people) about the positive contributions geothermal energy can make a greener Europe, and to foster trust in the geothermal energy community. In addition, education actions are needed to lower the knowledge gap among the stakeholders and let them better understand what are the benefits and incentives to adopt geothermal energy. Indeed, education at all levels is paramount for the successful uptake of geothermal resources and the following suggestions support their adoption:

- Community outreach to link schools and communities, educating through learning and involvement.
- Schools' programmes to illustrate the geothermal energy and how the sub-surface reacts to the utilsation of resources, including also the building of simple seismic monitoring networks.
- Local and National government programmes, demonstrating how the geothermal energy can bring COP26 targets within reach, especially the decarbonisation of domestic energy usage.

Project Group

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