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IER Institut für Energiewirtschaft
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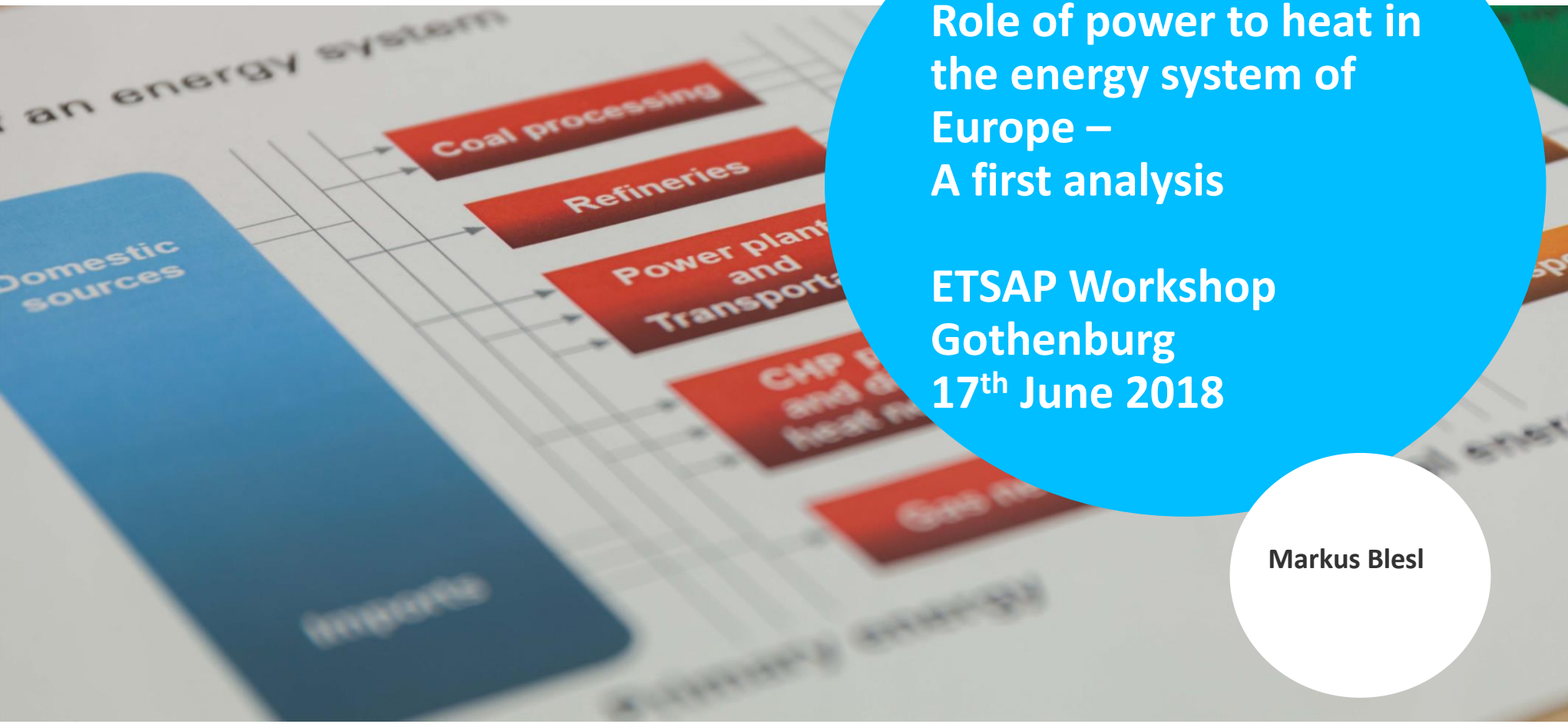

Role of power to heat in the energy system of Europe – A first analysis

ETSAP Workshop Gothenburg 17th June 2018

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Outline

- Energy- and Climate Policies
- Modeling in TIMES
- Scenario definition an Analysis
- Some conclusions

