# Markets Forum

## Net Zero Market Design Update

22nd June 2021

NGESO Markets

The webinar will start shortly.
Please make sure you are on mute and your camera is turned off.
Please note that the webinar will be recorded.

nationalgridESO

# Markets Forum
## Net Zero Market Design Update


Speakers:
Cian McLeavey-Reville
Tim Gregory
Simon Targett
Shona Watt

Guest speakers:
Kayte O'Neill (NG ESO)
Rob Hewitt (BEIS)
Tom Corcut (Ofgem)

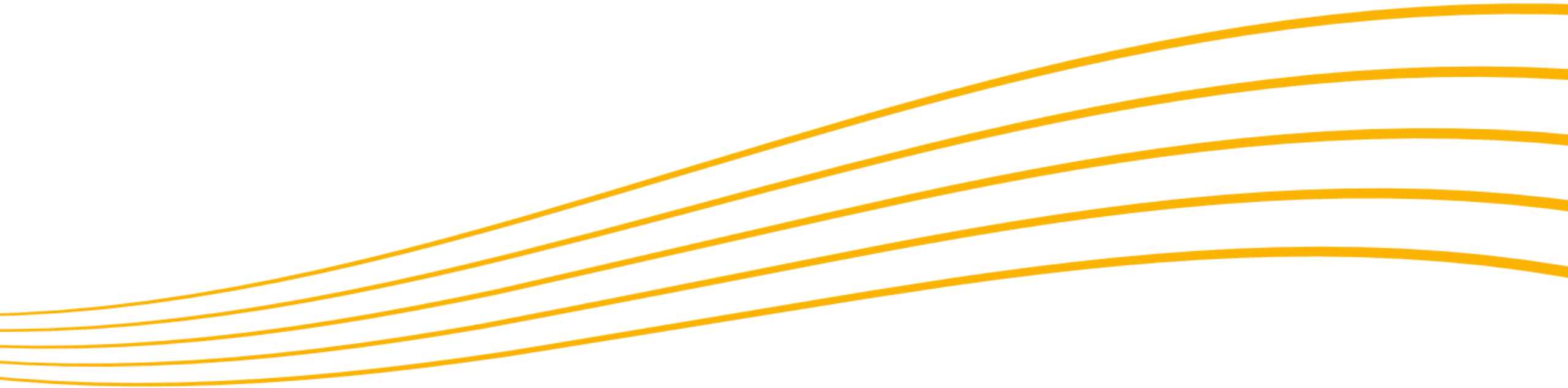
# Agenda
# (as presented at webinar)

1. Welcome
2. Re-cap and reflection
3. How will we be tackling this?
4. What's next?
5. Guest speakers
6. Q&A

## Appendices (new content)

1. Phase 1 external engagement feedback
2. Operability workstream (further detail)
3. Responses to unanswered questions

# Re-cap and reflection



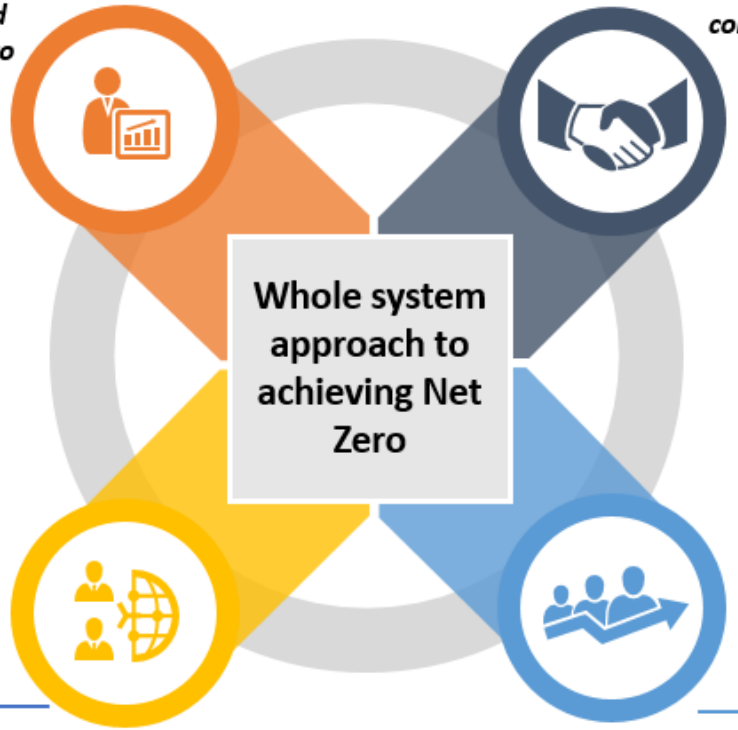
# Re-cap and reflection

## Net Zero Requirements

***Ensuring that the system takes account of the changing consumer, societal, market participant and physical needs on the pathway to Net Zero***

## Open Markets

***Market design needs to enable fair access to all market participants – including consumers, generators, and offerings in between these***




## Market Signals

***Market design, regulations and policies to provide clear and consistent signals to investors and market participants***

## Industry Governance

***Industry governance that enables Net Zero market reform at pace, rather than acts as a barrier***

## Feedback from launch event:

Launch event scoring:
"How would you rate the event?"

Average score = 8/10

How does this align with other similar work?

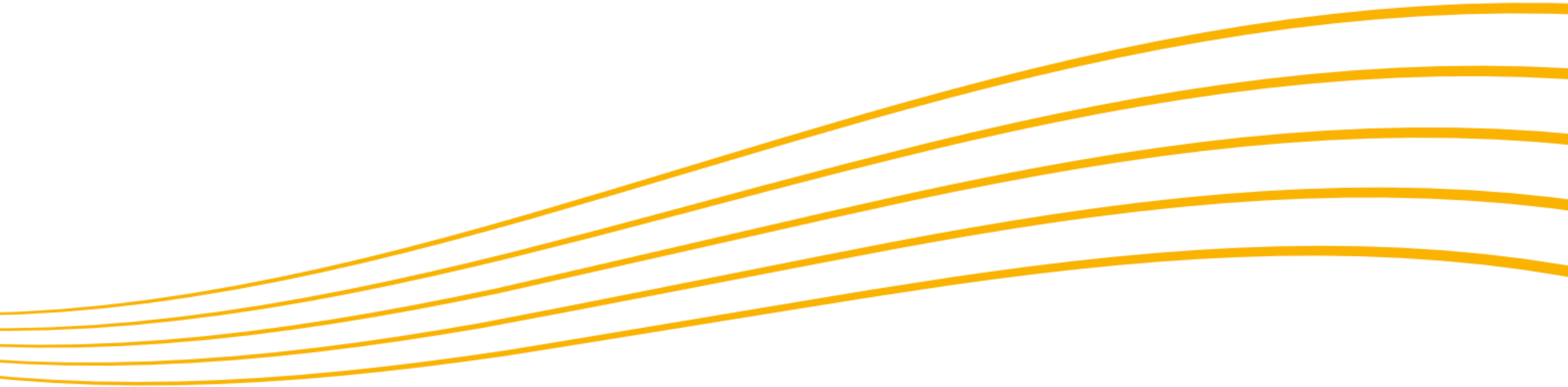
Really pleased to see ESO's involvement

What about the short term?

