



Customer-Led Distribution System project

Update on project learning (2019)

The UK's decarbonisation commitments require a growth of renewable generation and the electrification of heat and transport which in turn requires a smarter more flexible energy system to deliver the low carbon transition cost-effectively without compromising the security of supply.

Future distribution system operators (DSOs) will play a key part in enabling customers' distributed energy resources (DERs) such as distributed generation, energy storage and flexible load, such as electric vehicles, into highly valuable assets that could radically increase local energy system flexibility. By fully utilising the local power networks we can operate a more flexible energy system and avoid unnecessary infrastructure investment in either networks or generation.

About the project

The future role of the DSO is the subject of much investigation and debate, which has been focussed largely on network services provided by DERs to address network congestion and constraints, and on the interactions between the electricity transmission system and the distribution system¹.

With this project, we approach the future of the distribution system with a bottom-up customer-led approach by extending the DSO debate from vertical services (between DERs and the system) to horizontal local energy markets (between DERs). We investigate, the radical changes needed in the system, its players and markets to facilitate and propel the growth of DERs in a subsidy-free environment, with a focus on local energy markets and specifically on the interactions between markets for energy, markets for network services, network operation and network planning.

We have identified the potential value of DERs²

Local energy markets incentivise customers with flexible load to follow and buy locally produced renewable energy. Owners and users of DERs can get significantly more value from their assets by participating in local energy markets compared to providing services only to the distribution network. The benefits to DERs from participating in local energy markets are between 20 and 63 times greater than the benefits from participating in the network services market, dependent on the network conditions e.g. whether the networks are dominated by domestic or commercial load and whether they are lightly or heavily loaded. The benefits to DER owners and users from local energy markets are estimated to be of the order of £90bn during the period 2030 to 2050.

¹ [Mapping of DSO projects](#)

² [Value creation by local energy markets and the implications for the transition to DSO](#)

Local market arrangements should be put in place and designed with the objective of maximising the value of DERs for their owners and users and for the energy system as whole. These arrangements should be appropriate for the local DER mix and penetration levels, their times of operation, and the characteristics of local demand.

... and the arrangements that would enable customers to tap into this value

As DER penetration increases, new arrangements can deliver their full value, in turn facilitating and accelerating the growth of DERs. This growth will co-evolve with the structures and markets for distribution systems, representing a transformation towards a customer-focussed decentralised and decarbonised energy system that delivers the optimal value for all key stakeholders, while ensuring the sustainability, security and affordability of electricity supplies.

The introduction and evolution of local energy markets will enable increasing volumes of energy to be supplied by local renewable sources. Key to this is the introduction of real-time local energy markets which deliver value to both the seller, such as a customer with PV, and to the buyer with flexible load such as EVs.³

Accompanying this market development is an evolution of the industrial structure of the distribution sector from the current centralised arrangements where the transmission system operator is largely responsible for whole-system efficiency and security, to one based around regional and then community based scales of operation where the DERs contribute to improving efficiency, maintaining security and long-term supply reliability.⁴

We have developed an architecture that captures an integrated understanding of all the commercial and technical elements of the current and future distribution system⁵. We have set out three evolutionary states for the industrial structure and shown how their relative merits can be assessed in a way that identifies optimum outcomes across a range of stakeholders⁶.

Potential pathways We have shown that owners and users of DERs can obtain real value from their flexibility and their assets by participating in local energy markets that are designed for that purpose. This is a world in which customers can play an active part in contributing to the UK's decarbonisation and be rewarded for doing so, at the same time as delivering benefit for everyone by improving the efficiency of the energy system and reducing its cost.

With the value to customers being significantly higher than the value from participating in markets to provide services to address network congestion and constraints, there is an imperative to ensure that there is sufficient focus on how to implement local energy markets. Going forward, the provision of network services needs to be considered alongside the higher value available to customers of trading energy.

³ [Electricity Market Structure, Market Design and DSP Implications](#)

⁴ [Future Industrial Structure of the Distribution Sector](#)

⁵ [Electricity Market Structure, Market Design and DSP Implications](#)

⁶ [Future Industrial Structure of the Distribution Sector](#)

Local energy markets are expected to make an important contribution to our smarter more flexible energy system. DSO must also enable customers' access to a changing mix in the transmission connected generation (particularly in offshore wind but with nuclear and flexible gas). We need to understand how local system operation can benefit this changing national mix to ensure that the service provided for customers enables them to access local and national markets for flexibility.

The challenge and the opportunity is to identify and remove any barriers to this transition, and to innovate to develop, trial and implement attractive service offerings, backed by the necessary technologies, processes, standards and consumer protections, that can make participating in this new energy system a simple, attractive and widely accessible option.

For more information about the project please visit the [project page](#)