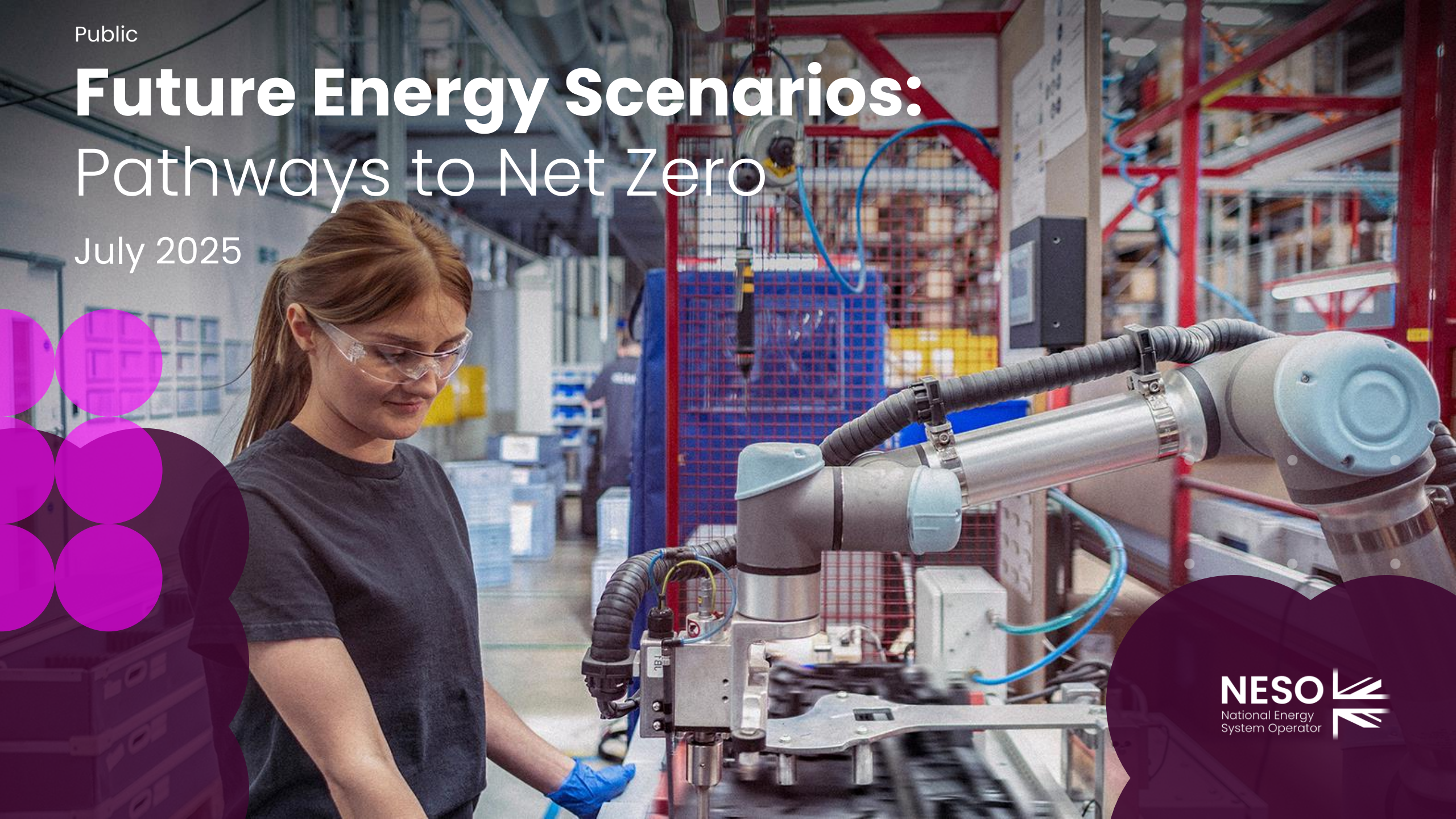
Public

Future Energy Scenarios:
Pathways to Net Zero

July 2025



NESO
National Energy System Operator

Public

FES 2025:
The key changes from 2024 to 2025 and main assumptions

Thursday 17 July 2025
10am – 11.30am

NESO
National Energy System Operator

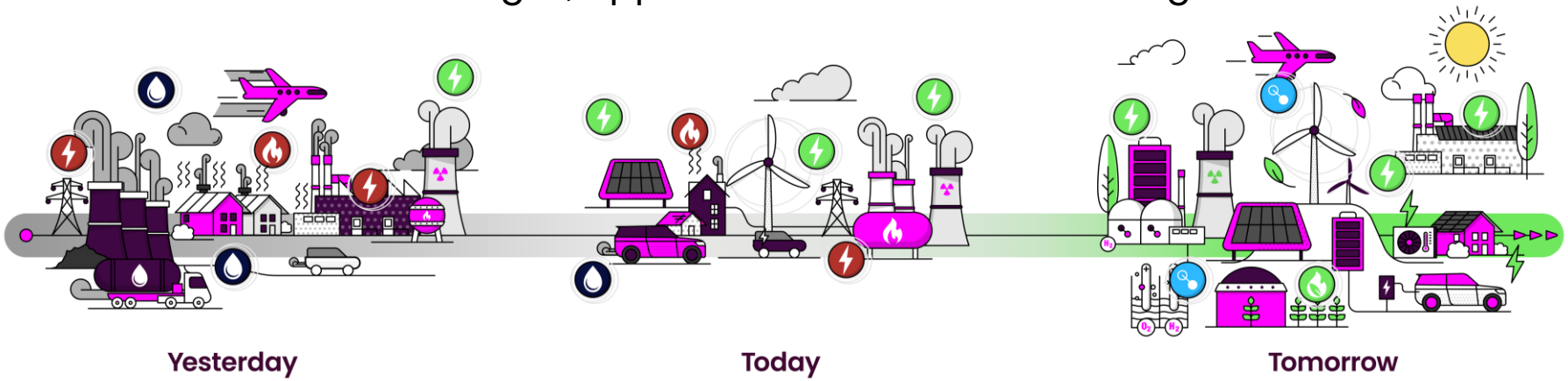
Agenda and content

10 – 11.30am	Time	Presenter
Welcome	10:00	Emily Leadbetter
Framework and Pathways	10:05	Jonathan Morris
Key changes to modelling for 2025	10:10	Jonathan Morris
Emissions	10:15	Jonathan Morris
Energy demand	10:20	Katherine Uzzell
Electricity supply	10:30	Katherine Uzzell
Hydrogen	10:40	Jonathan Morris
Q&A	10:45	Host: Emily Leadbetter
Close	11.30	Emily Leadbetter

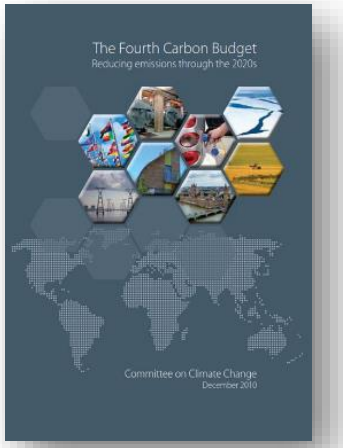
Why do we need pathways to net zero?