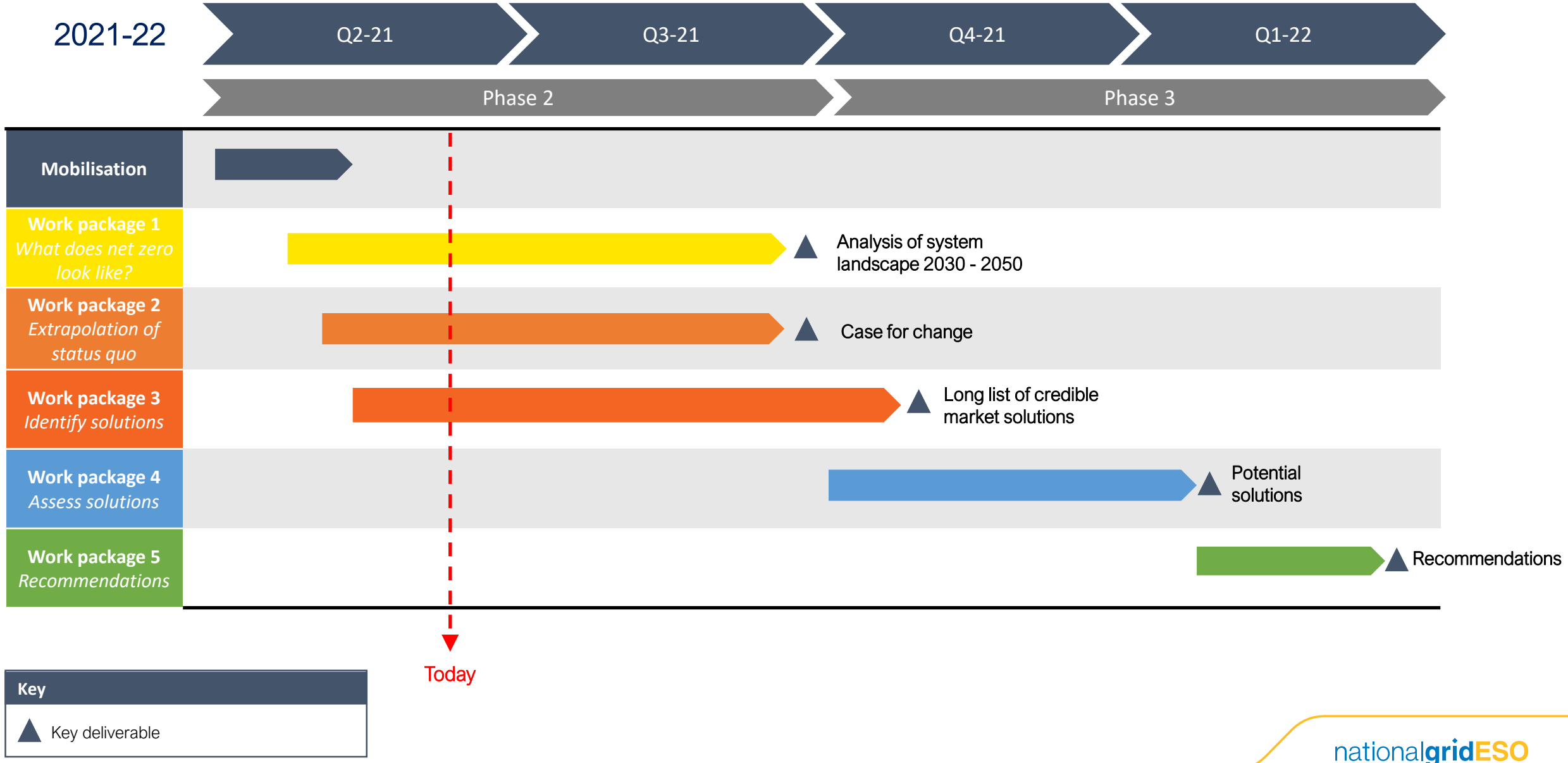
Ofgem & BEIS need to be integrated

Need a flexible approach

# How will we be tackling this?



# Project timeline



# Phase 2 and 3 Overview

*Apr-21* **PHASE 2 (WP1-WP3)** *Sep-21*

**What are the current and future challenges in the electricity market and what is the 'Case for Change'?**

- Phase 2 has been divided into workstreams:

| | |
|---|---|
| **Investment** Will we see the investment we need? | **Location** Will investment happen in the right place? |
| **Flexibility** How will supply and demand be matched? | **Operability** Will operability issues be manageable? |

- Market objectives and success criteria for achieving Net Zero
- Emerging problems with current market design
- Evolution of the characteristics of the energy system
- Range of market design options to address the challenges

*Oct-21* **PHASE 3 (WP3-WP5)** *Mar-22*

**Options assessment and recommendations**

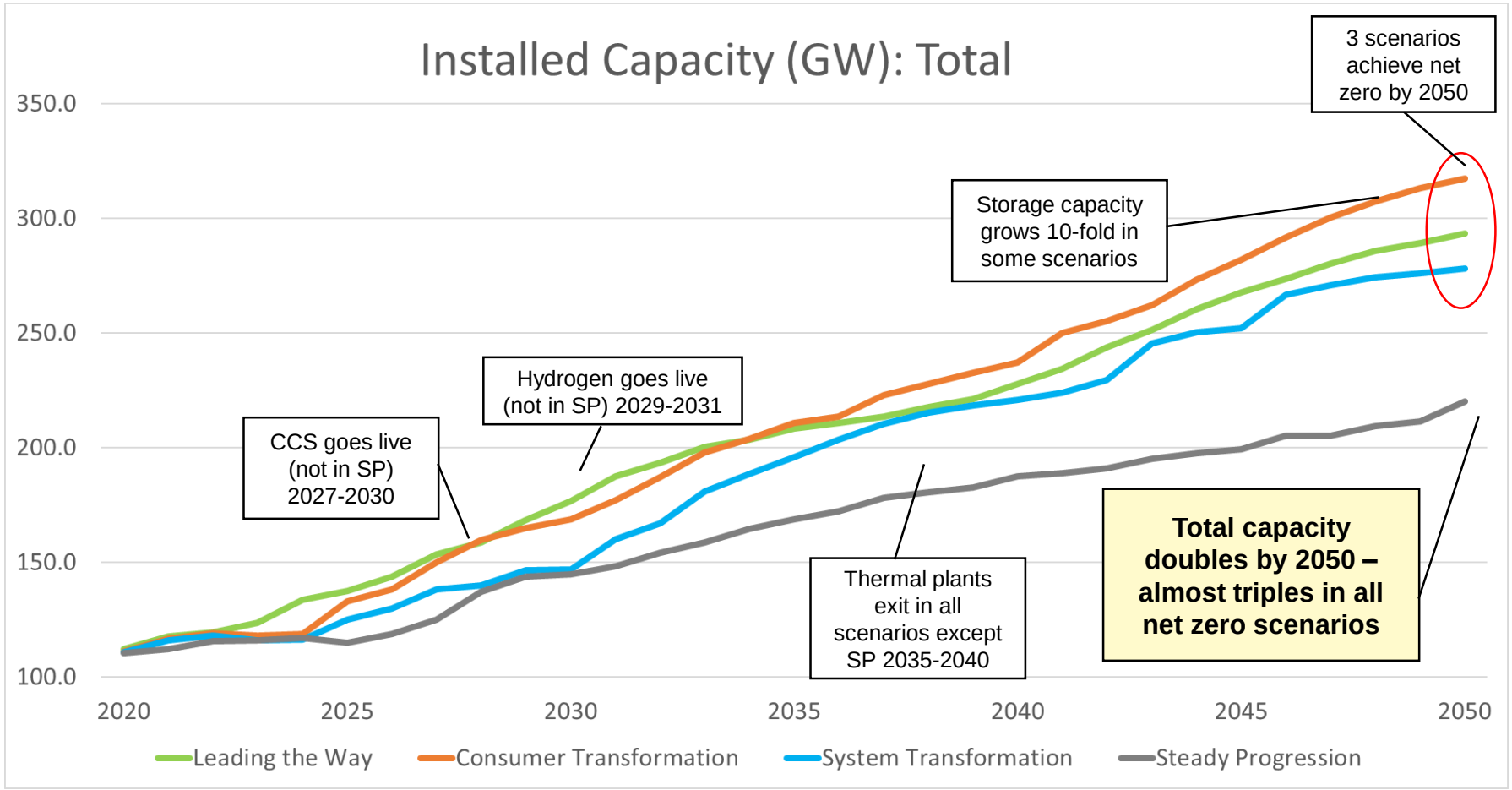
- Assess the range of market design options to address the challenges in Phase 2
- Inherent trade-offs, natural combinations and incompatible options
- Evaluate each credible set of solutions identified against agreed market objectives and success criteria
- Recommend preferred high-level package of solutions

