

# Energy System Integration in the transition to **Net Zero**: Beyond electricity

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# Overview

Our Journey and Future in Energy

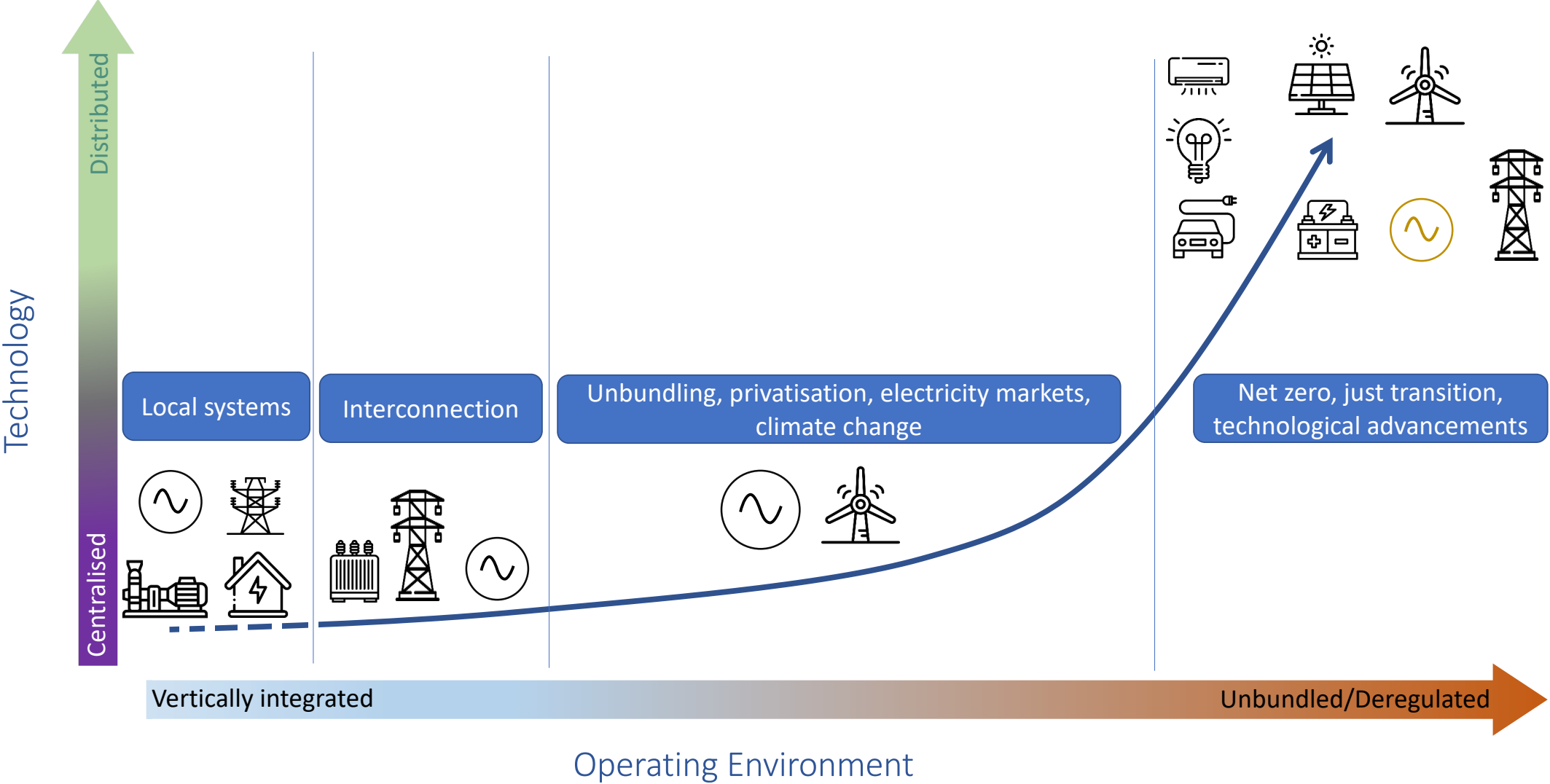
The electricity grid as an enabler