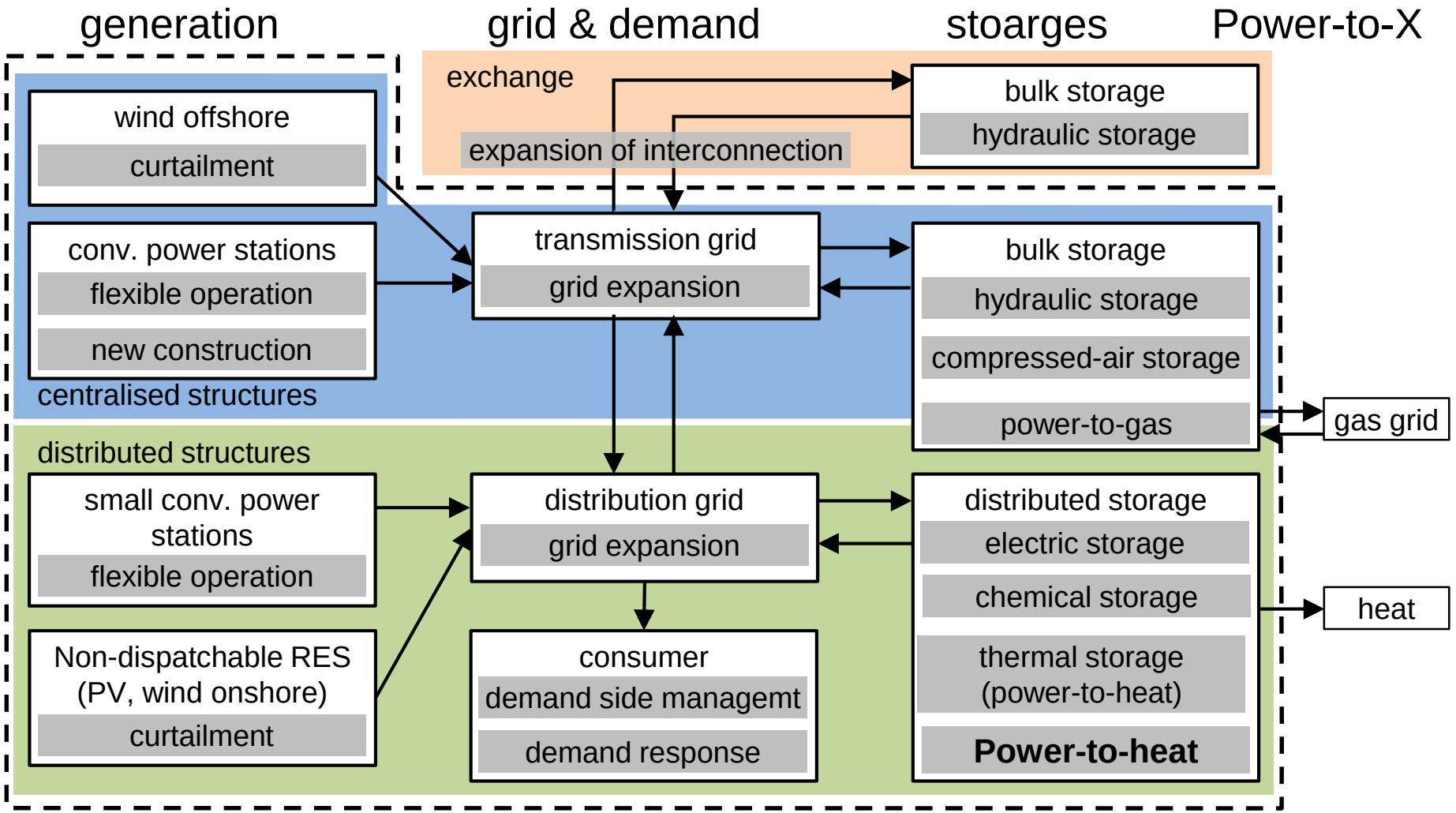
Energy and climate policy objectives in the EU-28

- For energy conversion units covered by the ETS (Emission Trading System), a binding reduction of emissions by a total of 21% in relation to 2005 according to EU Directive 2009/29/EC. For the phase 3 of the EU ETS (2013-2020) a linear **reduction factor of 1.74%** of allowances, compared to 2008-2012 average is given.

