IRENA
International Renewable Energy Agency

19 April 2023

Twenty-fifth meeting of the Council
Abu Dhabi, 23-24 May 2023

# Background Note
# Global Status of Geothermal Market and Technology

## Background

1. Growth in the use of geothermal energy worldwide is driven by multiple factors. Energy demand is increasing as a result of economic growth. At the same time, to counteract climate change and to move towards a green economy, there is a global effort to transition to renewable energy sources. The demand for sustainable heat is also increasing, leading to a growing trend towards the use of geothermal resources for heating and cooling applications where technically and economically feasible.

2. Geothermal energy can and should play a greater role in meeting global energy needs, for both electricity as well as heating and cooling. Geothermal resources are widely available in areas with volcanic activity and in sedimentary basins. These attributes make geothermal a cost-effective and weather-independent source of renewable energy. With the recent accelerated deployment of variable power from wind and solar photovoltaic (solar PV) sources, geothermal energy can contribute to the stabilisation of electricity grids.

3. In addition, geothermal energy technology has evolved beyond its focus on the electricity market to encompass a broader range of applications within the energy sector, including for sustainable heating and cooling.

4. The geothermal sector has grown at an average rate of around 3.5% since 2000 to reach an installed capacity of 16 GWe in 2021, while geothermal heating and cooling applications grew faster, by around 9% to 107 GWth in 2020. As a result, geothermal still accounts for a mere 0.5% of renewables-based installed capacity for electricity generation, and heating and cooling, globally.

5. Nevertheless, geothermal energy holds a unique place in the renewable energy ecosystem. It can provide both electricity and heat, as well as value-added mineral extraction. As an electricity source, it provides reliable generation with high plant efficiency, low greenhouse gas emissions and a small ecological footprint, making it a long-lasting sustainable source when properly managed. As a heat source, geothermal is scalable, has low operating costs, offers increased efficiency by supplying heat directly and reduces electricity consumption for heating and cooling while providing a long-lasting source of sustainable heat.

6. Geothermal energy development still faces challenges that have limited its development, even in regions endowed with easily accessible resources. Compared with other energy technologies, geothermal projects have longer project development timelines, require higher upfront capital expenditures, and face high risk during the early phases of exploration. Other challenges are related to financing, policy and regulatory frameworks, institutional and technical expertise, and technological advancements, which affect both electricity generation and heating.

7. In February 2023, IRENA, in collaboration with the International Geothermal Association (IGA), published a report entitled *Global Geothermal Market and Technology Assessment* to highlight the status of geothermal development globally and identify key emerging trends that are likely to drive its growth in the coming years. It also provides recommendations to guide policy makers, project developers, investors, financiers and other stakeholders on how to promote the growth of geothermal markets, harness the potential of geothermal energy and further expand its integration within global energy systems. The Report also reviews the status of geothermal technologies, with reference to new technological approaches and developments that have the potential to scale up the use of geothermal energy. A practitioners' group of geothermal experts largely from the constituency of the Global Geothermal Alliance supported the development of the Report through a consultative process of review and feedback.

**Objective of the session**

The objective of the session is to share the key findings of the report on *Global Geothermal Market and Technology Assessment* with a view to raising awareness on the role of geothermal technologies in the energy transition and promoting deployment for electricity generation and direct uses. Discussions will focus on recent trends in the geothermal sector, challenges hindering its development, potential solutions and opportunities for accelerating its development.

**Guiding questions**

- What key trends have emerged in recent years in geothermal markets and technological development that are likely to accelerate the development of geothermal energy in the short and medium term?

- What are the main challenges that your country/region still faces with regard to geothermal development and what measures are being undertaken to overcome those challenges?

- How can stakeholders benefit from the opportunities presented by geothermal resources (e.g. clean electricity generation, clean heating and cooling, extraction of critical minerals such as lithium, production of green hydrogen) to accelerate the energy transition and achievement of the Paris Agreement goals? What are the key success stories?

- How can IRENA, through the Global Geothermal Alliance and in cooperation with other development partners further support the accelerated deployment of geothermal energy worldwide?

**Associated Publications**

- Global Geothermal Market and Technology Assessment (2023)
- Powering Agri-food Value Chains with Geothermal Heat (2022)
- Integrating low-temperature renewables in district energy systems: Guidelines for policy makers (2021)
- Geothermal Development in Eastern Africa: Recommendations for power and direct use (2020)