Innovations and Developments

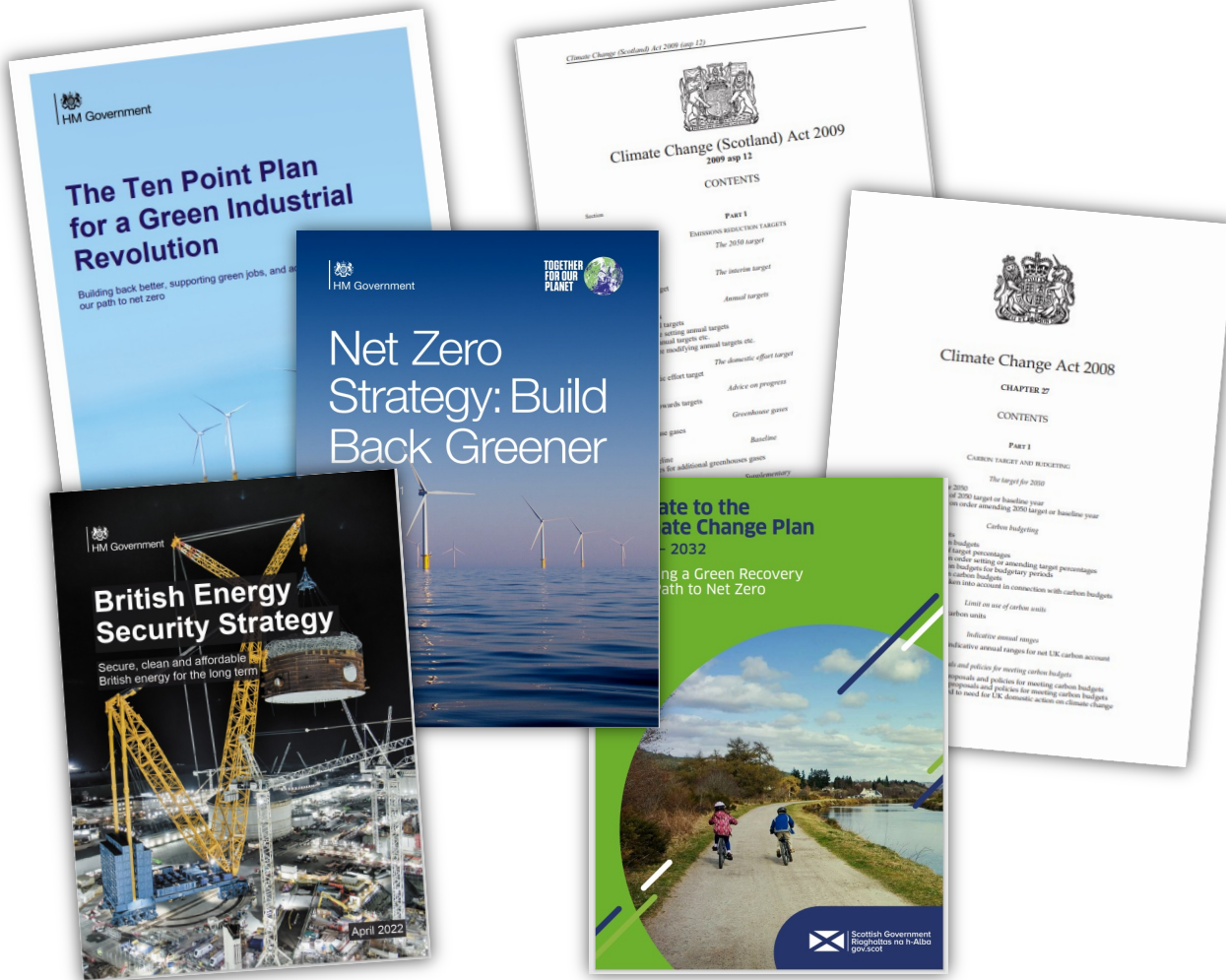
Energy System Integration



# Our journey: where are we now?

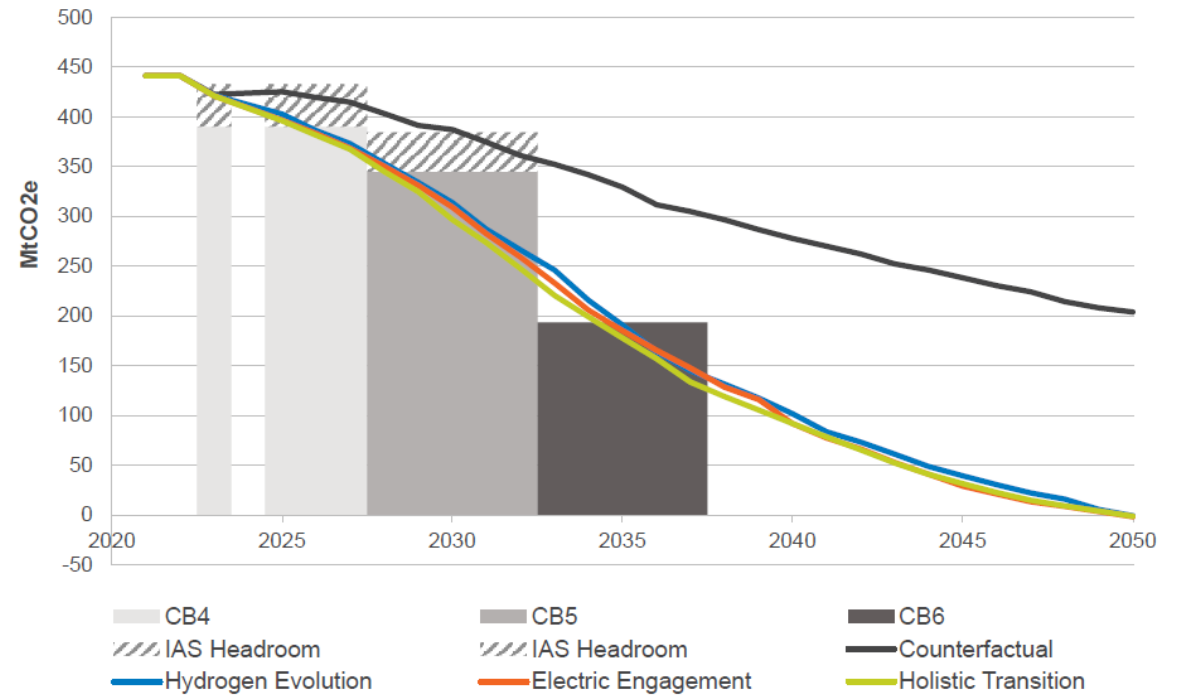
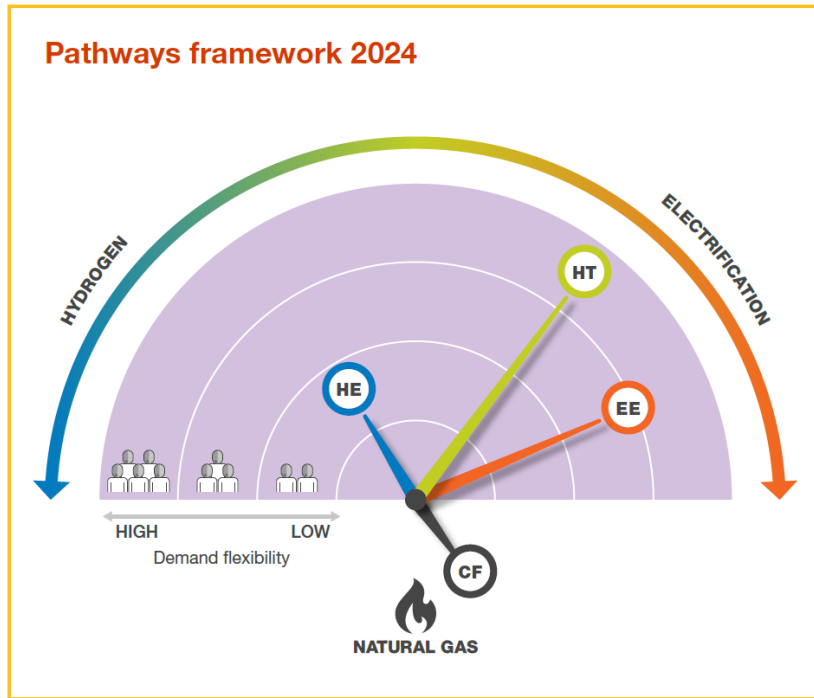


# Renewable Generation Targets and Net Zero



- ✓ Scottish Government's Net Zero goal by 2045
- ✓ UK Government's Net Zero by 2050 and Clean Power by 2030
- ✓ UK Government's 50GW by 2030 offshore wind target
- ✓ Scottish Government's 11GW offshore wind by 2030 target
- ✓ Scottish Government's 20GW of onshore wind by 2030 target

