What will decarbonising home heating mean for Great Britain's energy markets?

Breakout Speakers

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Decarbonising heat will be essential to reduce emissions from buildings, which accounted for 19% of UK territorial emissions in 2018

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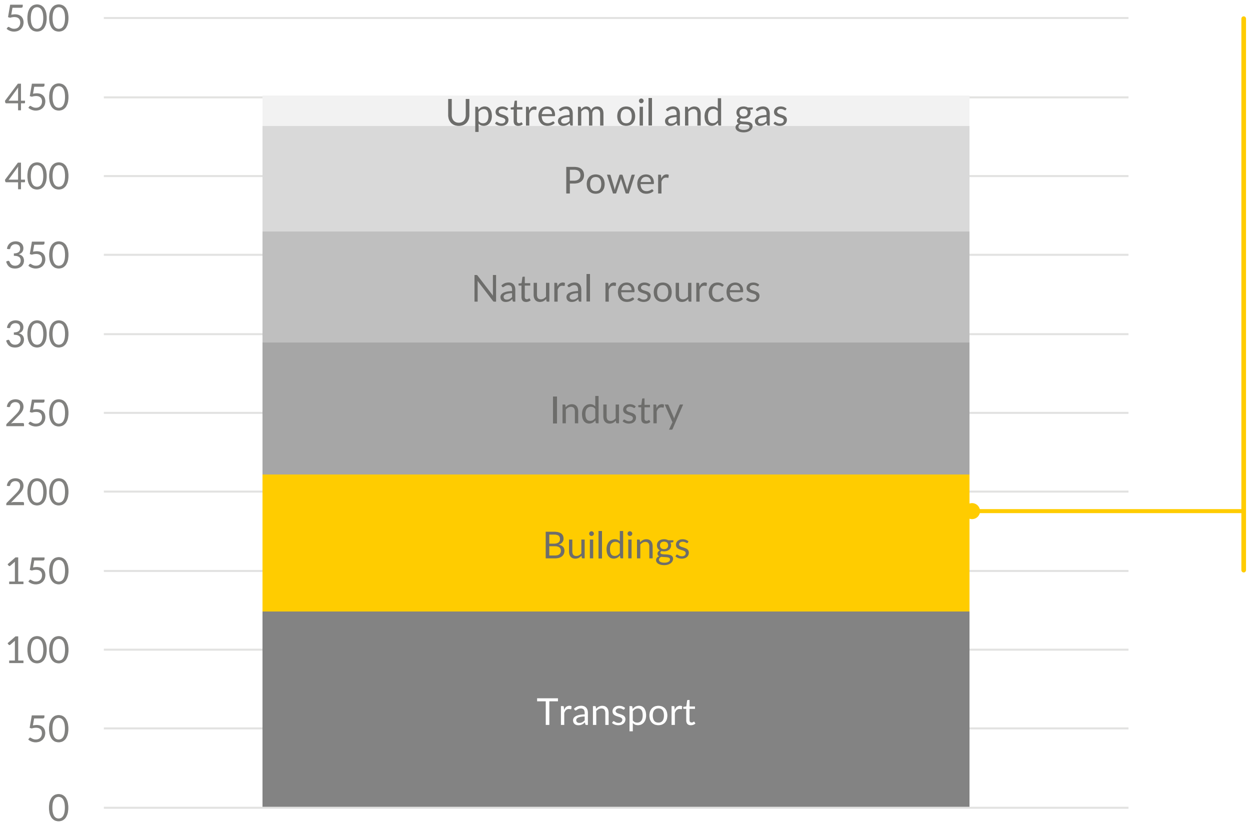
UK territorial emissions 2018

$MtCO_2e$



- Buildings accounted for 87Mt, 19% of the total of 451Mt
- Residential buildings accounted for 68Mt, more than the whole power sector
- Heating accounts for the great majority of residential buildings emissions
- Almost 90% of homes in England currently use fossil fuels
- About 85% of these are connected to the gas grid

Sources: Aurora Energy Research, BEIS Analysis of "Final UK GHG emissions national statistics" cited in Energy White Paper, December 2020

Decarbonising heat represents a major challenge, requiring millions of decisions at the local or household level