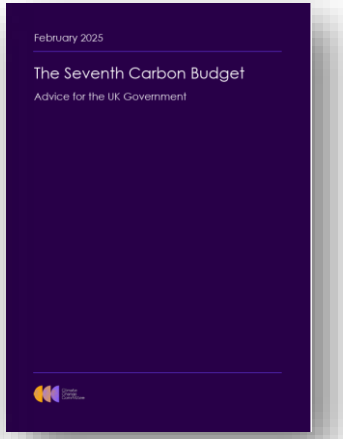
Net zero brings a huge amount of change to the energy system.

We need to understand the challenges, opportunities and inform the big decisions.



Climate Change Act 2008





NESO
National Energy System Operator

What are the Future Energy Scenarios?

NESO whole energy system publication

National view: Great Britain's route to net zero 2050

Considering legally binding emissions targets along the way

Pathways, not forecasts, and no longer scenarios

What do we model?

FES models supply and demand to build whole energy system pathways to net zero.

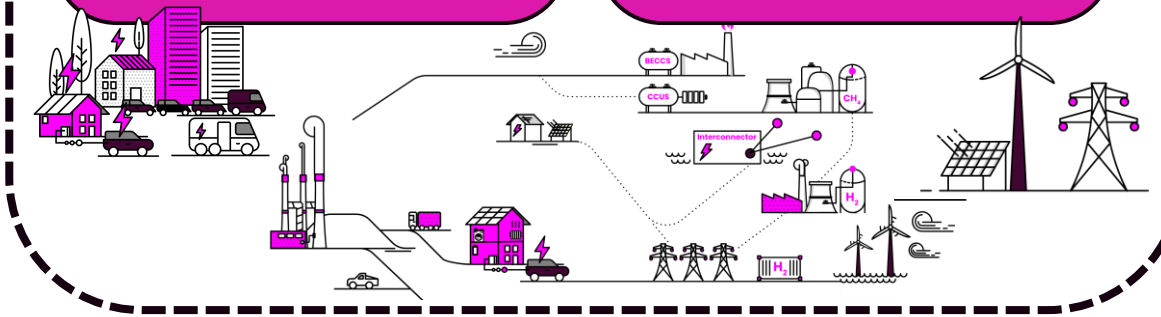
We model these sectors…

- Road transport
- Residential heat
- Appliances
- Commercial
- Industrial
- Demand flexibility

Demand

- Electricity generation and flexibility
- Hydrogen supply
- Gas supply
- Engineered carbon removals

Supply



We don't model these sectors – but do use values from the Climate Change Committee

- Aviation and shipping
- Biomass supply
- Land use, land use change and forestry
- Agriculture
- Fluorinated gases
- Fuel supply
- Industrial process emissions

"Non-FES sectors"

NESO National Energy System Operator

NESO Pathways to Net Zero

FES feeds into, and works alongside, established and new energy system processes:

Inputs:

- Stakeholder engagement
- Policy and targets
- External technical data
- Economic data

Outputs:

FES analysis and insight

- Pathways, Falling Behind and Ten Year Forecast of:
  - Energy demand
  - Electricity supply
  - Gas supply
  - Hydrogen supply
  - Bioenergy supply
  - Emissions

Uses:

- Strategic Energy Planning
- Markets
- Security of supply
- Operability
- Strategic insights and advisory
- Private sector and energy industry

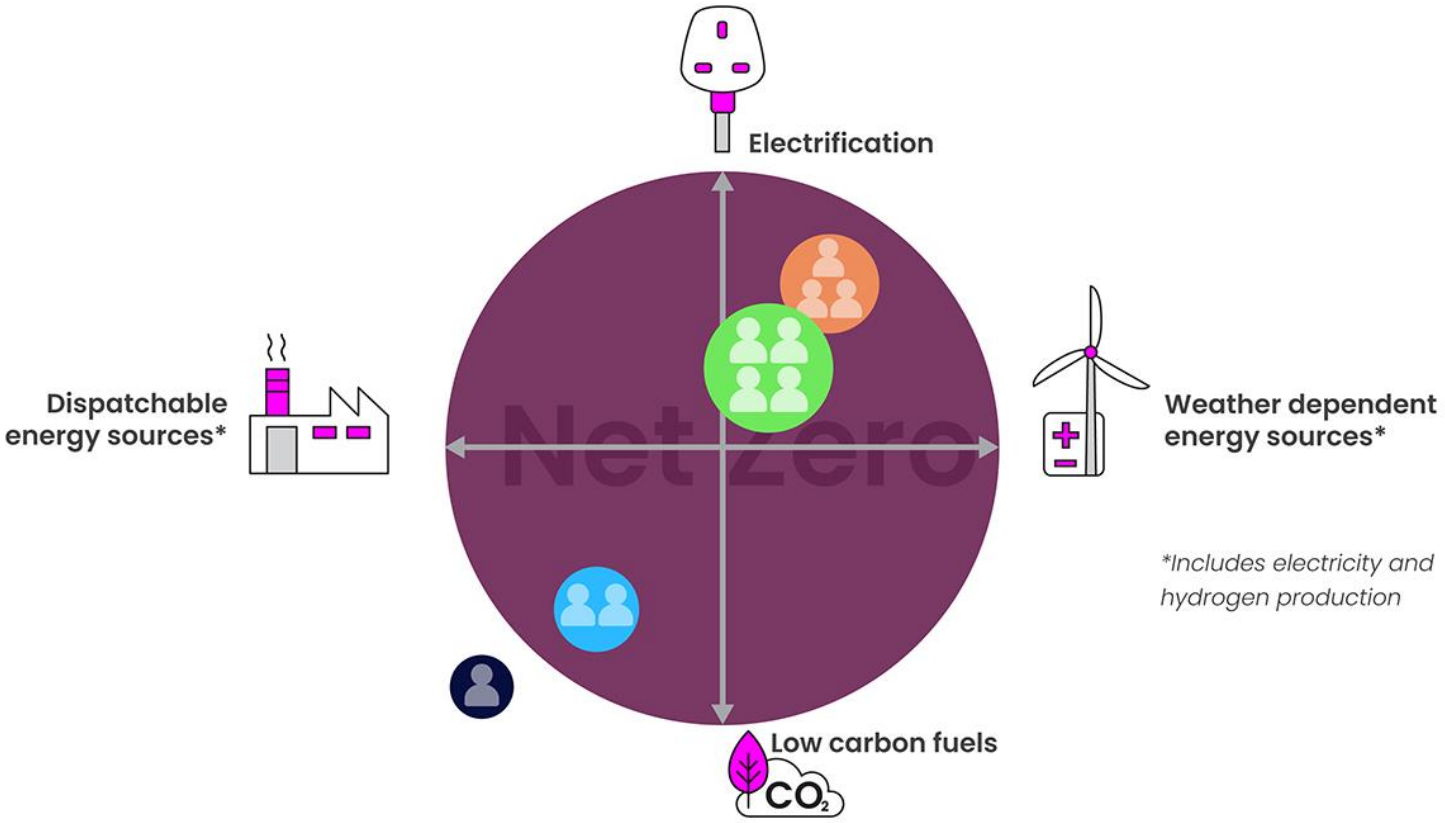
While based on the SSEP*, the CSNP** will use FES for stress-testing for electricity and hydrogen.