# Future Energy Pathways



! IAS stands for international aviation and shipping

Source: *Future Energy Scenarios: Pathways at a glance*, nationalgrid ESO, July 2024



# The Electricity Grid

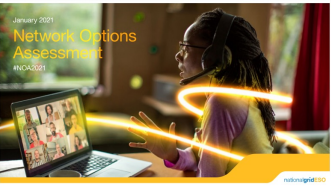
Enabling the transition to Net Zero



# The planning frameworks are changing



January



January



March (Beyond 2030)



July (NOA7 Refresh)

July 2022  
Network Options Assessment 2021/22 Refresh  
Network Options Assessment 2021/22 Refresh

July (Pathway to 2030)

July 2022  
Pathway to 2030  
A holistic network design to support offshore wind development for net zero

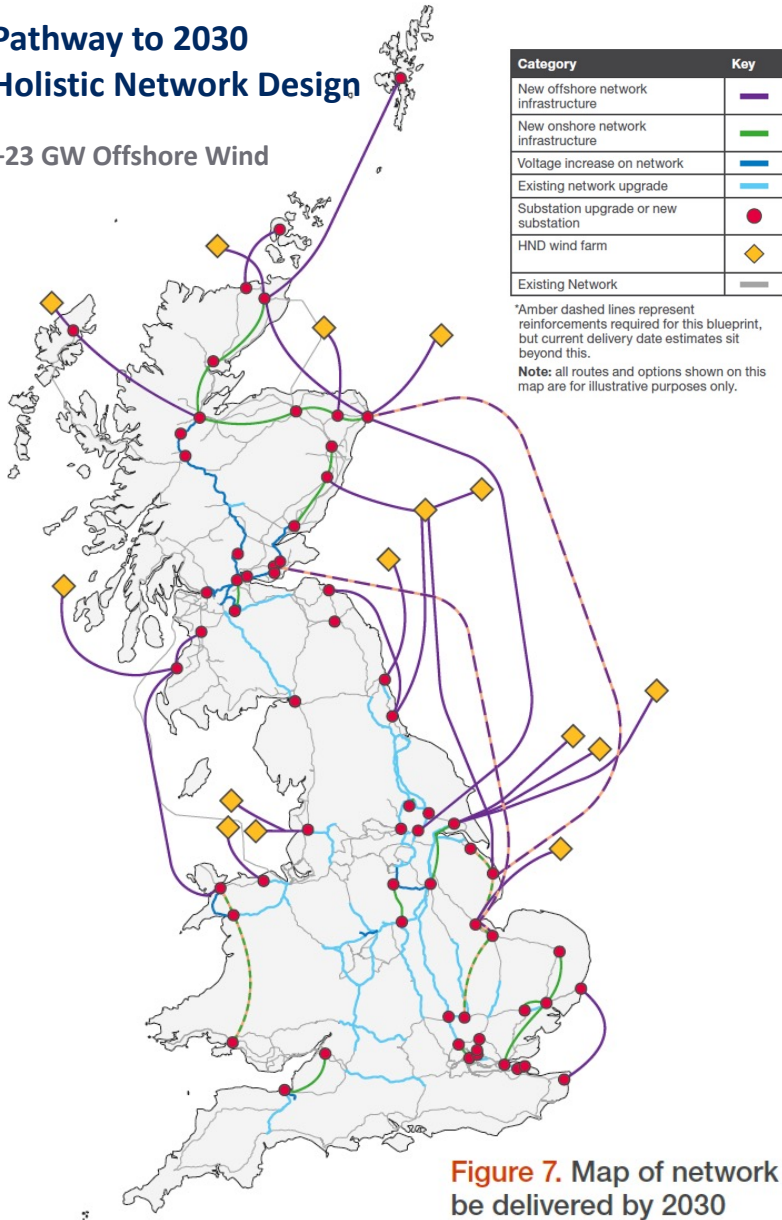
tCSNP1

Coordinated Offshore Network Design Recommendation

transitional Central Strategic Network Plan 2 (tCSNP2)

