Building a Paris Agreement Compatible (PAC) energy scenario

CAN Europe/EEB technical summary of key elements

June 2020

2.11 Mobilising ambient and geothermal energy

Key assumptions

- Ambient heat captured by heat pumps is the key driver for electrification of heating mainly in residential and tertiary sectors. Technology developments also allow an increased share for industries' low temperature processes. Heat pump potentials are based on Heat Roadmap Europe.[1]
- The PAC scenario assumes that 1 kWh of gross heat production from heat pumps entails 0.7 kWh of ambient (aero- or geothermal) heat captured by heat pumps and 0.3 kWh of direct electricity demand.[2]
- In contrast to ambient energy captured by heat pumps, deep geothermal energy potentials are primarily mobilised through cogeneration. The PAC scenario is based on assumptions from the European Technology & Innovation Platform Deep Geothermal (ETIP DG) and the EWG/LUT model.[3]

Evolution of energy supply

Heat pumps that capture ambient (aerothermal and shallow geothermal) energy quickly ramp up their energy supply from 25 TWh in 2015 to 497 TWh in 2030. They become the most important renewable energy supply for heating buildings in the residential and tertiary sectors after 2030, leaving solid biomass behind them.

Deep building renovation induces a steady switch from individual fossil heating systems to heat pumps. They are the first choice for individual heating. However, starting from the middle of the 2020s, a quarter of energy supplied by heat pumps is also distributed through the growing district heat networks. Up to 117 TWh are consumed in industry in 2040, covering 5% of industry's final energy demand.

Deep geothermal energy projects are more difficult and take more time to be mobilised than individual heat pumps. Primary energy supply in 2030 (81 TWh) nevertheless is four times higher than in 2015. Until 2050, supply triples to reach 247 TWh, mainly due to a stronger uptake of geothermal CHP feeding also into district heat networks. Electricity from geothermal CHP plants however only covers a maximum of 2% of final electricity demand by 2050.

Integration of members' and experts' feedback

In a number of countries short-term market forecasts indicate a slower uptake of geothermal electricity generation capacities than projected by the EWG/LUT model. Growth rates during the 2020s were adopted and further uptake delayed.[4]

1 Aalborg University: Heat Roadmap Europe 4.

2 The electricity demand of heat pumps is already included in final electricity demand and not a renewable energy source as such. It is thus not included in the aforementioned numbers. The electricity consumed by heat pumps to harvest the renewable energy source of ambient (aerothermal and geothermal) energy however will have a 100% renewable electricity mix by the year 2040.

3 ETIP DG: Implementation Roadmap for Deep Geothermal, April 2019; EWG/LUT.

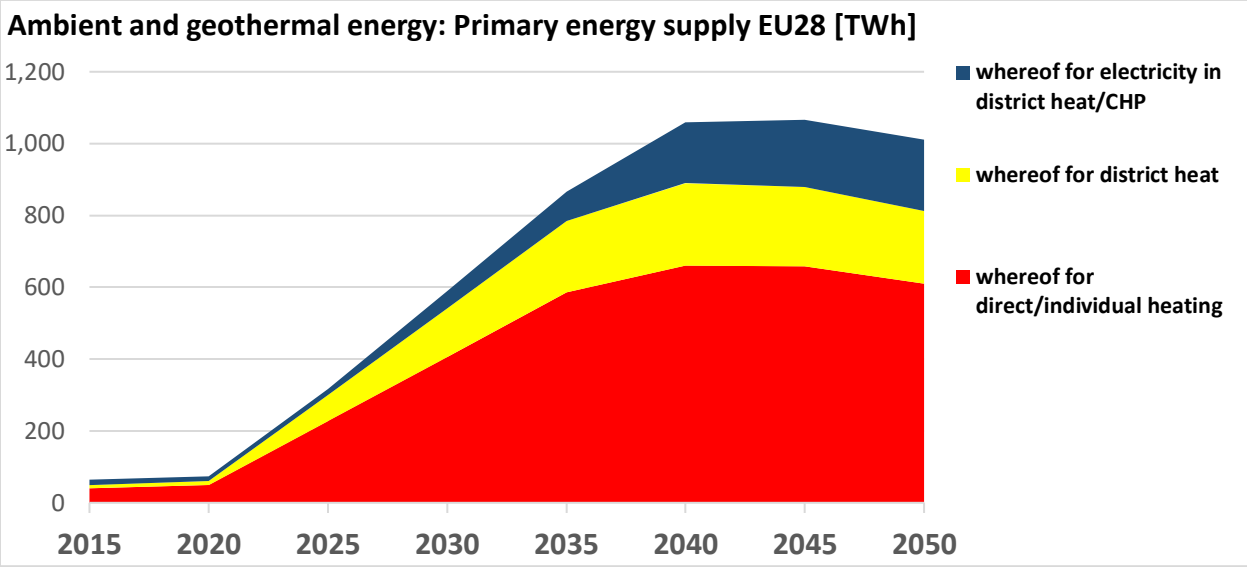
4 Eurobserver: Heat pumps Barometer, Nov. 2018; European Geothermal Energy Council: Geothermal market report, June 2019.