- In March 2011, the European Commission made a **proposal for a reduction of 80-95% of greenhouse gas emissions** compared to 1990 by 2050 in its "Roadmap for the transition to a competitive low-carbon economy by 2050"

- In October 2014, the Commission adopted the Climate and Energy Package with the objectives for the year 2030. The targets are **40% greenhouse gas reduction, 27% renewable energy share** and the **reduction of primary energy consumption by 27%.**

Flexibility options in the electricity system



Times PanEU Model

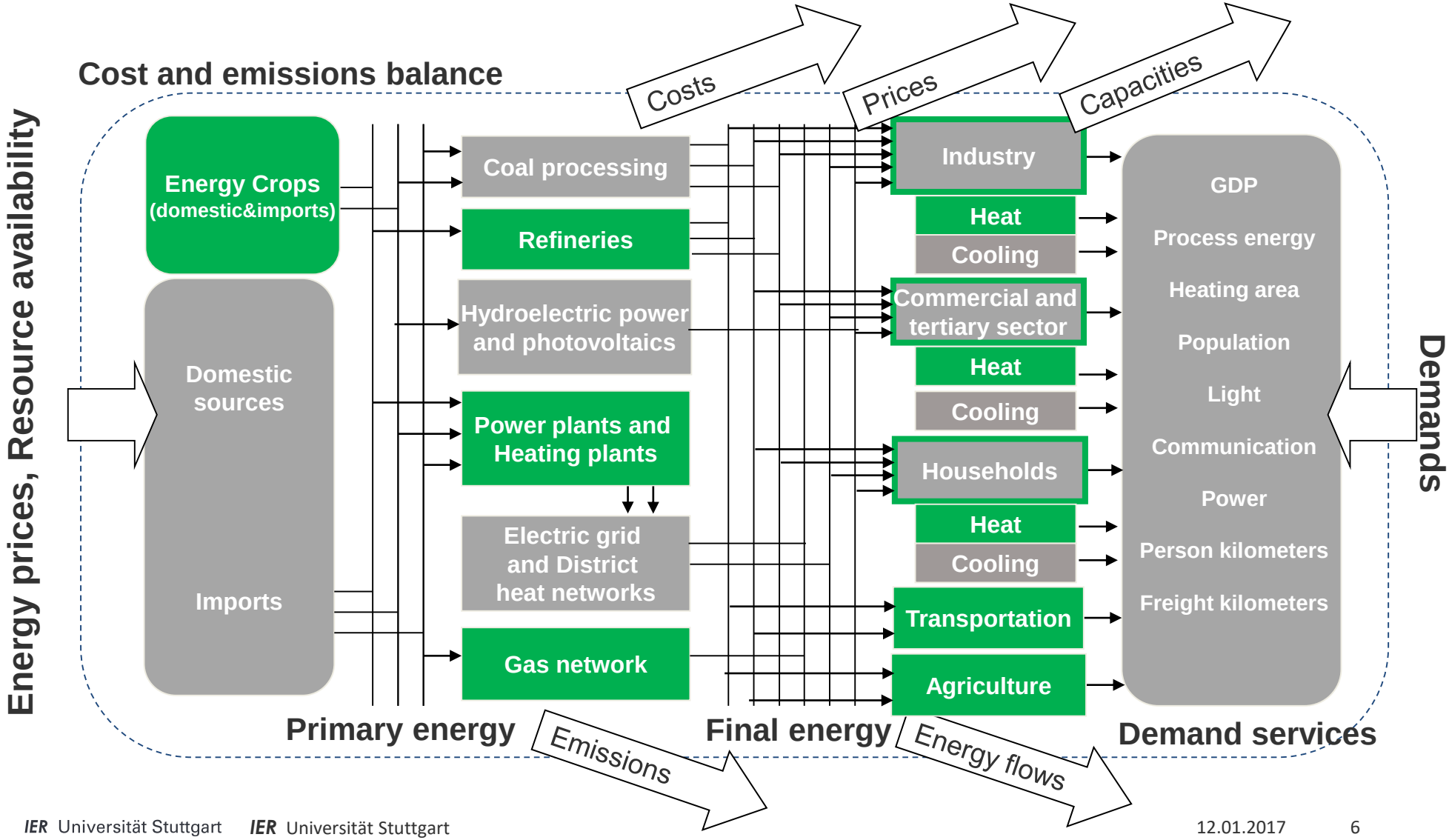
Energy System Model I/II

Characterization TIMES PanEU

- European energy system model
  EU28, Norway, Switzerland, **Baden-Württemberg**
- Technology-oriented, bottom-up optimization model with perfect foresight
- Country-specific detailing of the energy generation and the demand sector, as well as detailed mapping of the boundary coupling line capacities according to ETSO
- Intertemporal optimization in the period 2010 – 2050
- 12 sub-annual time segments (four seasonal and three daily segments)
- Emissions: Greenhouse gases (CO2, CH4, N2O)
- Sector-based: public and industrial energy supply, industry, households, Commercial and tertiary sector, transport, agriculture and refineries
- **Objective function:** minimization of the total costs (optimization model)

