

CIGRE Post session 2024 conference



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What's on the agenda today



- Introduction to Energy Systems Catapult
- Innovating to Net Zero 2024
- Enabling Distributed Flexibility
- Resilience in the electricity system
- Electricity Networks Commissioner report

Introduction to Energy Systems Catapult



Energy Systems Catapult

Mission: Accelerate Net Zero energy innovation



We help energy innovators launch new products and services



Independent, not-for-profit



Based in Birmingham, 250+ experts



Established by Innovate UK



SME support



Consumer insight and proposition design



Whole system modelling



Delivering trials and demonstrations



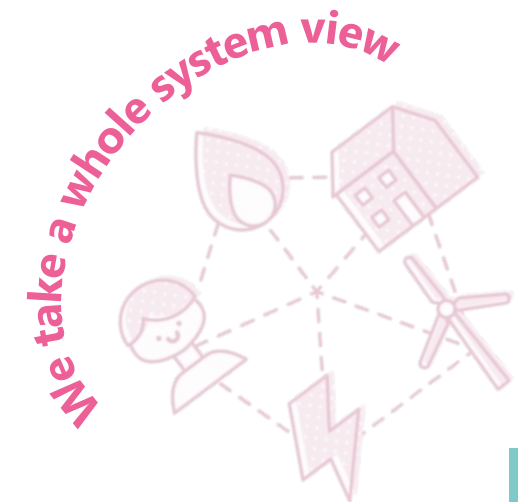
System and clean technology engineering



Digital and data expertise

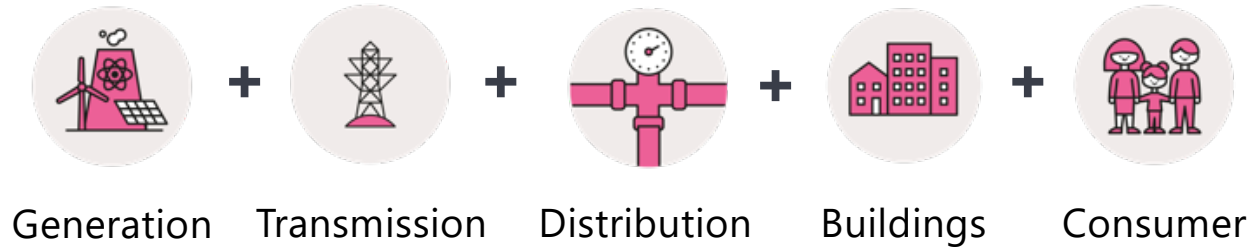


Markets, policy and regulation



Our philosophy – whole systems thinking

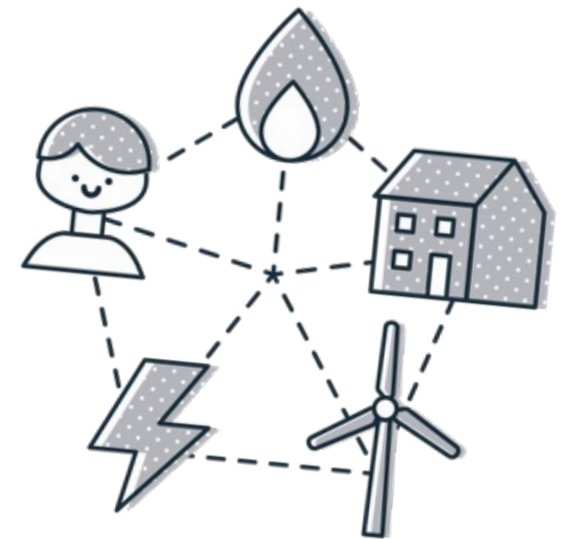
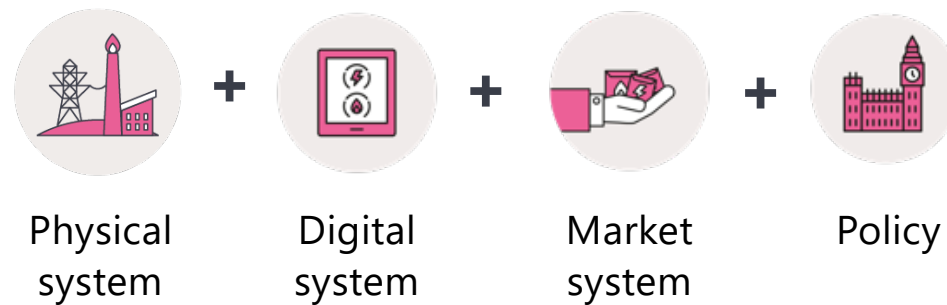
Joining up the system from sources of energy to the consumer



