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Benefits of the Closed Loop Geothermal Technology

Executive Summary

Geothermal energy is a form of energy derived from heat emanating from within the Earth through underground rocks and fluids. This type of clean, sustainable energy, permanently available is used to produce electricity and heat, which is then distributed to consumers through grids.

However, the use of this type of energy is still limited in Romania also because of the significant limitations that the conventional (open loop) heat capture systems present, requiring to be situated nearby hot water sources as well as very high temperature gradients. The requirement for high temperature gradients and the existence of permeable aquifers significantly limit the large-scale development of conventional geothermal energy projects, making it a niche technology suitable only in hot regions (Rybach, 2010). A further restriction is that geological hot water resources need to be close to heat demand, represented by cities with heating networks.

Closed loop geothermal systems (CLGSs) offer a solution for universalising the use of this type of energy, including in Romania, a country with longstanding tradition in the exploration, drilling and exploitation of mineral resources, as well as with deep know-how and expertise in this field.

The closed loop technology, currently already in use in Canada, Germany, and the US, presents significant key advantages with respect to the conventional (open loop) system. These include the absence of fracking, the possibility to exploit geothermal energy regardless of the availability of hot water aquifers nearby the cogeneration plant, the lack of risks relating to induced seismicity, no use of water involved, the absence of any elements subject to corrosion/erosion/deposition and the direct connection between demand cities and hot water resources.

Moreover, the closed loop technology can guarantee a permanent (24/7) baseload in electricity production and competitive costs compared to renewables, the latter being considered relatively limiting in terms of considerable land footprint and asset longevity, but also in terms of generation source availability. Furthermore, given the extremely small land footprint of the technology as well as the quiet operations, the social impact of the operations is minimal. Applied on a large scale, and in parallel by upgrading heat distribution systems in cities, the technology can replace current heat sources with a sustainable source with low production costs and permanent availability.

The closed-loop system involves drilling pipes made of a special thermally conductive material into the ground at significant depths, near the magmatic rock layer, where temperatures of around 300°C are recorded. Similar to a radiator through which water is recirculated, the pipe system captures the underground heat of the magmatic rocks and brings it to the surface as a hot liquid, which is then converted within the cogeneration plant into both electricity and heat power.

In this context, a unique legislative approach is recommended to regulate geothermal power, associated with the Mining Act 85/2003 as the only key legislative framework suitable to govern this distinct type of mineral resource, and not to other existing pieces of legislation.

From a legislative perspective, the wider use and exploitation of geothermal energy could be facilitated in Romania by reviewing the current Mining Act 85/2003, to provide: (1) a clear definition of geothermal energy, including an extended terminology to explicitly define geothermal heat, geothermal power, and geothermal water exploitation among the resources which can be exploited; (2) a simplified /single authorisation process, with transparent criteria for investors' requests; (3) easy access to authorisation procedures, and reasonable granting periods; and (4) longer periods for drilling permits granted for geothermal applications.

An important aspect to be considered is that the initial investment in this case is much higher than in the case of conventional heat capture systems, with payback over time. However, operational costs in the long run are significantly lower than in the case of traditional applications.

Furthermore, this sector has the potential to generate new workplaces, as well as improve the country's overall environment performance as Romania recently joined European and wider efforts aiming to reduce carbon emissions and increase the amount of energy obtained from renewable sources.

The government and the private sector should collaborate to ensure that Romania benefits from the latest applications available on the market, and the clear advantages presented by the closed loop technology, to turn the benefits of geothermal power into reality for a wider population.

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Conclusions

For Romania, a country with extensive experience, human capital and know-how specialised in oil and gas exploration and exploitation, the existence of significant geothermal sites near the Western border as well as near Bucharest present ample opportunities to use this clean resource.

At the local level, more are more communities are interested in using geothermal energy to heat their homes.

Geothermal energy is highlighted in the latest version of the National Integrated Plan in the field of Energy and Climate Change (PNIESC), as an innovative technology based on renewable energy sources. The growing role of this type of energy is also mentioned in Romania's Long-Term Strategy for Emission Reduction.

In this context, the innovative closed loop technology brings with it several key advantages, compared to the traditional open-loop systems. Most importantly, the closed loop technology can be scaled up at the global level, and its extensive use also in Romania could allow more municipalities in Ilfov county and in western part of the country to heat up extensive residential areas with geothermal energy.

The closed loop technology has significantly more advantages compared to the traditional (open loop technology), as it involves no resources being extracted, no fluid disposal, no rare metals being used, low operational costs in the long run and no emissions being released during operations.

From an investor perspective, one of the important barriers limiting the wide use of geothermal energy is related to the very high upfront capital costs which need to be covered in an initial development stage, characterised by high uncertainty with respect to the success of the project.

Looking at other European states with interest and experience in developing geothermal power systems, it is worth noting that Hungary, Germany and the Netherlands have already regulated the exploitation of geothermal power within the framework of their respective Mining Acts. These examples could serve as reference for future attempts to regulate the use of geothermal power.

The abundance of legislative norms over the past years has generated situations leaving room for contrasting interpretations of the same norm, in some cases also with overlapping competencies of the different authorities in the energy sector.

To further stimulate significant investments in the geothermal energy sector, Romania should focus in its future attempts to regulate the use of geothermal power on referencing the Mining Act as the only fundamental legislative framework, to avoid creating any further legislative parallelisms.

To support the development of long-term geothermal power projects in Romania, proposals to revise the Mining Act should provide the following:

- A clear definition of geothermal power;
- A simplified /single authorisation process, with transparent criteria for investors' requests;
- Easy access to authorisation procedures, and reasonable periods;
- Extending the terminology used in the act to explicitly include geothermal heat, geothermal power and water exploitation among the resources which can be exploited under this legislative act;
- Extended periods, up to 30 years, for drilling permits granted for geothermal power projects;
- Removal of the fiscal burden associated with the regulation documentation.