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Information Paper

Flexible electrical networks for a low carbon future

Network and built environment opportunities for enabling smarter networks

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This Information Paper provides an introduction to the concept of flexible electrical networks. It provides an overview of technical solutions that can be applied (by network and building designers, owners and operators), at either the network or built environment level, to increase flexibility in the energy system and assist the UK's transition to a low carbon future.

It will be of particular interest to network and building designers, owners and operators. The techniques presented include recently trialled Distribution Network Operator (DNO)-led smart grid solutions that focus on increasing and enhancing the capability of existing network infrastructure in constrained areas.

The Information Paper also highlights built environment energy-efficiency opportunities that building designers, owners and operators can consider in order to save energy and reduce peak demand, while supporting wider network flexibility and efficiency.

Opportunities for flexibility exist across the energy system

1 Introduction

The Department of Energy and Climate Change (DECC) report *Towards a smart energy system*[1] highlighted a number of challenges facing the UK's energy system. It states: 'most trajectories of energy demand and supply to 2050 anticipate significant new system challenges as we incorporate more low carbon generation, and meet increases in peak demand (typically 16:00 to 20:00 on winter weekdays), driven largely by the extent to which transport and heating become increasingly electrified'[1]. The report highlights that under a range of future scenarios, peak demand is forecast to increase, and in some scenarios these increases could be very significant. In order to meet the increases in demand, DECC suggests that a large increase in low carbon generation is needed as well as a smart energy system that incorporates new forms of flexibility, smarter networks, energy storage, demand side response and increased interconnectivity. The report also highlighted that it may also involve a focus on energy-efficiency improvements which target peak demand.

It is anticipated that distribution networks will be required to connect and manage increasing levels of demand from electric vehicles, heat pumps and general load increases. The distribution networks will also need to manage increased distributed generation (eg large scale renewables) and other embedded generation (eg microgeneration at the built environment level). This growth of low carbon technology on the electrical network is widely expected to be rapid, in order to achieve ambitious climate change mitigation objectives. It is also expected to be localised, eg focussed on major centres of population or by geographical areas offering significant potential for distributed generation. As a result, DNOs are expected to have limited forward visibility to enable them to plan and implement network upgrades. This introduces a risk that the rate of change within some parts of the network may exceed the capability of DNOs to respond with traditional solutions. In addition, complexities associated with demand and generation profiles for low carbon technology have the potential