

Department For International Trade (DIT)

Supporting the Development of UK Capability in Energy Storage

Phillip Nicholson MBE
DIT Electrical Networks Specialist

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HM Government





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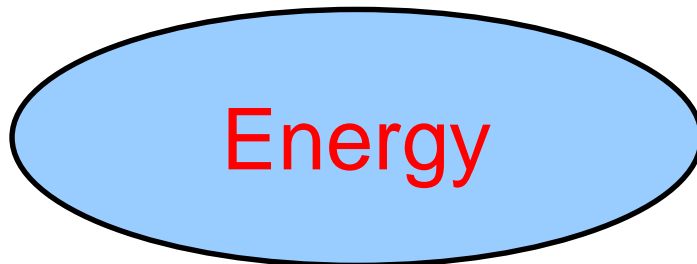
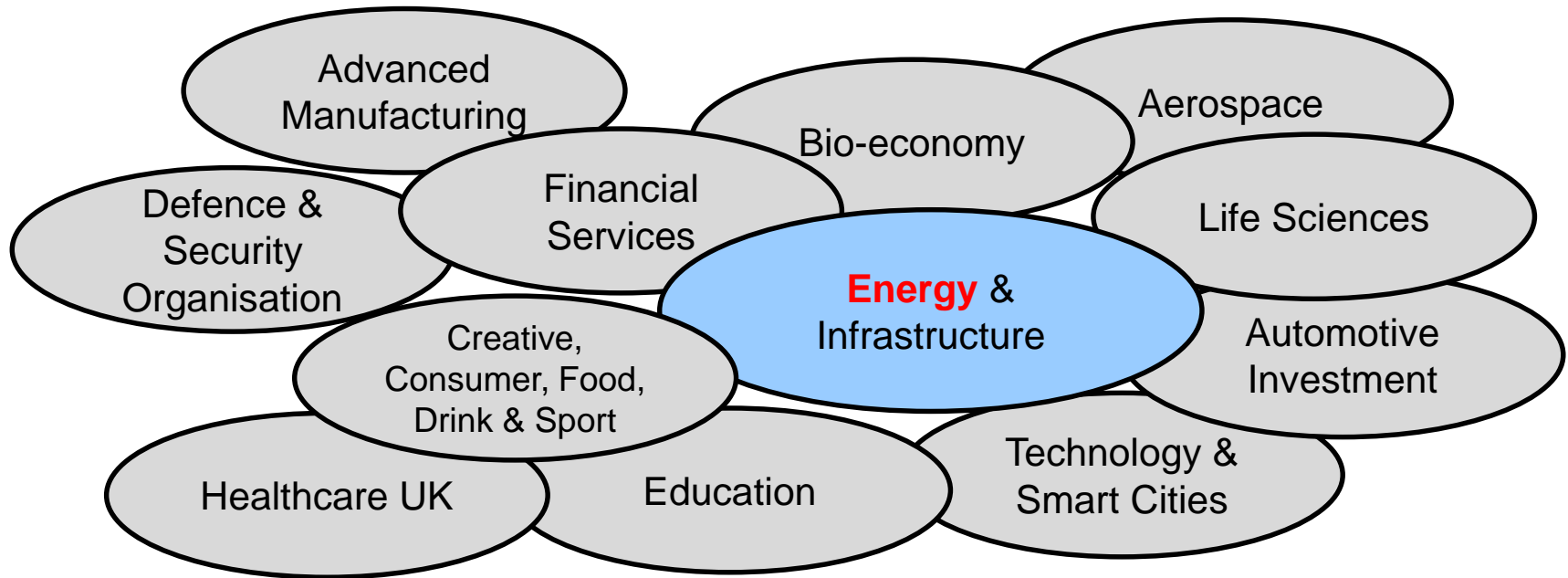
Agenda

- Introduction
- DIT Renewables Team
- Energy Storage & Flexibility
- Regulatory Implications
- A Structured Approach to UK Energy Transition
- Innovation Strategies
- Opportunities For UK Investment