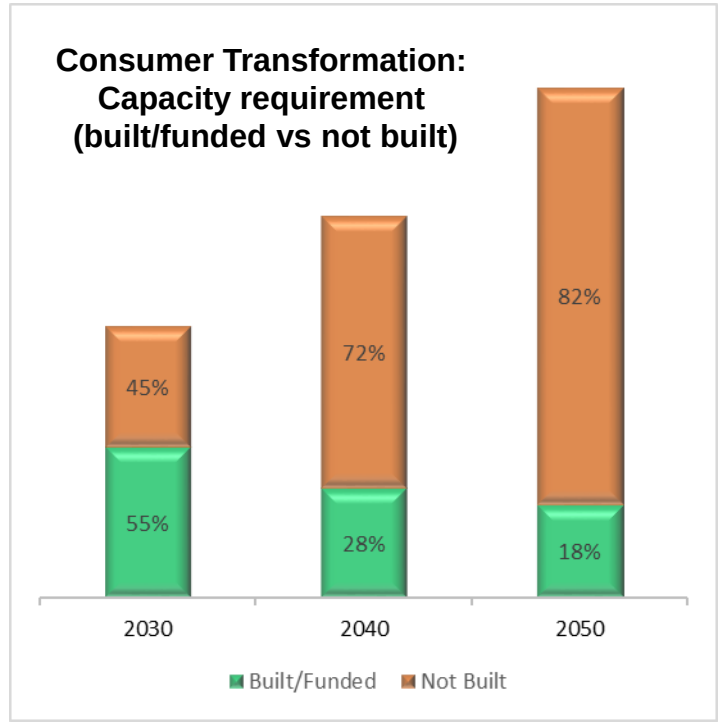
**Stakeholder engagement throughout**

# Investment: What is needed?

**Investment**
Will we see the investment we need?

*Based on the Future Energy Scenarios (FES), the UK will require between 220GW and 320GW of installed capacity (including storage and interconnectors) on the electricity system by 2050 to meet demand. To achieve net zero seen in three of the scenarios, increased capacity is focused on low carbon generation types and technologies.*



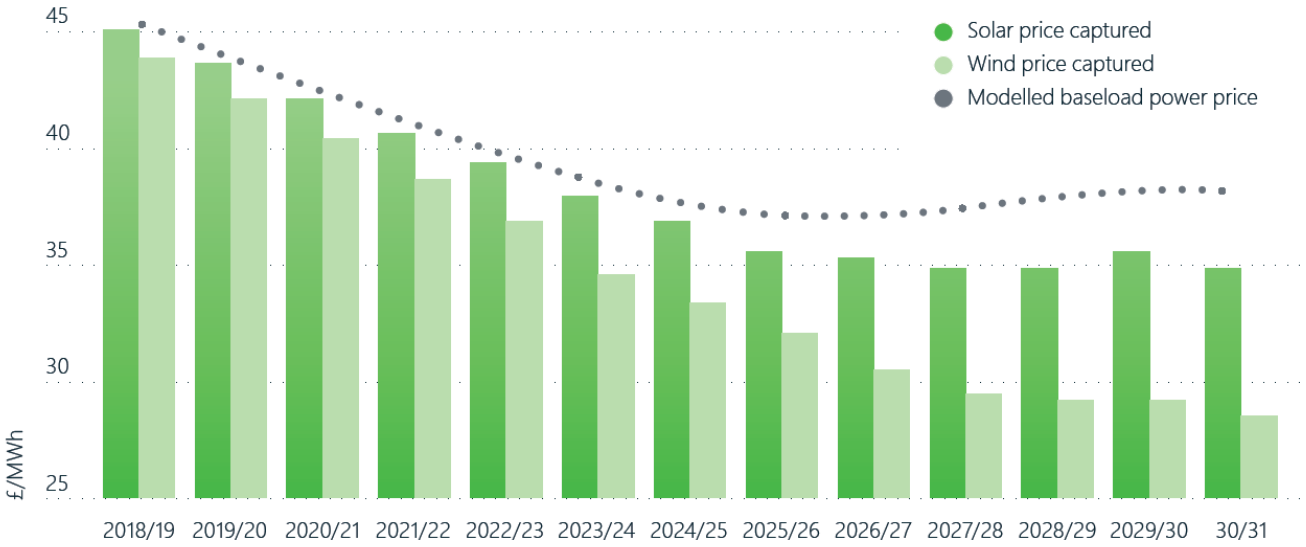



# Investment: Do signals deliver investment case?

**Investment**
Will we see the investment we need?

***Do current markets deliver the investment case needed to build the required capacity?***

Modelled capture prices for wind and solar, and impact on wholesale power price
(Source: Energy Systems Catapult, Rethinking Electricity Markets, Mar-21)




**How will we answer this?...**

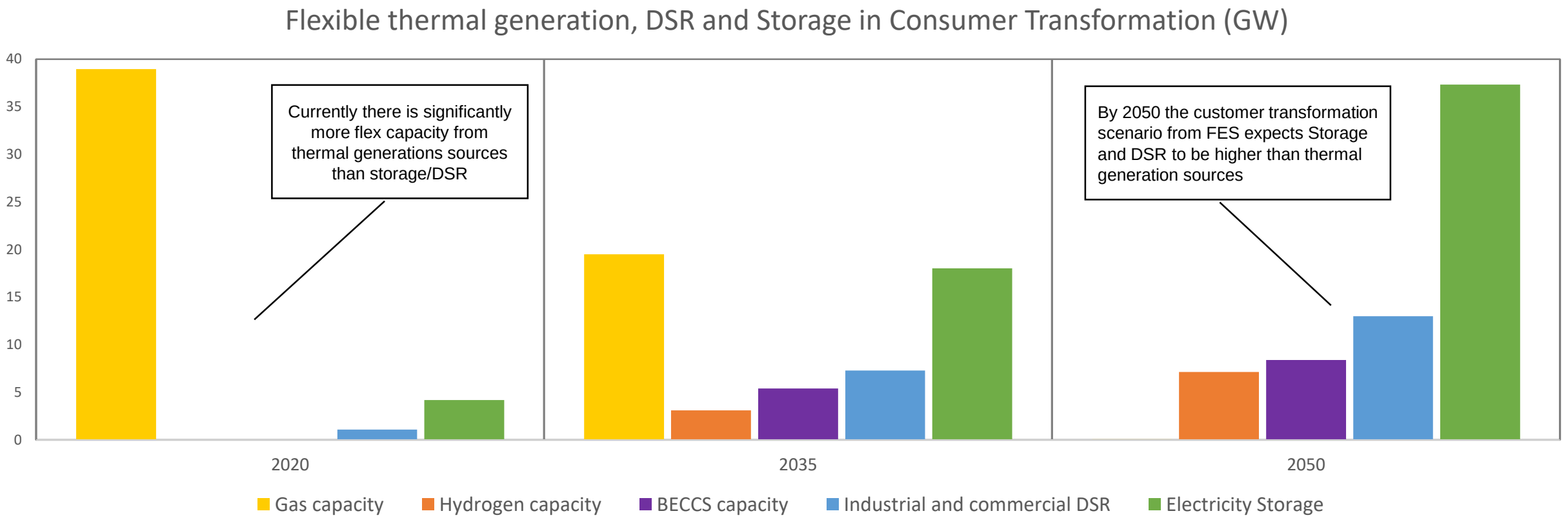
- How much investment is needed in each generation type or technology?
- How will the magnitude and predictability of different revenue streams evolve?
- How will costs of various technologies evolve?

