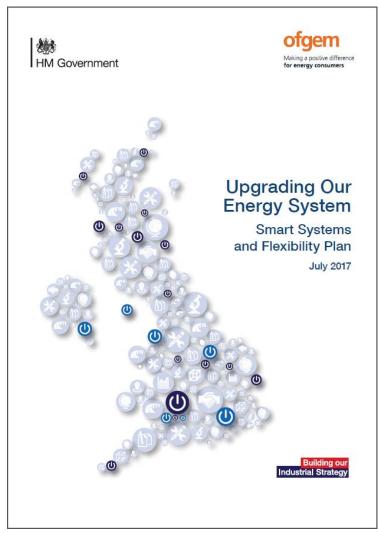
Whole System Approaches for Smart, Flexible Energy Systems

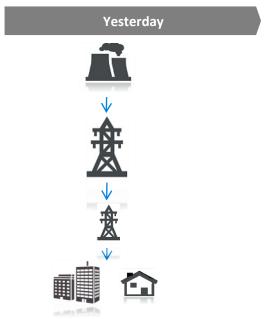
Dr Edward Nelson Senior Policy Advisor Smart Energy team, BEIS



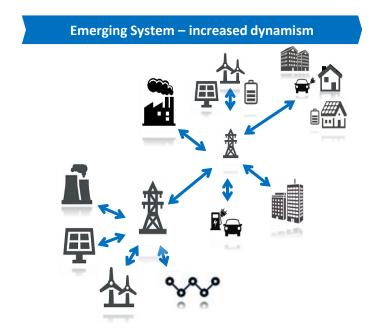




Our electricity system is undergoing fundamental change



- Carbon intensive
- Centralised generation
- Predictable supply to consumers



- Distributed
- Low carbon
- Interconnectors
- Storage & DSR
- Electric vehicles/heat
- Smart grids, IoT

Research by the Carbon Trust & Imperial College estimates the benefits of a smart, flexible energy system at **£17-40bn** to 2050.

Our vision

What is a smart, flexible energy system?

A smart energy system uses information technology to manage generation, storage and demand in a flexible, safe and coordinated way; making the system more secure, affordable and clean for consumers.

Our vision is that by 2025...

- All consumers benefit from participating in a smart energy system
- The value of flexibility is reflected within prices, markets and contracts
- New entrants, innovative technologies and disruptive business models can compete on a level playing field with incumbents
- Institutional and market frameworks deliver whole system benefits



Why is it of value to the GB energy system?

Reduce the costs of our future low carbon energy system, while ensuring system is secure and consumers are in control (£17-40bn cumulative savings for GB to 2050*)

Defer or avoid network investments

Cumulative savings to 2050 are primarily on the distribution network side, with £4-13bn in avoided distribution costs and £0.04-1.5bn in avoided transmission costs) comparing flexibility option scenarios with a noflex counterfactual*

Reduce overall back up capacity required

Cumulative savings to 2050 from capital costs are £14-19bn compared to a noflexibility counterfactual*, which reflects a reduced need for low carbon capacity (6-9GW) and peaking plants (3-29GW)

Reduce system operation costs (e.g. balancing)

Maximise the use of low carbon capacity

Cumulative savings to 2050 from avoided generation costs could be **£13-15bn** compared to a noflexibility counterfactual* by improving the utilisation of low-carbon (low marginal costs) generation and reducing reliance on peaking fossil fuel plants.

Consumers more in control, benefiting from a secure energy system, with lower bills

Energy consumers engaged (through intermediaries or directly). Increased participation in energy markets with competition benefits (new entrants and more engaged existing).

Source: Least regret flexibility project (2016)

*Cost savings in Least-regret flexibility project reflects the benefits of all flexibility options, i.e. not just storage and DSR but also interconnection and flexible CCGTs



Rapid technology change, new business & consumer opportunities

Lithium-ion battery costs have fallen by more than 50% since 2012.

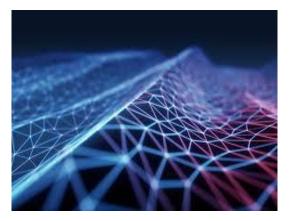




EV sector growing; charging hardware deploying, and can help manage grid demands with V2G

Smart meter roll out underway – more choice and control in the home





Aggregators working with market leaders to deliver / monetise demand response



Approach:

- Remove barriers and create a level playing field
- Ensure markets work for flexibility
- Support innovation

However:

- Cyber-security
- Consumer engagement and protection
- Changing relationship with technology

Removing barriers to smart technologies



Smart homes and businesses



Markets that work for flexibility



Deliver regulatory clarity and ensure fair charges to create a level playing field

- Define storage and ownership rules
- Deliver a storage licence
- Planning reform
- Recalibrate policy/ network charges
- Enable co-location with renewables

Enable greater demand response participation among domestic and nondomestic consumers

- Deliver smart meters
- Enable time of use pricing
- Appliance standards to enable automation & ensure cyber security

Ensure markets allow the best flexible solutions to emerge and compete fairly

- Improve access to markets (e.g. Balancing Mechanism & Ancillary Services)
- Enable value stacking from different markets
- Create new local markets for flexibility

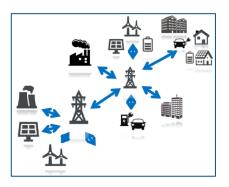


Whole systems thinking

- Industrial Strategy
- Clean Growth Strategy
- Decarbonisation of power, heat and transport
- Changing relationship with technology
- Multi vector (power, heat, transport)
- Generation, storage, consumption
- Decision making and optimisation of energy assets
- Price, markets and revenue
- Business models
- Data
- Scale, scalability and replicability
- Consumers (role, engagement and protection)
- Security of supply, and data





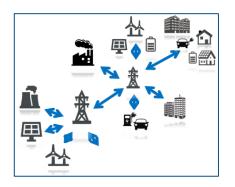


Prospering From the Energy Revolution

- Industrial Strategy Challenge Fund
- £102.5 million
- Focusing on the integration of electricity, heat and transport vectors
- Using smart and other technologies / business models
- Innovate UK Role to support businesses with innovation
- Careful of bias towards power (Whole Systems thinking)
 - Upfront analysis about energy challenge
 - Electricity, heat and transport
- Replicability
 - Be clear how to apply elsewhere/ scale up your project
- Huge consumer aspect to this
 - Multi disciplinary, multi stakeholder









Thank you for listening

