EPSRC
Engineering and Physical Sciences Research Council

Research Councils UK Energy For a Low Carbon Future

Energy Networks

Energy Infrastructure Planning

- Development of tools to analyse long term investment options for energy infrastructure
- Characterisation of value of smart technologies as enablers of efficient use of network infrastructure
- Report "Infrastructure in Low-carbon Energy System to 2030: Transmission and distribution", submitted to The Committee on Climate Change, January 2014

A team working in HubNet and Top & Tail Transformation has developed a Dynamic Transmission Investment Model (DTIM) which determines optimal network plans given data on the generation mix and demand (across the regions of Europe and for each half-hourly period across multiple years) and data on the cost of transmission assets, storage, demand-side action and cost of interruptions. The tool can be used to identify the difference in network investment needed with and without certain technologies present. A good example of this is to examine the network infrastructure investment and generation mix for networks with more or less flexibility present in the form of energy storage and or demand response.

The model has also been used to examine the advantages and disadvantages of various development strategies for an offshore grid in the North Sea. Broadly, the comparison is between strategically planned network developments versus incremental building of links on a case-by-case basis. This is a critical issue because more than 30% of the cost of offshore wind is associated with the network infrastructure. Also, this work demonstrated potentially significant interaction between offshore grid and interconnection among North Sea countries and assessed the benefits of offshore grid taking the role of interconnection.

The model has been further refined and adapted to examine the role and value of energy storage (through the project on Energy Storage of Low Carbon Grids EP/K002252/1) and for whole-system energy models (WholeSEM, EP/K039326/1)

Case Study: National Infrastructure Commission

A team was commissioned to write a report "Delivering future-proof energy infrastructure" for the National Infrastructure Commission. The team comprised Prof Strbac (HubNet), his team, Prof R Green (Top and Tail) and Prof Pollitt. The report drew together evidence from a number of previous reports and studies, each in turn had used the DTIM model to examine the value of smartgrid technologies, notably energy storage, demand response and international interconnection. Overall conclusions were drawn on the investment required to create a secure low-carbon electricity system in 2030 using smart technologies and using traditional means to provide secure supply of energy and assuming a pathway toward 2050 carbon targets.

The NIC reported its findings and used the Imperial-led report to substantiate its main finding that consumers could save up to £8 billion per year in 2030 from the network component of the energy bills being lower than otherwise if smart technologies are used. The NIC also identifies, based on our evidence, that the UK needs to solve issues of high penetration within the boundaries of its island system before the larger systems in Europe and thus "the UK is uniquely placed to lead the world in a smart power revolution. Failing to take advantage would be an expensive mistake."

> A Smart Power revolution across our energy sector – principally built around three innovations, Interconnection, Storage, and Demand Flexibility – could save consumers up to £8 billion a year by 2030, help the UK meet its 2050 carbon targets, and secure the UK's energy supply for generations
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> Press statement from Lord Andrew Adonis

Achievements:

- Been influential in framing the debate on the role of smart technologies in transforming our energy networks evidence to NIC.
- Identified cost savings to consumers from alternative approaches to network design and investment while still meeting carbon targets and securing supply
- dentified the opportunity to create a leading knowledge business in the smart power sector for the UK
- Verified operation of new control scheme in a laboratory-scale test-rig including ride-through of DC-side short-circuits

EPSRC Outcomes Focus:

This case study delivers impact with industry in the form of a new product design that contributes to the following outcomes: R1, R2, C2, P2 andP4

- Resilient
- Connected
- Productive
- Healthy

Academic partners:
Imperial College London, University of Cambridge

The Supergen Programme, part of the Research Councils UK Energy Programme, led by the Engineering and Physical Sciences Research Council (EPSRC), aims to contribute to the UK's environmental emissions targets through a radical improvement in the sustainability of the UK's power generation and supply.

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