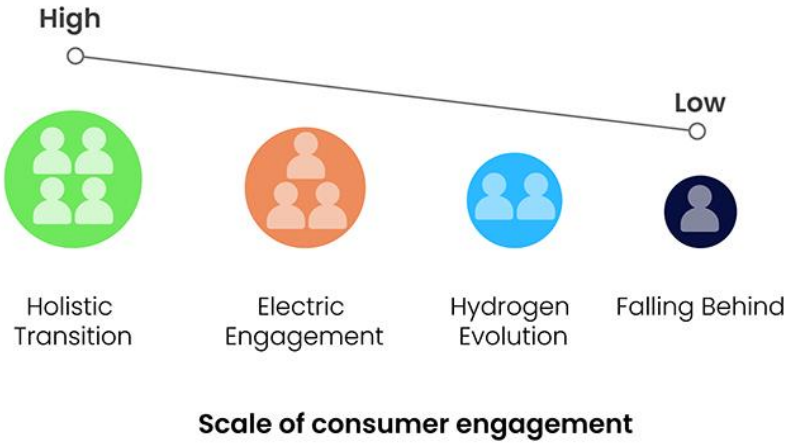
Some of the FES technical data is also used in the SSEP and RESP***.

See Appendix 1 of the FES 2025 report

*SSEP = Strategic Spatial Energy Plan
**CSNP = Centralised Strategic Network Plan
*** RESP = Regional Energy System Planning

The pathway framework

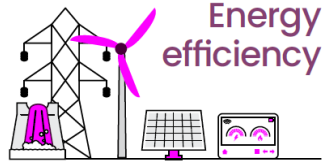




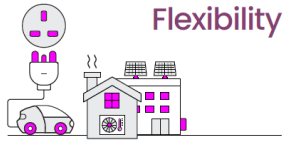
Key messages

> Only bold and sustained action in all sectors will unlock the benefits of an affordable and secure, clean energy system. This means matching the ambition and pace of the clean power goal, accelerating progress across the whole energy system and looking beyond 2030.

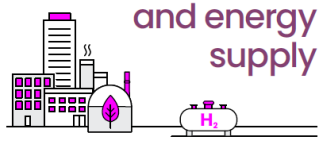
This means action on:



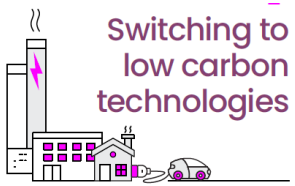
Energy efficiency



Demand Flexibility



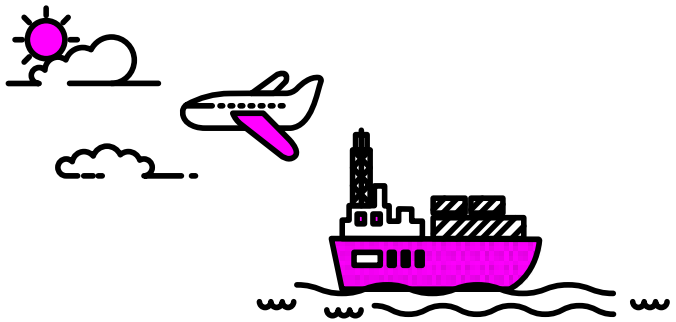
Infrastructure and energy supply



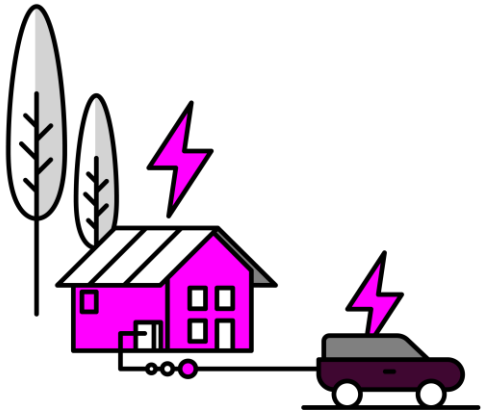
Switching to low carbon technologies

	Today	2030	2040	2050
	Acceleration	Growth	Horizon	
1 Energy efficiency	Implement policy to accelerate widespread adoption of energy efficiency measures	Push forward with efforts to improve efficiency of heat pumps and electric vehicles over time	Maintain momentum on energy efficiency measures and embed optimal operating practices	
2 Demand flexibility	Empower households and businesses willing and able to make informed energy choices	Rapid rollout of smart energy solutions, such as using electric vehicles to support the grid and making heating more flexible	Ensure effortless participation	
3 Infrastructure and energy supply	Deliver coordinated strategic plans across electricity, gas, bioenergy, hydrogen and CO_2 transport and storage	Build the strategic whole system energy infrastructure at pace, considering electricity, gas, bioenergy, hydrogen and CO_2	Drive continuous innovation to fully realise and maximise the value of a net zero energy system	
4 Switching to low carbon technologies	Implement policy to encourage homes and businesses to switch to low carbon energy sources	Deliver mass adoption of low carbon technology and infrastructure to provide certainty for industry	Further reduce reliance on unabated fossil fuels	

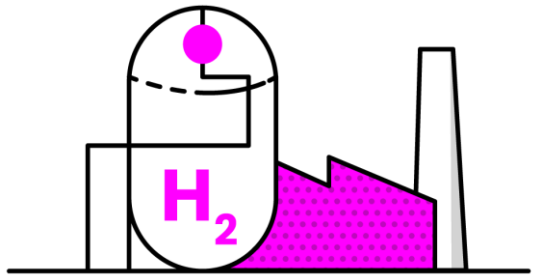
Key changes to modelling for 2025



For non-FES sectors we use the Climate Change Committee's Seventh Carbon Budget analysis



