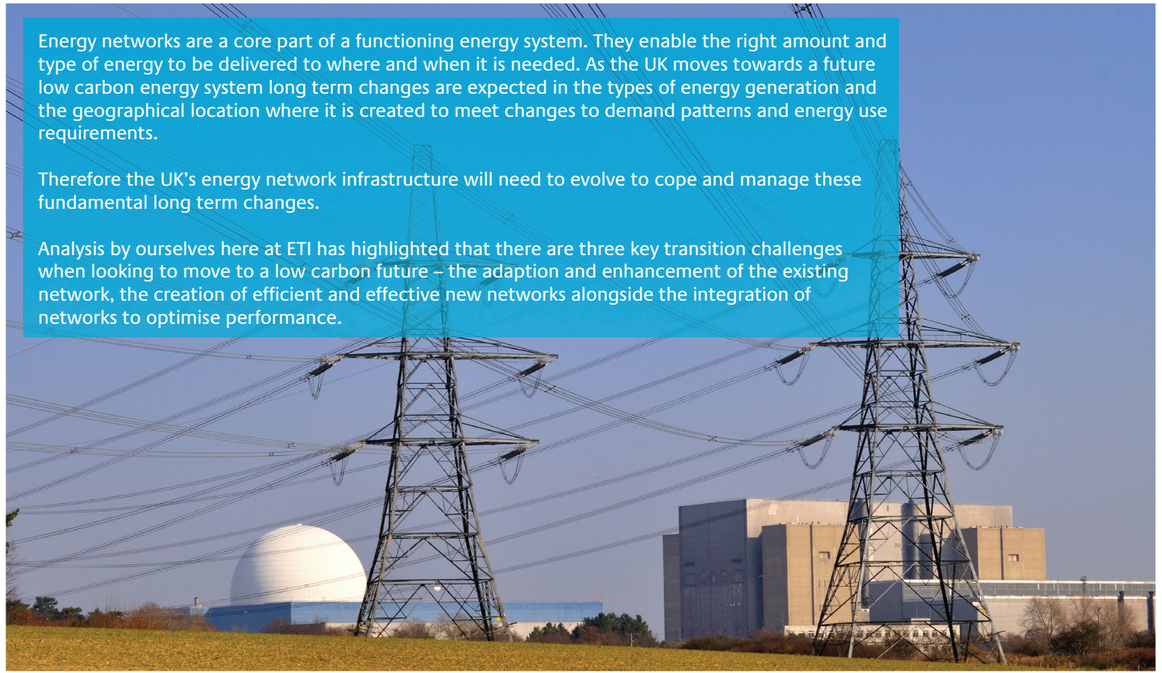
energy technologies institute

An ETI Perspective

Low carbon transition challenges for UK energy networks

ETI10 TEN YEARS OF INNOVATION 2007 – 2017

A LOW CARBON TRANSITION



Energy networks are a core part of a functioning energy system. They enable the right amount and type of energy to be delivered to where and when it is needed. As the UK moves towards a future low carbon energy system long term changes are expected in the types of energy generation and the geographical location where it is created to meet changes to demand patterns and energy use requirements.

Therefore the UK's energy network infrastructure will need to evolve to cope and manage these fundamental long term changes.

Analysis by ourselves here at ETI has highlighted that there are three key transition challenges when looking to move to a low carbon future – the adaption and enhancement of the existing network, the creation of efficient and effective new networks alongside the integration of networks to optimise performance.

WHAT ARE THE CHALLENGES?

For each network there are specific challenges and questions that need to be met and overcome:

- Electricity – there is the question of how networks can handle increased capacity, deliver new connections and balance supply and demand?
- Gas – how do you decommission the network (especially within the distribution network) how can the network operate at much lower utilisation levels and how can low carbon fuels be integrated at significant levels?
- Heat – how do you reduce cost and advance technology, how can the UK supply chain scale up to deliver increased low carbon heat demand and how can adoption of heat networks be increased to provide cost-effective operation?
- Hydrogen – how does this fuel play an increasing role in meeting the needs of different sectors and again how do you scale up the industry to meet new levels of demand?