→ **Does ROI meet the required hurdle rates for investment?**

# Flexibility: What is needed?

**Flexibility**
How will supply and demand be matched?

***As total capacity increases, FES expects, dispatchable thermal capacity to decrease across all scenarios which lead to net-zero. This means there is a need for a significant increase in flexibility from non-traditional sources.***

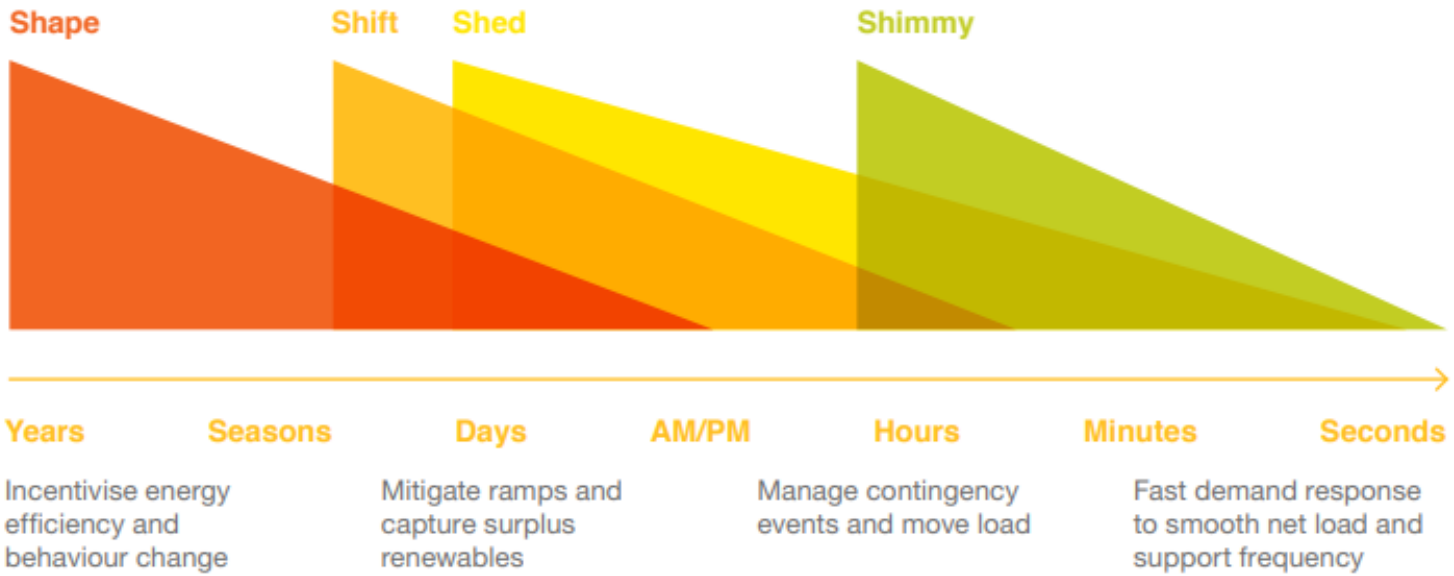



This is data taken from one of the FES 2020 scenarios. Electricity storage includes battery, pumped hydro, liquid air and compressed air. There are other sources of flexibility and demand-side reduction which have not been included in this graph.

# Flexibility – Do current markets signal flexibility effectively?

**Flexibility**
How will supply and demand be matched?

**How will market signals for flexibility evolve, and will they encourage enough investment?**




Do half hourly settlement periods give adequate market signals for short term variations?

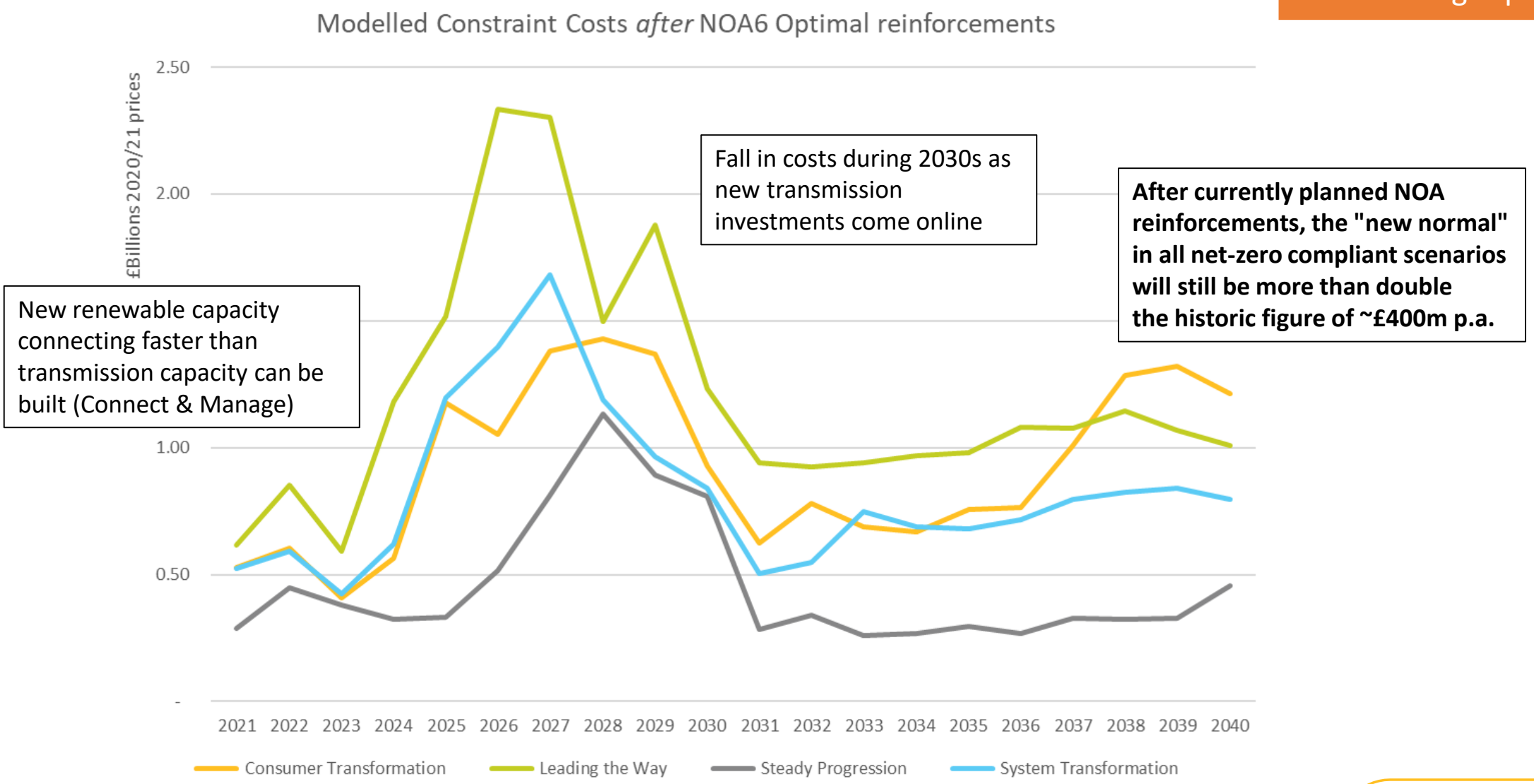
Will any of today's markets incentivise the long-duration flexibility needed?

How do markets account for unlikely events which require flexibility(1 in 30 years events)?