All pathways have an electric vehicle uptake faster than current policies



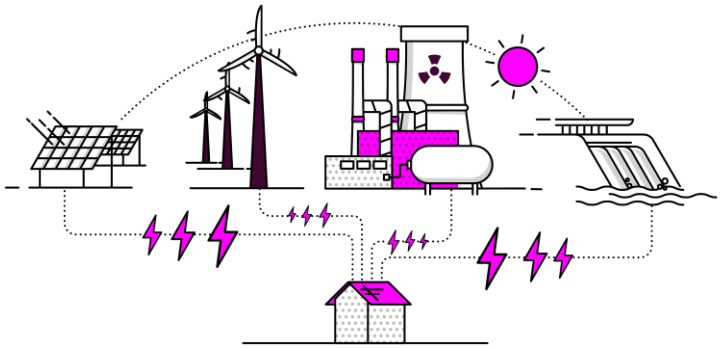
Lower levels of hydrogen for transport, heat and industry across the pathways

NESO National Energy System Operator

Key changes to modelling for 2025

Increased electricity demand in the pathways and Falling Behind

Updated European dataset with closer alignment to the FES framework



Increased firm generation capacity and use of low-carbon dispatchable power

NESO
National Energy System Operator

A year in energy

General election

The July 2024 election brought focus on low carbon energy

Industrial clusters

The first revenue support contracts for low carbon hydrogen and carbon capture projects were awarded in late 2024

Connections reform

Connections reform is underway following Ofgem's acceptance of NESO proposals in April 2025

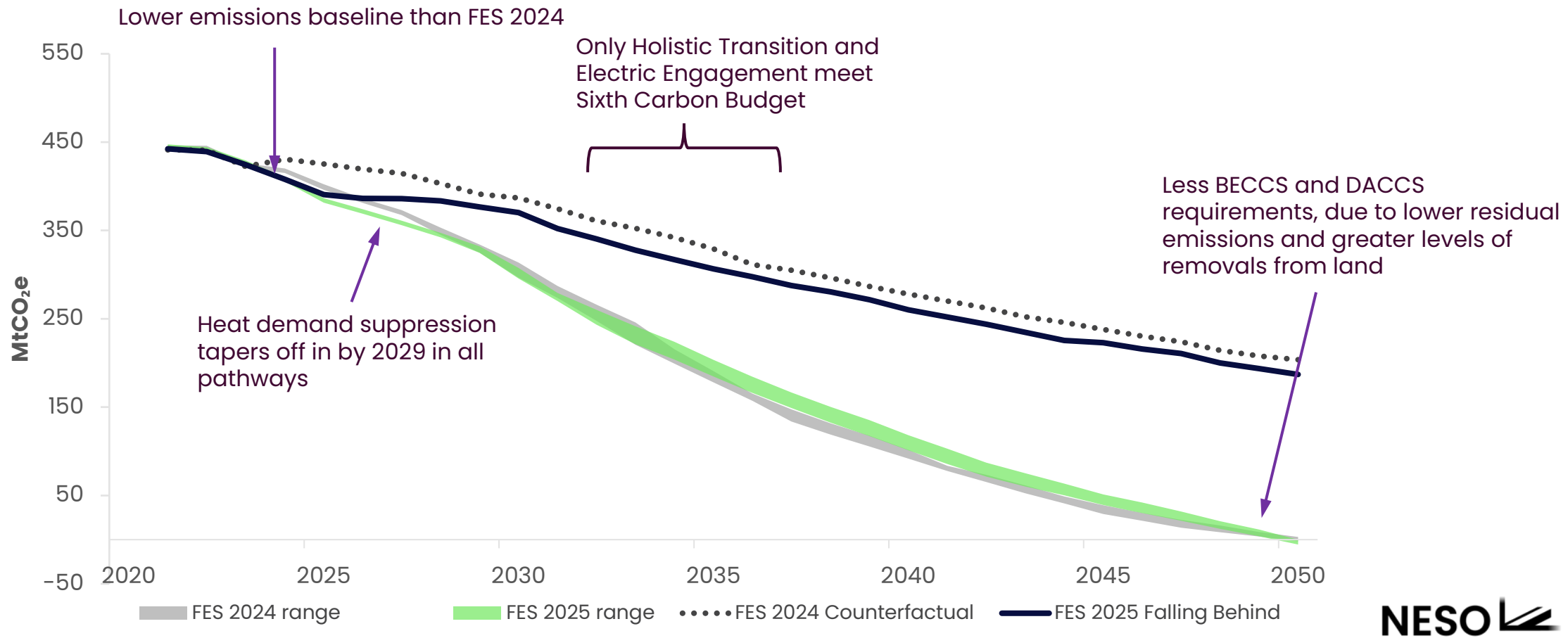
Establishment of NESO

The UK's 2023 Energy Act set the legislative framework for an independent system planner and operator