Department For International Trade - Sectors



The Energy Sector is broken down into 3 parts: Oil and Gas, Civil Nuclear and the **Renewable Energy Team**. The Energy Sector interacts with other Government Departments, Trade Associations, Overseas Posts and Government and Non-Government Agencies to promote exports and inward investment in the Energy Sector



The Renewable Energy Team

The Team has responsibility for:

- Supporting increased Foreign Direct Investment (FDI) into the UK Renewable Energy Sector, as well as Outward Direct Investment (ODI) into foreign markets
- Supporting UK based companies, both home grown and already in the UK through investment, to export renewable energy goods and services internationally
- Supporting other Government Departments to understand the trade and investment implications of their domestic and international policy work

The Renewable Energy Team comprises a mixture of experienced Civil Servants and Industry Specialists

The Team was originally formed to focus on Off Shore Wind only, but at the beginning of 2017 it's scope was expanded to include other sub sectors:

- Offshore Wind
- Onshore Wind
- Energy from Waste
- Electrical Networks
- Energy Storage
- Hydro
- Solar
- Tidal Stream
- Geothermal
- Heat Networks

The DIT Renewables Team Works with UK & Overseas Companies

- There are 1,400 staff, working within 108 countries and there is a sector network of 300 people
- The UK based team works with the overseas teams to promote inward investment and provide support to UK companies with identifying opportunities in markets of interest
- This work includes identifying companies who express interest in working within the supply chain to support projects that incorporate storage into flexible solutions
- Supply chain capability development is very important as it helps to promote and bring together complimentary technologies
- Working with SME scale companies, support is provided by making and facilitating introductions, identifying potential opportunities and making sure that the companies are kept informed

An Introduction to **Energy** Storage Technologies

As storage becomes an integral asset to flexible systems, it is increasingly helping to improve system operability, reliability and resilience, whilst also helping to integrate generation sources and saving consumers money

There are a number of diverse technologies that can provide benefits to a grid system and each of these provide a range of storage benefits to support supply, operations and renewable integration

Typical Energy Storage System Categories:

- **Batteries** (a range of solutions, including advanced chemistry batteries, flow batteries and capacitors)
- **Thermal** (systems that capture heat and cold to create energy on demand or offset energy needs)
- **Mechanical** (e.g. systems that utilise gravitational energy)
- **Hydrogen** (excess electricity generation can be converted into hydrogen by electrolysis and stored)
- **Pumped Hydropower** (utilises large scale reservoirs of potential energy)

In order to fully embrace these technologies, they need to be incorporated into flexible systems

Flexible **Electricity** Systems

As the UK Electricity System becomes increasingly decentralised, the pattern of power production and consumption is changing and new types of flexibility are being developed to help manage these changes

Flexible systems require flexible solutions – these solutions are required on the supply side and the demand side


- Grid Balancing & Flexibility
 - Balancing Electricity Supply & Demand – (NGESO from 1st April 2019)
 - System Inertia & Balancing Services
- Supply Side Sources of Flexibility
 - Flexible Generation
 - Electricity Storage
 - Interconnectors
- Demand Side Sources of Flexibility
 - Flexible Residential Demand (DSR)
 - Flexible Demand & Electric Vehicles

Regulations need to change to ensure that flexible systems can be implemented

UK Onshore Electricity Transmission & Distribution Networks – Regulated Monopolies

Electricity Transmission

- 1  Scottish & Southern Electricity Networks
- 2  SP ENERGY NETWORKS
- 3  Northern regional Electricity Networks
- 4  nationalgrid

 nationalgrid ESO Electricity System Operator



Electricity Distribution

- 1  Scottish & Southern Electricity Networks
- 2  SP ENERGY NETWORKS
- 3  Northern regional Electricity Networks
- 4  Electricity Networks
- 5  Electricity Networks
- 6  NORTHERN POWERGRID
- 7  WESTERN POWER DISTRIBUTION
- 8  UK Power Networks
- 9  Scottish & Southern Electricity Networks
- 10  ESB NETWORKS

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Independent distribution network operators

