



Foreign, Commonwealth
& Development Office

Clean Power by 2030: Managing a Flexible and Resilient Power System

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There are many aspects to a “resilient” system...

Geopolitical exposure

Reduce exposure to fuel price volatility, supply chain diversification

Flexibility

Ability to adapt to variability & uncertainty, dynamically balance supply and demand

System operation

System real time stability, recover from outages and faults

Physical infrastructure

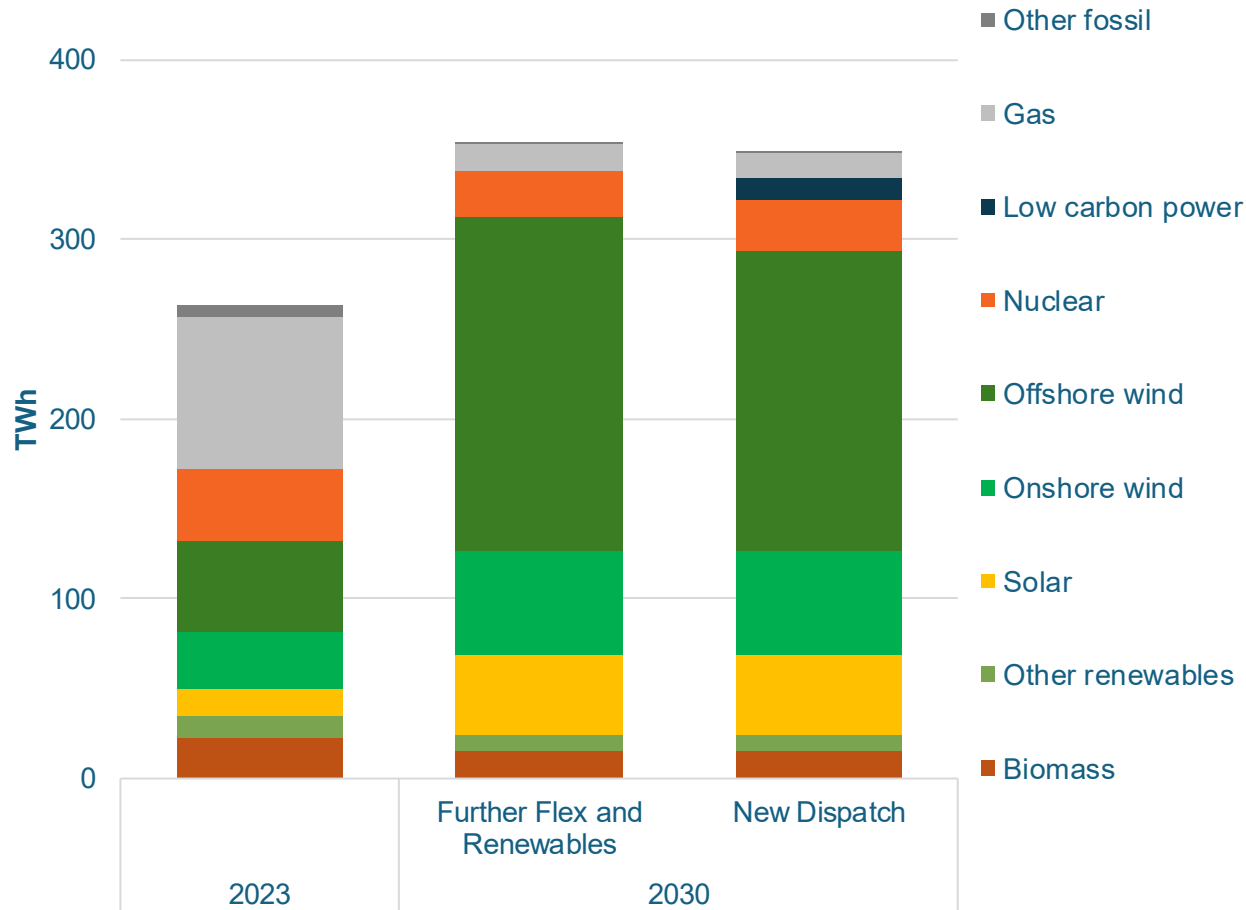
Ability to withstand and recover from shocks (weather, faults)

Digital resilience

Data visibility and accuracy, predictive maintenance, cyber security

Fundamentally about ensuring we can deliver reliable, affordable energy to homes and businesses.