**Do the markets incentivise the flexibility that will be required?**

# Location: How will constraint costs evolve?

**Location**
Will investment happen in the right place?




New renewable capacity connecting faster than transmission capacity can be built (Connect & Manage)

Fall in costs during 2030s as new transmission investments come online

**After currently planned NOA reinforcements, the "new normal" in all net-zero compliant scenarios will still be more than double the historic figure of ~£400m p.a.**

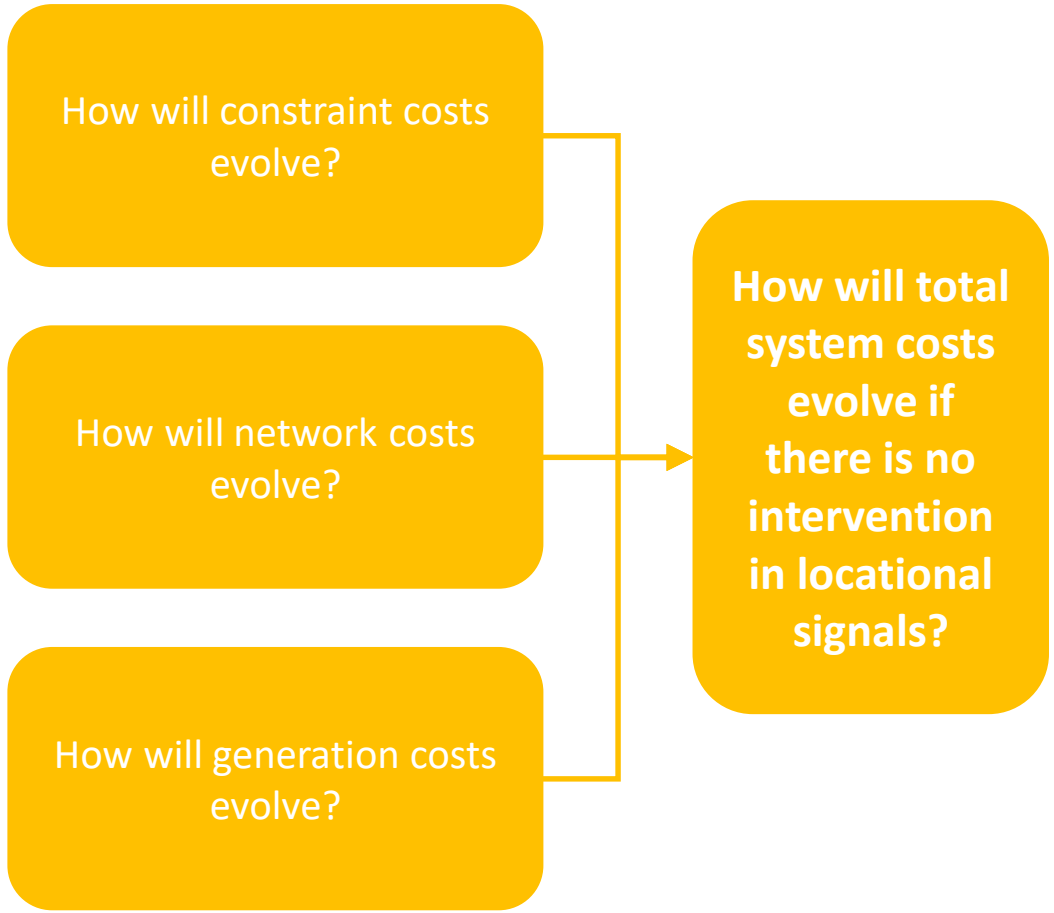
** Thermal constraint costs only (excl. actions required for Voltage and stability limits & ROCOF)*

# Location: Current GB Signals – Transmission

**Location**
Will investment happen in the right place?

**How will total system costs evolve if there is no intervention in locational signals?**

| Current market signal | Locational? |
|---|---|
| Wholesale Market | No |
| Balancing Mechanism | Yes |
| Capacity Mechanism | No |
| CfD | No |
| BSUoS | No |
| TNUoS | Yes |
| DUoS | Yes |
| Transmission and Distribution Losses | Yes |



# Operability: What is driving requirements?

**Operability**
Will issues be manageable?

*Ultimately, operability will be a function of the energy system that is delivered by the previous 3 market signals (investment, locational and temporal).*

| | Stability | Frequency | Voltage | Thermal | Restoration |
|---|---|---|---|---|---|
| **What do future requirements look like?** | ↑ **Increased requirement** despite ESO actions to operate at lower levels | ↑ **Increased requirement**, but set dynamically | ↑ **Significantly increased requirement** for reactive power absorption | ↑ **Rapidly increasing** to late 2020s (see slide 13) | **New Restoration Standard in development** |

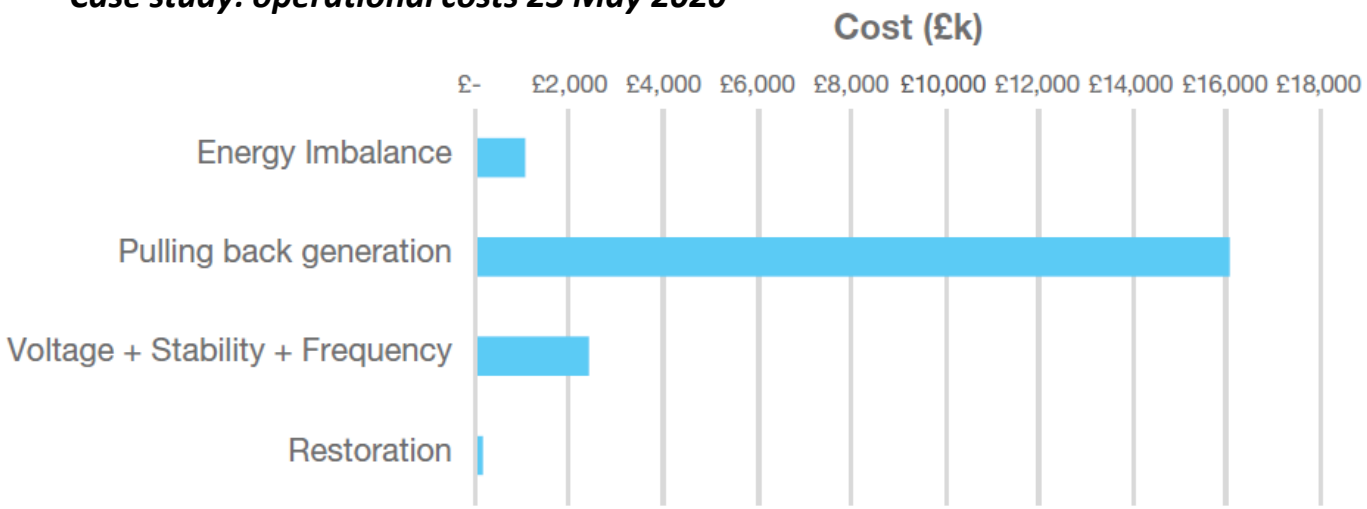
Further detail in Appendix 2

# Operability: Are current markets efficient?

**Operability**
Will issues be manageable?

## Current electricity markets are not optimised for operability

***Case study: operational costs 23 May 2020***




- Market provided close to 100% zero carbon generation but ESO had to reduce to ~80% and spend £19.7m to manage operability challenges
- ~4GW of zero carbon plant replaced by thermal to manage stability
- 11 synchronous generators instructed on to provide reactive power
- ~5GW of actions to reduce zero carbon generation to manage thermal constraints

## How will we tackle this workstream?

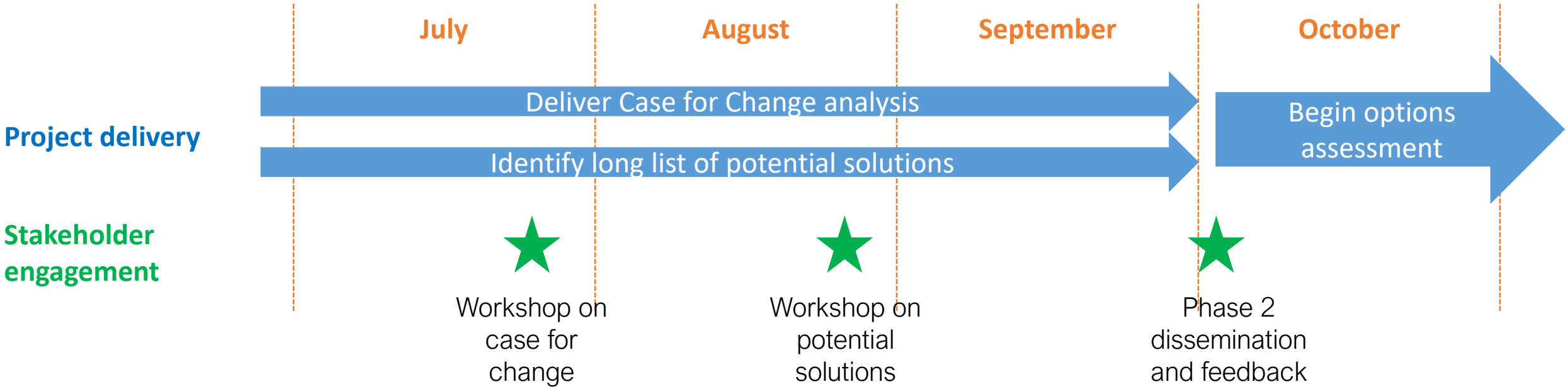
What does the current and future operability landscape look like?