## Pathway to 2030 Holistic Network Design

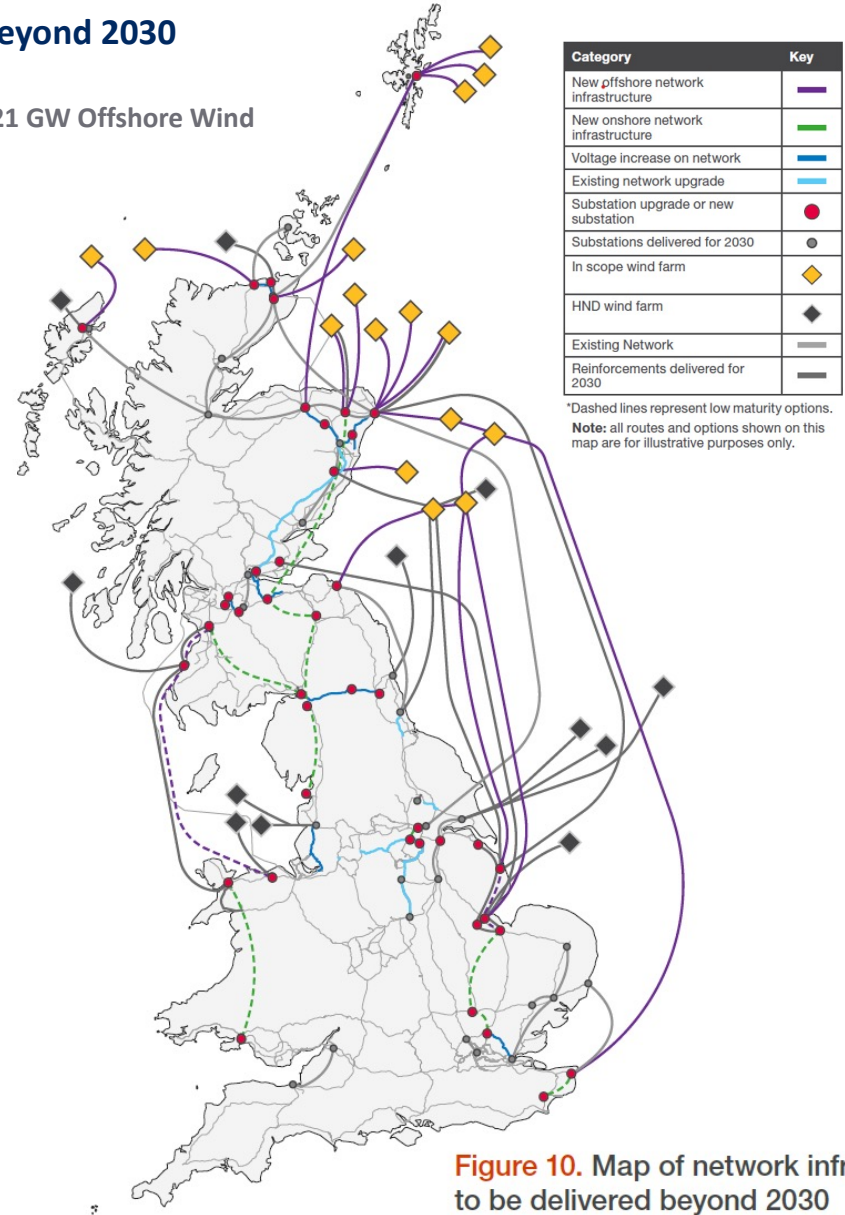
+23 GW Offshore Wind



**Figure 7.** Map of network infrastructure to be delivered by 2030

## Beyond 2030

+21 GW Offshore Wind

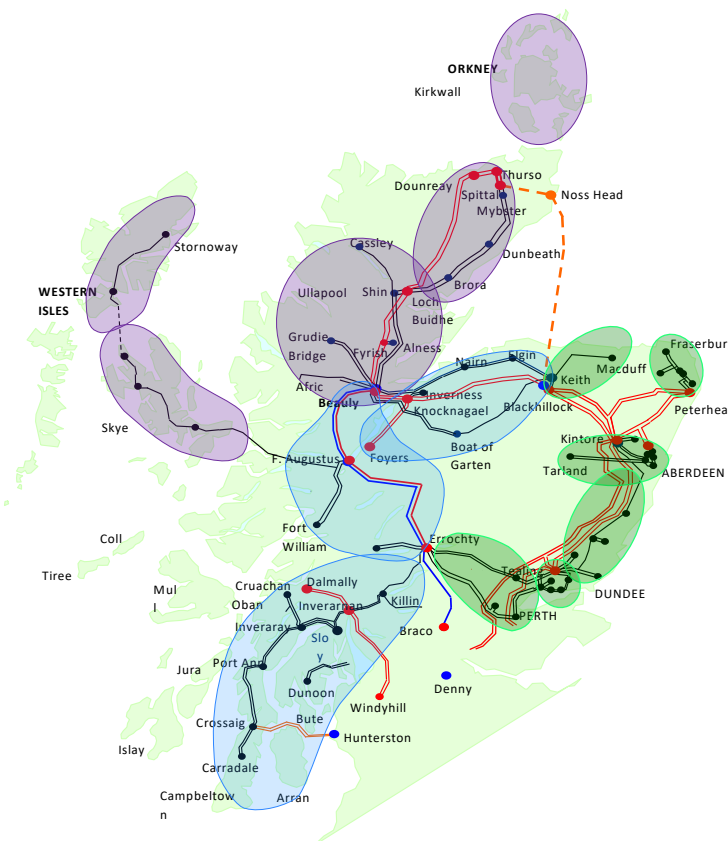


**Figure 10.** Map of network infrastructure to be delivered beyond 2030



# Completing the picture – Regional System Planning

- Offshore wind alone is not enough to reach net zero
- Onshore renewables and flexibility resources are essential
- Regional transmission and distribution networks need to be planned and developed in a coordinated way
- A fit-for-purpose connections regime is mandatory



# The system is here to stay but it is changing...

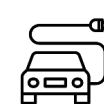
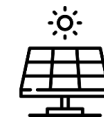
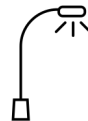


