Smart Systems Forum

3 March 2021

How you can input into today's session

We will be using Microsoft Teams and MeetingSphere to run the session – **please join both**!

Part 1 – BEIS/Ofgem presentations
You can ask clarification questions using the chat function on MS Teams – please try to refrain from wider discussions at this point, you'll get a chance to do so later!

Part 2 – Breakout discussions
We will use MeetingSphere to facilitate a text-based discussion. We will direct you to the appropriate topic on MeetingSphere during each session.

Part 3 – Plenary Session
We will use MS Teams to facilitate a verbal discussion. This session will be recorded through MS teams to aid the minutes.

Part 4 – After the event
MeetingSphere will remain open until COP Friday for you to provide feedback on the questions asked today.

To help things run smoothly, please:
- **Remain muted on MS Teams**
- **Turn off your webcam!**

If you want to say something – please use the text-based chat in Microsoft Teams

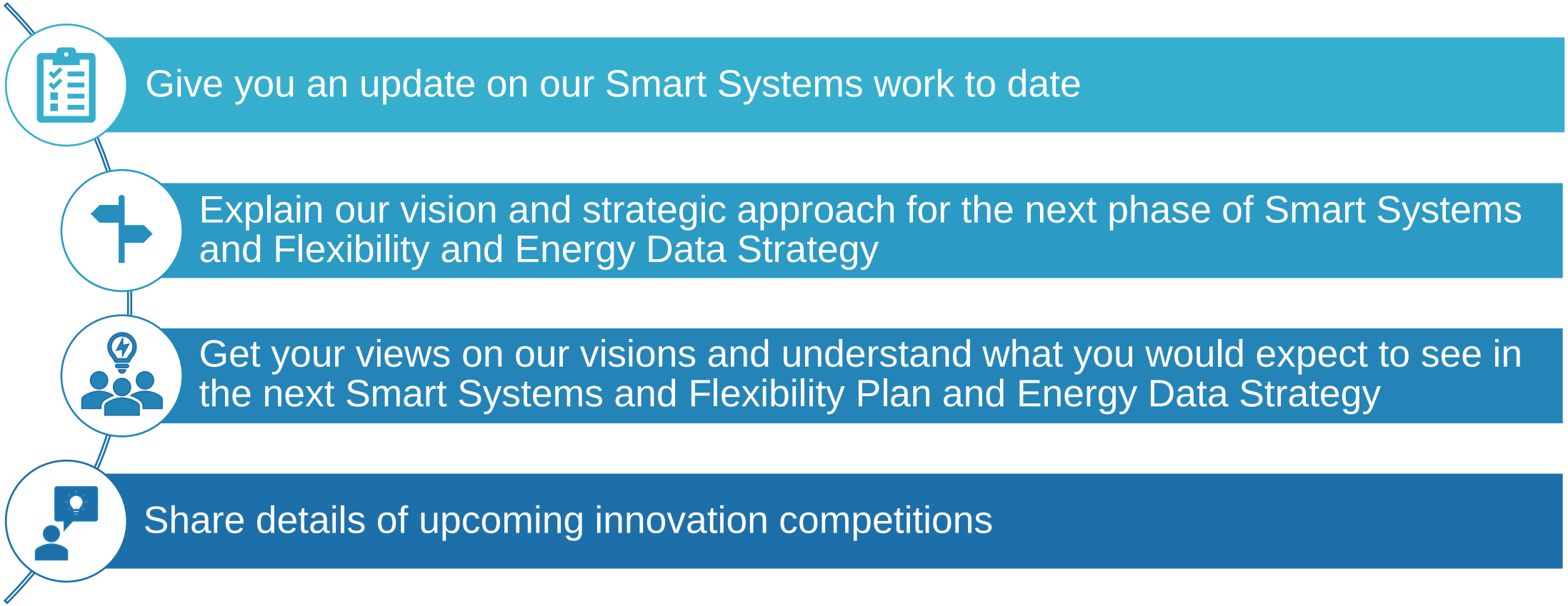
- **Technical queries & clarifications** – use the MS Teams chat function
- **Policy input** – use MeetingSphere

If you want your comment to be considered after today's workshop, use MeetingSphere!

Agenda

14:00	**Introduction and opening remarks** • How the session will be run (5 mins) • Chair introduction from Teresa Camey (BEIS) and Richard Smith (Ofgem) (20 mins)
14:25	**Delivery update - how we are doing against the existing smart plan** (5 mins)
14:30	**Next phase of smart systems and flexibility**
14:30	Presentation of high level slide pack (40 mins)
15:10	Breakout – MeetingSphere (20 mins)
15:30	**Break (10 mins)**
15:40	**Energy Data Strategy**
15:40	Presentation of high level slide pack (20 mins)
16:00	Breakout 2 – MeetingSphere (20 mins)
16:20	**Net Zero Innovation Portfolio (NZIP) Energy Storage and Flexibility innovation (10 mins)**
16:30	**Plenary session on overarching programmes (25 mins)**
16:55	**AOB, final words and round-up**

Aims of today's Smart Systems Forum



Delivery update - how we are doing against the existing smart plan

Smart Systems and Flexibility Progress

28 out of 38 actions implemented

Removing barriers to smart technologies

7/10 actions implemented

Progress since the last forum (Sep)…

- Legislation to take storage out of national planning regime came into force
- Final consumption levies / licence
- Storage H&S gap analysis completed
- Guidance on network connection queue management published

Still to be implemented:

- Define storage in legislation
- Final code mod for storage charging
- Code modification for connecting storage

Smart homes and business

10/17 actions implemented

Progress since the last forum…

- BSI PAS standard review on smart appliances
- Post 2020 smart meters consultation

Still to be implemented:

- Smart meters offered to every home
- Final decision on market wide HHS
- Consumer protection
- Cyber security
- Consumer engagement
- Smart appliances regulation next steps