What are the interactions with other markets and policies?

How will certain extreme future scenarios impact on the scale of the operability challenge?

**Will future operability challenges be manageable / affordable?**

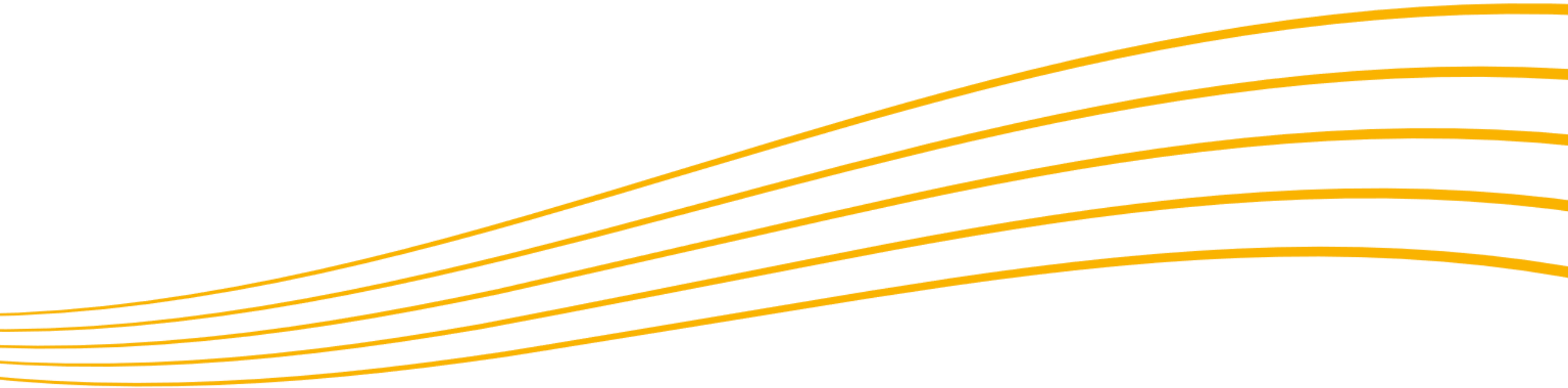
# What's next?


July
August
September
October
Project delivery
Deliver Case for Change analysis
Identify long list of potential solutions
Begin options assessment
Stakeholder engagement
Workshop on case for change
Workshop on potential solutions
Phase 2 dissemination and feedback

# Guest speakers

| | |
|---|---|
| **Kayte O’Neill** | Head of Markets, National Grid ESO |
| **Rob Hewitt** | Deputy Director – Energy Security, BEIS |
| **Tom Corcut** | Deputy Director – Wholesale Markets, Ofgem |

# Q&A

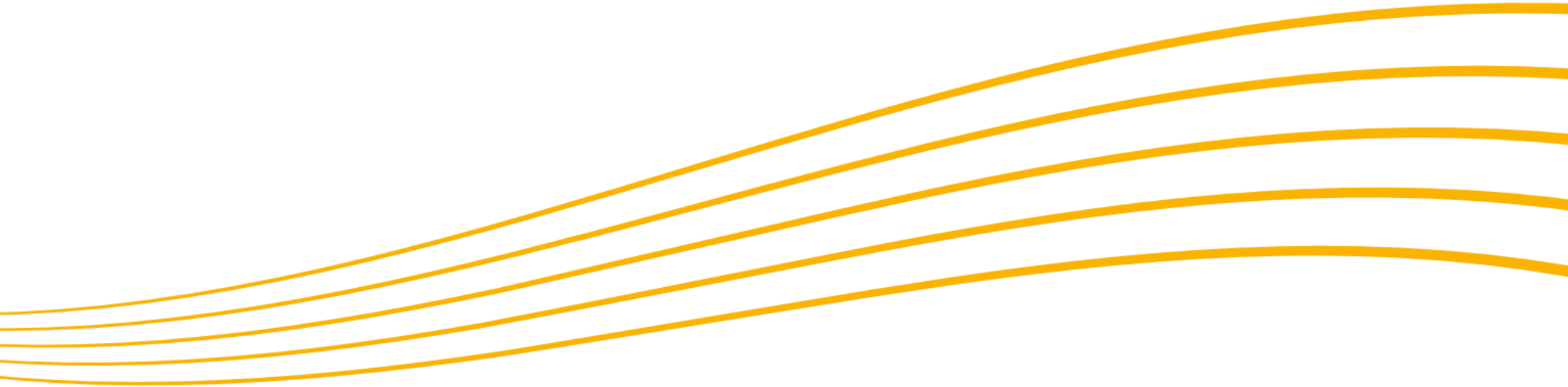


## Any further questions or comments?

## Contact us:

email: simon.targett@nationalgrideso.com

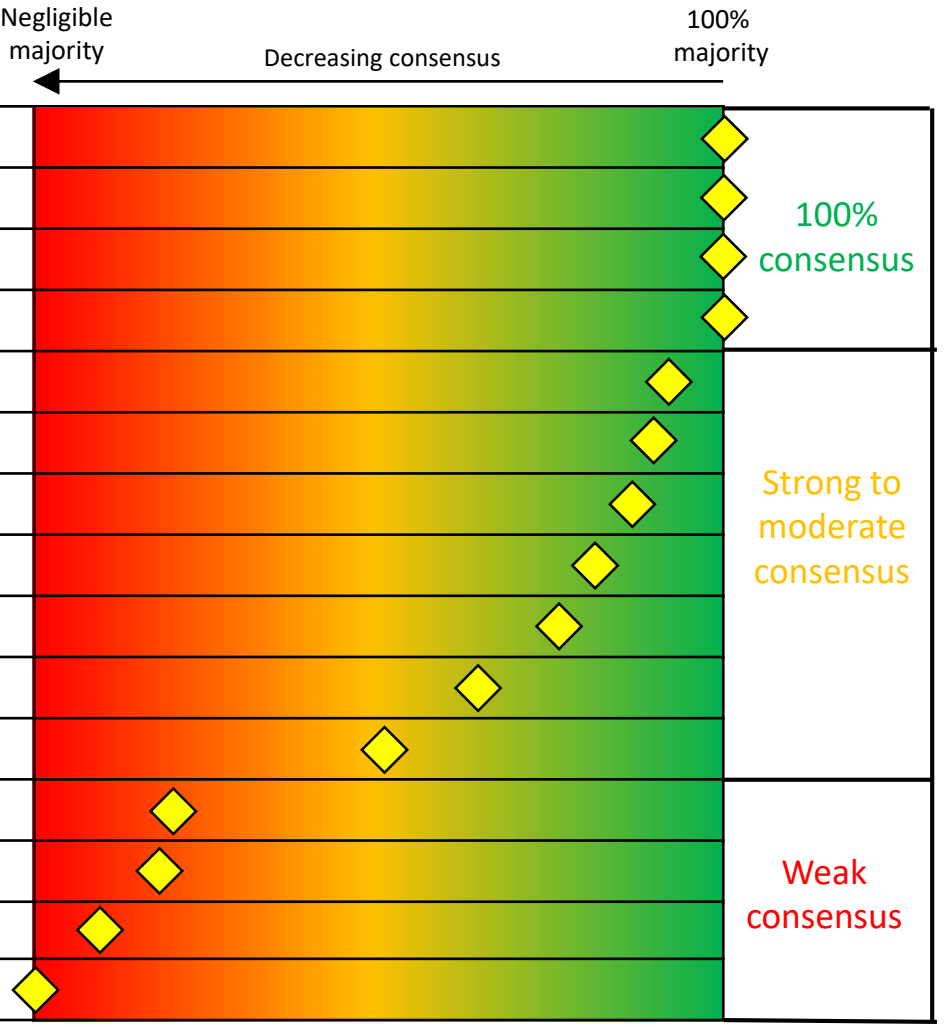
# Appendices



# Appendix 1: External stakeholder responses – Phase 1 interviews

*As part of Phase 1 we asked 23 external stakeholders their standpoint on a number of statements related to current market design and possible future solutions. There was strong consensus and agreement in relation to the overall need for change, flexibility and a whole system approach, however less of a consensus in terms of specific solutions.*

