



Building a Paris Agreement Compatible (PAC) energy scenario

CAN Europe/EEB technical summary of key elements

June 2020



1.2 Residential sector

Key assumptions

Technology changes and behavioural changes both bear sufficient potential to drive down the residential sector's final energy demand by more than two thirds between 2015 and 2050.

- The PAC scenario takes over assumptions of the EU Calc project: that the annual renovation rate of the EU building stock will increase from 1% to 3% of which 70% are deep renovations that cut the energy need of buildings by 60% and remaining renovations cutting 40% of energy needs on average.
- A high annual demolition rate of 1% is also foreseen with 70% of new constructions being highly efficient. The residential floor area per capita drops from 48 to 37 m² in 2050.²
- In addition to renovation and replacement of inefficient heating systems, new societal trends (urbanisation, building automation, behavioural changes triggered by improved awareness-raising) contribute to energy demand reduction with roughly one third, taking over Fraunhofer ISI assumptions.³

Evolution of energy demand

The final energy demand for space heating and hot water in residential buildings decreases by 77% from 2015 to reach 572 TWh in 2050. Primary energy will be used more efficiently because of a gradual replacement of inefficient individual fossil fuel- and solid biomass-fired heating systems by district heating networks. A strong increase of electricity demand for heating is induced by the expansion of heat pumps as the dominant technology for individual heating systems. They take over demand for gaseous energy carriers between 2030 and 2035.⁴

The remaining final demand stems from cooking, cooling, lighting and home appliances. Final energy demand for cooking decreases only slightly. Increasing electricity demand largely replaces demand for fossil fuels for cooking. The increase of final energy demand for space cooling will be offset by renovated buildings' improved protection against heat and by efficiency gains of the air conditioning installations. Final energy demand of appliances and lighting annually reduces by 2.9% to reach 139 TWh in 2050.⁵

Integration of members' and experts' feedback

Members and experts argued in favour of further mobilising energy savings through behavioural changes and societal trends. In order to mobilise these potentials and avoid rebound effects, a set of policies would need to play an important role, such as strong regulation, adequate guidance for end users and provisions to ensure no consumer is left behind. A short-term ban on gas boilers and financial incentives are considered indispensable.⁶

¹ EU Calc: Technical documentation: WP2 –Buildings module documentation (including households and services). Preliminary version for expert review, April 2020, <http://tool.european-calculator.eu>.

² Taking over assumptions from EU Calc.

³ Fraunhofer ISI: Study on Energy Savings Scenarios 2050. January 2019.

⁴ Aalborg University: Heat Roadmap Europe 4. Quantifying the Impact of Low-Carbon Heating and Cooling Roadmaps, Oct. 2018.

⁵ Taking over assumptions from Fraunhofer ISI.

⁶ CAN Europe/EEB: Summaries of PAC scenario workshops.

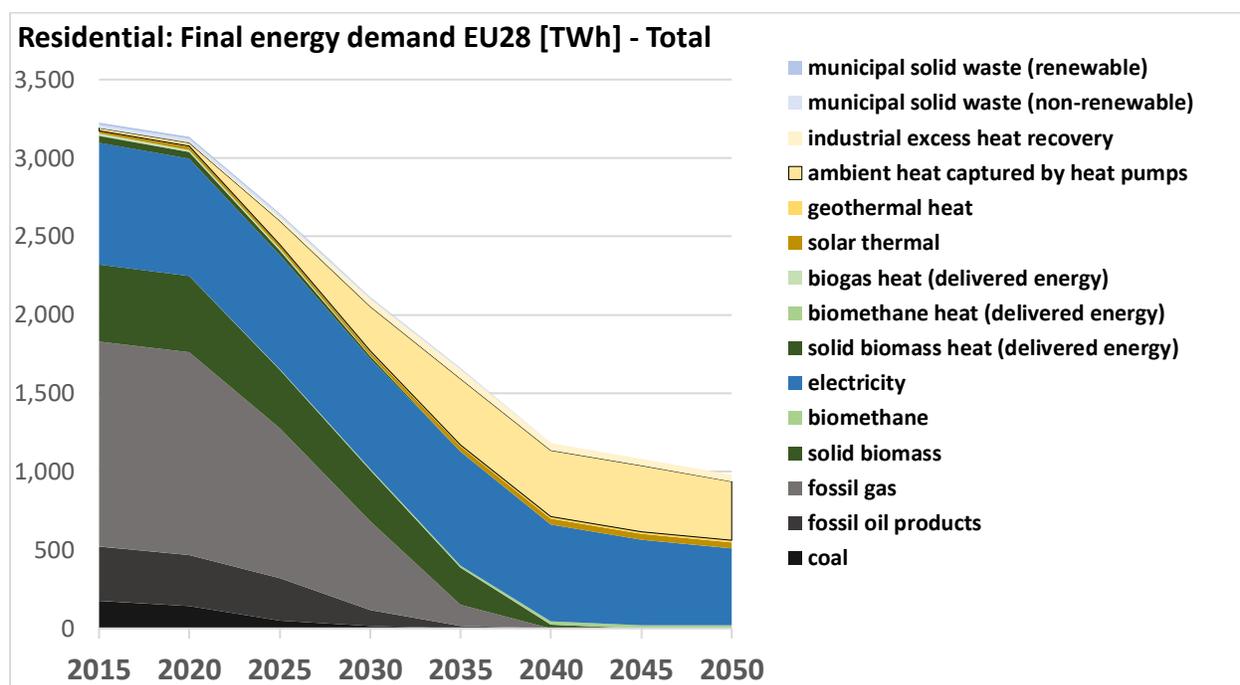
Sensitivities and limitations

Behavioural changes are difficult to predict. Their integration in scenarios necessarily leads to higher uncertainties. The potential impacts of connected appliances on households' energy demand has not been analysed.

Several studies indicate significant energy savings that can be achieved from space heating in buildings.⁷ Their parameters on issues such as renovation rates, energy savings per renovation and demolition rates vary. Literature shows that the energy savings potentials from technology changes and from new societal trends do not need to be mobilised both to their full extent for realising the PAC scenario's pathways.

Key results

- Compared to other sectors, the residential sector brings about the strongest reduction in final energy demand, through deep renovation, as well as by new societal trends.
- Electricity constitutes 53% of final energy demand in 2040. Demand for fossil fuels disappears after 2035 while district heating and heat pumps take over most of the demand.
- The demand for gaseous energy carriers beyond 2035 is limited to marginal amounts of biomethane for cooking. No demand for renewable hydrogen neither for synthetic methane is expected in the residential sector.



⁷ EUCalc, Fraunhofer ISI, Eurima/Climact: The key role of energy renovation in the net-zero GHG emission challenge, Oct. 2018.