Markets for flexibility

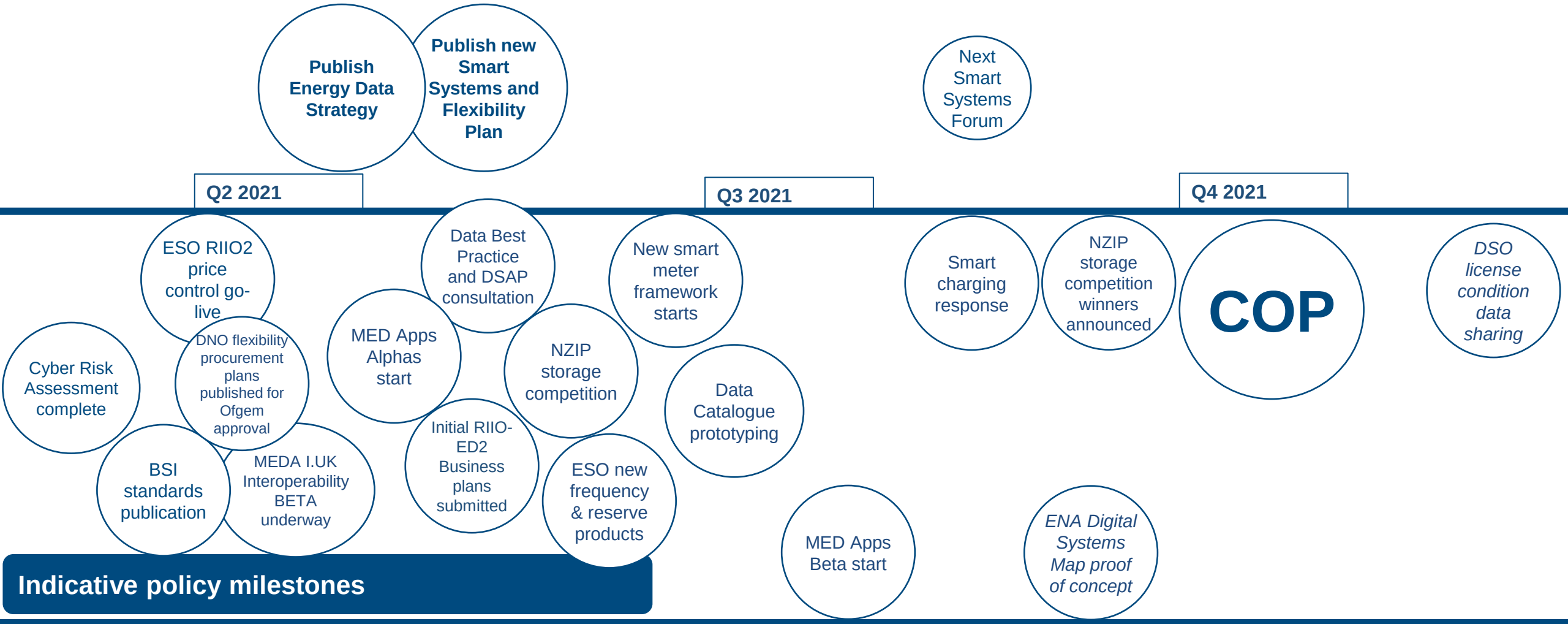
11/11 actions implemented

Progress since the last forum…

- RIIO-ED2 Sector Specific Methodology Consultation decision published
- Engineering Standards Review published

2021 forward look

Smart Systems and Flexibility plan next steps…



Indicative policy milestones

Next phase of Smart Systems and Flexibility

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Contents of the plan

	Forewords (BEIS and Ofgem)
	Executive Summary
Chapter 1	**Introduction**
	Analysis: The role of flexibility in a net zero system
Chapter 2	**Facilitating flexibility from consumers**
	Enabling smart buildings
	Smart and flexible electric vehicles
	Local energy
Chapter 3	**Removing barriers to flexibility on the grid including storage and interconnection**
Chapter 4	**Reforming markets to reward flexibility**
	System costs and charging reforms
Chapter 5	**Digitalising the system**
Chapter 6	**Delivering this plan**
	Monitoring flexibility
	Wider economic benefits: Skills, supply chain and exports
Chapter 7	**Next steps**
Annex	**Actions Table**

Topics to be discussed in this session

This will be discussed in the second session

What is a smart, flexible energy system?

We need more **flexibility** in our electricity system – the ability to shift energy in time or location to balance supply and demand within the constraints of our networks.

In the past, much of our flexibility has been provided by fossil fuels, but this cannot continue. To meet the UK's target to have net zero emissions by 2050, we will need to shift away from fossil fuels to use low carbon sources of energy.

This means:

- **More intermittent or inflexible generation**, particularly from wind and solar
- **Increased electricity demand,** as we electrify transport and heat.

In addition, the system is becoming more decentralised, for example homes, businesses and communities installing rooftop solar.

We need an energy system that matches energy from the wind and sun to these new sources of demand and can harness energy assets across the system to do so – from large power stations to local-based solutions.

We need to use low carbon sources for flexibility. These low carbon sources will need to be **smart** – able to harness big data and digitalisation. This will enable them to respond quickly to price signals and operate optimally alongside millions of other system assets.

A smart, flexible, low carbon energy system will **facilitate the integration of high volumes of low carbon power, heat and transport**. It will be more affordable than a system with minimal flexibility, **giving consumers more control** over their bills, and more **security**. It will also create **jobs and exports**.

Flexible technologies

Electric batteries

Demand-side response

Interconnectors

Scope and approach

Scope: This Plan sets out to **drive smart systems and flexibility**, based on the current energy market framework. We recognise that wider reforms to our market frameworks may be needed to drive decarbonisation beyond the 2020s and we will continue to discuss this with industry following publication of this Plan. In the meantime, it is essential that the we maintain momentum in delivering flexibility.

Whilst we have considered multiple sectors when developing this Plan, it is necessarily focused on **facilitating electrification of the energy system**.

Our approach: The system is evolving constantly, and so **our measures to facilitate this change need to be continually adjusted**. The value of flexibility should be recognised across the energy system and our approach should be adaptive to remain effective as the industry grows and changes. To do this we are **focusing on a series of actions to remove barriers, facilitate change and spur innovation** to allow the industry to evolve to respond to the needs of our future energy system.

Based on extensive stakeholder engagement we have identified 5 key areas of focus:

Flexibility from consumers	Barriers to grid flexibility	Flexibility markets	Data and digitalisation	Flexibility monitoring

Following publication, **we will continue to work closely with industry to identify and address barriers to a smart system**. We will continually adapt our approach as necessary.