Breaking down silos between different parts of the energy system



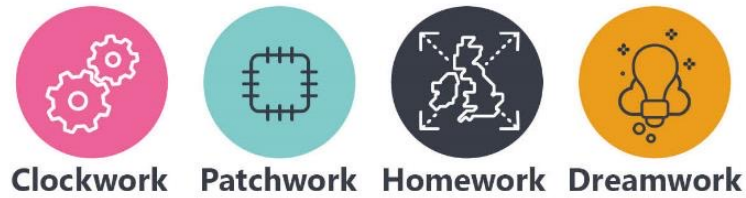
Joining up physical requirements of the system, with policy, market and digital arrangements



Innovating to Net Zero 2024

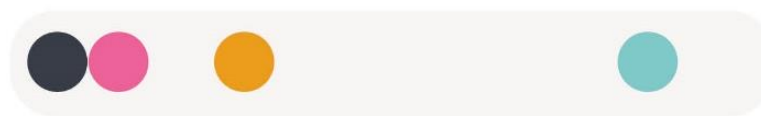


Four Scenarios all meet Carbon Budget 6 and Net Zero, but represent different futures



Centralised vs devolved government

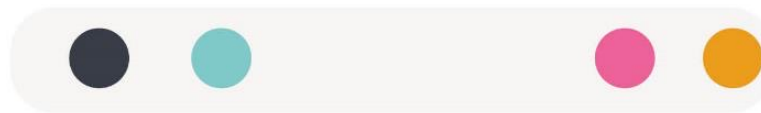
Central Government led



Locally led

Consumer choices

Consumers willing to make more choices in support of decarbonisation



Consumers do not make choices in support of decarbonisation

Innovation

High innovation, faster cost reductions and deployment of nascent technologies



Low innovation, slower cost reductions and fewer technology choices

Global stability

High global stability with international collaboration



Low global stability with high protectionism

Implement – at pace

We have 26 years until we need to have delivered Net Zero

There are **established low regret technologies that we should implement now at even faster pace:**

- Solar farms and offshore wind
- Electricity network reinforcement
- Heat pumps
- Build more molecular salt cavern storage
- Town-city scale heat networks
- Large scale nuclear



Innovating to Net Zero has shone a spotlight on three macro-challenges



Delivering flexibility

Flexibility is the ability to meet our demands for energy-related services across all time and spatial scales whilst keeping within system constraints. Delivering a low-cost flexible energy system presents a huge innovation opportunity

Meeting peak gap

The challenge of meeting a 1-in-20 style peak event in a Net Zero system, maintaining the services that people need whilst providing back-up. Hybrid heat pumps offer large system benefits

End-goal vs transition

Whilst there might be many agreements on what a 2050 energy system looks like, we must think about how to maintain security of supply at low cost during the transition as we roll out low carbon end user technologies

Enabling distributed flexibility for Net Zero



Unlocking behind-the-meter domestic and small non-domestic flexibility can provide multiple benefits

Delaying the need for network upgrades

The financial and logistical benefits of deferring reinforcement of both distribution and transmission network infrastructure.

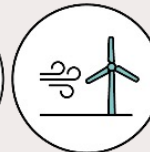
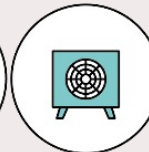
Reducing capital and operational costs of generation and grid storage

The financial benefits of improving utilisation of assets, avoiding the investment and build of additional high cost, lower utilisation assets.