| Statement* | Majority View |
|---|---|
| There is a need for change | Yes |
| A whole system approach is key for delivering Net Zero | Yes |
| Effective demand side response is vital for delivering Net Zero | Yes |
| The market must deliver a higher value for flexibility | Yes |
| Greater transparency, data and digitisation are essential | Yes |
| We need to keep the consumer at the heart of market design | Yes |
| There is a need for long duration storage | Yes |
| Role of local balancing will increase in importance | Yes |
| ESO has a key role to play | Yes |
| Keep, but reform, the CfD and CM in short to mid term | Yes |
| More consumer participation on the demand side is important | Yes |
| A market-led approach is most appropriate | Yes |
| Advocate for more volatile pricing to help drive innovation | No |
| The approach for market reform should be evolution rather than revolution | Yes |
| Locational Marginal Pricing should be explored as a possible solution | No |




Stakeholder groups included:

- Energy Suppliers
- Government
- Regulator
- Aggregators
- Generators
- Academics
- Thinks tanks
- Consultants
- Trade associations
- Investors
- Storage Providers

*25 statements were presented to the stakeholders. 10 statements have been removed from the above where less than 50% provided a response. Responses were with either Yes, No or Not Sure.

# Appendix 2

**Operability**
Will issues be manageable?

# Operability: what is driving requirements?

*Ultimately, operability will be a function of the energy system that is delivered by the previous 3 market signals (investment, locational and temporal).*

| | Stability | Frequency | Voltage | Thermal | Restoration |
|---|---|---|---|---|---|
| **What do future requirements look like?** | ↑ **Increased requirement** despite ESO actions to operate at lower levels | ↑ **Increased requirement**, but set dynamically | ↑ **Significantly increased requirement** | ↑ **Rapidly increasing** to late 2020s (see slide 13) | **New Restoration Standard in development** |
| **What is driving requirements and our ability to manage them?** | ↑ Increasing largest losses<br>↑ Fewer synchronous generators<br>↓ Faster acting response products<br>↓ Accelerated Loss of Mains Programme<br>→ Need to limit ROCOF to 0.5Hz/s | ↑ Falling inertia<br>↑ Increasing largest loss<br>↓ Pathfinder procurement of inertia | ↑ Declining Q/P ratio<br>↑ Increased export from Dx to Tx<br>↑ Less thermal generation absorbing reactive power | ↑ More generation built far from demand<br>↑ Network build lagging renewables<br>↓ More access to units to redispatch<br>↓ More Tx capacity in 2030s | ↑ Less traditional providers<br>↓ Ability to restore from DER |

# Appendix 3: Q&A

**Where can we find the summary of the work you have carried out already - for example the research on other countries?**

This was covered in our launch event on 26th March 2021. A recording of the event and the associated slides are on our website. Please use the below link, scroll down to “Deep Dives” and click on “Deep Dive 4: Net Zero Market Design”.

https://www.nationalgrideso.com/industry-information/balancing-services/road-to-net-zero-electricity-markets/events

**Are there any options that are off the table? Will locational marginal pricing be considered?**

There are currently no options off the table, including locational marginal pricing. All credible options must be assessed before we can justify removing them as an option and this will happen as part of Phase 3.

**Could you post a link to the constraints paper mentioned, please?**

https://www.nationalgrideso.com/document/194436/download

**Is "Location" still the right question to ask? Is it time to turn the question around and look into ways the infrastructure can accommodate the natural locations?**

The case for change analysis will feed into the identification and assessment of possible market solutions which will be prioritised based on assessment criteria. We will consult on these criteria with stakeholders.

In order to meet our net zero target in the most cost effective way, we need to determine the market design which will best optimise the whole system costs, including system constraints, network reinforcement and generation costs.

# Appendix 3: Q&A

**It's not clear how FES capacity (which is non-locational) translates into NOA or ETYS - will you publish how you translate FES capacity to locational capacity for network planning?**

We currently publish the translation of FES capacity to planning network requirements by way of the Electricity Ten Year Statement (ETYS). https://www.nationalgrideso.com/news/electricity-ten-year-statement-etys.

Within the ETYS we present regional summaries of generation and demand, taken from the FES, and show planning expectations of future electricity transmission system power flow requirements by means of transmission boundary analysis.

This analysis is built upon in the Network Options Assessment, which provides details of all options considered when developing the electricity transmission network to satisfy the projected requirements outlined in ETYS.

Details on the methodology and supporting data for the FES, ETYS and NOA can be found on their respective web pages. We are regularly asked for a detailed breakdown of FES for individual generators by unit, but unfortunately, we are not permitted to publish this data due to confidentiality restrictions. The closest individual generator unit data that is published are the connection registers which can be found here: https://data.nationalgrideso.com/data-groups/connection-registers.

**Having made strides to reduce locational impacts to BM, are you saying that this may backtrack in the future? That is concerning from investment perspective**

The services we need to ensure the system can operate will always have a degree of locational requirement. Over the past decade we have sourced some of these services through the BM, with consequential energy impacts. Our pathfinders and roadmaps are focused on delivering these essential system services at the lowest overall cost, which in most cases results in separating out the energy component of the requirement, such as with the voltage and stability pathfinders.

We will still need to take a number of locational BM actions to ensure safe and secure flows on the network. Ultimately, we need to deliver the optimal balance of investment in capacity, investment in the network, and operation of assets to deliver the most cost-effective outcome.

# Appendix 3: Q&A

**Salami slicing services is like buying all a car's components: three times as expensive and without its assembly, testing and warranty. Why not buy the complete car? I'm referring to flexible plant.**

Bundling products together has benefits for those assets which can provide multiple services at the same time, however it inhibits competition and market access for smaller parties, creates barriers to entry for certain technologies that might not be able to provide the full range of services, lacks transparency of both our requirements and the market price for individual services. All of this could result in higher prices for consumers. Unbundling and standardisation of our balancing services was supported by industry through our SNaPS consultation in 2017.

The decisions we make over the duration of our procurement is based on the overriding principle that we are delivering value for consumers. Long term contracts provide benefit for developers, as they can support investment funding in new flexible assets which would otherwise not be funded, and this then ensures that the ESO has a larger pool of potential providers which can increase competition. However, where there is already competition, long term contracts can lock us into paying for a service which may be above the market price and act to stifle innovation and competition. Short term contracts also give us the ability to manage our services to meet operational needs closer to real time, and avoid the risk of over- or under-procurement. Through the work we are doing on the reform of balancing services and pathfinder projects, we are investigating both long- and short-term markets for flexibility, as we believe a mix of both approaches will best deliver value to the end consumer.

We would also note the Clean Energy Package and Electricity Balancing Guidelines require us to move our procurement of some balancing services to close to real time markets to ensure low carbon, storage and demand side providers can better participate and balancing service costs reflect the real time cost of energy**.**

**Will you be considering the CCC scenarios alongside the FES scenarios?**

We will consider including any credible scenarios if they result in different outcomes that would be valuable to explore.

**What are the main drivers behind your baseload price forecast dropping to £37 in 2025?**

This is not an ESO forecast. This was referenced from Energy System Catapult's Rethinking Electricity Report (Figure 8).