Analysis: The role of flexibility in a net zero system

Draft results - Analysis yet to be published

- We used BEIS' model of the electricity sector, to explore the cost of the future electricity system under a range of different flexibility assumptions. This builds on the modelling work published with the EWP[1].
- Our modelling shows that **increased flexibility provides significant cost savings** in a decarbonised power sector**.** In the scenarios we tested, increased system flexibility provided system cost reduction of up to **£10bn per year[2]** in 2050 at 5g/kWh (high demand, no hydrogen scenario)
- The biggest system cost reductions are from lower capital costs (c£6bn pa) followed by reduced network costs (£2bn pa)

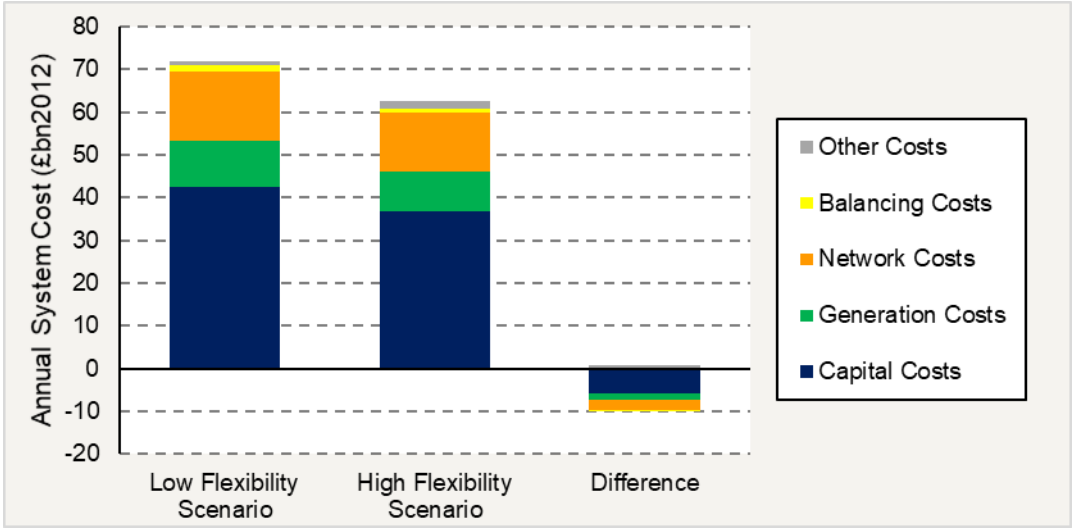

Figure 1: Illustrative system cost in 2050 at 5g/kWh under different flexibility scenarios (high demand, no hydrogen)[3]

Flexibility reduces costs because it:

- Reduces the need for additional low carbon capacity by better utilising renewable generation
- Reduces the volume and cost of network reinforcements by shifting demand from congested to uncongested periods
- Reduces the need for additional peaking generation by shifting demand from peak to off-peak
- Reduces generation costs (fuel costs) by maximising the use of low cost low carbon generation.

[1] Modelling 2050: electricity system analysis, https://www.gov.uk/government/publications/modelling-2050-electricity-system-analysis
[2] This is the upper end of the range representing a high demand scenario with no hydrogen use in the power sector. Scenarios with lower demand or with hydrogen in the power sector would result in lower benefits.
[3] Capital costs include all generation technologies, Network costs include transmission and distribution, Other costs include Carbon, Unserved Energy and Interconnection costs

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Analysis: What does a flexible system in 2050 look like?

Draft results - Analysis yet to be published

Levels of flexibility in 2050

Our modelling provides scenarios that indicate the scale of deployment that could be needed as we transition to net zero. Due to the uncertainty in energy system development these figures should not be seen as targets.

- In our modelled scenarios, **around 30GW of combined short-term storage and DSR[1] and 27GW of interconnection** lead to the lowest system cost in 2050. In our high flexibility scenario we assume around 15GW of storage[2] (60GWh of storage capacity) and 15GW of DSR. Our modelling includes a simplified representation of wholesale and balancing markets (including reserve and inertia), but does not consider the capacity of flexibility needed in other markets, such as frequency response.
- We have **not explicitly modelled longer-duration storage**, or the role that flexibility could play in managing local network constraints. If these aspects were considered, it is likely that **additional flexibility** could lead to lower system costs.

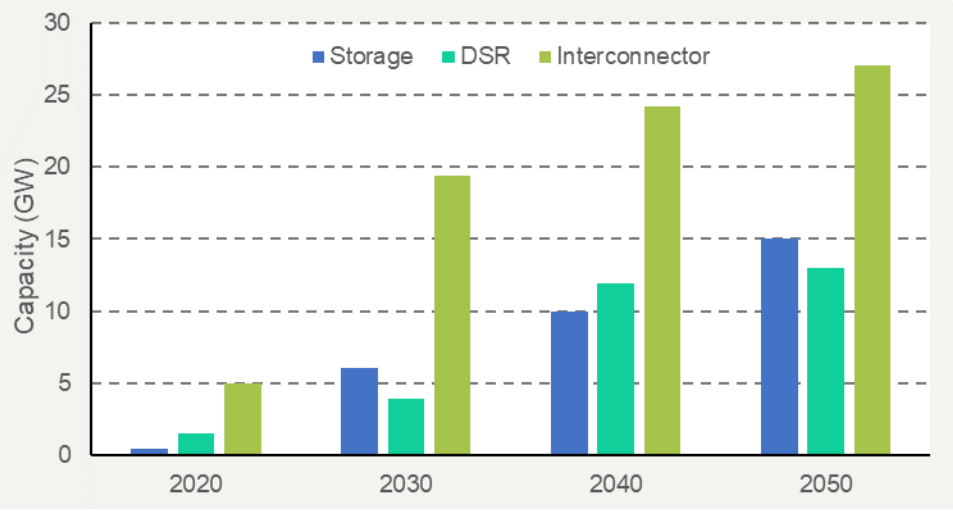

Figure 2: Capacity of flexible technologies (High Flexibility, High Demand Scenario)

Sources of flexibility – where could flexibility come from?

An integrated energy system with **flexibility provided across power, heat and transport** will be important to minimise costs**.**

- There is substantial potential for flexibility from i) smart charging of electric vehicles, ii) flexible use of heat pumps iii) hydrogen production from electrolysis and use in power generation. Whole system impacts should be considered when making decarbonisation decisions

Sources of flexibility are broadly substitutable (particularly short-term storage and DSR), greater progress in one area could reduce the requirement for other technologies.