Existing UK energy networks have evolved over time but they were largely engineered to address a different set of operational challenges to those that the country now faces. Operationally we are already seeing a greater electrification of UK energy and an increase in the country's renewable generation capacity, and most forecasts show this is likely to continue to increase. Therefore in the future the mix of energy sources and their generation location throughout the UK will change dramatically.

Our present networks were also built under different funding models. Mainly public funding. But over the years a number of these assets have transferred to private ownership. This brings with it complications for any large scale coordinated change to the networks. The current investment models are focussed on getting the best return on the existing assets, they are not targeted on delivering significant adaption or transformation. Existing regulation – because of the merits of competition measures in specific markets – also limits coordinating activity that might otherwise deliver wider energy system benefits.

A WHOLE SYSTEM APPROACH

ETI's argument for the transition of UK energy networks is that whole energy system thinking is critical. There is a need to view this as a challenge of knowing where, when and how to enhance and adapt the UK's energy networks to deliver benefits across the energy system for consumers and stakeholders.

Choices have to be made about which networks to build, develop, maintain and decommission alongside when and where to do so. As part of this process, the impact of any such decisions should be analysed across the system as a whole, not just for individual networks in isolation. However, because of their complexity networks cannot be easily moved or changed – they take decades to be established – so any major infrastructure decisions taken need to be right for the long term. Additional pressures come from having to identify and invest ahead of need, because any changes to networks cannot be implemented quickly.

The ETI sees real future value in networks working together in a more coordinated manner. This would mean a change in approach to service provision from today, but energy system analysis (from a number of sources) indicates that greater interaction between parts of the energy system could emerge and that this would result in increased efficiency, performance and subsequent lower investment costs. Therefore we would argue that there is a need to develop a greater understanding of the opportunity for, and the implications of moving towards integrating network operations so informed decisions can be taken on the benefits to the wider energy system of such action in practice.

We see that there are multiple instances where, in the future increased integration between networks could yield benefits for the UK because interdependencies could arise in terms of how our networks are developed and also how they are operated.

It is clear that any change has to be measured and understanding the value of such approaches will come from quantifying the scale of benefits they can offer, understanding the wider technical and operational implications upon each network and identifying the barriers to integration and developing the solutions to overcome these barriers.

WHAT IS IN STORE FOR THE FUTURE?

It goes without saying that energy networks are a vital part of the energy system. Whilst most of the focus of debate today is centred on generation options, it is critical that over the next decade the country makes decisions on the three areas of which existing networks to enhance or adapt, which new networks to create and examines robustly how new and existing networks can be integrated to optimise their performance and operation for the benefit of the whole energy system.

Decision makers will need to consider factors such as changes in how energy can and will be generated and consumed, the ability of different networks to meet needs both individually and in unison, the design of transition pathways for generation, demand and the networks that would eventually link them together with identifying the network lifecycle and investment opportunities.

Against this backdrop, making robust choices is important as networks can take years or even decades to build and once they are built, they cannot be easily moved or changed. This is why we believe systems thinking is critical and has to happen across the many vectors up and down the energy supply chain.

From such activity you should be well placed to inform decisions that are based upon well evidenced data and analysis. And that makes the next decade critical to develop the evidence – through ongoing research and technology demonstrations which increase in scale – to provide confidence and address the three challenges we highlighted earlier.

FURTHER READING

UK network transition challenges - A systems view

http://www.eti.co.uk/insights/uk-network-transition-challenges-a-system-view

UK network transition challenges - Electricity

http://www.eti.co.uk/insights/uk-network-transition-challenges-electricity

UK network transition challenges - Gas

http://www.eti.co.uk/insights/uk-network-transition-challenges-gas

UK network transition challenges - Heat

http://www.eti.co.uk/insights/network-transition-challenges-heat

UK network transition challenges - Hydrogen

http://www.eti.co.uk/insights/network-transition-challenges-hydrogen

Options Choices Actions - UK scenarios for a low carbon energy system

http://www.eti.co.uk/insights/options-choices-actions-uk-scenarios-for-a-low-carbon-energy-system

energy technologies institute

An ETI Perspective

01509 202020

www.eti.co.uk

info@eti.co.uk

@the_ETI