Times PanEU Model

Energy System Model II/II



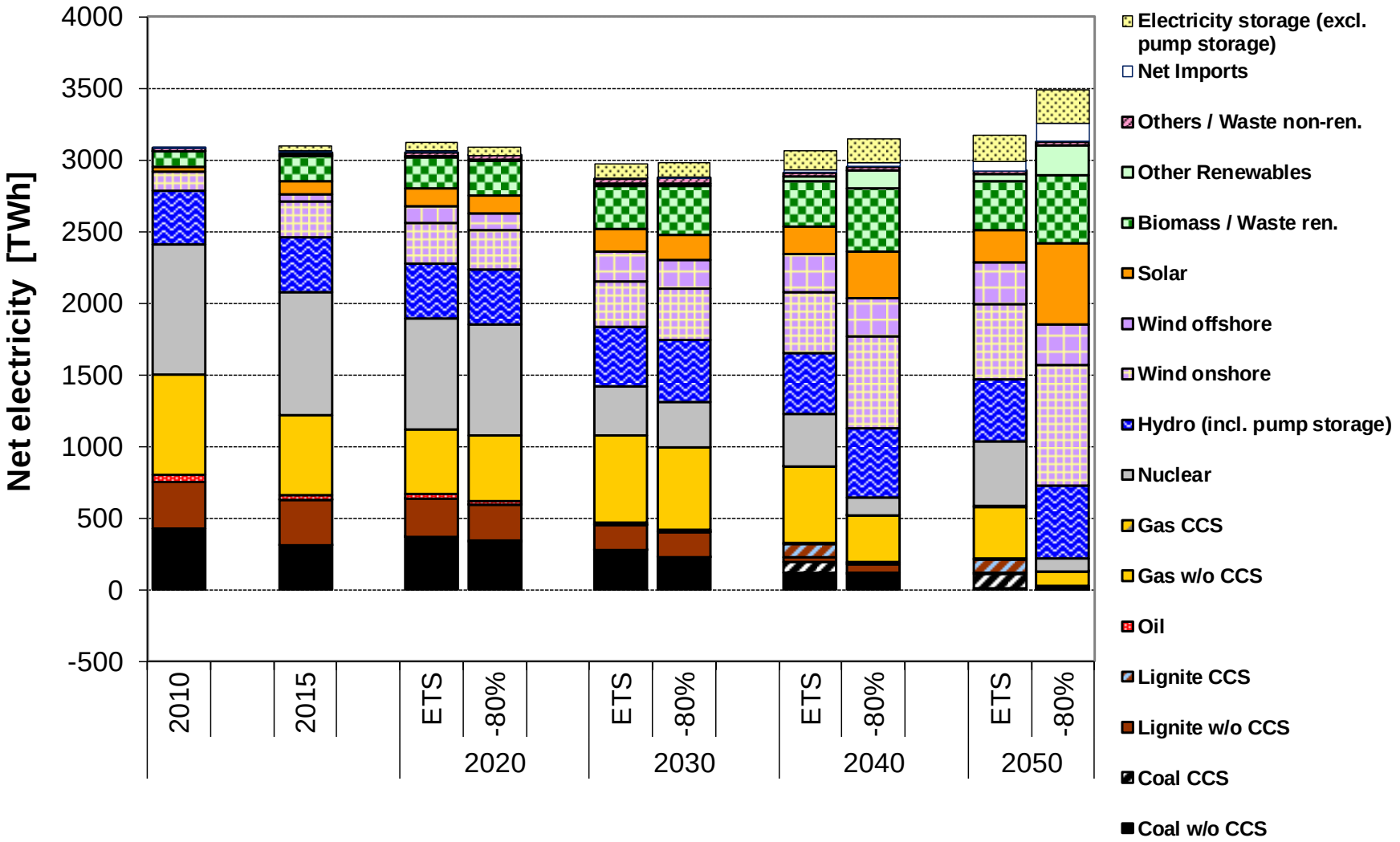
Scenario definition

Over all assumptions; Energy prices form the WEO 2017; population and GDP projection from the EU