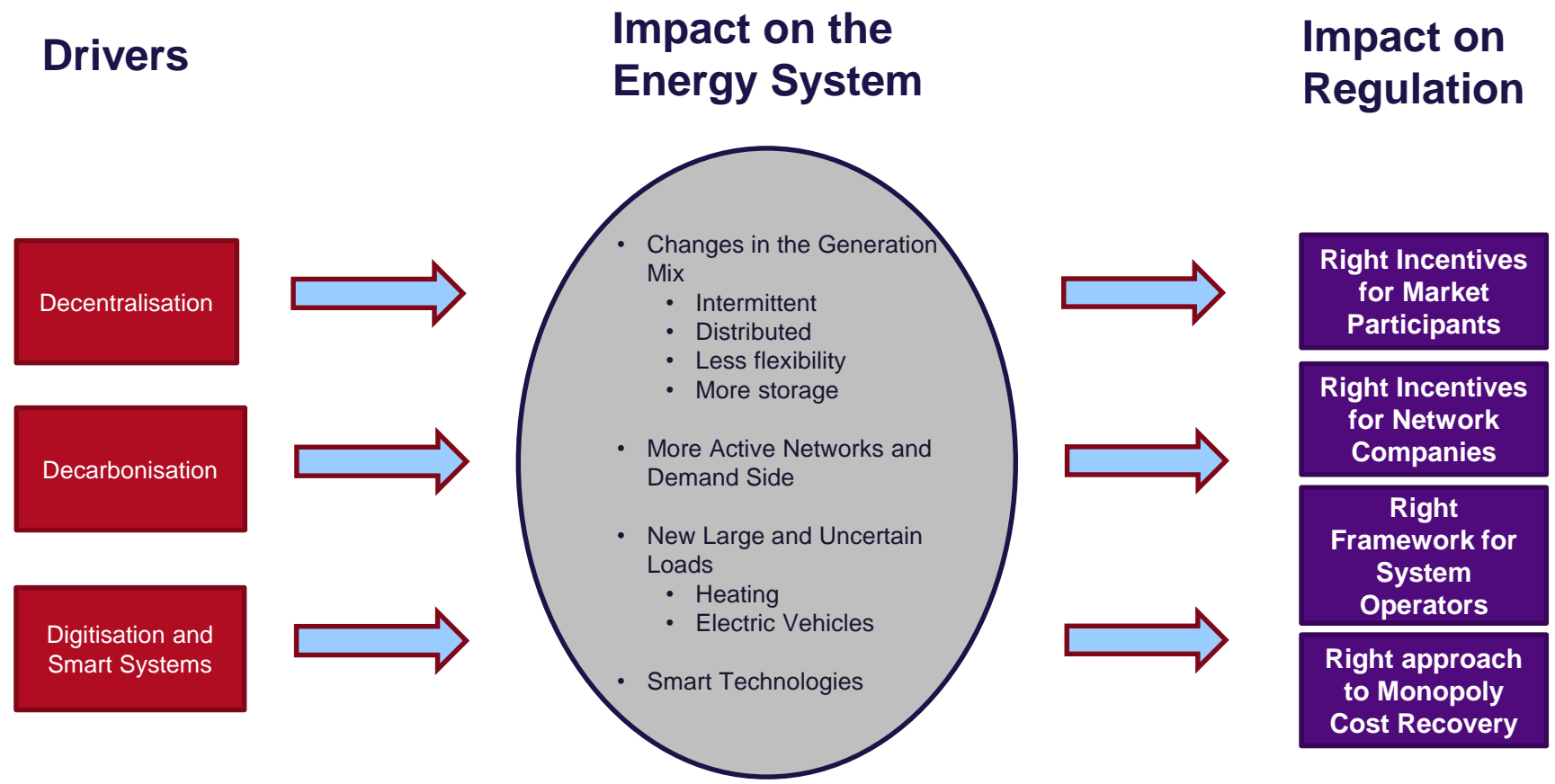


- 3 Transmission Owners (TOs): National Grid, SSE and Scottish Power
- 15,000km
- 6% of consumer bills
- National Grid ESO