- There is huge potential from demand side flexibility, but there is also significant uncertainty about how much can actually be delivered. A policy approach needs to consider energy system-wide flexibility, and monitor progress from a range of sources rather than focus on individual technologies

[1] In our modelling demand side response and batteries are limited to intraday transactions. DSR is measured by the reduction in annual peak demand
[2] Storage assets are in additional to existing pumped hydro capacity. We assume all new storage capacity has 4 hour duration.

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Wider economic benefits: skills, supply chains and exports

The benefits of a smart system go beyond the system itself - there are many **wider economic benefits** to a smart system.

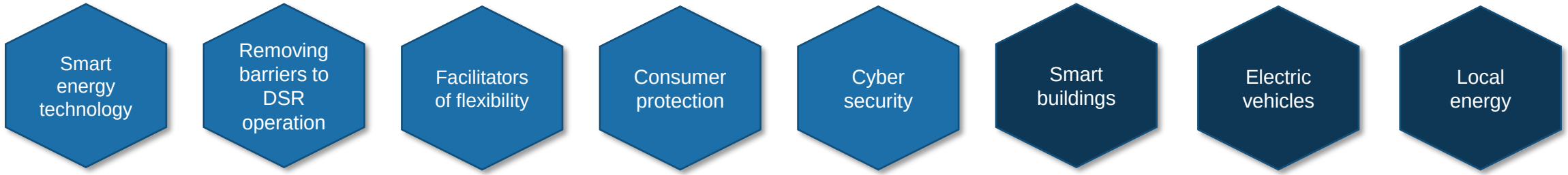
By 2050 the domestic market for smart systems and flexibility solutions could be worth as much as **£1.3 billion to GDP** and **10,000 jobs**. These jobs cover a huge variety of sectors including installers, electricians, data scientists and engineers. These **jobs are nationwide supporting the levelling up agenda**.

The UK is a global leader in the technology and science behind smart systems, and as more of the world grapples with the challenge of climate change there will be more opportunities for UK businesses. Trade and export potential **in 2050** could be worth as much as **£2.7 billion** and **14,000 jobs**.

A **Green Jobs Taskforce** was announced in the Prime Minister's Ten Point Plan for a Green Industrial Revolution. This work sets out to join up across government and work to ensure businesses are equipped with the skills to deliver net zero.

Vision: Facilitating flexibility from consumers

- **By the mid-2020s,**
  - The infrastructure and regulatory framework will be in place for consumers of all sizes to be able to participate in DSR. We will have **reached market-wide rollout of smart meters** to domestic and smaller non-domestic consumers across GB. The market for smart tariffs will have matured, with a much greater variety of tariffs on offer to consumers of multiple needs and type, as **more consumers are settled half-hourly.** Consumers will have access to a wide range of interoperable and secure "energy smart" appliances and will be empowered to participate in offering flexibility services.
  - With rapidly rising numbers of electric vehicles, **drivers will benefit from smart charging**, and vehicle to grid technology will be close to becoming a commercial reality.
  - Smart technologies will be incorporated across government's energy efficiency, heat and fuel poverty policies.
  - Consumers of all kinds (including low income and vulnerable) will have the opportunity to choose and benefit from **affordable smart energy products and services**, while those that do not participate will still receive **fair and affordable outcomes**. Flexibility from industrial, commercial and public sectors will represent a fully mature and well-functioning market.
- **2030 and beyond…**
  - **Consumers will be providing significant flexibility to the system**, with the domestic sector expanding rapidly as low carbon heating deployment increases and most drivers choose electric vehicles. "Energy smart" behaviour will be normalised, with products and services for dynamic DSR commonplace.
  - We want to see over 10 million electric vehicles on the road by 2030[1], with drivers able to adopt smart charging at point of sale alongside time of use tariffs, and we want to see commercially sustainable V2G being deployed at scale.
  - Consumer, system, and environmental benefits of "energy smart" participation will be well established in the public consciousness. Flexibility providers will have offers to cater for all levels of consumer engagement, with **consumers in charge and able to choose** how dynamic their participation should be.



[1] In line with National Grid Future Energy Scenario 2020 estimates

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Vision: Removing barriers to flexibility on the grid: storage and interconnection

- **By the mid-2020s,**
  - We will have created a **best-in-class regulatory framework for storage at all scales;** investors and developers will be confident in the framework; this will trigger a marked increase in the deployment of storage.
  - There will be a **level playing field for domestic and small-scale storage.** Customers will be confident in the benefits and framework for installing storage in their homes and businesses.
  - Supported by government innovation funding, **first-of-a-kind longer duration storage technologies will be built** and providing services to the system.
  - **Increased interconnection** delivered under current cap and floor arrangements and participating efficiently and flexibly in cross-border markets across all timescales. Ofgem's **interconnector policy review** has concluded and changes to arrangements for new interconnectors implemented, ensuring the **full range of potential benefits and impacts** have been captured.
  - As we work towards realising our **2030 ambition of at least 18GW of interconnector capacity**, we have a coherent approach to interconnector operability and their role in the system. BEIS has also concluded the Offshore Transmission Network Review and there are recommendations for the role **and future of multi-purpose interconnectors**.

- **2030 and beyond…**
  - **Storage will be deploying in the most optimal locations and at all scales**. We will be on our way to the deployment of up to 30GW of intraday storage and DSR that could be needed in 2050. Storage will be providing significant flexibility to the system and helping to address many of the challenges presented by a low carbon system; shifting when generation is needed, alleviating constraints and providing stability services.
  - In many cases storage will be replacing flexibility from traditional fossil fuelled generation. We will begin to see longer duration storage help us to decarbonise the grid further providing key services to the grid in order to integrate and maximise the use of 40GW of offshore wind and other low carbon generation.
  - **Frameworks for interconnector operability** support a flexible, increasingly decarbonised grid, which **utilises the full potential of flexibility interconnectors can provide for the system**. Interconnection is an essential part of the solution for an increasingly decarbonised flexible grid, in the run up to net zero.