New energy conversion technologies

New transmission technologies

Offshore network expansion

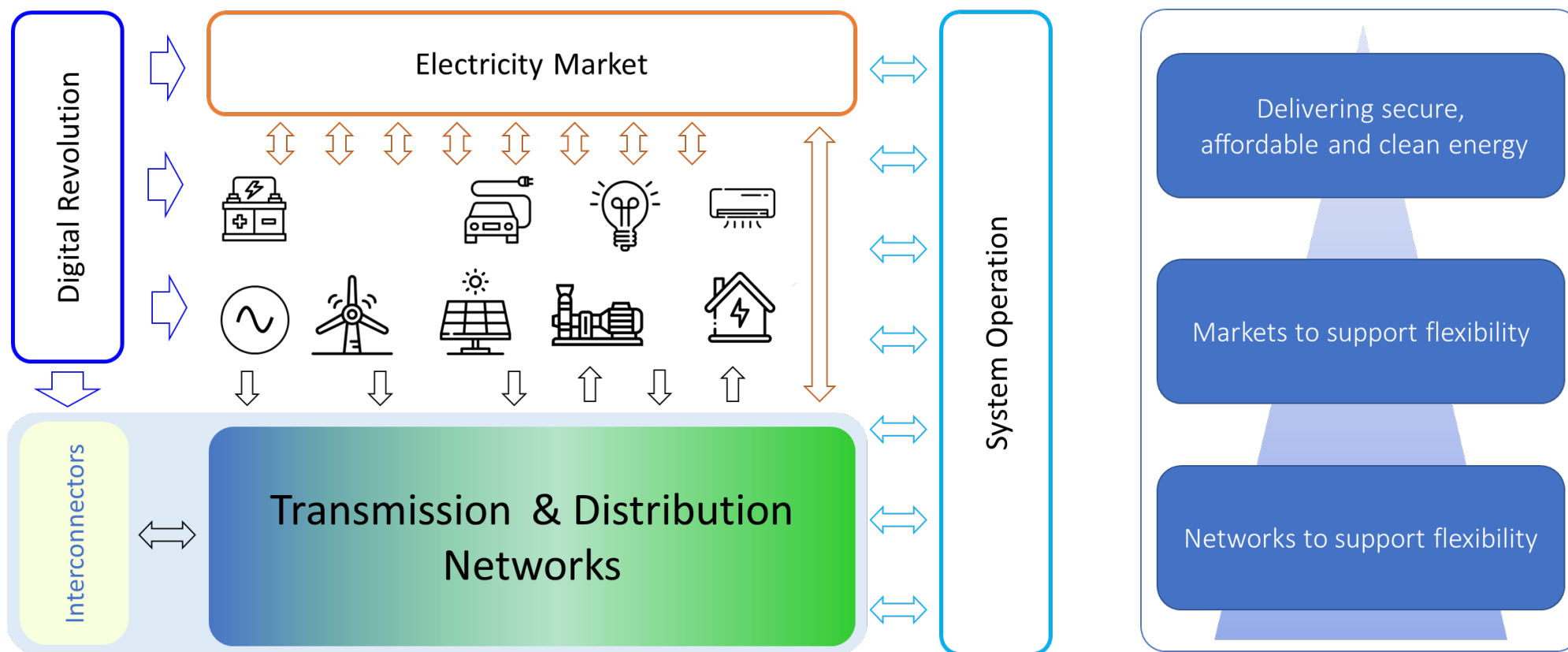
Changing system characteristics



# Innovations and Developments



# We need to go further with innovation...



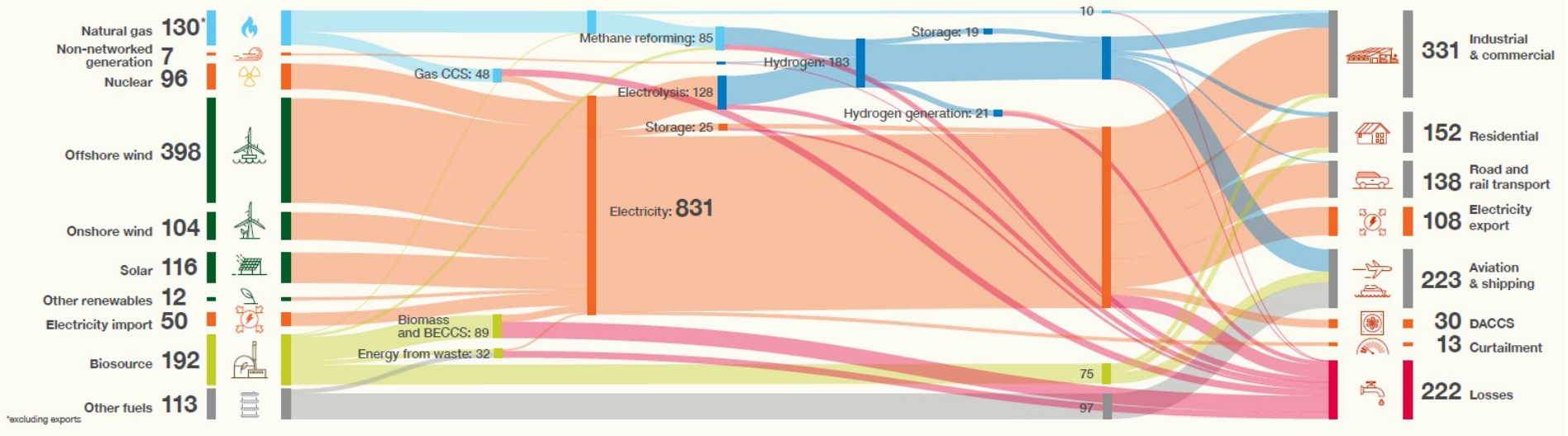


# Net Zero is about the whole energy system

## Holistic Transition

Reliance on fossil fuels has significantly reduced, with nearly all the remaining gas used for power and hydrogen production being abated through carbon capture and storage (CCS). Overall energy demand falls by 488 TWh from 2023 driven by efficiency improvements and electrification. Electricity and hydrogen work together to supply 60% and 19% of the 2050 energy demand respectively.

 Total energy supply  
1218 TWh



Source: Future Energy Scenarios: Pathways at a glance, nationalgrid ESO, July 2024

# ...turning to **Whole Energy System thinking**

The introduction of the National Energy System Operator (NESO) is welcome

We have detailed gas and electricity system models

There is huge potential for Hydrogen as an energy carrier

A clean and secure energy system requires the dependencies between the different energy vectors to be modelled accurately to ensure:

- Whole energy system economic and efficient outcomes – optimisation of energy technologies and transportation infrastructure
- Whole energy system security – a full review of events that the system needs to be secured for





# Thank You

Our efforts to-date are not wasted.

In fact, we need to do more...

But we need to start thinking

- *Whole energy system*
- *Multi-energy vector*
- *Co-optimisation challenge constrained by carbon, cost and security*