NESO
National Energy System Operator

Emissions

Emissions

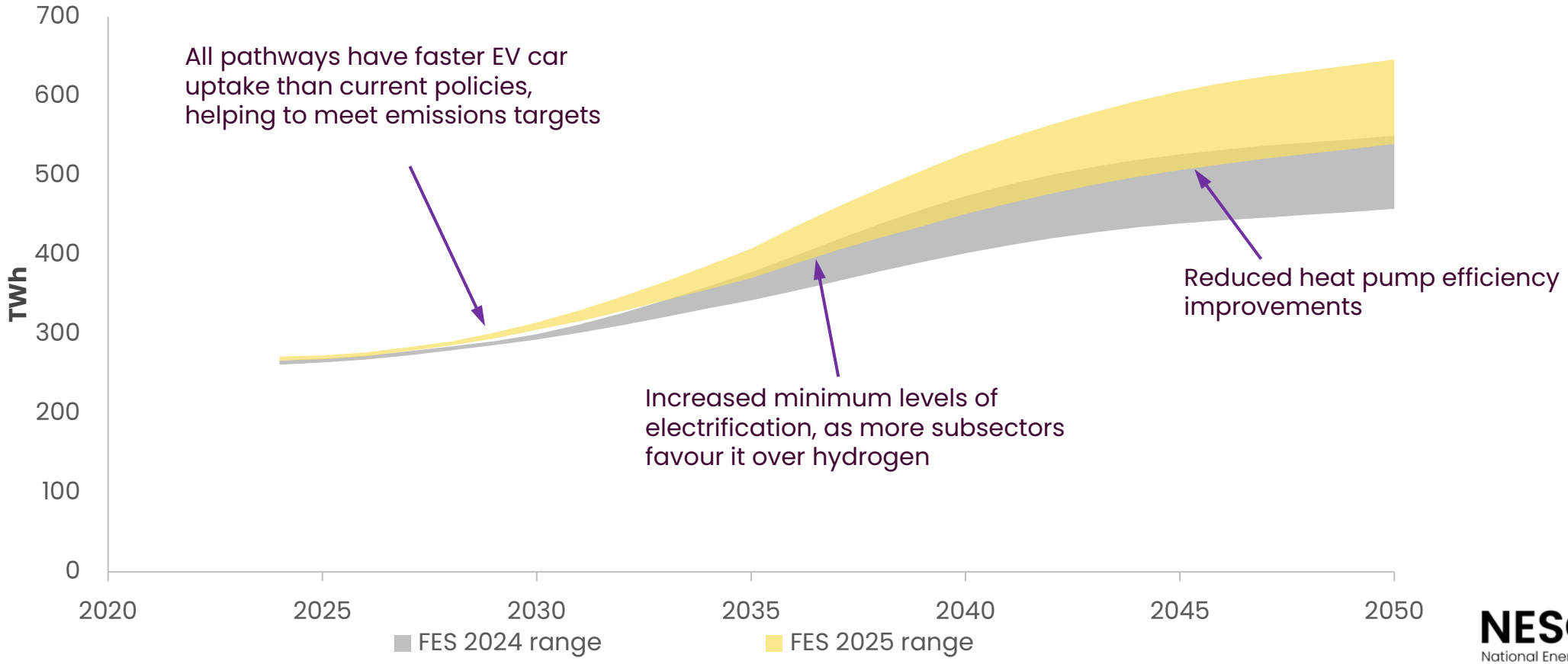

Lower emissions baseline than FES 2024
Only Holistic Transition and Electric Engagement meet Sixth Carbon Budget
Less BECCS and DACCS requirements, due to lower residual emissions and greater levels of removals from land
Heat demand suppression tapers off in by 2029 in all pathways
MtCO2e
550
450
350
250
150
50
-50
2020
2025
2030
2035
2040
2045
2050
FES 2024 range
FES 2025 range
FES 2024 Counterfactual
FES 2025 Falling Behind

Energy demand

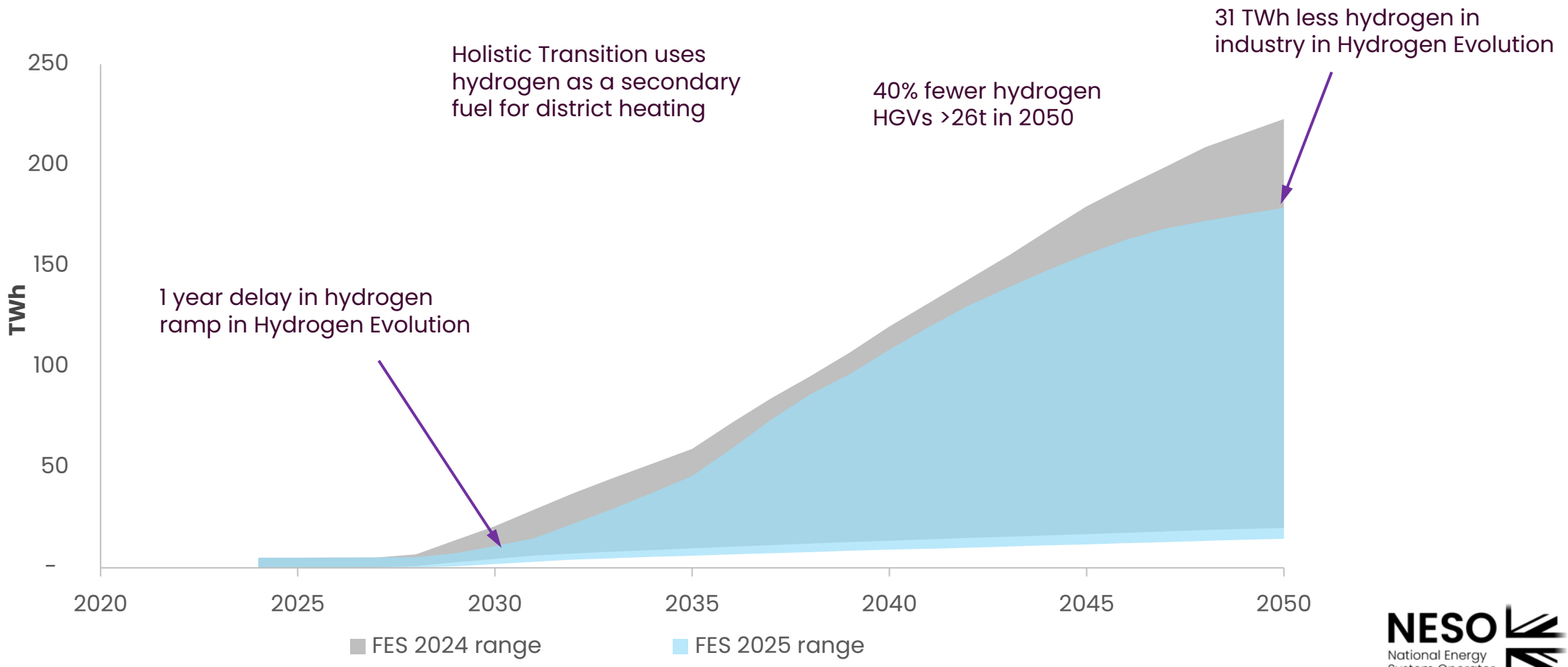
Consumer electricity demand

Population growth forecast increased from 0.2% to 0.4% year-on-year increase

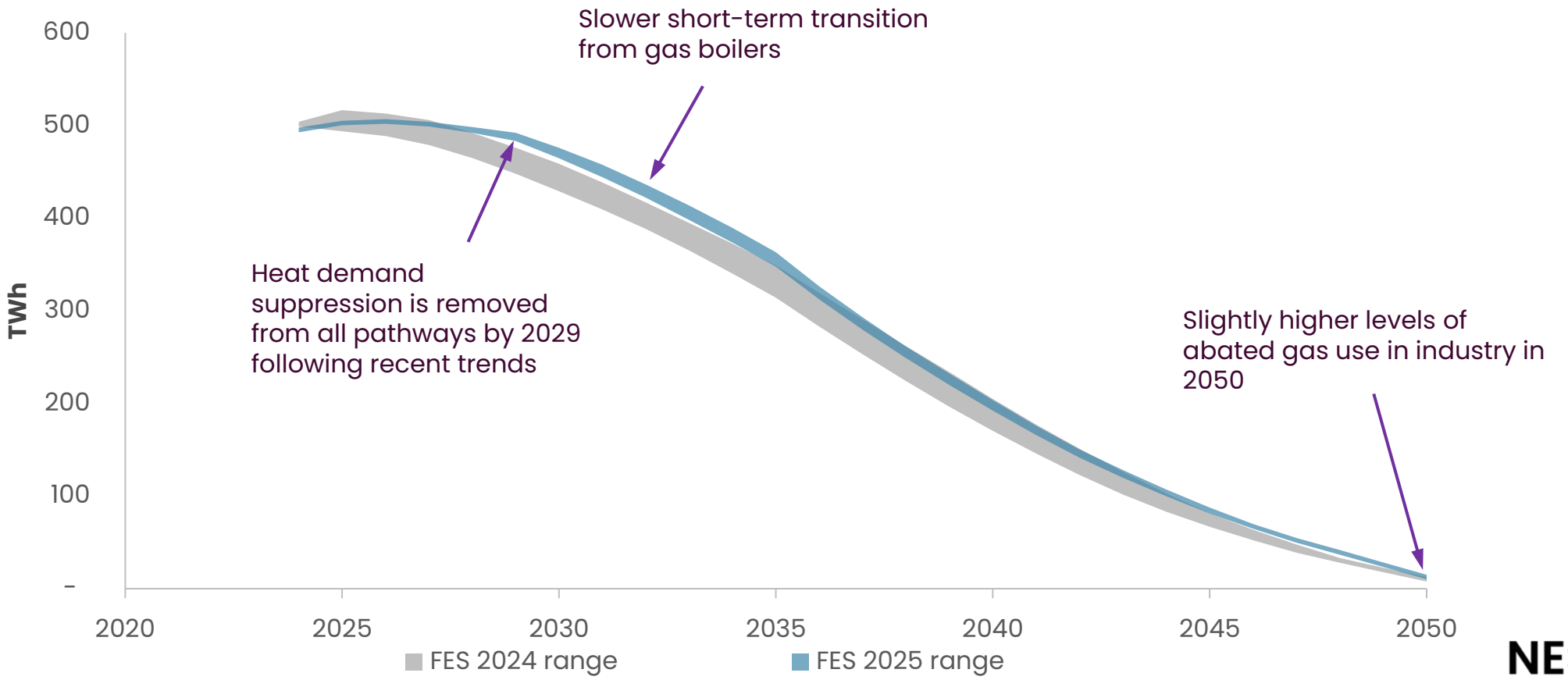
Higher levels of direct electric heating, as this is found to be a favourable consumer choice in a Public First and NESO survey