Clean Power 2030 – what it means for the UK energy mix



Onshore wind
– around 2x
current

Solar –
around 3x
current
capacity

Offshore wind
– around 3.5x
current
capacity

Nuclear and
biomass
capacity
needed after
2030

Source

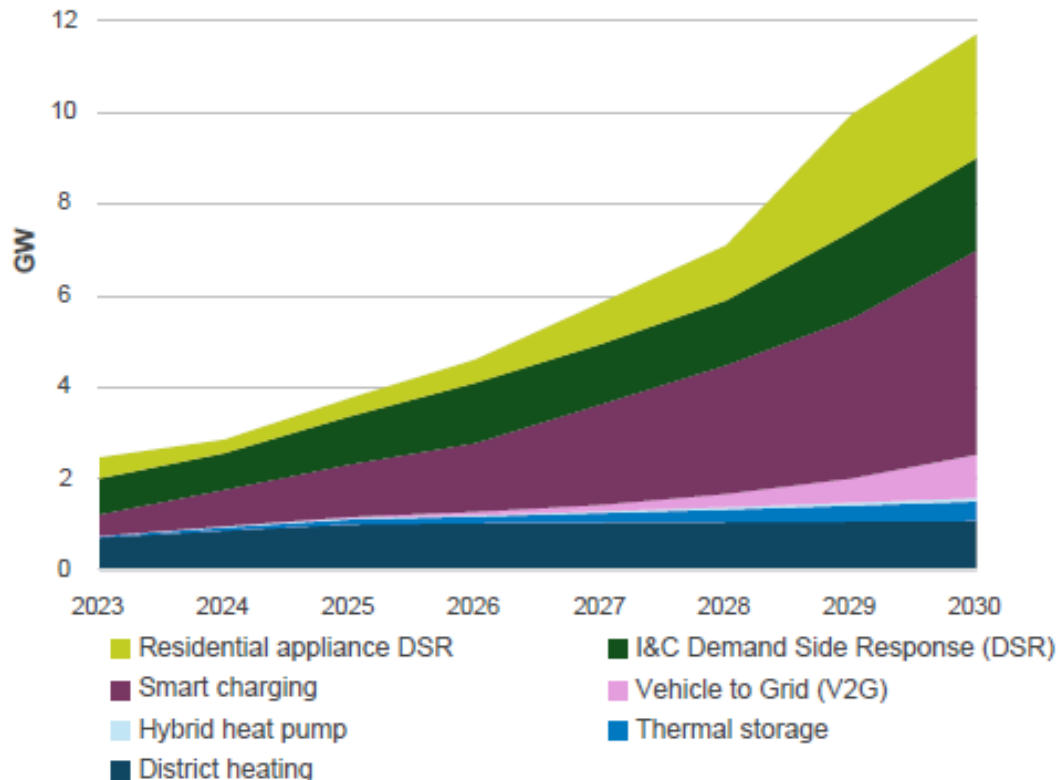
NESO “Clean Power 2030: Advice on achieving clean power for Great Britain by 2030”

Flexibility...critical for Clean Power 2030

SUPPLY SIDE

Demand flexibility at peak

DEMAND SIDE



Note: Figures show the DESNZ Clean Power Range, based on NESO advice.



Long Duration Energy Storage (LDES) up from 3 GW to **4-6GW**



Interconnector capacity increases from 8.4 to **12-14GW**



5-6x more battery storage, providing short-term flexibility within day **23-27GW**



Low-carbon flexibility such as gas plants with CCS, hydrogen-fuelled turbines, and DSR **2-7 GW**

Systems operation

UK National Energy System Operator (NESO) thinks about **operability** across different scenarios (generation mixes, demand, network outage conditions...). Seven operability areas identified:

Frequency	Voltage	Stability	Thermal	Within Day Flexibility	Restoration	Adequacy
<ul style="list-style-type: none"> Ensuring that the grid frequency remains within limits ~50Hz 	<ul style="list-style-type: none"> Ensuring voltage remains within limits on transmission and distribution systems 	<ul style="list-style-type: none"> Ensuring the system has enough inertia and short circuit current to remain stable 	<ul style="list-style-type: none"> Ensuring that thermal constraints on power system assets do not prevent the system from being operable or delivering energy 	<ul style="list-style-type: none"> Ensuring we have sufficient flexibility in the system to balance supply and demand 	<ul style="list-style-type: none"> Ensuring that we can recover the system from a power outage within regulatory requirements 	<ul style="list-style-type: none"> Ensuring that there is a very high probability of us being able to supply enough electricity to meet demand

Physical infrastructure and climate risks



Options for enhancing resilience include:

1. Infrastructure upgrades
 2. Emergency response
 3. Network monitoring
 4. Demand flexibility
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- Need to consider resilience in the way energy infrastructure is planned and developed
 - Climate risk modelling, data availability and simulation capabilities should be improved, with role for AI.