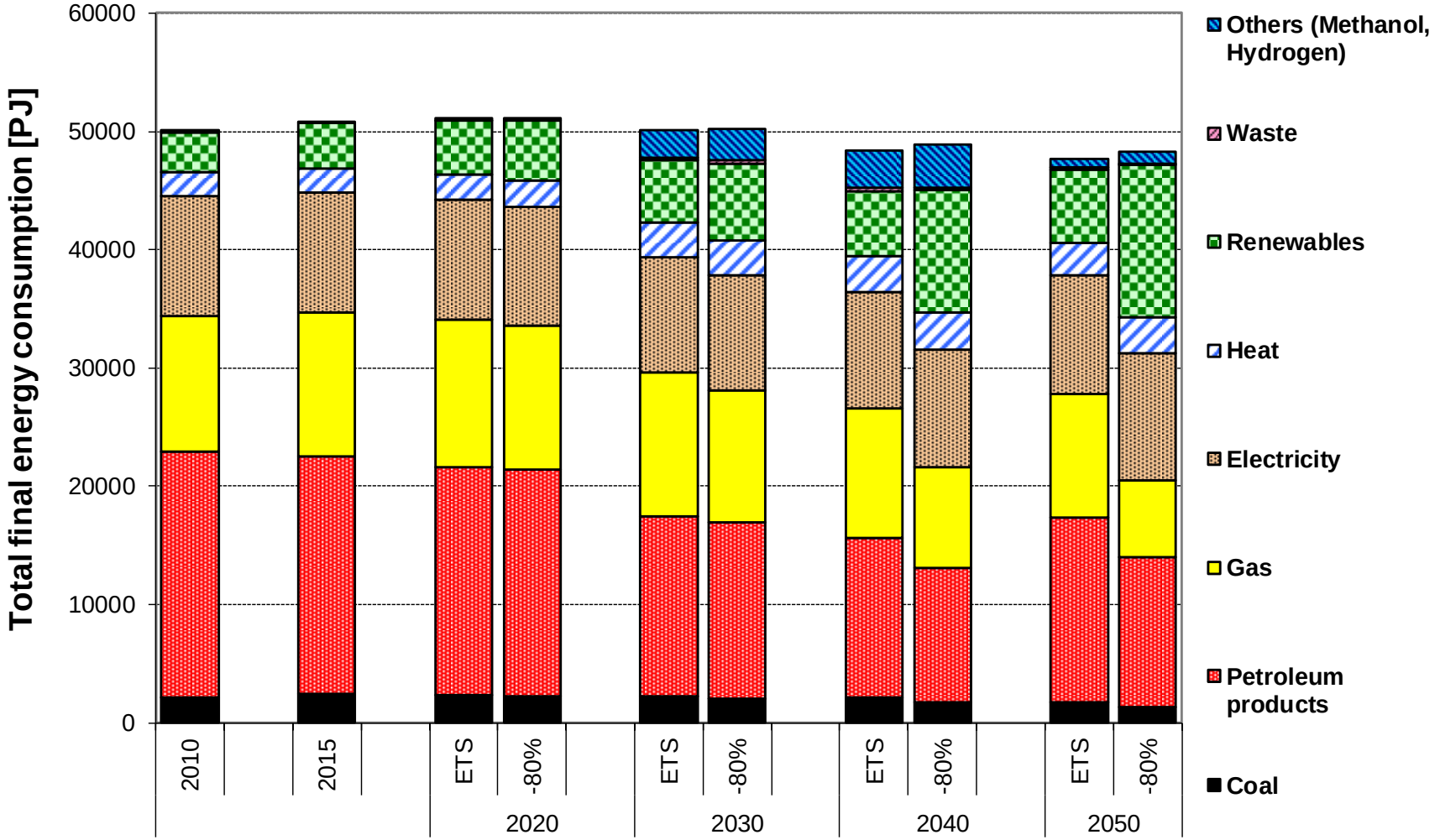
ETS -1.7 %/a reduction of the CO2 – Emissions for the Emission trading system