Consumer hydrogen demand



Consumer gas demand

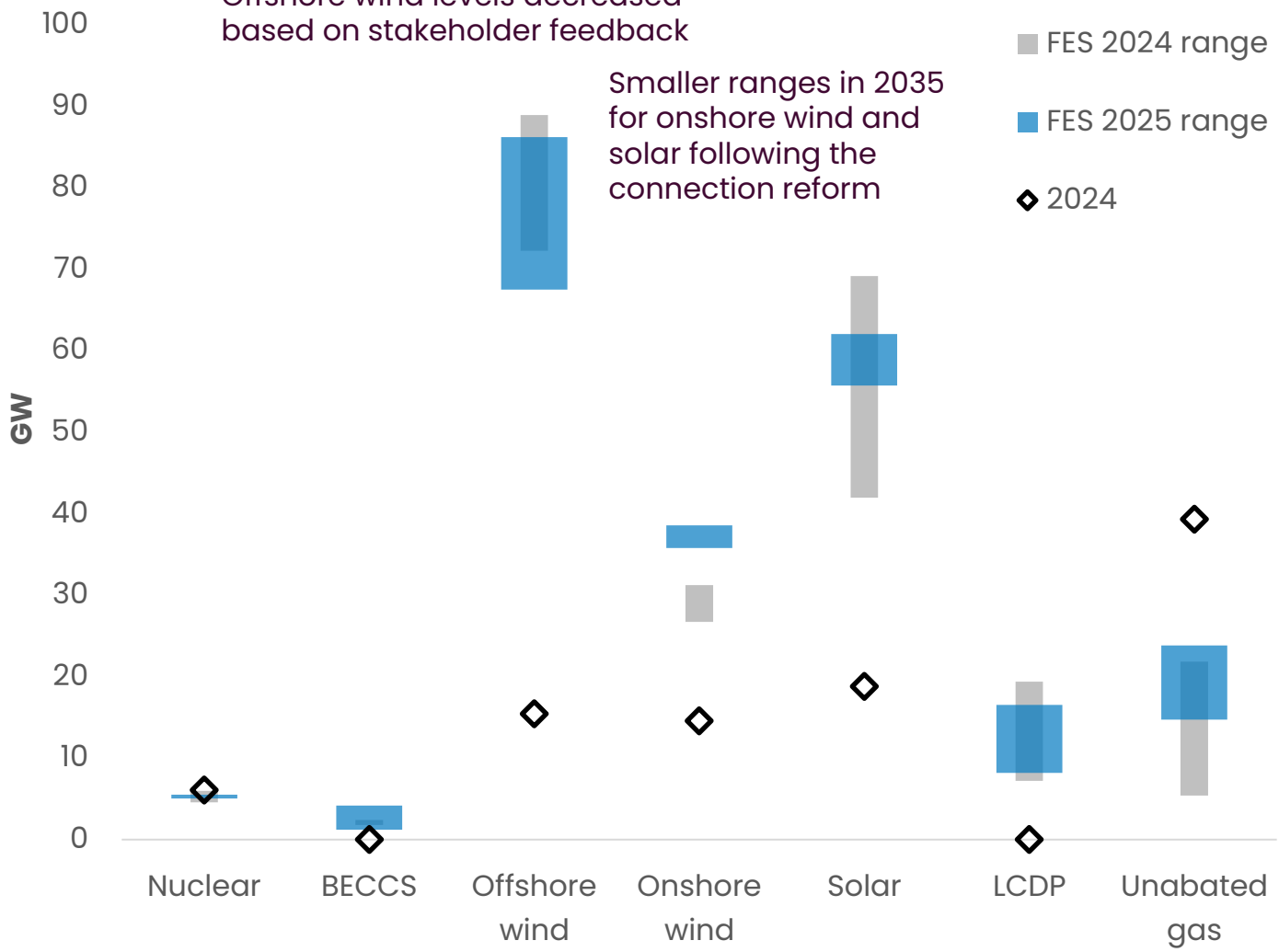


Electricity supply

2035 electricity capacities

Offshore wind levels decreased based on stakeholder feedback

Smaller ranges in 2035 for onshore wind and solar following the connection reform