- 6 Distribution Network Operators (DNOs) operate in 14 services areas
- 800,000km
- 18% of consumer bills
- 13 iDNOs



Changes in the System Require Changes in Regulation



In the UK there are a number of Government supported initiatives that are helping to facilitate an increase in flexibility in energy systems

RIIO (Revenue = Incentives + Innovation + Outputs) - A World Leader for Electricity Regulation

UK regulation is evolving through experience

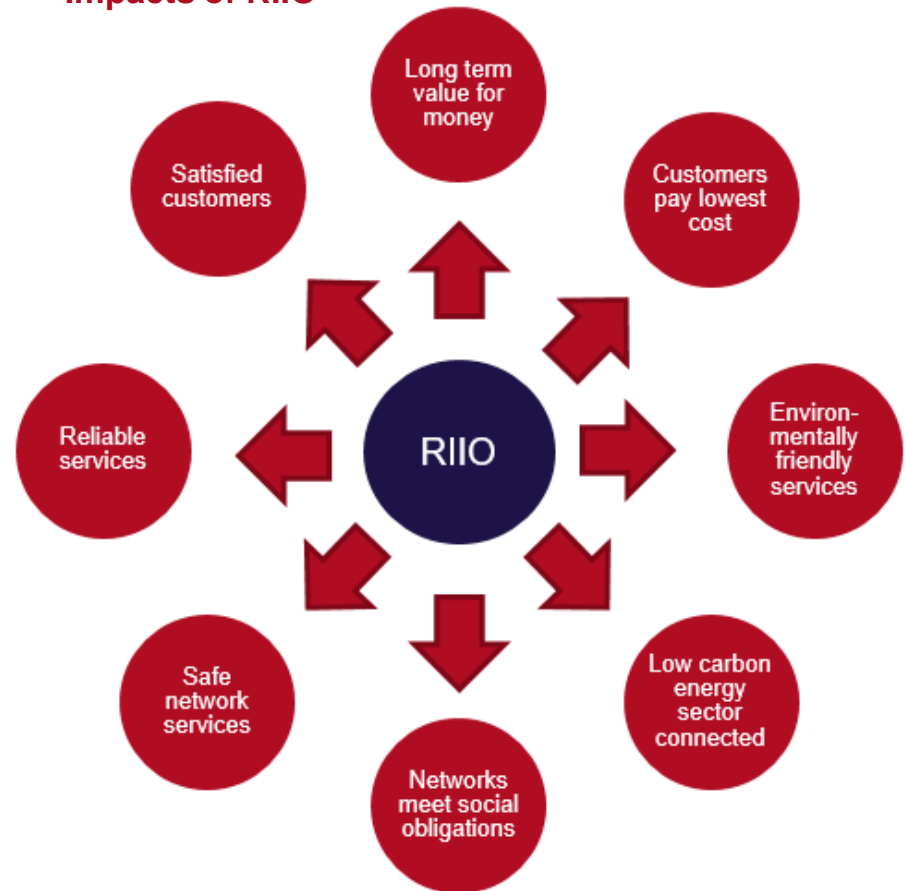
The UK was at the forefront of the transition to a market-based approach to electricity. While the regulatory regimes in the UK have evolved since they were first developed, many other jurisdictions with privatised infrastructure sectors have looked to the UK as an example of best practice. Therefore, regulation in the UK shares many characteristics with other jurisdictions while at the same time being the leading, mature market in terms of the tenor of the regimes

The overriding objective of this approach is to encourage electricity network companies to play a full role in the delivery of a sustainable energy sector, and to deliver long-term value for money to customers

Evidence to date suggests that RIIO has succeeded at incentivising network companies to better deliver outputs for customers. Analysis shows that high returns are, in part, a result of network companies improving their efficiency and their performance against output targets. Those are positives that reflect the ways in which the RIIO framework is working effectively

In 2021 a new round of price control will begin and Ofgem are developing a RIIO-2 Framework that will continue the policy of continuous learning to inform the regulatory environment in the UK