-80 % -80% GHG reduction till 2050 compared to 1990 over all sectors

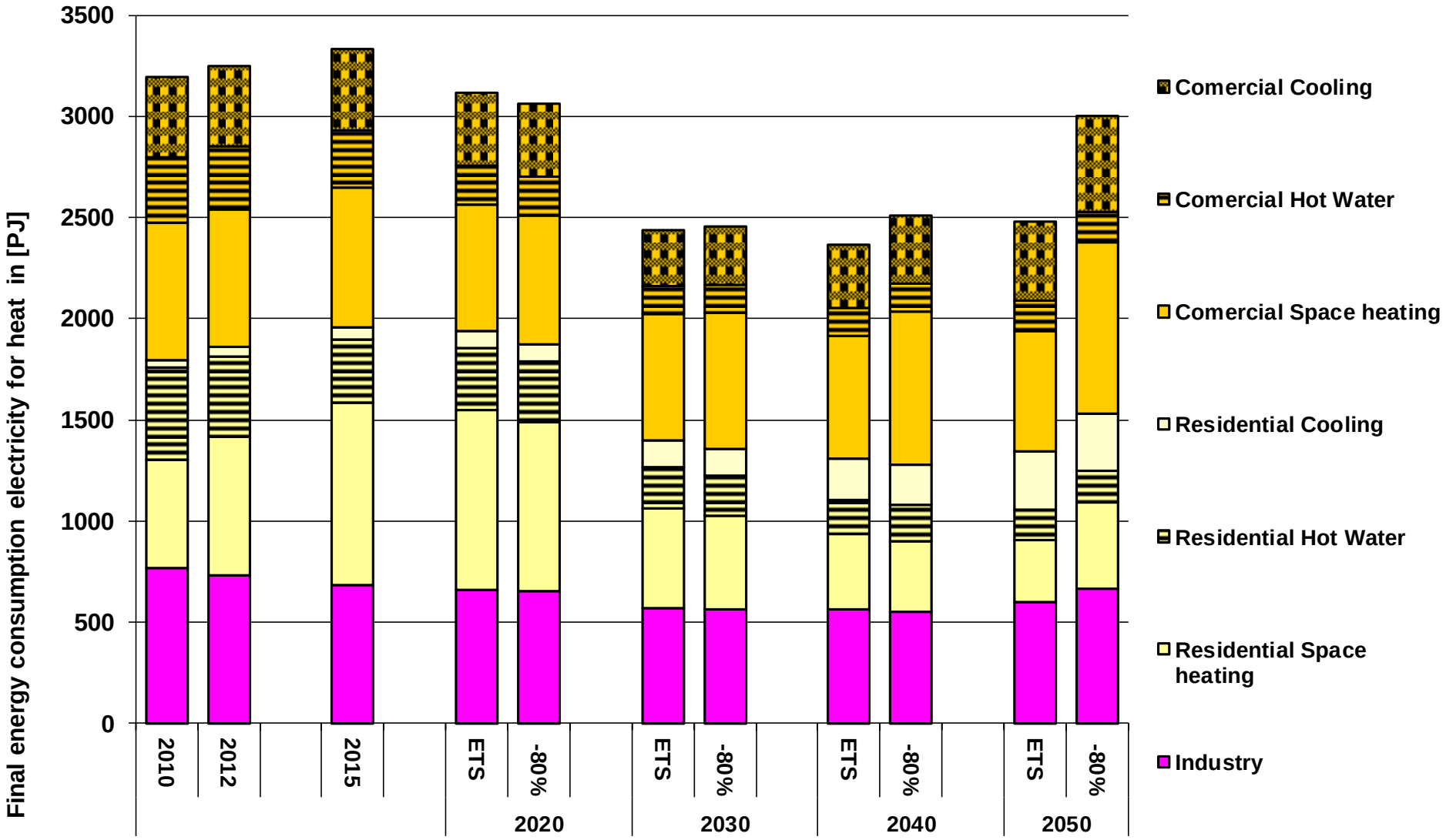
Electricity generation in the EU28 a scenario comparison



