Institution of Civil Engineers (ICE) written submission to the Energy and Climate Change Select Committee: Low carbon network infrastructure

It is noted this inquiry relates to electricity network infrastructure. However, ICE believes it is important the electricity network is not approached in isolation from the rest of the low carbon electricity infrastructure.

Energy should be considered in its totality, not simply focusing on electricity. For example, both demand side and forms of energy sources such as gas and petroleum – all of which are inter-dependent – also need to be decarbonised. Consumers can achieve major savings by reducing demand through better insulated buildings, smart technologies and changes in energy consumption.

- **What are the limitations of today's electricity infrastructure and how can these limitations be addressed?**

A key limitation with electricity infrastructure is that it is set up to transmit power from a small number of large generators to demand centers. While the infrastructure generally works well at present, with more distributed generation in the form or renewables and increasing demand (from the electrification of heat and transport, for example), balancing and maintaining the system will become increasingly complex. These limitations are likely to manifest at the distribution level.

There are several potential ways to address these limitations:

- Deployment of electricity storage across networks
- Greater use of demand side management
- Further installation of interconnectors
- Line upgrades.

They key point is not to look at individual technologies or responses in isolation but rather consider the electricity system as a whole. As such, there is a need for systems engineering and a 'system architect' to ensure integration of design, implementation and operation of energy networks to address the energy trilemma[1]

- **What will a low carbon network look like, what are the challenges for Government and other bodies in achieving it, and what benefits (environmental, financial or otherwise) will it bring to the UK?**

A low carbon network is not an end in itself - it is part of the infrastructure that allows customers to enjoy their appliances while limiting environmental impacts. However, it has

[1] See IET (2013) 'Handling a Shock to the System' for more detail.

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key features that contribute to the security of supplies of energy and is likely to be hugely important for decades to come.

There is significant historic investment in network assets and they are long lived. A substantial portion of the electricity networks that exist now will still be in service in 2050 and beyond. This means that a low carbon network will be similar to our current network.

To achieve a low carbon network, it is not just about the transmission or distribution infrastructure being low carbon in its own right. It is also about being able to enable / accommodate low carbon and widely dispersed sources of generation on the system. This will require smart systems for consumption, generation and network management.

The main challenges for Government and other bodies who will be delivering future networks is that there remains a lot of uncertainty around what that low carbon future looks like. For example, changes to the current prevalence of centralised generation, amount of new distributed, intermittent and required storage capacity at both transmission and distribution levels. The planning for future network infrastructure development needs to accommodate this uncertainty.

The transition to a secure, affordable and low carbon future is feasible but requires a clear vision from Government and policy makers, with cross-party support to maintain the necessary policy stability.

- **How can we ensure that a low carbon network is designed and operated fairly and in a way that helps to minimise consumer bills?**

Government and regulators pursue a policy of cost-reflective pricing, but this is rarely applied properly. There is a tendency in the UK for network costs to be spread either across all users of the network or across all citizens. Most customers pay a flat rate use of system charge, and costs of long lived assets are not necessarily shared equitably between yesterday's, today's and tomorrow's customers.

Economic regulators continually grapple with these challenges, making cost allocation as fair as possible, including considering the needs of vulnerable customers. The political, economic and efficiency challenges of network charging require continued strong, independent regulation to ensure appropriate charging structures. Significant costs for new uses of the network are sometimes cited as "unfair", when in fact they are economic and unsubsidised.

- **How can we ensure that grid connections are readily accessible across the country and that costs are fair?**

Strong economic regulation needs clear policy guidance on assumptions about future network needs, including grid connections. Historically, the approach has been reactive. There has been a presumption against strategic investment, such as grid reinforcement

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unless there is an immediate need to facilitate greater supply or demand. However, future needs are often driven by Government policy and there have been significant gaps in the ability of regulated network companies and regulators to anticipate policy shifts.

Regulatory arrangements recognise the necessity for strategic investment to allow accessible grid connections, although the burden of proof is generally placed too much on the network companies, who often can only guess at future effects of public policy on networks. For example, the rapid growth in solar PV is placing significant stress on parts of the transmission and distribution systems. Greater stability and predictability of policy would help network operators plan future development.

- **What are the key technologies available today and how effectively do Government and Ofgem incentivise innovation and development of the grid and grid technologies?**

ICE considers electricity storage to be a key technology for the development of electricity networks to manage the transition to a low carbon economy. It has a range of benefits throughout the electricity system, from small-scale renewable generators to the system operator. Electricity storage can help:

- Meet renewables and emissions targets
- Ease the tightening of capacity margins
- Manage increasing peak demand and the intermittency of renewables
- Extend aging infrastructure and tem increasing costs.

Ofgem expects companies to realise around £900 million of benefits to consumers over the period as a result of their innovation stimulus such as the Low Carbon Network Fund (LCNF). The LCNF ran from 2010-2015 and included investment in storage facilities such as UK Power Networks facility Li-ion battery at Leighton Buzzard.

The LCNF has been replaced with the annual Electricity Network Innovation Competition for 'innovation projects which help all network operators understand what they need to do to provide environmental benefits, cost reductions and security of supply'. Up to £81m per annum is available, however, the 2015 competition did not help fund any further storage development.

ICE believes storage's important role should be recognised and encouraged through a clear system of support and by removing of regulatory barriers to its further deployment.

We would encourage the Committee to consider our recent report, 'Electricity storage: Realising the Potential' in order to explore this issue further.

- **What impact will changes to the electricity system – including distributed energy generation/storage, demand response and interconnection – have on the role of**

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National Grid and the Distribution Network Operators? (e.g. in terms of ownership structures, responsibility for system balancing and system security)

The structure of the industry should be kept under review. The GB industry has a fragmented supply chain (generators, transmission, distribution, suppliers, aggregators, meter operators, data collectors etc.). There is a need to ensure regulated competition that distinguishes between cost and cost-effectiveness (i.e. what can be achieved for the price). This will assist the development of supporting capabilities: the efficient delivery of energy infrastructure will require a cost-effective supply chain and skilled workforce.

Managing the connection of an ever-increasing share of distributed generation combined with the electrification of heat and transport, plus increasing numbers of customers actively taking part in the market will be a challenge, particularly for DNOs. With multiple, intermittent generation sources, more active demand side management and interconnector flows, networks will no longer be just from transmission to customers, but rather multifaceted networks with two-way flows.

DNOs will feel pressure to operate new services, such as storage and ancillary services, to actively manage their networks. However, at present DNOs' (and the Transmission System Operator's) licences prevent them from operating generation in the market and, therefore, they cannot control storage facilities, nor participate in demand side management or smart metering.

There is a strong case to examine the licensing of regulated activities with a view to freeing up this red tape to reflect the changing nature of maintaining balance in the system.

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