Storage of all scales | Large-scale and longer duration storage | Domestic and small-scale storage | Interconnection

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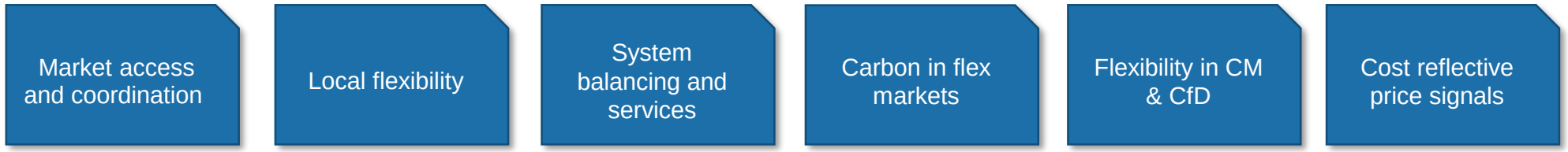
Vision: Reforming markets to reward flexibility

- **By the mid-2020s,**
  - Flexibility technologies **of all types and sizes will have access to all markets** and be able to stack revenues across multiple markets where this enables whole system optimisation.
  - Greater utilisation of flexibility resources **reduces curtailment of intermittent low-carbon generation**. Flexibility is widely used as an alternative to network build at both distribution and transmission, underpinned by transparent network investment decisions and competitive tendering.
  - We will have **implemented new access and charging arrangements** which incentivise more efficient and flexible network use.
  - A step-change improvement in **DNO/ESO coordination** will ensure balancing and constraint management services are optimised to maximise overall benefits to the system. The ESO will have executed reforms to existing markets and implemented new markets for the provision of evolving system requirements enabling periods of zero carbon operation. Network operators have opened up as many services as possible to competition.
  - We will have stronger **investment signals for flexibility** in the Capacity Market and Contracts for Difference, and **carbon reporting and monitoring** will be business-as-usual in all markets.
- **2030 and beyond…**
  - **Full-chain flexibility is unlocked**. Dynamic, close-to-real time markets will ensure the most efficient assets are dispatched. There will be clarity on how this will be delivered across possible reforms to wholesale market arrangements, enhanced procurement of system services, reforms to the Balancing Mechanism (BM) and more granular charging and access arrangements. Some of these changes may need to be initiated in the 2020s to deliver from 2030 and beyond.
  - Stronger **long-term investment signals** will signal when and where flexibility will be needed, complementing operational signals and existing procurement mechanisms. Fair and consistent **governance arrangements** across transmission and distribution will guarantee full participation in the market for all energy resources, while transparent and clear processes will ensure market participants have confidence in the market. **Carbon will be valued for all assets** in all flexibility markets, to ensure they are compatible with our net zero target.
  - We will have clarity on how the **design of our energy markets**, including the Wholesale Market, CM and CfDs, will take us through to net zero.



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Breakout 1

- What are your views on our visions?
- Given the narrative that we've presented, what would you expect to see in the plan?

Break

Back in 10 minutes

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Energy Data & Digitalisation Strategy

High-level thinking for a joint strategy for delivering a future digitalised energy system by BEIS, Ofgem and Innovate UK.

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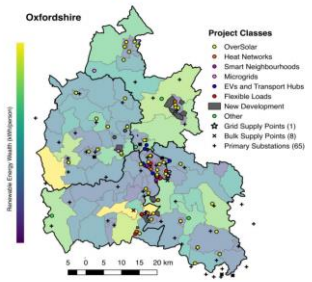
Data and digitalisation is key to a successful transition away from carbon

Project LEO
Local Energy Oxfordshire

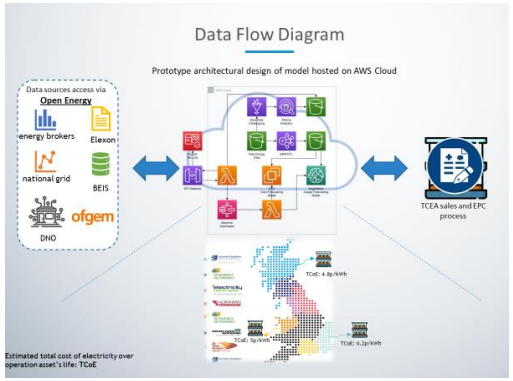


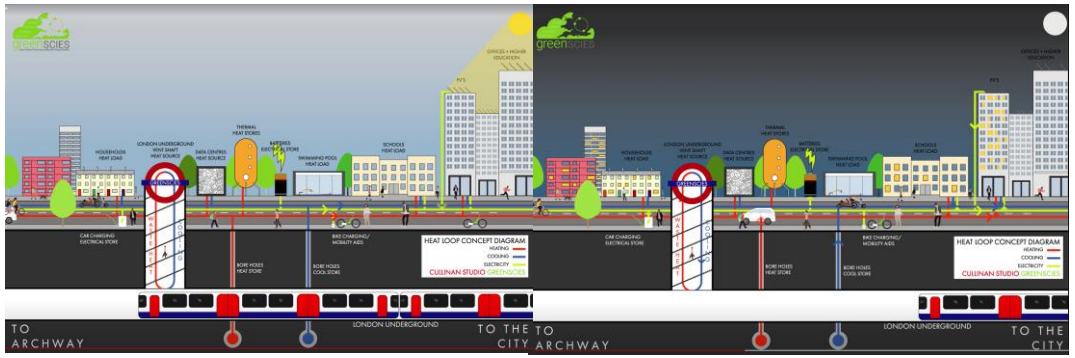
System benefits:

- Efficient system operation
- New forms of flexibility
- Better policy and regulation

Citizen benefits:

- Local decarbonisation solutions
- Lower energy bills
- Better services
- More choice
- Improved consumer protection





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The UK's first Energy System Data and Digitalisation Strategy

Scale of change

Leadership & collaboration

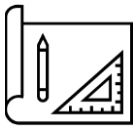
A. Develop a clear vision with industry to provide leadership (e.g. **UK's first Energy System Data and Digitalisation Strategy**).
B. Recognise the sector needs a confidence in a shared understanding of challenge ahead.
C. Work with industry on delivering the programme of work to take us on the path towards this shared vision (**Roadmap**, see next slide).
D. Take an adaptive approach, remaining open minded about further digitalisation opportunities to ensure the system is as effective and as efficient as possible.