Characteristics of residential heating that make it difficult to decarbonise

Consumer engagement

- Many decisions needed: 28m homes in Great Britain
- Behavioural patterns and non-cost barriers make change difficult

Complexity

- Differences in decision structures: owner occupiers, private landlords, social housing
- Differences in homes: insulation, space, type of building

Opportunities for change

- Low replacement rate for building stock: fewer than 200k new homes per year
- Long heating system lifetimes: typically 15 years or more

Costs

- Challenging economics: low carbon solutions are more costly today
- Network infrastructure needs to change at scale

Aurora recently completed a study examining the potential economics of deploying a range of low-carbon heating technologies

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Heating technologies analysed

- Gas boilers
- Air source heat pumps
- Ground source heat pumps
- “Networked” heat pumps
- Hydrogen boilers
- Electric resistive heating
- Heat networks

We modelled a range of assumptions for costs and policy, resulting in different mixes of heating technologies by 2050

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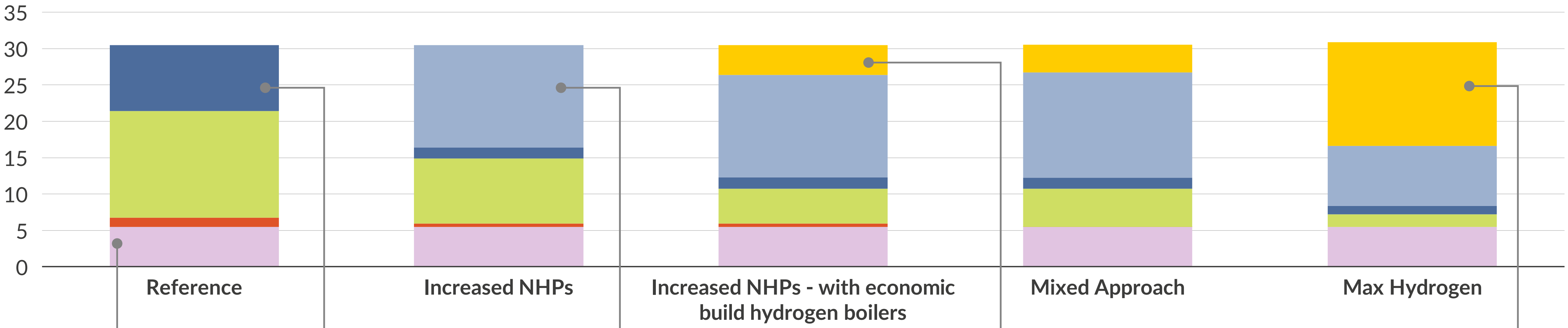
Homes with each technology installed in 2050

Millions of homes



In all scenarios, we **assume** a fixed deployment trajectory for heat networks, reaching ~18% of homes in 2050

In our reference scenario, the mix of ASHP and GSHP deployment depends more on assumed build limits than economics

NHP deployment may be lower than in our **economic modelling** because of practical and infrastructure constraints that we have not modelled

In this scenario, we assume any home can choose a hydrogen boiler if the in-home **economics** look favourable, regardless of network deployment

In the final two scenarios, deployment of hydrogen is **assumed**

Heat network | Electric resistive | ASHP | GSHP | NHP | Hydrogen

Source: Aurora Energy Research

Heat pump technology is ready for deployment today, but heat pumps are currently more costly to buy, fit and run than replacement gas boilers

