

## Energy Prices: the **geothermal** answer

### The 2021/2022 **high energy prices**, and security of energy supply crisis

At the beginning of summer 2021, gas prices started increasing tremendously globally due to a wide array of factors, from an exceptionally cold winter in Europe in 2020, to macroeconomic fallout of the COVID 19 pandemic, without mentioning geopolitics, to technical issues in infrastructure bottlenecks of the fossil fuel production infrastructure. As a result, gas prices shot up on the European spot market from 5-10 €/MWh in 2019-2020 to 50 €/MWh in September 2021. However, the story does not end here and will continue in 2022. In much of the European electricity market, gas power plants remain the main providers of flexibility and, as such, have an outsized impact on the price of electricity during supply crunches. Electricity prices on the European spot market shot up from 30-50 €/MWh in 2020 to 150-200 €/MWh in the summer of 2021, with spikes as high as 300€/MWh. In February 2022, following the invasion of Ukraine by Russia – which are respectively a key gas pipeline hub and the largest supplier of fossil fuels to Europe – prices spiked further, deepening the crisis and pushing the European Commission to come up with the RePowerEU communication to present new tools for reducing the exposure of the EU economy to Russian fossil fuel imports. Moreover, many voices have been calling for a revision of the EU electricity market framework – on the margin or at its core – to better incentivize investment in flexibility resources, notably from renewable technologies.

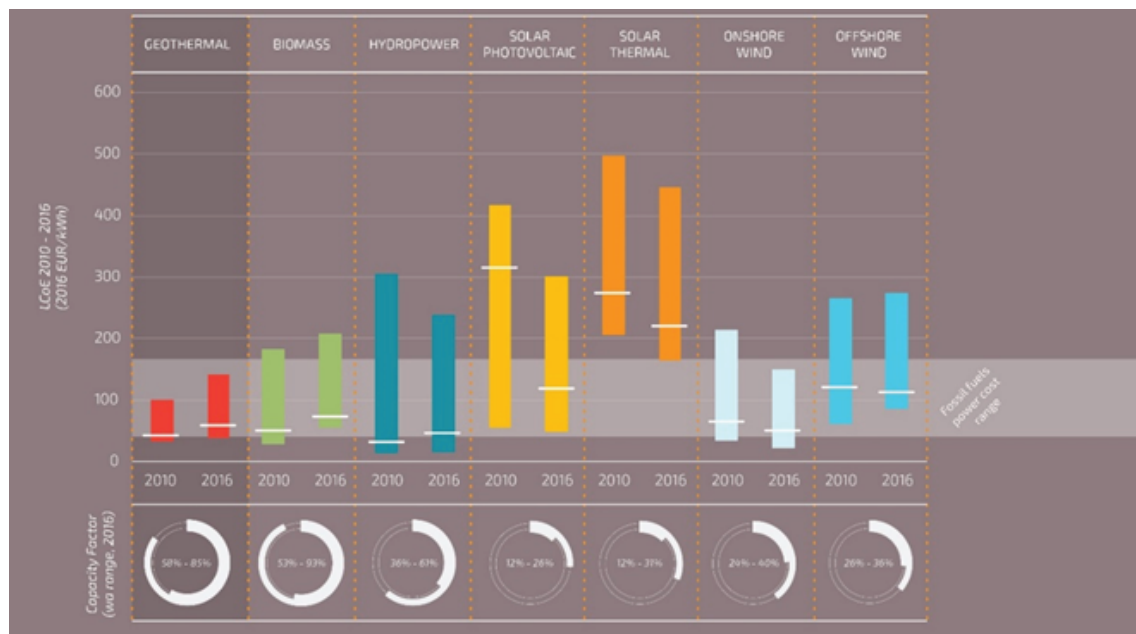
**This crisis is not just an “energy price crisis”: geothermal power plants are not more expensive to build and operate.** Geothermal district heating and cooling prices did not increase several times over. This is a gas price crisis, which is the result of a series of policy decisions taken by the EU and Member States.

The 2021/2022 energy price crisis highlights the vulnerability of the global fossil fuel supply chain and how vulnerable European citizens and businesses are to such events. **This crisis is also a warning when the European Commission is deploying the European Green Deal.** While European countries are laying up their Recovery plans, it is an opportunity to plan the infrastructure of the energy system around the provision of flexibility from renewables for greater resilience to the upcoming supply crisis.



## The role of flexibility from geothermal energy in preventing future crises

Geothermal power plants have proven their reliability in over a century of using this renewable resource to supply baseload electricity. Geothermal plants have collectively the highest capacity factor of any electricity generation technology – renewable or not. As market incentives evolve, geothermal power plant operators are likely to integrate the value of flexibility in their business models.



Comparison of LCOE and capacity factors of renewable technologies with fossil fuels (ETIP DG, Vision of a Geothermal Future, 2018)

Geothermal power plants are increasingly being designed around the capacity to provide flexibility services. Plants in Germany have shown that output can be ramped up or down by 70% in a matter of seconds to comply with balancing requirements. The GEOSMART project is looking at the implementation of technical solutions to retrofit plants and optimize the provision of flexibility in terms of efficiency and improve the economic viability of geothermal power plants in this evolving market.

**Moreover, geothermal technologies provide many different types of benefits to the electricity system beyond the simple operation of a flexible electricity generator.** Geothermal CHP plants can also optimise the supply of heat or the storage in a district heating network, and thermal storage is also a key solution for dealing with electricity market variability and seasonality.