Culture & incentives

Drive & incentivise sector to coordinate

A. Provide coordination to support cross-sector collaboration to achieve shared outcomes (**Bringing building regs and ENA notification requirements together**).
B. Incentivise delivery of industry built single services (e.g. **ENA National Energy System Map**).
C. Update regulatory expectations (e.g. **Network companies' Digitalisation Strategies**).
D. Drive and facilitate the sector to coordinate by providing the right incentives and regulatory expectations.

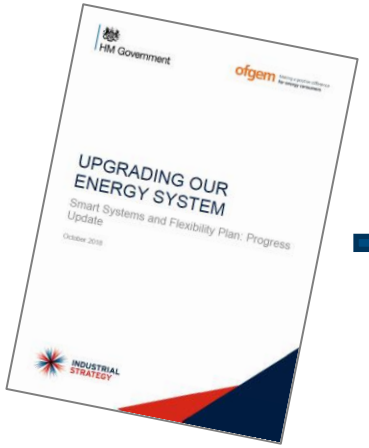
Shared infrastructure



Develop future solutions

A. Support open energy data initiatives (e.g. **Modernising Energy Data Access**).
B. Fund single services (e.g. **Energy Data Catalogue, Automatic asset registration.**
C. Align future shared infrastructure with wider initiatives (e.g. **align with CDBB information management pathway**).
D. Ensure all outputs are, first and foremost, driven by user needs, are mindful of lessons learnt from other sectors and countries that face a common challenge, and assess their impact on future market structures (e.g. **Emerging monopoly review**).

Journey so far



Smart Systems and Flexibility Plan: Progress update 2018

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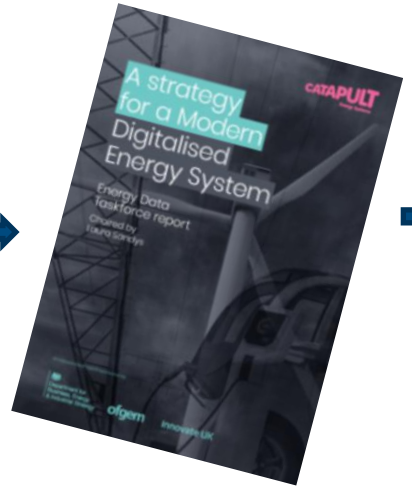
Modernising Energy Data Programme set up 2018



Energy Data Task Force (EDTF) report published June 2019

Government Endorsement of EDTF

Ofgem and BEIS formally endorsed the EDTF and deliver recommendations through the Modernising Energy Data (MED) programme

UK's first Energy Data & Digitalisation Strategy

Modernising Energy Data homepage: https://www.gov.uk/government/groups/modernising-energy-data

Demonstrating how value is delivered

e.g. BEIS develop an energy data visibility service

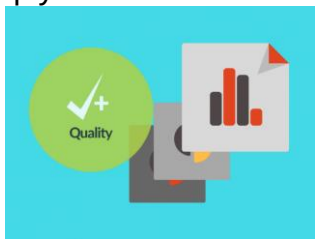
DATA VISIBILITY

e.g. UKRI innovation projects

STIMULATE MARKET

DATA QUALITY

e.g. Ofgem regulations setting expectations for data treatment, energy networks required to comply with Data Best Practice

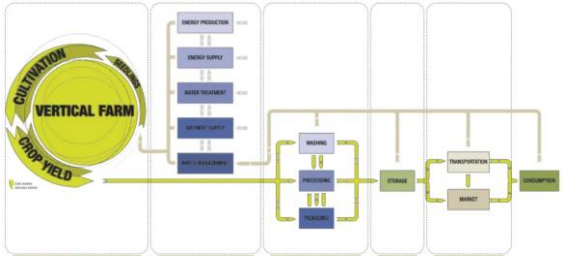


DATA ACCESS

e.g. Innovate UK procure competition to Modernise Energy Data Access (MEDA)

DELIVER VALUE

e.g. New business models, data products and services



IDENTIFY NEXT STEPS…

Breakout 2

- To what extent do you agree with our approach to the strategy?
- Given the narrative that we've presented, what would you expect to see in our data and digitalisation strategy?

Net Zero Innovation Portfolio (NZIP) Energy Storage and Flexibility innovation challenges