Managing high impact but low probability events

The financial and societal benefits of helping networks to mitigate and recover from high impact, low probability events like cold starts.

How much distributed flex we need at any point in the transition depends upon...



How much electrified supply and demand we've installed?



How effective are our markets at driving flexibility where and when we want it?



How much reinforcement has there been at each network level in each locality?



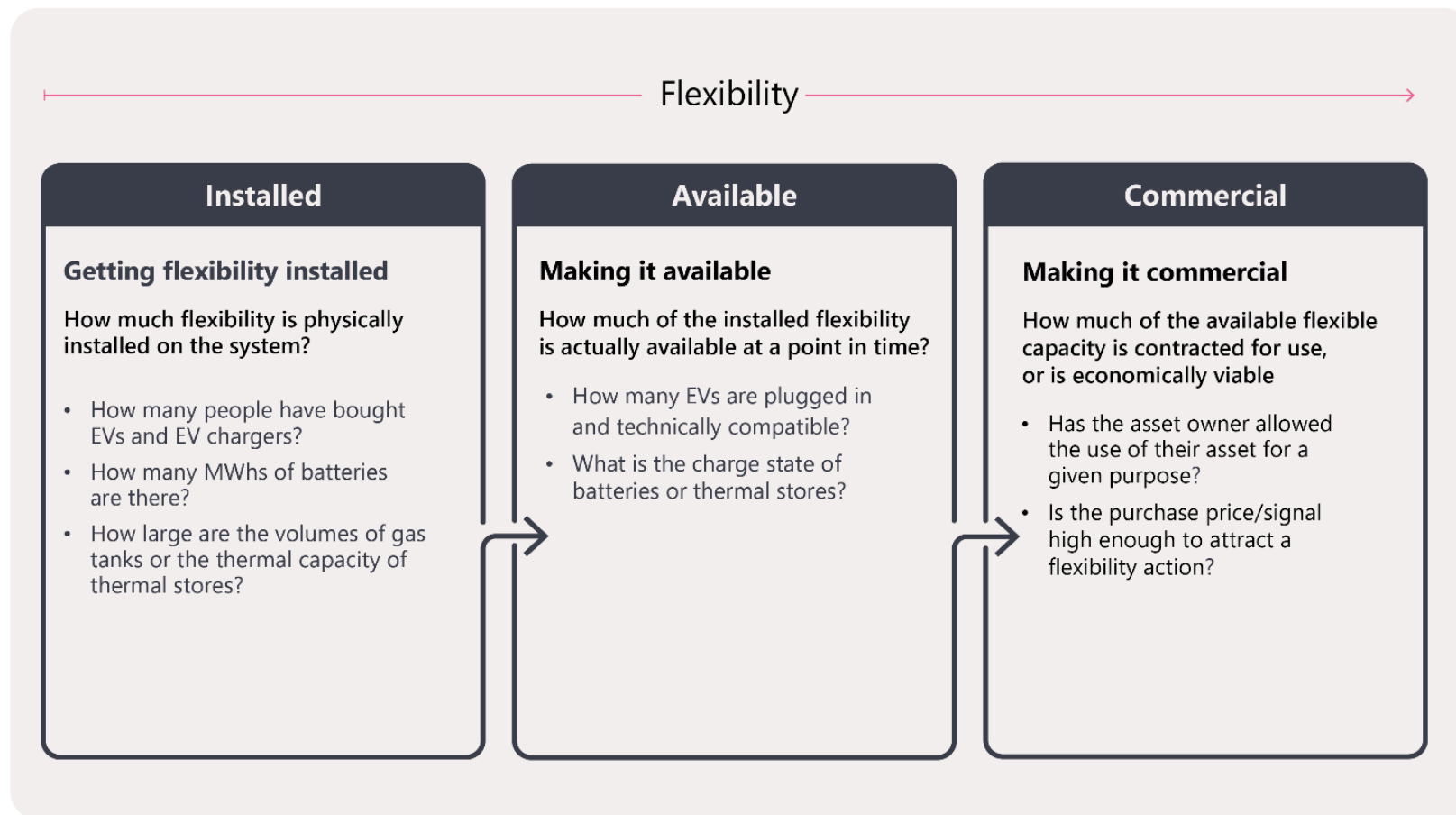
How effective is our digital infrastructure at conveying information on assets?