# Appendix 3: Q&A

**Will NG ESO support reform of TNUoS Charging in the North of Scotland to remove the current distortions which dampen investor interest in new generation?**

We are supportive of a review of the underlying principles and methodology for TNUoS. However, we believe that any review should be undertaken in a holistic manner, considering wider reforms to charges, technical arrangements and networks to ensure that any locational signals deliver consumer benefit. As this review has not yet commenced, we would not be able to comment on the impact this would have on different market participants.

**Agree entirely with Tom: current markets aren't working and need change but current market moves are more of the same wrong solutions. When will a different market structure be considered?**

All credible solutions and structures will be considered and be assessed.

**How important is it to ensure investors can amortise their capital over full asset life rather than just 15 years (as with current CfDs / CM)?**

There are many different facets to investor signals, including long-term certainty of revenue, that will all be considered.

**Why do you still illustrate storage in GWs rather than GWhs? Misleading.**

The graph was for illustrative purposes only. Rated power capacity, energy capacity and duration of storage are all important storage characteristics and will all be considered in the analysis.

**Is there an expectation that operability will become an explicit part of market design rather than a post market, residual action?**

We will be looking at market solutions that tackle some operability issues at their core, however until we start to identify and assess solution we have no such expectations at this time.

# Appendix 3: Q&A

**For BEIS - will policy costs be removed from retail electricity bills to remove the price distortion between retail electricity and retail gas prices?**

BEIS will soon publish a call for evidence on affordability and fairness in the energy system. The call for evidence will look at how future energy costs can be allocated in a way which is fair to all consumers and incentivises them to use cost-effective low-carbon technologies. This will include looking at the policy costs of gas and electricity bills and gathering evidence on the extent these do not act as a significant barrier to the deployment of low-carbon technologies.

**What is the timing of the locational work? Looks like locational topics stakeholders are asking to be addressed in short term could have delayed resolution because they are being rolled into this**

There are multiple projects ongoing with links to transmission charging such as market reform and OTNR. Consideration of these deliverables and likely outputs will dictate the timing of any wider review of locational charging.

We are supportive of a review of the underlying principles and methodology for TNUoS. However, we believe that any review should be undertaken in a holistic manner, considering wider reforms to charges, technical arrangements and networks to ensure that any locational signals deliver consumer benefit. As this review has not yet commenced, we would not be able to comment on the impact this would have on different market participants .

**Does NG ESO have a heatmap of projected 2050 energy usage, highlighting areas of expected highest usage?**

We are hoping to publish a spatial visualisation of our FES regional electricity breakdown data over the next few weeks subject to finalising user acceptance testing.

**If we're in a 'climate emergency' are there lessons to be learnt from how we've responded to covid to drive industry change as quickly as possible?**

We have taken on board a number of learnings from our response to COVID in developing new products and delivering on our RIIO 2 plan. Much of our COVID response was based around our existing approach to meeting the operability challenges. There is still work to do across all of industry to align outcomes to meet the challenges in decarbonising the electricity sector.

# Appendix 3: Q&A

**Key takeaway from the presentation is that investment in flexibility has to increase - what solutions are there to mitigate risk in investment and stimulate deployment in the right locations?**

This is one of the challenges that we will be looking at. Solutions will be identified and assessed during Phase 3 of the project.

**Why is electricity price identical whether intermittent or dispatchable, synchronous or asynchronous, when the value of each differs owing to the additional services NG needs to procure?**

How to value and incentivise behaviour / characteristics that support the system is something we will be looking at as part of this project.

**Does the ESO plan to undertake a NOA process for a 2050 system under the FES scenarios – considering additional heat & transport load for net zero?**

Yes, the Future Energy Scenarios are a key input into the NOA process, and they underpin the recommendations we make, ensuring we effectively plan and invest against this future uncertainty through an annual assessment. 2020 FES meets net zero targets by 2050 in 3 out of the 4 scenarios, these scenarios will provide the range of credible futures that will help us determine the optimal level of transmission investment required in the next year and beyond. The annual nature of the NOA means that we are able to review our investment recommendations each year and update them, ensuring the most optimal solution is always recommended, using the most up-to-date view of the future energy landscape provided by the FES.

Our NOA methodology explains the NOA process in detail. Ofgem approves the NOA methodology each year following the ESO's public consultation. Our NOA 21/22 methodology consultation has recently closed, however, we are keen to hear your views. If you have any feedback you can contact us at noa@nationalgrideso.com.

**How are you going to balance the objectives of locational cost reflective markets with investible markets that meet Net Zero? Which takes precedent?**

The case for change analysis will feed into the identification and assessment of possible market solutions which will be prioritised based on assessment criteria. We will consult on these criteria with stakeholders.

# Appendix 3: Q&A

**Given the scale of renewable generation we require, how do we enable new projects (that don't get CfDs) to raise investment and find a route to market.**

This is one of the challenges that we will be looking at. Solutions will be identified and assessed during Phase 3 of the project.

**Pathfinders are one off ways of exploring the market but are not a proper market nor efficient way to procure as they can discriminate. Will ESO promise to limit these & use tried & proven mkt design?**

To date Pathfinders have allowed both existing plant with existing connections and new assets to participate subject to the additionality criteria of the tender being met. The Pathfinders are used to 'top up' what is already provided through the energy market. We believe to date we've designed the pathfinder tenders in a way that secure value for the consumer while meeting the operational requirements of the system.

We will be launching an innovation project to review a broader range of approaches for procuring stability including inertia. Once this has launched, we will be inviting views from the industry on this.

**Double generation capacity => double grid size unless renewables connect to grids via suitable scale/duration storage, needing contracts & benefits sharing based on models. Why aren't these possible?**

The ESO balances constraint costs and network investment costs to achieve the lowest overall cost for consumers. The NOA process ensures that network reinforcements will only be made where the cost of associated constraints exceeds the network reinforcement cost. A doubling of generation capacity can therefore be accommodated with less than double grid size.

The existing market framework does not prevent suitable scale and duration storage assets entering into commercial agreements to co-locate with renewable generation assets to reduce transmission entry capacity requirements. where this is mutually beneficial. Any further facilitation of such business models for energy storage is outside the remit of the ESO.

Our Net Zero Market Design project will examine the investment case for different types of flexibility, to determine whether current market signals are adequate to deliver the level of flexibility capacity required to achieve net zero. If current market signals are judged to be inadequate, the next phase of the project will consider options to reform the market design to secure the investment required.

# Appendix 3: Q&A

**Significant voltage challenge yet next to no progress on reactive roadmap. Hmm.**

All planned activities for the reactive roadmap have been published in the Operability Strategy report. The high-level plan and timescales can also be found on this webinar from earlier this year. Updates on the Voltage Pathfinders can be found here.

**Hurdle rates and capital costs are not static over time either, how will they change across the analysis?**

This will be determined as part of the investment case for change analysis.

**Is it 'too late' to address the forecast high constraint costs in 2023-30? What could, and should, be done to reduce these (e.g., increased network investment or increased flexibility investment)?**

The ESO balances constraint and network investment costs to achieve the lowest overall cost for consumers. Rising constraint costs are the signal we use to trigger network investment. This has been the approach since 'Connect and Manage' was implemented in 2009 and it has been very effective at allowing the rapid growth we have seen in the connection of renewables whilst minimising costs for consumers. We expect to see an even faster growth in renewables, particularly offshore wind, between now and 2030. This will lead to a significant increase in both constraint costs and network investment. The 2021 NOA analysis signalled the need to invest more than £16 billion to manage heavily constrained system boundaries through asset build options into the mid-2030s, to more efficiently facilitate the net zero FES scenarios.

We actively manage, and seek to reduce, constraint costs through all our network planning and system operation activities. Reducing the level of these costs represents a key focus for the ESO and is closely monitored by Ofgem and industry. Recognising the potential step-up later this decade, we also have a medium/long term plan in place to mitigate these projected increases through a range of initiatives on which we are working closely with industry - please see our 5-point plan to manage constraints on the system for further information.

**If you would like to discuss any of the answers provided or you have any further questions then please contact simon.targett@nationalgrideso.com**