Lower upper values of hydrogen to power

Higher capacities of unabated gas for security of supply

Limited potential for overall growth in nuclear by 2035

Higher use of BECCS helps to meet the Sixth Carbon Budget

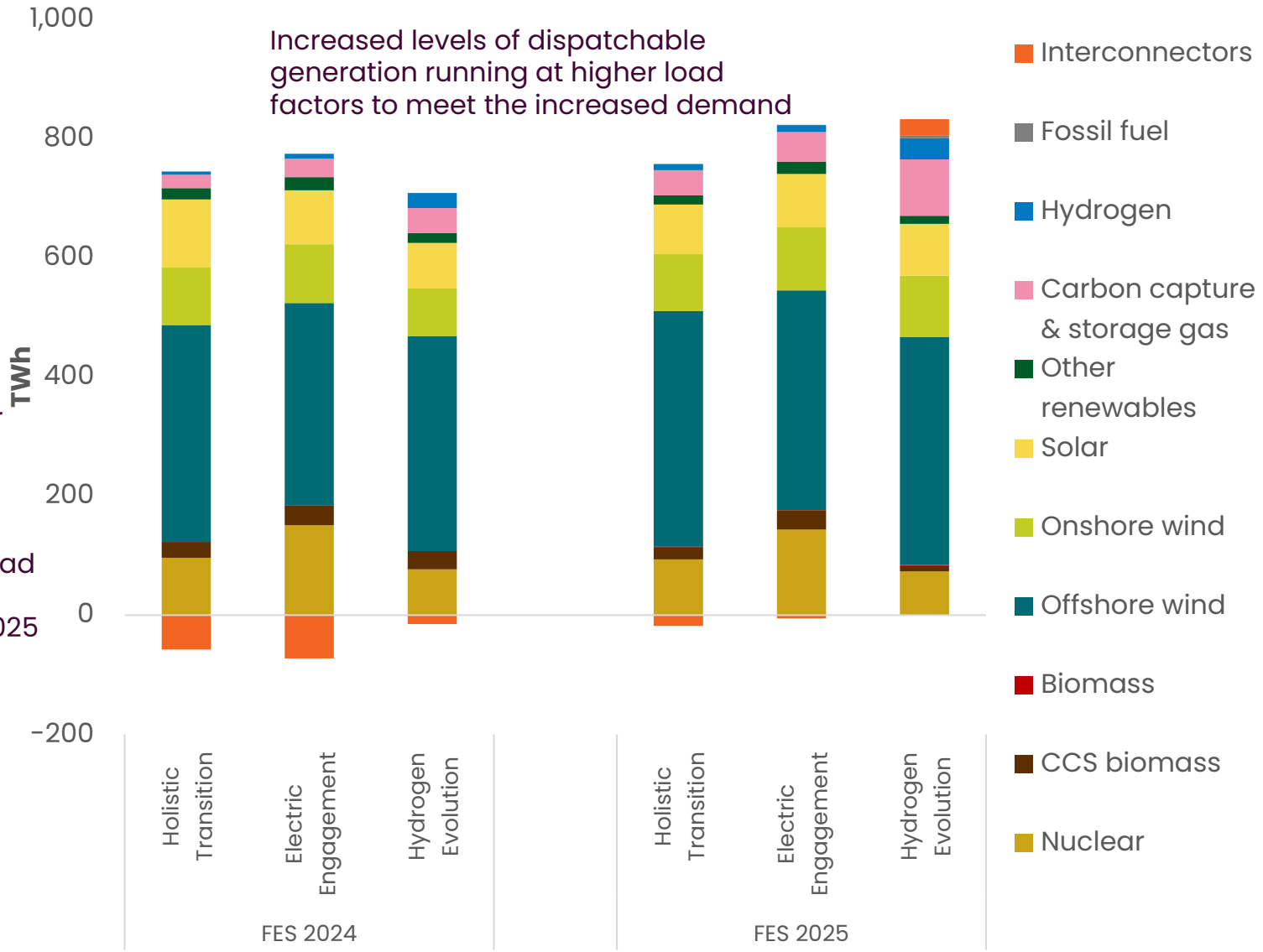
LCDP = Low Carbon Dispatchable Power

NESO National Energy System Operator

2050 electricity generation

Levels of renewable generation have increased, from higher electricity demand

2050 levels of baseload generation are comparable in FES 2025

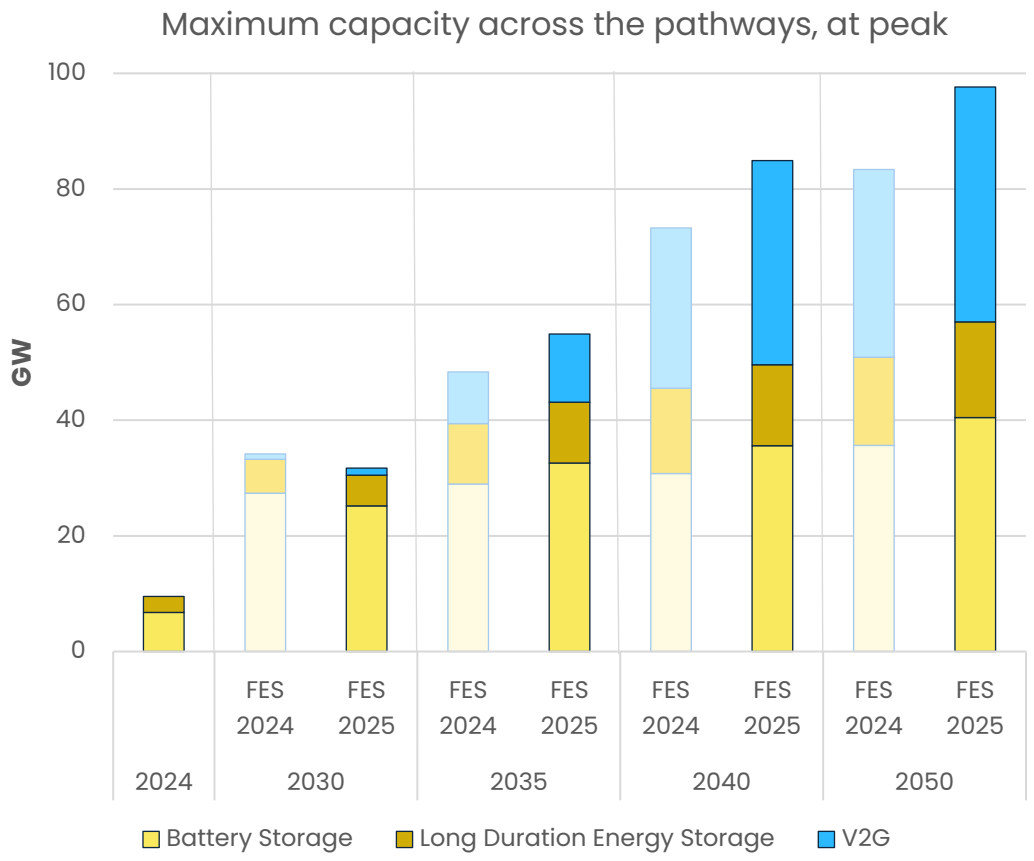


Lower levels of electricity exports in Hydrogen Evolution make it become a net importer of electricity, from more reliance on dispatchable power