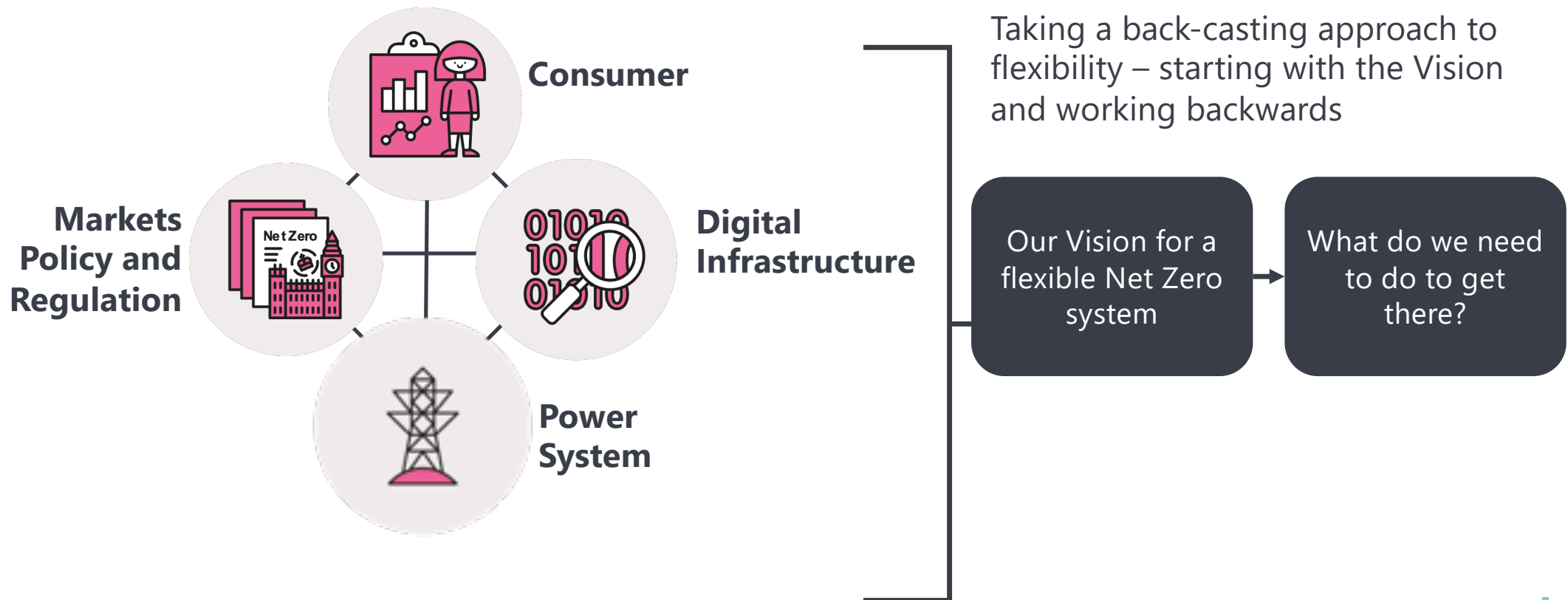
How attractive are the consumer propositions around domestic flexibility?

Three steps to enabling distributed flexibility

Flexing demand will require millions of distributed flexible technologies responding to system signals – most will be on low voltage (LV) networks, 'behind-the-meter', in people's homes and small businesses.