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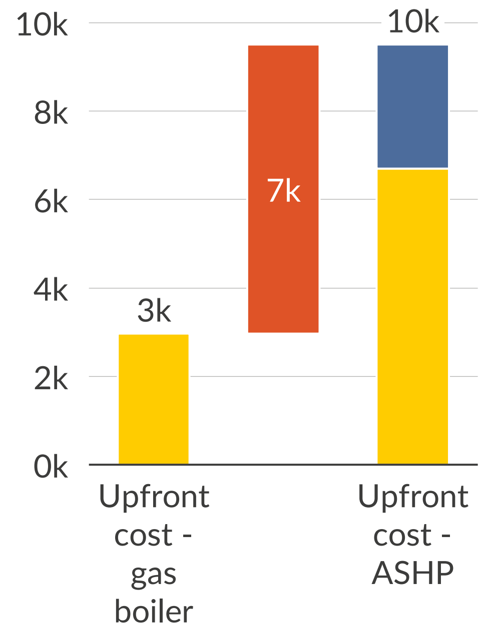
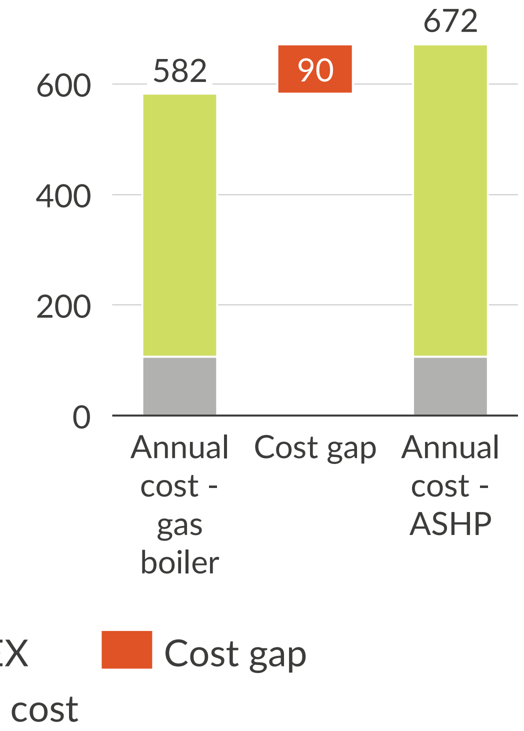
Example costs for air source heat pumps compared with gas boilers in 2021

Costs for an efficient, owner-occupied house, £ (real 2020) – note costs vary widely between home types

Up-front costs



Annual running costs[1]



- The difference in running costs reflects current policy design
  - Heat pumps are typically over 3 times as efficient as gas boilers
  - However, retail prices per MWh are about 4 times higher for electricity than for gas
  - Electricity prices incorporate carbon prices paid by generators and the cost of subsidies to renewables; gas prices do not
- Examples of policy options to close the cost gap :
  - A carbon tax on fossil-fuel-fired home heating
  - Shifting policy costs from electricity bills onto gas bills
  - Shifting policy costs from electricity bills to general taxation
  - A grant to help with the cost of a new heat pump
- It may be more effective to use separate policy measures to address the up-front costs and the running costs
- For measures that raise costs of gas boilers, distributional effects and impacts on low-income households need to be treated carefully

1) These are based on our April forecast for 2021 prices, and do not reflect recent rises in wholesale prices.

Sources: Aurora Energy Research, Ofgem, BEIS,

In all our scenarios, electricity demand for heat increases in the decades ahead, but total energy demand for heat falls

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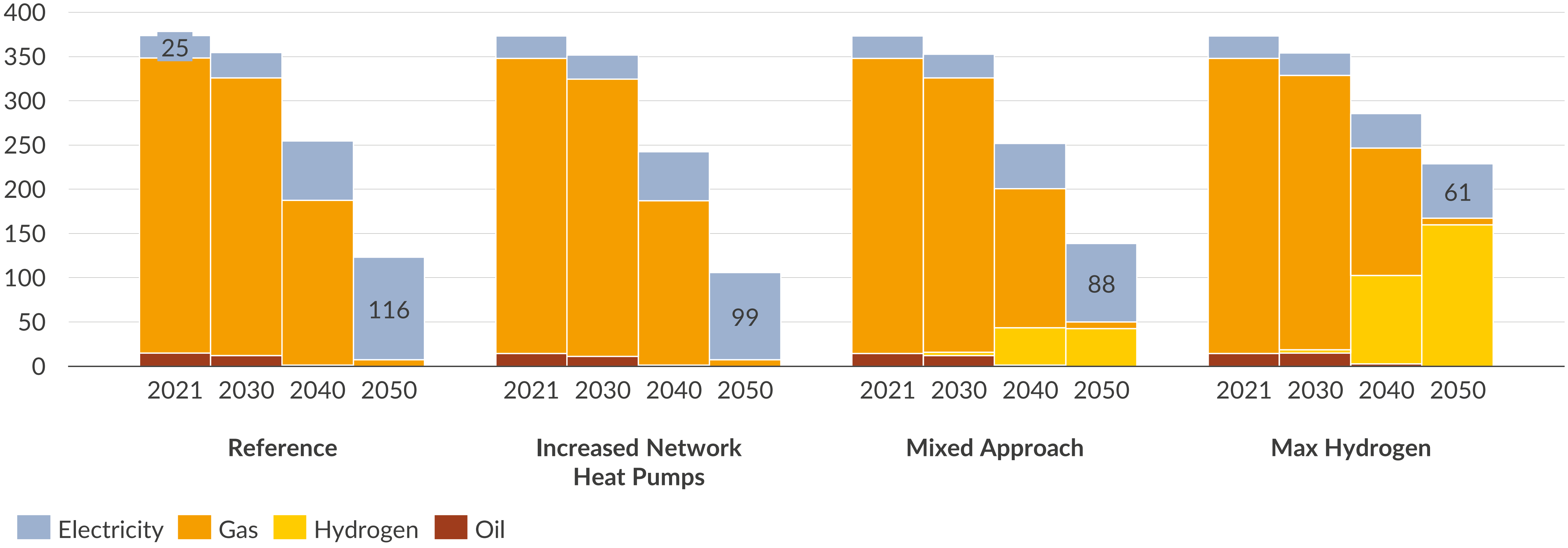
Fuel demand for heating
TWh