The flexibility benefits provided by geothermal technologies put them at the center of the integrated energy system. Promoted by the European Commission, energy system integration looks to tap into synergies between different components of the energy systems, from demand response services by geothermal heat pumps or electricity storage in EV batteries. Geothermal power plants are a crucial factor of reliability in such a system defined by the abundance of flexible resources as it is the variability of the production of electricity. They can provide baseload power when needed or flexibility if necessary. Thanks to geothermal power plants, it is possible to avoid additional investments in grid infrastructure because their reliability dramatically reduces the need for additional redundancies. To enable geothermal power plants and other technologies to reap part of the benefits they provide the energy system overall, evolutions in support schemes and business models are necessary to allow these technologies to become market competitive.

## Toward an **economic** and **regulatory** framework that promotes flexibility from **renewables**:

There are no technical limitations to the operation of geothermal power plants as a provider of flexibility to the electricity system and take the place occupied by gas power plants to this day. The barriers are mostly economic – geothermal power plants are yet to achieve full market maturity in much of Europe – and regulatory. Indeed, the electricity market structure, the nature of incentives schemes, and the lack of reliable mechanisms to reward the provision of renewable flexibility to the market are clear incentives for geothermal power plants to operate as baseload. For investors, there are fewer incentives to invest in geothermal power plants since their specific technical benefits are not reflected in the price their energy can be sold.

A crucial factor in the success of such policies is how they can enable the operators of flexible renewable power plants to capture the value of the flexibility they provide to the grid. In the current market system, some studies estimate the value of behaving as a flexible provider for gas power plant to be around 7-15 EUR/MWh on the long term (14-30% of the average electricity wholesale price prior to the current crisis). Studies also highlight the high value put by the market on the capacity of operators to react to volatility of electricity supply (i.e. linked to higher penetration of variable renewables like wind and photovoltaic): when volatility increases by 100%, the value of solving this need increases by up to 5 times. Other estimates put the value of flexibility by other providers such as demand response at between 15-31 USD/MWh.

The market must integrate tools that provide clear indicators of the value of flexibility during the day and the value of reliability over long periods. The balancing market and capacity remuneration mechanisms introduced by the revised electricity market regulation are the first steps, but they are not sufficient since they are balanced around maintaining the capacity of fossil gas power plants as the default flexibility provider instead of being focused on promoting the deployment of renewable flexibility and reliability providers, such as geothermal power plants.





## Key steps to be taken in adapting the European electricity market rules

**Key steps to be taken in adapting the European electricity market rules** – within the 2018 Electricity Regulation Framework and the implementation of the European Green Deal and Clean Energy Package – include:

- **Align Capacity Remuneration Mechanisms with the Renewable energy directive:** CRM currently allow power plant operators to benefit from additional income to behave as a flexible operator on the long term even if they emit 550 gCO<sub>2</sub>/kWh, five and a half times the threshold to qualify a “sustainable investment” according to the sustainable finance taxonomy. The CRM threshold must be reviewed and aligned with the Renewable Energy Directive: these tools must be used to bring to the market the next generation of flexible renewable technologies.
- **Need cost indicators for policy makers and investors that reflect the value of flexibility and reliability on a life cycle basis:** Today policy makers do not know how to recognize the value of reliability and flexibility in renewable energy technologies. LCOE figures erase the different behaviours of renewable technologies on the electricity market and the differences in services they provide. Indicators must be promoted to highlight the benefits provided by technologies such as flexible geothermal power plants.
- **Investment in renewable infrastructure – locking out vulnerability to external supply shocks:** the EU has invested billions of euros in natural gas import infrastructure, and it provided financial guarantee for many more projects, via facilities such as the TEN-E, CEF, EFSI, or through the EIB. This locked the EU in a dependence on gas as a core component of its heating and cooling sector and as a provider of flexibility on the electricity market. The EU must now anticipate the phase out of this dependency and the dramatic risks it imposes on European citizens and businesses. It must lock-in a renewable infrastructure that allows the cost-efficient deployment of flexibility resource (for instance the availability of geothermal risk mitigation schemes throughout Europe ). Being produced domestically, renewables are a factor resilience against short term disruption. Moreover, promoting European renewable infrastructure and deployment is a mean to consolidate the European renewable energy industry which is a net exporter, notably for geothermal energy technologies.
- **Prevent and minimise the risk for stranded assets:** To comply with the EU’s decarbonisation objective, the EU will need to phase out fossil fuels over the coming decades. Many existing fossil assets are at risk of becoming stranded assets, and new investments in such projects are quite assured to become so. The EU must enforce strict requirements that it does not support – nor do Member States – fossil fuel projects, especially where renewable alternatives such as geothermal energy are available.
- **Consider energy sector integration instead of a narrow focus on electricity and gas nexus:** The EU has historically taken a narrow approach to the energy sector focused on the achievement of an internal market for electricity and an internal market for gas. This approach is directly responsible for the ongoing energy price crisis, having prevented an integrated approach to decarbonization that reduces reliance on gas for heating and cooling, and promoting the reliance of gas as a flexibility provider. The EU must refocus its effort on the achievement of a decarbonized internal electricity market and a decarbonized heating and cooling market. The development of a “Heat Market Design” legislative package appears as the first step to prevent future gas price crises.