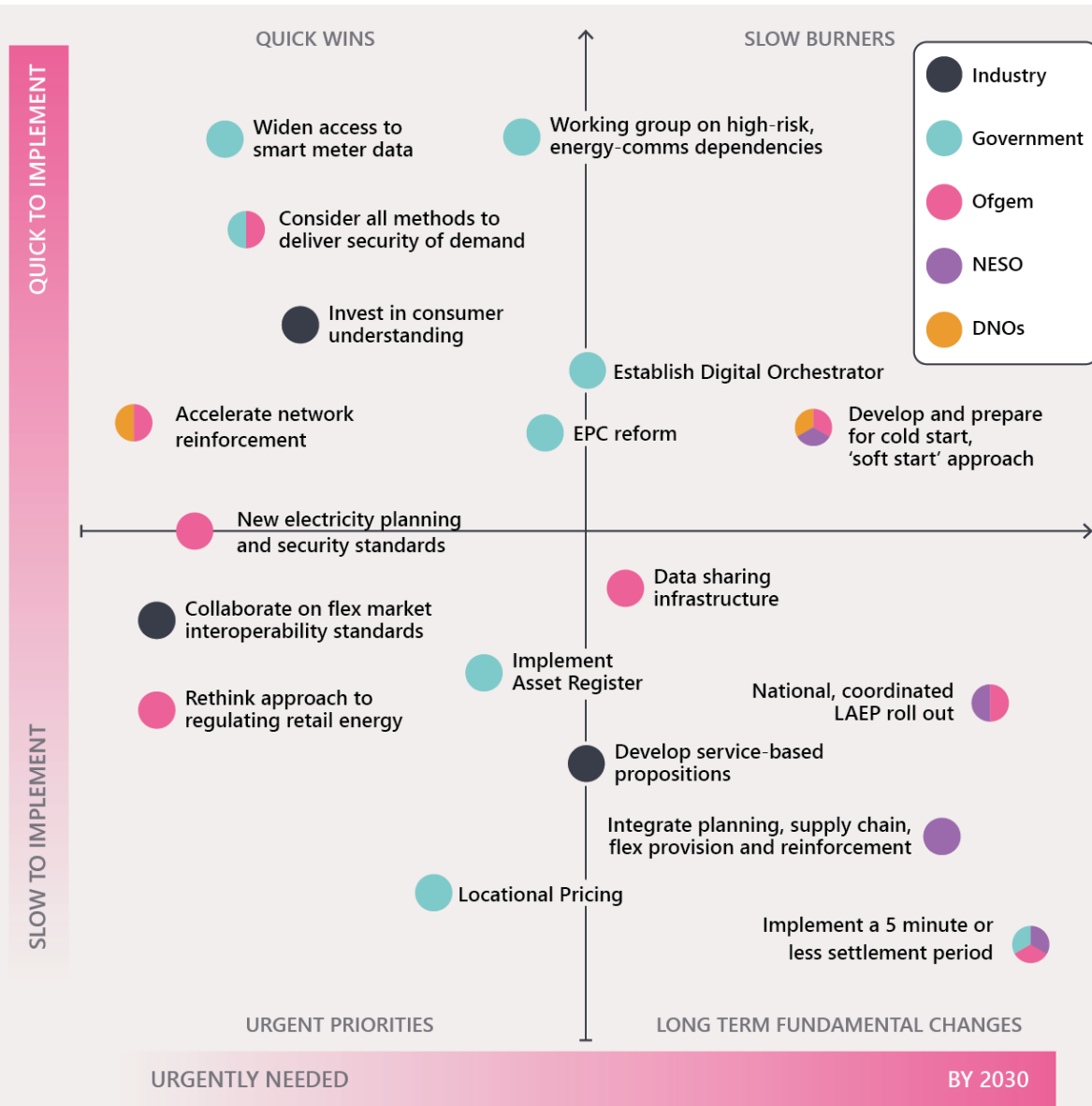


A multi-faceted challenge that requires a whole systems approach

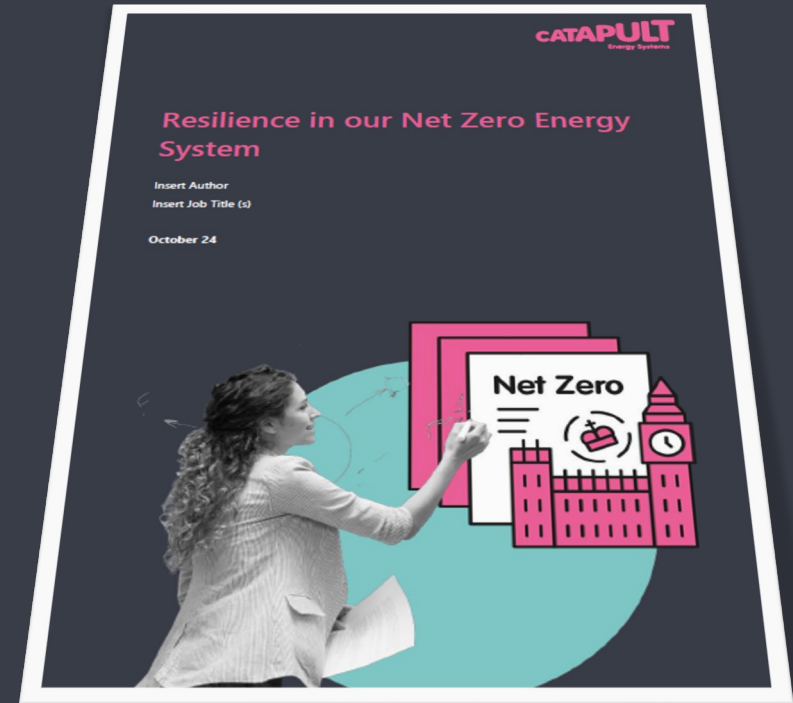


To unlock it, we need coordinated actions and cross-sector collaboration

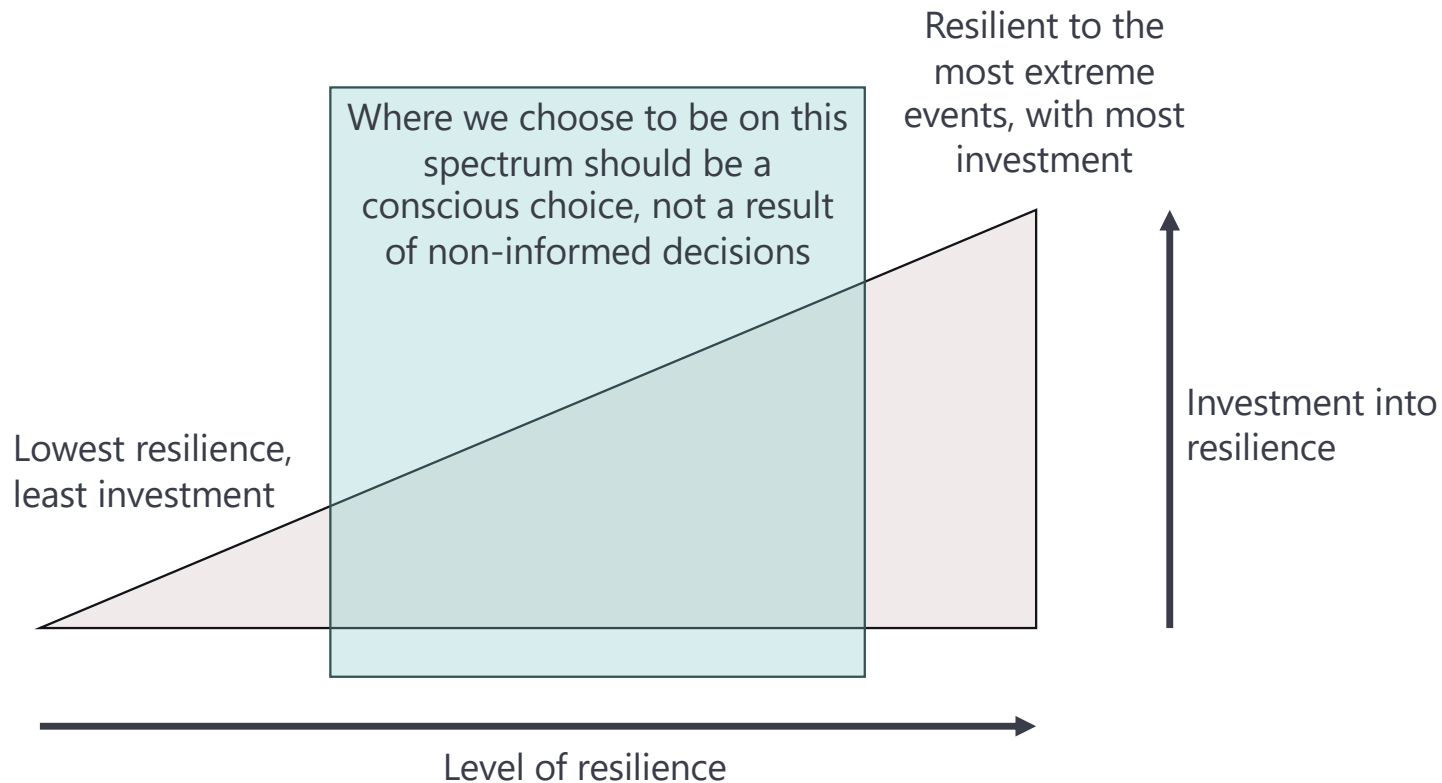
- The 18 actions we've identified do not include the delivery of ongoing processes (e.g. market-wide half hourly settlement and smart meter roll out)
- They aim to identify the lead stakeholder(s) but will often need collaborative approaches across industry
- They build upon existing progress made - not looking to reinvent the wheel.