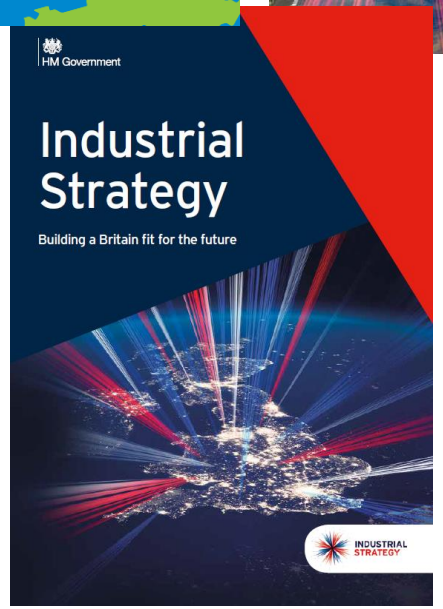
HMG Strategies

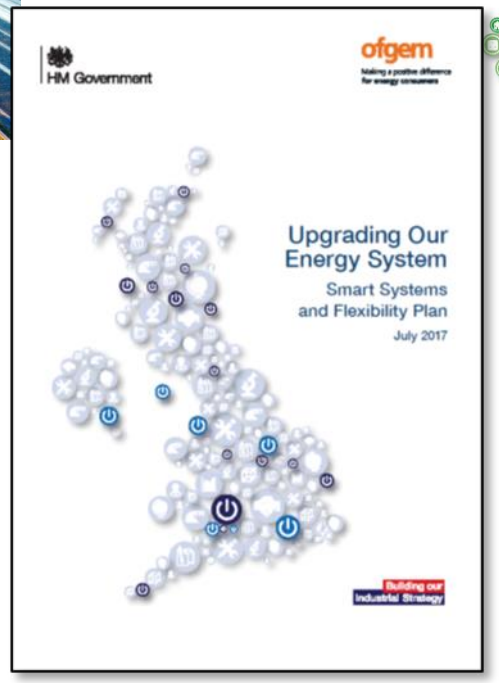
HM Government

INDUSTRIAL STRATEGY

The Road to Zero

Next steps towards cleaner road transport and delivering our Industrial Strategy





HM Government

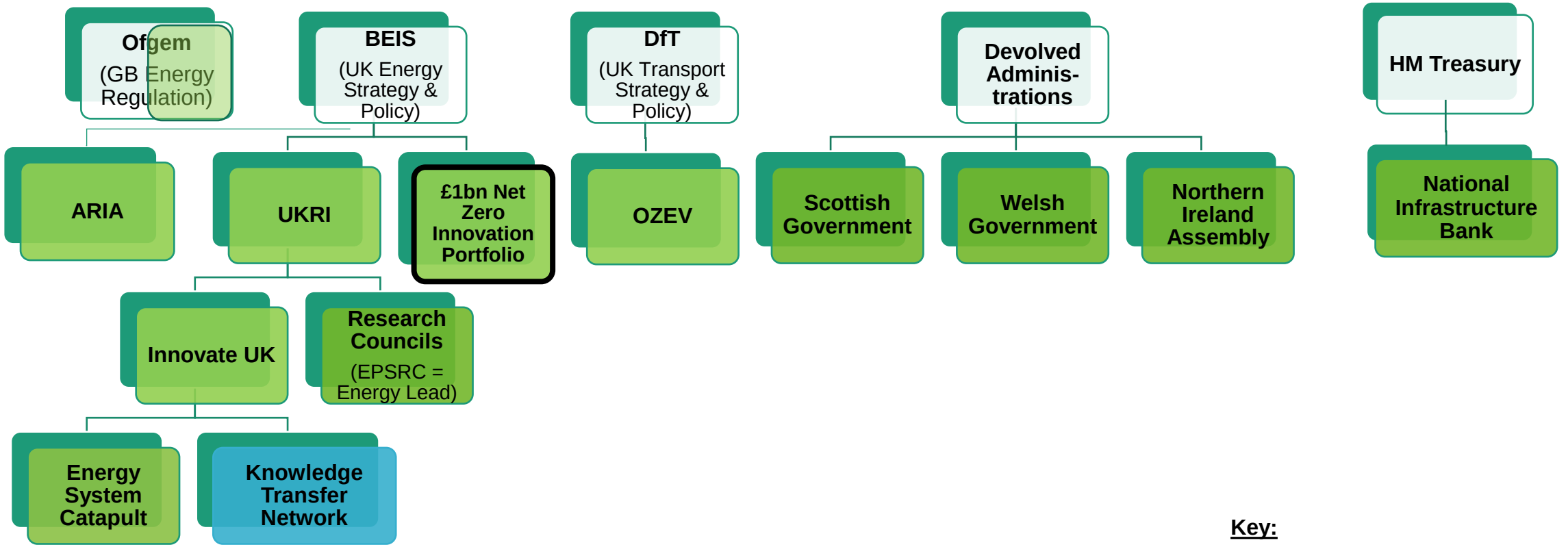
The Clean Growth Strategy

Leading the way to a low carbon future

Building our Industrial Strategy

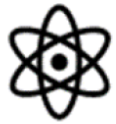
Target of Net Zero by 2050 – in June 2019 the Government Committed to Net Zero by 2050

Innovation funding landscape



Energy Innovation Portfolio (EIP)

The aim of the BEIS Energy Innovation Programme (EIP) is to accelerate the commercialisation of innovation cheap, clean, and reliable energy technologies by the mid 2020s and 2030s.



£180m Nuclear

Driving down costs and building new UK supply chains and skills

£15m Renewables

Driving down the cost of low carbon electricity at scale

£100m Industry & CCS

Low carbon options for industry, lowering energy costs

£90m Built Environment

More cost effective energy efficiency and low carbon heating

£70m Smart Systems

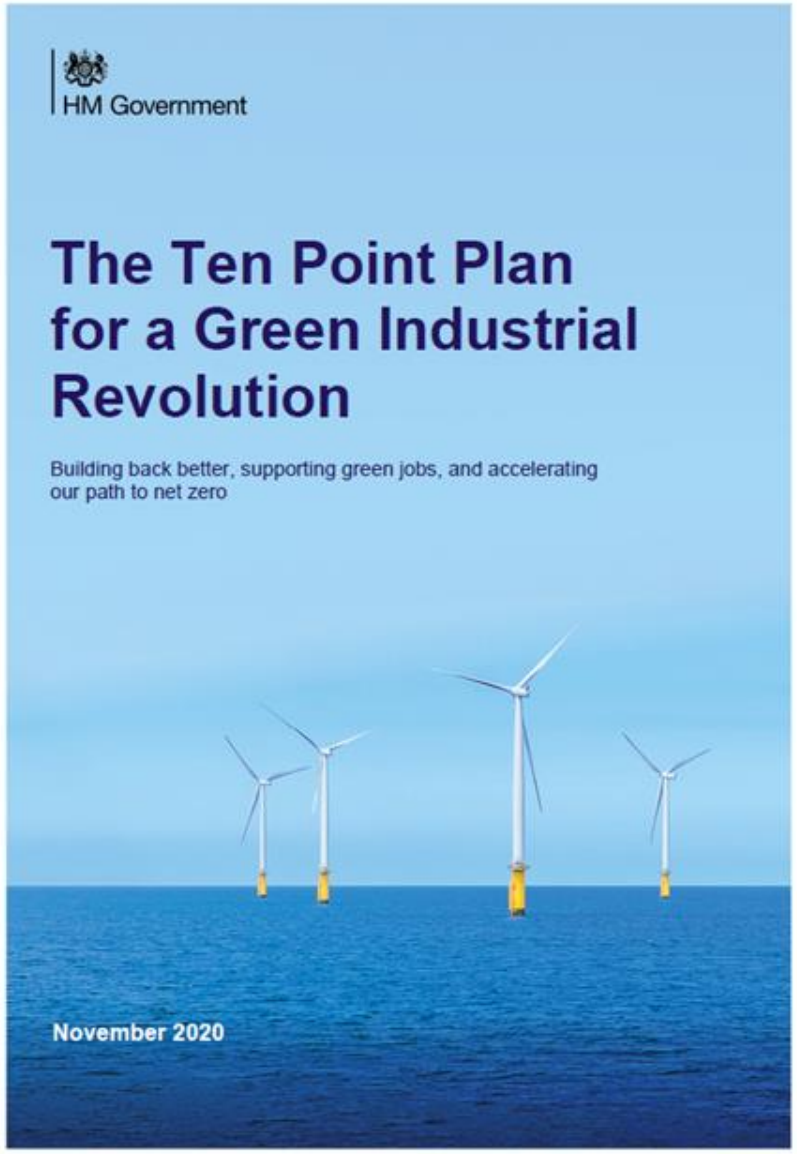
Scaling up flexibility and looking for new storage options

