Developing flexibility as the new cornerstone of the UK grid

Multiple forces are driving the transition to a low-carbon energy future across Europe. These include political, consumer and economic pressures to reduce air pollution in cities, address climate change and above all exponential reductions in the cost of renewable energy and battery storage.

According to Bloomberg New Energy Finance (BNEF)'s respected 'New Energy Outlook' modelling, more than half the total electrical energy supplied to grids in large European economies will come from variable renewables by 2030. On the demand side, an equally seismic change is coming with the mass adoption of electric vehicles (EVs) and electrification of heat.

The main challenges of the energy transition:

- **Energy mix and grid flexibility requirements:** Planning must start now for how to manage seasonal gaps with economic, low carbon solutions when there is not enough wind and solar power to meet peak demand. This change in how we generate the bulk of electricity from fossil fuel to renewable sources will create significant economic, technological and policy challenges for the energy industry and governments.

- **EV charging infrastructure:** As EV concentration increases, charging infrastructure deployment runs into existing grid limitations in the shape of sub-stations, transformers and cables sizing, as it has been doing in Norway in recent years. Being able to time EV charging according to the energy system requirements will significantly lower the system costs by avoiding grid upgrades and providing flexibility to absorb variable renewables cost-effectively.

- **The need for longer-term backup capacity:** A large increase of demand-response, storage and smart charging of EVs can substantially mitigate intermittency issues in a high renewables energy system. However, it cannot completely address it – there will still be weeks and months of low variable renewables (solar and wind) production that require long-term backup capacity. A zero-carbon scenario would require lower carbon substitutes for fossil fuels given doubts about the cost and viability of nuclear power and the need to retain dispatchable on-demand power sources for long periods as well as light-weight, dense energy sources for specific use cases.

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Outdated grid regulation slowing the UK's energy transition

Policies that provide regulatory certainty are urgently needed to spur private investment in the flexibility technologies required to ease the transition to a high-renewable energy future.

The following are the most important deficiencies where regulatory action could make the biggest immediate positive impact. Many of the related recommendations are based on the experience of the Nordic markets, which are the most advanced in Europe in terms of regulation and government policy that encourages private investment in smart, flexible energy systems.

- **Weak or non-existent flexibility markets:** Deep and liquid flexibility markets are an essential prerequisite to provide investors certainty on long-term cash flows. Where they exist today in Europe, they often provide only short-term visibility on possible cash-flows for flexibility assets. Reform is needed to provide predictable, long-term cash flows, for example via a combination of multi-annual contracts and annual auctions guaranteed to run for several years.

- **Unequal access to ancillary services and capacity markets:** Increasingly, electricity will be provided and managed by a range of technologies, including decentralised wind and solar power, batteries and smart EV chargers, working alongside centralised power plants. All these resources should compete on a level playing field, including in balancing markets. Current grid regulation in the UK favours centralised generation assets, through connection, testing and metering provisions, availability requirements, capacity payment haircuts for storage assets and other administrative costs and minimum size thresholds. These hurdles penalise aggregators of small, distributed assets and make it difficult for all flexibility technologies to compete evenly.

- **Need for smart and bi-directional EV chargers:** Smart EV chargers will be essential to integrate variable renewables by shifting peak demand to times of peak supply. Smart charging would also lower the system cost of adding EVs, for example by avoiding the need for local grid upgrades, and new-build generation capacity to meet higher EV-related electricity demand. The latest EU charging rules focus on the numbers of chargers, rather than their flexibility - there is no requirement to make EV charging "smart", or to install V2G. As a result, in the UK, only a handful of either smart or V2G chargers exists. In the case of V2G chargers, there is also limited EV compatibility today.

- **Need for smart meters and dynamic consumer pricing:** Dynamic tariffs offer financial incentives for consumers to change behaviour, for example to shift to off-peak demand periods in response to market price signals. In Nordic countries, there is already near-universal, national rollout of digital meters. In Britain, dynamic pricing is now becoming available due to the target for universal roll-out by 2020. For example, Octopus Energy has introduced an "agile tariff" which tracks wholesale power prices and advises customers 24 hours in advance of low-cost periods.