Resilience in our Net Zero energy system



Resilience should be designed *into* our planning and investments – not as an afterthought



The Energy System: Technology innovation can help to provide resilience at lower costs to consumers

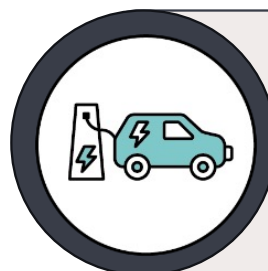
We're already using emerging technologies to provide resilience.

What other emerging technologies and approaches can have a meaningful impact providing resilience?



Artificial Intelligence*

Can be used to improve *anticipation* of events and improve our ability to *resist and absorb* disruptive events through improved technology design*. It can also help us *adapt* to and *resist* malicious actors using it to cause disruptions.



Flexible technologies and smart homes

For example, the ability to provide vehicle-to-home in times of system stress offers a form of resilience, as well as potentially providing day-to-day flexibility services to the energy system.



Technologies that enable smart local energy systems

When implemented appropriately, distributed energy assets, as part of smart local energy systems can provide another method for resilience at both local and, in aggregate, national energy system scale.

* A range of opportunities are identified in the ADViCE project:
www.turing.ac.uk/sites/default/files/2023-12/advice-ai_for_decarbonisation_challenges.pdf

The time for incorporating resilience into our Net Zero thinking is now. It cannot wait.

Set up for success

Government: Clarify roles and responsibilities for design and delivery
NESO: develop a whole system resilience capability
Industry: through Ofgem, critically assess existing standards