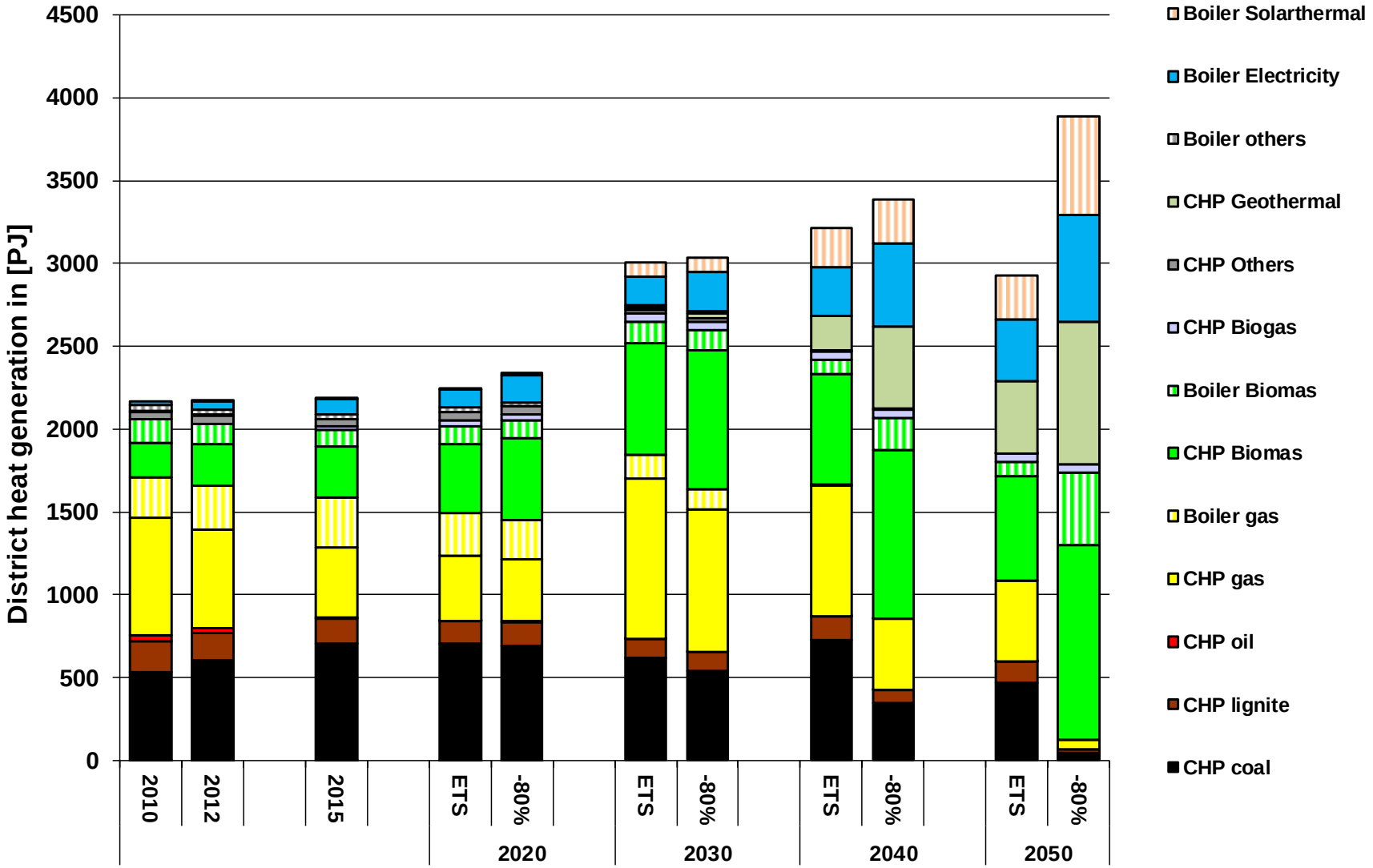
Final energy consumption in the EU28 a scenario comparison