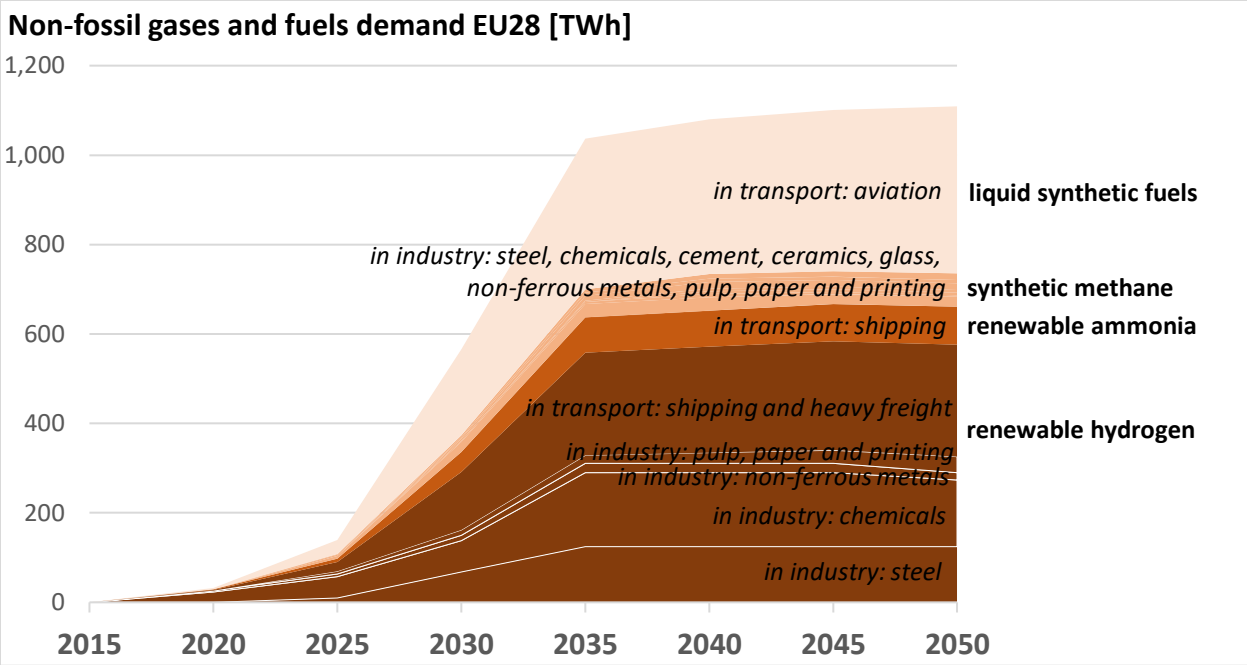
Sensitivities and limitations

Implementing deep geothermal electricity projects in many Member States is still economically relatively risky. Only half of the expected growth of capacities that was projected in the previous 2020 National Renewable Energy Action Plans (NREAPs) has been achieved. Stable support schemes are crucial for the deployment of the trajectories described in the PAC scenario.

Key results

- The deep renovation of buildings presents an opportunity for installing heat pumps as an easy to deploy heating technology. Heat pumps efficiently increase the use of renewable electricity for heating. They cover 15% of gross final heat consumption in 2030 and 54% in 2040.
- It is more challenging to scale up CHP plants and heating stations using deep geothermal potentials. In the PAC scenario, primary energy supply of geothermal energy increases more than ten-fold from 21 TWh in 2015 to 247 TWh in 2050.





Primary energy supply

Energy transformation