Source: Aurora Energy Research, NGESO, EE

Demand from heat could drive almost a third of the growth in electricity demand by 2050 in a net zero scenario

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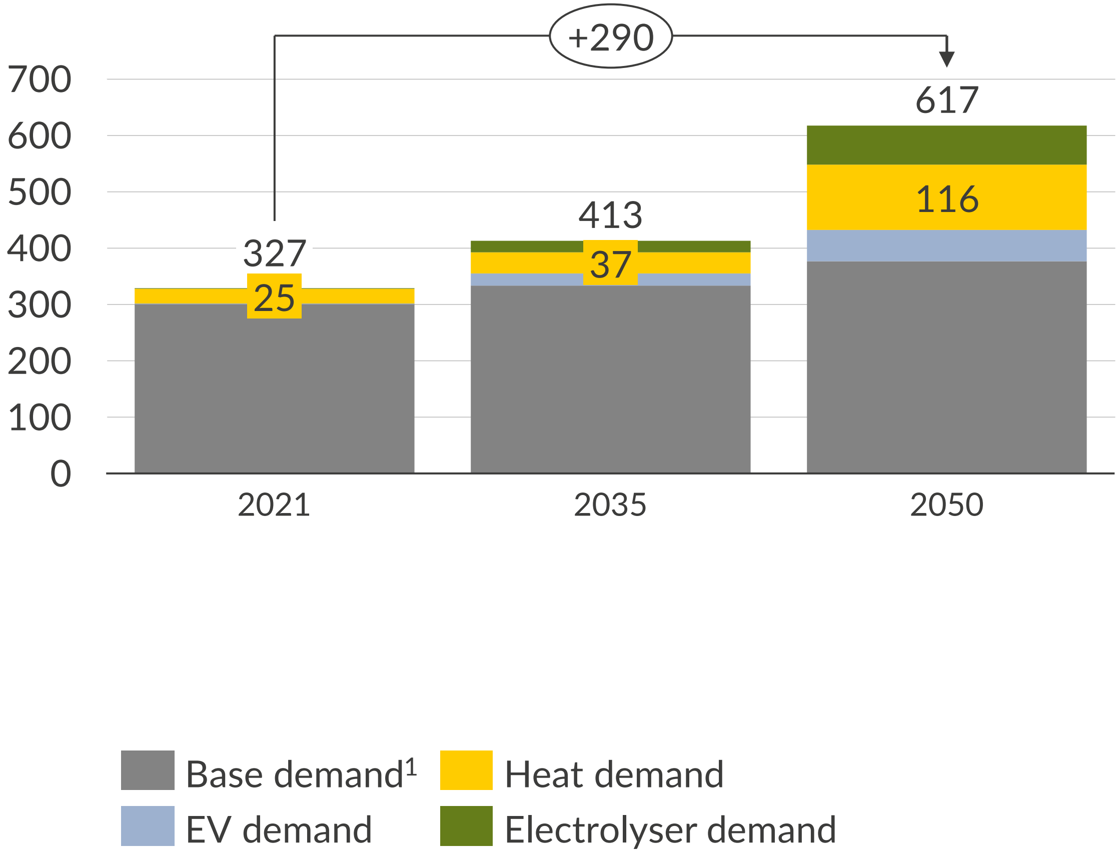
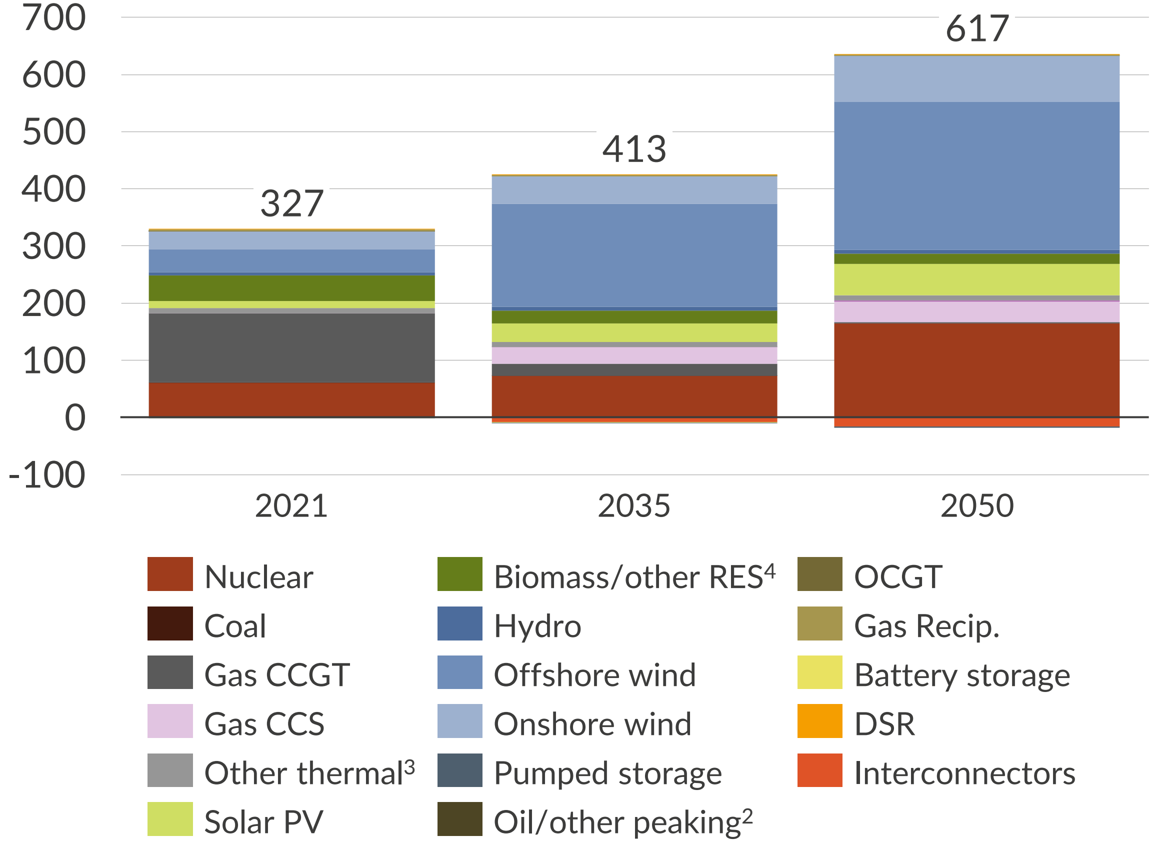
Electricity Demand

Net zero power scenario, reference heat scenario, TWh



Electricity Generation

Net zero power scenario, reference heat scenario, TWh



1) Base demand includes industrial and domestic non-heat demand 2) Peaking includes OCGT and reciprocating engines. 3) Other thermal includes embedded CHP. 4) Other RES includes biomass, BECCS, EfW, hydro, and marine.

Source: Aurora Energy Research

Any further questions?

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