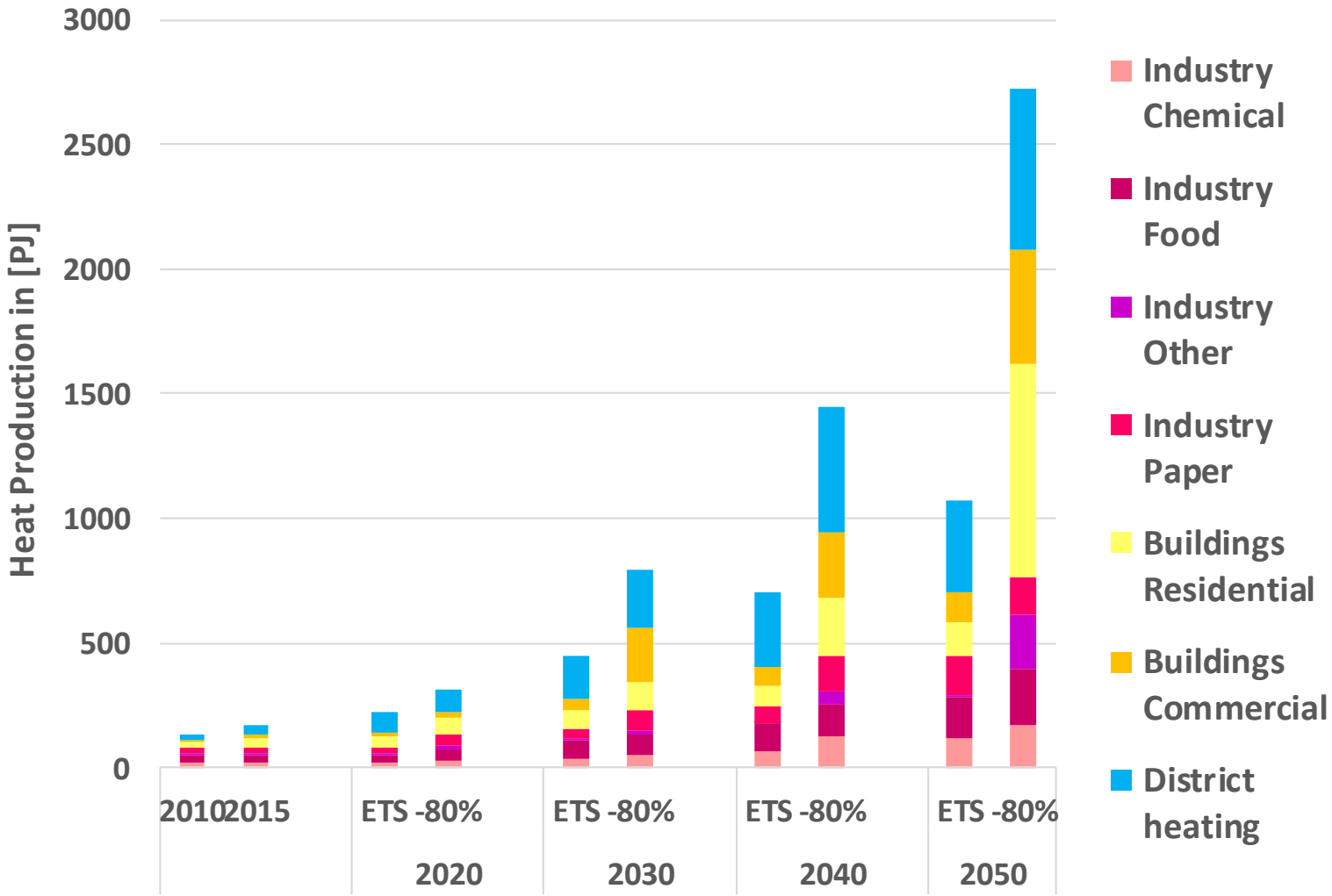
Final energy consumption electricity for heat a scenario comparison



District heat generation in the EU28 a scenario comparison



Heat generation by heat pumps in the EU28 a scenario comparison



Some Conclusion and Outlook

- Power-to-heat especially with heat pumps makes a contribution to manage the negative residual load, to improve the efficiency of the whole energy system and to integrate a higher share of renewables in the energy system.

- The proposed solutions for the energy transition depends on the integrated technologies in the energy system but also on the availability of the infrastructur.

- The decarbonisation of the whole energy systems needs a new thinking – a combination between resource/energy efficiency and a digital world

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Thank you for your attention !

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