Impacts of RIIO





Publications that Underpin and Support UK Commitment to Energy Transition

The Industrial Strategy



Upgrading Our Energy System



Electricity Networks Innovation Strategies



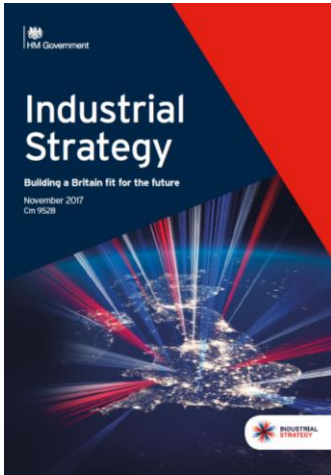
The Clean Growth Strategy





Publications that Underpin and Support UK Commitment to Energy Transition

The Industrial Strategy



Upgrading Our Energy System



Electricity Networks Innovation Strategies



The Clean Growth Strategy

Driving Clean, Smart, Flexible Power

*Invest up to **£265M** in smart systems to reduce the cost of electricity storage, advance innovative demand response technologies & develop new ways of balancing the grid*

Extract: Clean Growth Strategy





Publications that Underpin and Support UK Commitment to Energy Transition

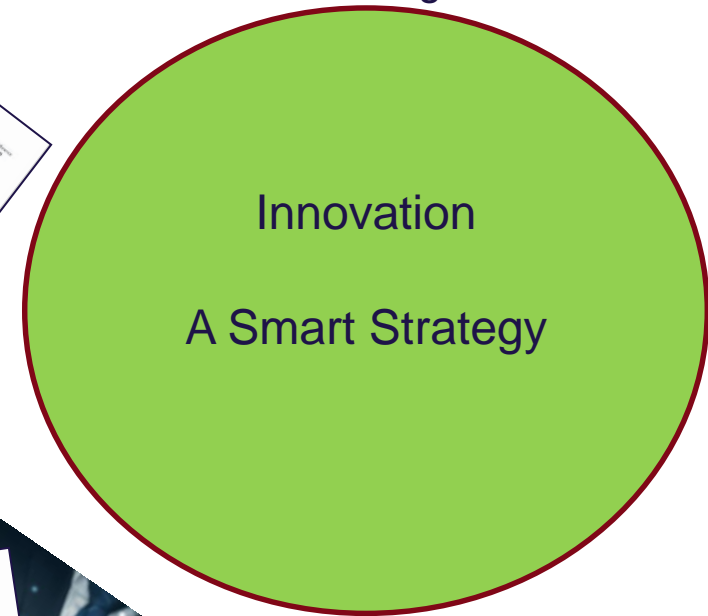
The Industrial Strategy



Upgrading Our Energy System



Electricity Networks Innovation Strategies



The Clean Growth Strategy

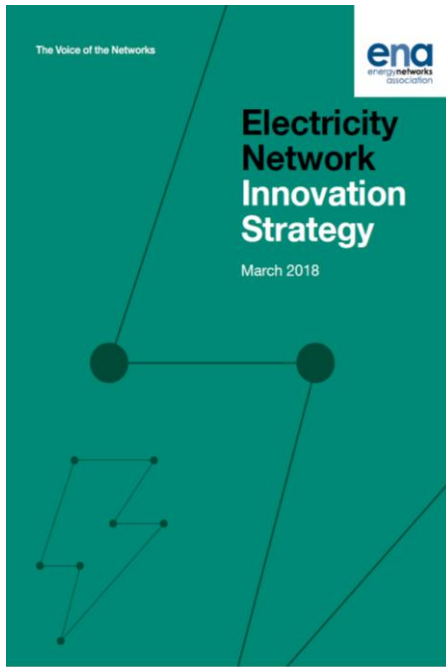


The Electricity Network Innovation Strategy

The objectives of the overall **Open Networks** Project are to:

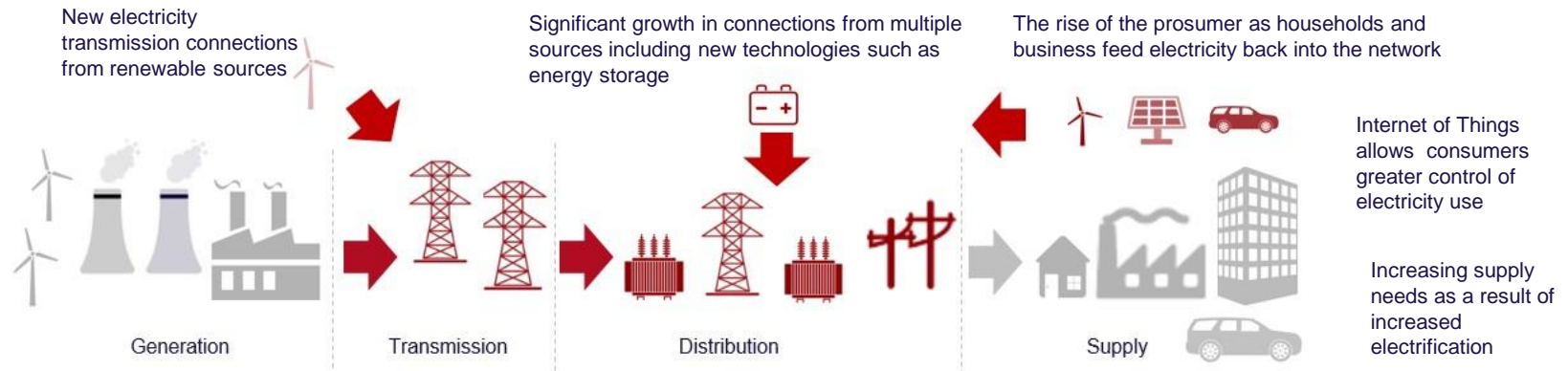
ENAs 'Open Networks' Project is a cross industry collaborative project

- Share information and work collaboratively across network operators, with Ofgem, BEIS and other stakeholders to progress the transition to DSO and improve outcomes for customers
- Maintain a leading position for network operators in the development of Open Networks
- Ensure that the customer is kept at the centre of any process development to ensure that their experience can be improved, we allow connecting customers to realise value from their technology and that our outputs deliver lower cost outcomes for all consumers and society
- Bring consistency in approaches across networks through existing and new processes to support the transition to DSO, interactions with each other and interactions with customers
- Enable data visibility and better access to non-confidential data across transmission and distribution and for customers
- Ensure conflicts of interest are proactively identified and appropriate measures are put in place to address them appropriately
- Take a whole electricity system approach to ensure that the value across the wider system is considered and widen this to consider a whole energy system approach
- Inform the regulatory debate around funding (including ET2 & ED2). These overall objectives underpin how we approach the development work in Open Networks and then we have further targeted objectives for each workstream



Opportunities in a changing network

How the network is changing



Government support for lower carbon energy has transformed the market and challenged how companies operate

- A less linear movement of electricity from generation to supply requires new approaches for managing markets
- The consumer is becoming even more important as technology gives them more control of both supply and demand
- Increasing digitalisation of the network requires control systems that are able to manage ever increasing complexity
- More devices connecting to the network has increased the demand for cybersecurity systems and services
- New business models are required to allow network operators to take advantage of changes in supply and technology
- Increased electrification of transport requires adaptations in existing connection infrastructure and offers new supply opportunities

Anyone who can provide solutions to these challenges, either through research, partnership or supply, is a potential investor in the UK electricity networks market

The UK has the potential to create a significant energy storage sector, and to export the knowledge and capabilities that will be generated to the global energy market



Growing commercial models for electricity storage

The Role of Energy Storage

Energy storage allows the shifting of energy delivery from a time when it is less valuable, to a time when it is more valuable either to the consumer or to the network. In general terms electricity storage provides three types of service:

- **Response** - the ability to respond quickly (milliseconds – minutes) to a signal (e.g. Enhanced Frequency Response)
- **Reserve** - storage of energy to be used at a time when it is required. From a simple back-up capability or providing the capacity at a larger scale
- **Price and time shift** - storing energy to be used at times of higher price/cost periods