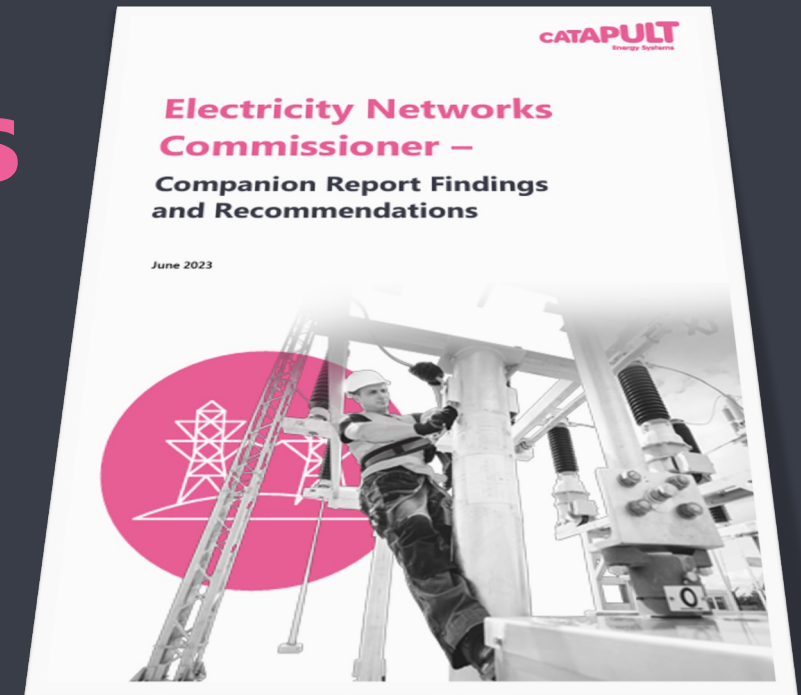
Implement

All: integrate resilience into planning and investments
NESO: recommend new or improved whole system Net Zero metrics
All: Embed resilience within national-local planning frameworks

Solidify and adapt

All: provide training on resilience to ensure informed decision-making
NESO/all: adapt pathways to deliver resilience as we transition
All: Use systems engineering to improve resilience standards over time

Electricity Networks Commissioner report



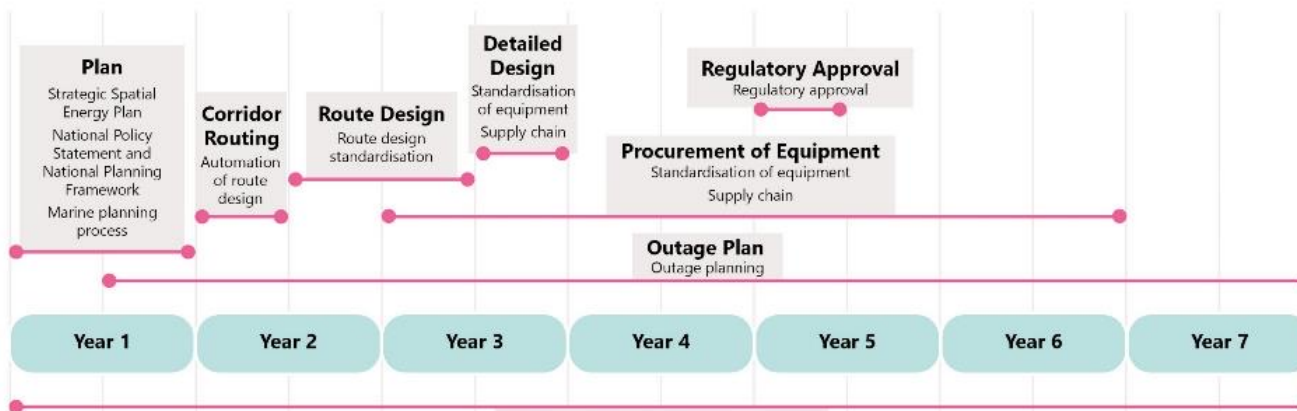
Halving the time to build new power lines...

Every part of this process must – and can – be dramatically improved including introducing a spatial energy plan and design principles outlining where and why we need new lines, and how both the environmental and economic impacts have been considered.

Nick Winsor, Electricity Networks Commissioner

The government also agrees with the ambition behind each of the recommendations and in several cases our proposed actions go further.

**Rt Hon Claire Coutinho MP
Secretary of State for Energy Security and Net Zero
November 2023**



The Electricity Networks Commissioner report and the detailed companion report by Energy Systems Catapult set out 18 Recommendations including:

- Future systems operator to produce a Strategic Spatial Energy Plan
- National Policy Statement should be updated urgently
- Implement a focused information campaign on the need for a grid refresh.

Summary

Take a whole system perspective

The electricity grid is critical to Net Zero

Meeting peak gap defines overall system cost

Digitally enabled flexibility is critical to affordability

Coordinated action is needed across the sector

Continued need for innovation



Any Questions

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