**Comprehensive analysis of the large-scale deployment of heat pumps by 2030 following the REPowerEU plan**

Aktive (4) Endkunden-/Prosumerpartizipation

& Gebäudesektor

Agne Toleikyte[[1]](#footnote-1)(1), Johan Carlsson(1), Juan Carlos Roca Reina(1), Jonathan Volt(1)

(1)Joint Research Center, Energy, Transport and Climate Directorate

Unit C.7 Knowledge for the Energy Union, European Commission

Motivation und research questions

The European Commission launched the REPowerEU plan to make the European Union independent of Russian fossil fuels well before 2030. Heat pumps play a crucial role in achieving this objective. In fact, the plan sets out to install 30 million hydronic heat pumps by 2030, transforming the European heating and cooling market.

The study aims to conduct a holistic analysis of the consequences of accelerating the deployment of heat pumps to support the implementation of REPowerEU.

The research questions are:

* 1. How will the fast deployment of heat pumps impact the residential heating sector?
* 1.1. What is the required/optimal renovation level for different buildings?
* 1.2. How should the deployment of heat pumps interlink with the increase of building envelope renovations (i.e. Renovation Wave targets) and solar PV installations?
* 1.3. Which policies are needed to enable the rapid increase of heat pump installations in the EU?

Methodology

The study concerns the residential building stock using fossil-based individual and central heating systems. The time period analysed is from 2021 to 2030.

The study looks at the impact of only adding heat pumps, and combinations of heat pumps and building performance improvements. The heat pump types analysed are air/air, air/water, ground/water, high-temperature, and hybrid (heat pump + gas/oil boiler or electric heater).

As a first step, we gather data about typical building typologies (small/large multi-family building, detached, semi-detached, year of construction, thermal insulation, heat source) as well as climate data and techno-economic data from public data sources. Second, we use a building model to select suitable heat pump types for each building typology. We pay particular attention to the heat pumps’ efficiency by considering their coefficient of performance as a function of ambient and heat supply temperatures. The building typologies are then arranged based on their suitability for installing heat pumps and compared with the expected rate of upgrades from the Renovation Wave. We identify the building typologies most suitable for installing heat pumps. Finally, remaining buildings are analysed for cost-effective upgrades of roof/walls/floor/windows per building typology to reach the 2030 targets.

Results und Conclusions

Our assessment shows that replacing existing gas boilers with 30 million heat pumps has the potential to reduce gas use in dwellings by 36% by 2030. To achieve this, the annual replacement rate of gas boilers needs to increase to an average of 5% until 2030. This requires a 23% increase in the annual installation rates of heat pumps across the EU, compared to 2020 levels. The recent developments of the EU heat pumps market shows an annual increase of 28% in 2022 compared to 2021, outpacing the trajectory towards the RepowerEU target by 2030 (EHPA 2022, European Commission 2022). This growth is mainly the result of high energy prices and national policies supporting heat pump installation. However, certain building segments such as buildings with poor efficiency, multi-family buildings have been less effected by this market dynamic. Furthermore, heat pump installation rates vary considerably among EU countries.

In my presentation, I will show how much of the EU building stock is ready to install a heat pump without undertaking a building renovation. Next, I show what level of renovation should be reached to achieve an efficient use of heat pumps in different building categories, climates etc. Finally, I will discuss how the European policy and financial framework can support this transformation.

This abstract is part of an ongoing and comprehensive heat pump analysis by the European Commission’s JRC. The study also covers the following:

* Impact on power system showcasing the stability of the power system during winter peak demand, and highlight potential issues.
* Potential bottlenecks such as access to components, such as compressors, and critical materials on the market, and availability as well as reskilling of skilled installers.
* Social aspects such as effects on vulnerable households.
* Competitiveness of EU industry.

The study is planned to be published in the first quarter of 2023.

Literature

[1] EHPA (2022) European Heat Pump Association. Provisional data for 2022 shared on Twitter by Thomas Nowak: <https://twitter.com/ThomasNowakEU/status/1572855973441638400>

[2] European Commission (2022) REPowerEU Plan, Communication, COM(2022) 230 final, SWD(2022) 230 final, European Commission, Brussels, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN>

1. Westerduinweg 3, 1755 LE Petten, Niederlande, [agne.toleikyte@ec.europa.eu](mailto:agne.toleikyte@ec.europa.eu) [↑](#footnote-ref-1)