An emerging domestic market

The domestic microgeneration and electricity storage model is a market with large growth potential in the UK. This is being driven by continued reduction of electricity storage costs, the introduction of smart meters and time of use tariffs

Suppliers or innovators who can further reduce storage costs or develop ways to exploit smart meter usage will have commercial opportunities in the UK

Commercial opportunities for larger scale storage

Key models for larger scale electricity storage installations include:

- The response service model has seen considerable commercial interest, especially with storage installations that can provide rapid response and delivered over a short time frame
- The Enhanced Frequency Response service tendered by National Grid is one example of this service. This is likely to be provided by a large electricity storage installation (10-20 MW power rating and 6-10 MWh energy capacity), situated on a brownfield site (e.g. an industrial estate)
- A 'behind the meter' electricity storage installation located with a high energy user, such as industrial manufacturers, data centres or hospitals. This model is based on using electricity storage to avoid higher energy consumption costs at peak periods. Price arbitrage and peak shaving are potential revenues for this type of electricity storage
- There is considerable interest from government in stimulating energy storage and in 2019 they committed £20m to support up to three demonstration projects with a target minimum output power of 30 MW or minimum capacity of 50 MWh

Source: Energy Networks Association: Electricity storage guide for communities and independent developers



Trade & Investment Opportunities For Electrical Networks & Storage

Supply Chain Opportunities for Electrical Networks & Storage	Potential Within The Supply Chain
Development & Project Management	Electrical Network Design & ‘Smart’ Whole System Planning
Hardware / Component Supply	Cables / Conductors / Substation Plant & Equipment / Protection & Control Hardware / Remote Control & Automation
Professional & Support Services including Consultancy	Regulatory Advice & Guidance / Network Analysis / Network Management / Network Operation / System Operation / Cyber Security / Specific Equipment Manufacture Training / Standards, Codes & Specifications / Specific Areas of Consultancy for ‘End to End’ Smart Solutions / Flexibility (Energy Storage , Demand Side Response, Aggregation etc.)
Installation & Commissioning	The connection of ‘Smart Networks’ Electrification Projects including retrofit of remote control & automation switchgear equipment
Balance of Plant – Installation Infrastructure	Substation Equipment / Energy Storage & Ancillary Equipment
Operation, Maintenance & Services	Commissioning, Inspection & Maintenance of Existing & New Infrastructure / Electrical Network System Monitoring & Evaluation / Substation Earthing - System Design & Integrity Monitoring / De-commissioning



Getting involved in electricity storage in the UK

Overview

As Distribution Network Operators (DNOs) transition into Distribution System Operators (DSOs) they will need to work much more closely and proactively with local electricity generators, high energy users and electricity storage providers. **This transition will itself create opportunities for electricity storage providers as DSO's procure additional flexibility and balancing services and create an important new market for electricity storage**

It is therefore essential that electricity storage providers and DNOs have a close working relationship and fully appreciate their mutual requirements, and their network impacts. Electricity storage is currently treated as generation under the licencing conditions of Electricity Act 1989. As such, DNOs treat an electricity storage application to get a connection to the network as generation

Future Energy Scenarios suggest total electricity storage capacity of 10GW by 2030 and up to 50GW by 2050

Applying for a network connection for storage

Electricity storage project applicants need to provide as much information to the DNO during the network connection application process as possible, particularly in relation to the mode of operation.

The application route and specifications for connecting to the network is dependent on the size of the connection required. This is determined by the total aggregated capacity of the project if for a new electricity storage project.

Before applying it is advised to contact the local DNO representative. Each DNO will have a number of local representatives that respond to connection applications and are well placed to advise on a potential electricity storage application.

A guide is available for investors looking to develop new electricity storage projects who want to know how to connect to the network. Click [HERE](#) for more details.

*Sources: Energy Networks Association: Electricity storage guide for communities and independent developers
National Grid (2018) Future Energy Scenarios*