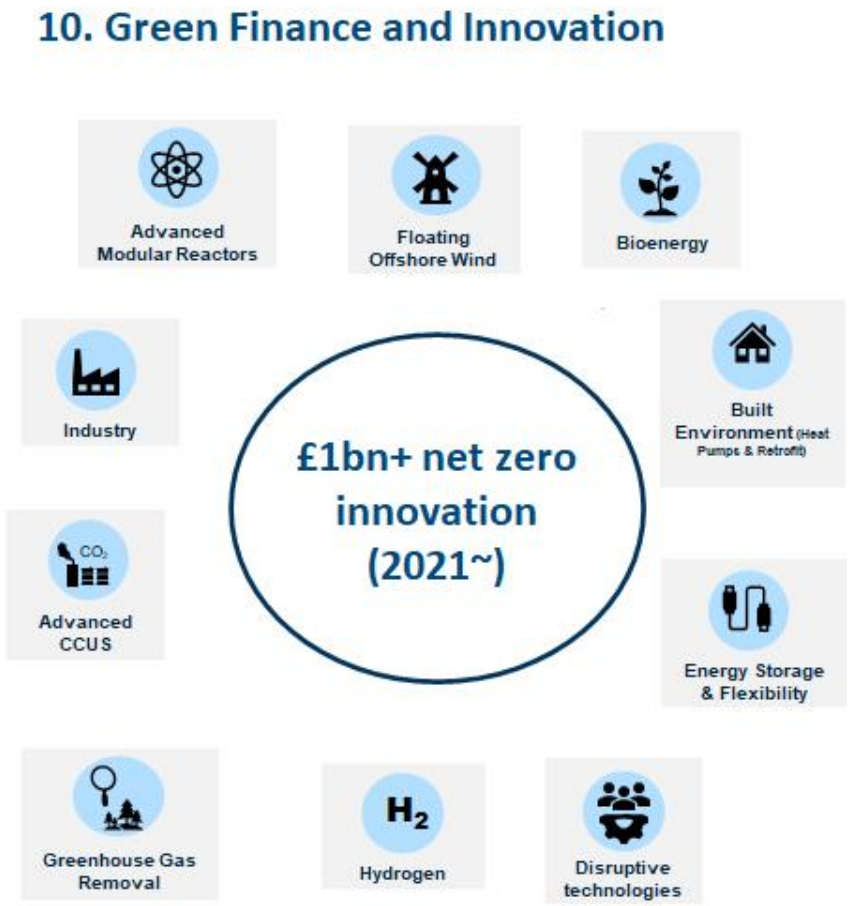
£50m Cross Cutting

Supporting disruptive innovations (particularly for SMEs), including using innovative finance.

Competition open for bids for the Energy Data Visibility Project (EDVP) Alpha Phase:
https://www.contractsfinder.service.gov.uk/Notice/613cd73f-9750-45e8-ac9a-9683702b4261
(closing 23rd March)

Net Zero Innovation Portfolio (NZIP)





"We will provide £100 million for Energy Storage and Flexibility innovation challenges – *essential technology as we move towards an increasingly renewables-heavy system to allow us to store energy over hours, days and even months."*

Alternative Energy Markets (AEM) Programme

In order to support cost-effective decarbonisation, over time we may want the policy and network charges that suppliers face (and pass on to consumers) to be recovered differently - in ways that better reflect the system costs that result from consumer energy choices.

This could involve making some charges more dynamic and time sensitive, which would allow suppliers to offer new types of tariffs, products or Services, and test how best to enable consumer engagement with demand side response. However, there are only a few meaningful routes now for testing such reforms in real-world environments before taking decisions.

We are **exploring options** for a scheme which would provide **a real-world testing environment for potential reforms to existing policy and network charges**, and/or the ways any new charges could be introduced.

We are currently in the **scoping stage**, looking at the charging regime for policy and network costs and considering questions of detailed design and viability of such a programme. We **plan to issue an Invitation to Tender in Q1/Q2 2021** for scoping work into these issues. We are keen that all with an interest have an opportunity to input into this thinking.

Further information will be provided in due course.

NZIP Energy Storage Programme – Longer Duration Storage Competition

"Through the Net Zero Innovation Portfolio, ***we will launch a major competition to accelerate the commercialisation of first-of-a-kind longer duration energy storage,*** *as part of our £100 million investment in storage and flexibility innovation, with delivery from spring 2021"*

ofgem
Making a positive difference for energy consumers

Department for Business, Energy & Industrial Strategy

NZIP Energy Storage Programme - Longer Duration Storage Competition

Why Energy Storage?

- Energy storage is expected to be one of the **key components in a smarter, more flexible energy system** which can maximise the use of **intermittent and distributed renewable generation**, provide essential **balancing services** and defer or avoid the need for costly network reinforcement to secure a lower-cost, low carbon and secure energy system for the future.

Why Longer Duration Storage?

- Longer duration storage (across days, weeks and months) **could help reduce the cost of meeting net zero** by storing excess low carbon generation for longer periods of time - helping to **manage variation in generation**, such as extended periods of low wind. This will **reduce the amount of fossil fuel** and low carbon generation that would otherwise be needed and **optimise the output from renewables** (rather than curtailing this output, i.e. paying to turn off generators when there is excess supply).

Why non-conventional?

- Lithium-ion batteries are important for **Electric Vehicles and short-term energy storage**. However, for longer-duration (days, weeks and months), other energy storage technologies (many 10s – 1000s MW) are expected to **provide the most cost-effective electricity storage** (in terms of levelised cost/MWh) in the longer term.
- Pumped Hydro Storage is out of scope as it is a **commercially mature technology** and has been **deployed across the UK**.

Plenary session on overarching programme

This session will be recorded through MS teams to aid the minutes. This will not be shared outside of the teams.

AOB, final words and round-up