NESO National Energy System Operator

Supply and consumer electricity storage

Batteries are the main electricity storage technology out to 2035

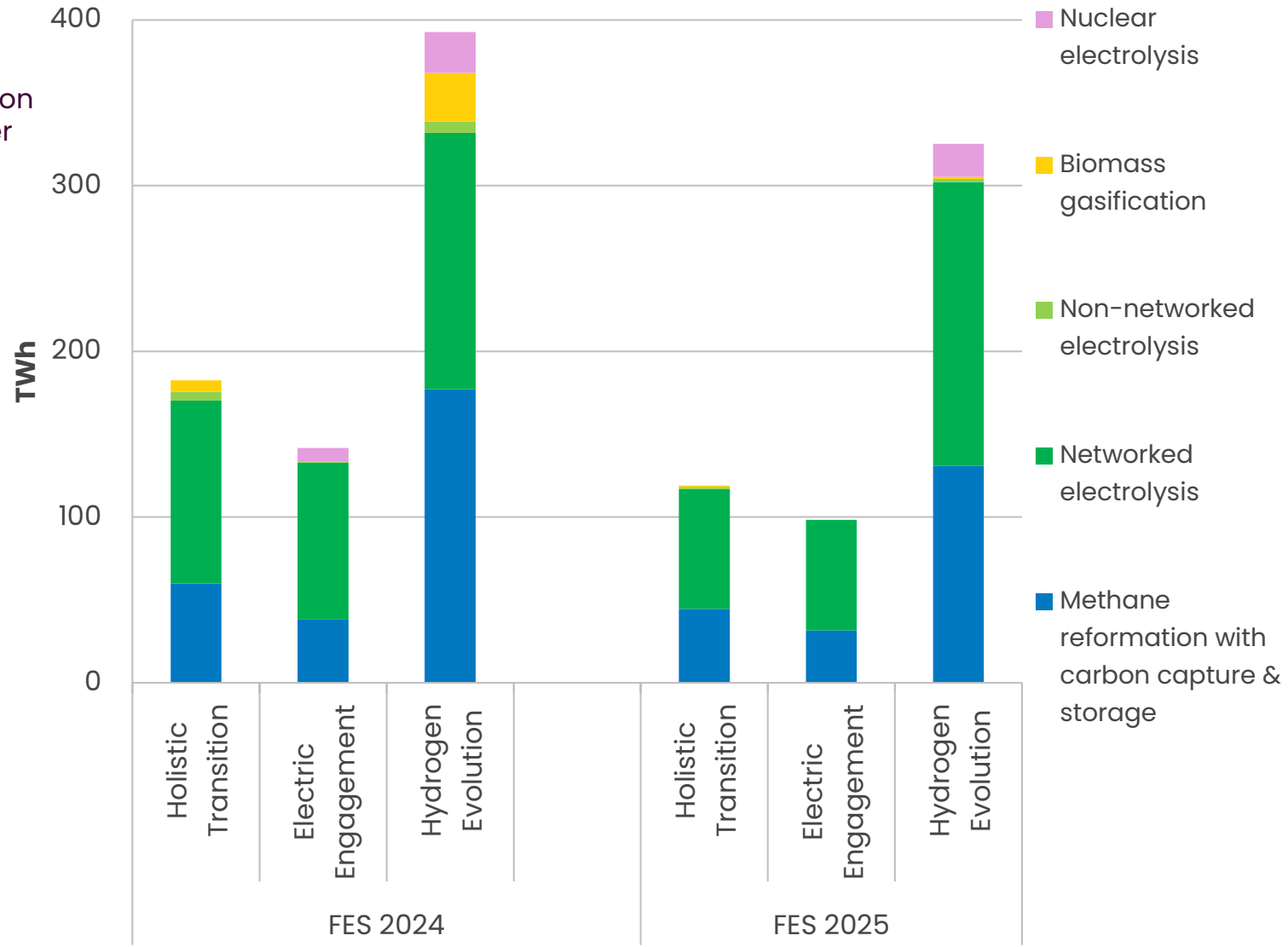


By 2050 V2G and long duration energy storage play key roles in system flexibility

Hydrogen

2050 hydrogen production

Total hydrogen production reduces in line with lower hydrogen demand

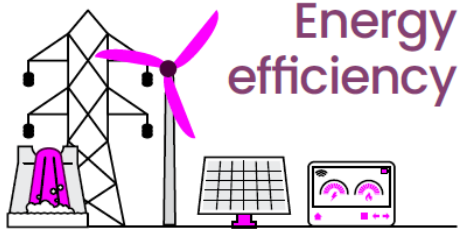


Comparable mix of electrolysis and methane reformation.

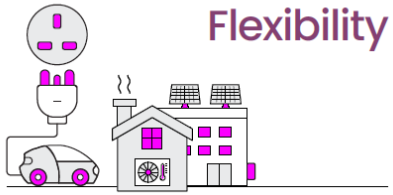
Methane reformation remains at higher load factors than electrolysers.

The choices we make today will shape the waves of the new energy era

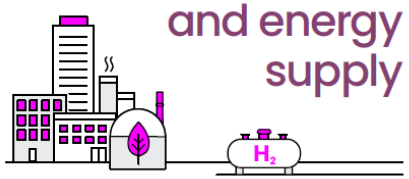
> Only bold and sustained action in all sectors will unlock the benefits of an affordable and secure, clean energy system. This means matching the ambition and pace of the clean power goal, accelerating progress across the whole energy system and looking beyond 2030.



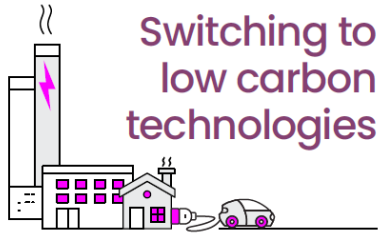
Energy efficiency



Demand Flexibility



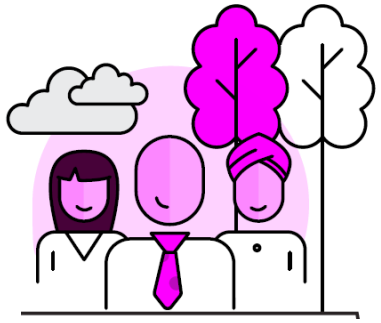
Infrastructure and energy supply



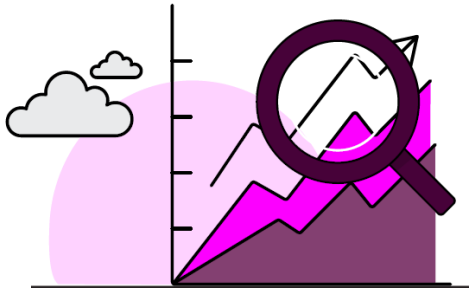
Switching to low carbon technologies

NESO
National Energy System Operator

Thank you



Thank you for engaging with our FES analysis throughout the year



Find out more in

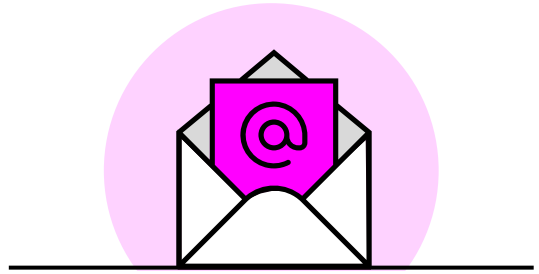
FES 2025

Data Workbook

Changes since FES 2024

Assumptions

Modelling methods



Contact us at

FES@neso.energy

Web: https://www.neso.energy/publications/future-energy-scenarios-fes

NESO National Energy System Operator