nationalgrid

Facilitating Whole Electricity System Outcomes

How the ESO is working with stakeholders to transform the energy landscape

The way we generate and use electricity is changing, driven by the challenges of decarbonisation, decentralisation and digitisation. This is creating new opportunities across the whole electricity system. As the Electricity System Operator (ESO) we need to work with our stakeholders on a whole system approach to harness these opportunities and deliver value for the consumer.

In this changing energy landscape many of the traditional distinctions between transmission and distribution networks and processes blur. In order to facilitate the systems and services stakeholders need whilst also delivering efficiencies for the consumer we need to take a whole system view of the electricity industry. Through taking a whole system approach we believe consumer and societal value can be maximised.

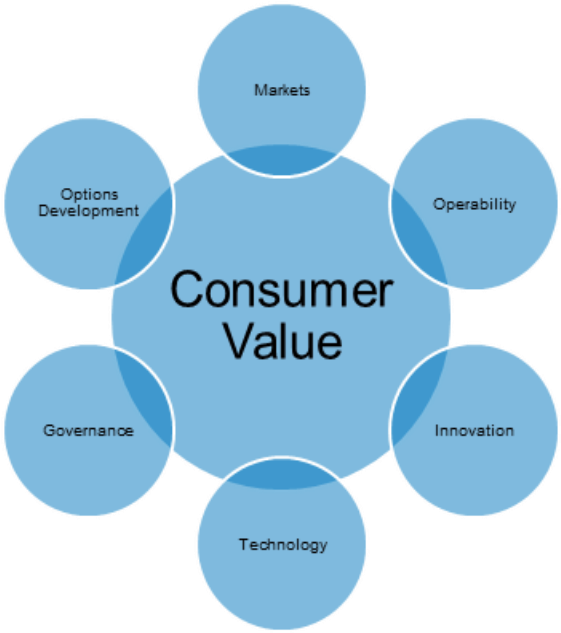
Stakeholders have told us that this co-ordinated development of the Whole Electricity System is one of the key topics for the industry and have asked us for our views and thought leadership. We need to work with all stakeholders to facilitate Whole System outcomes and are actively working on collaborative initiatives such as the Regional Development Programmes (RDPs) as well as through the ENA Open Networks project. Through such co-ordinated efforts we believe that options can be developed which will work for stakeholders and deliver great consumer value.

This paper describes the benefits of taking a whole system approach to the transforming energy landscape and how the ESO role is evolving in response. We welcome feedback on our thinking and encourage you to engage with the ENA Open Networks project and in particular its forthcoming 'Future Worlds' consultation.

1 The benefits of taking a Whole System approach

New consumer technologies such as smart meters and electric vehicles, together with increased volumes of distributed energy resource, such as solar and storage, are lifting the traditional distinctions between energy vectors. These changes create new opportunities to deliver value to the end consumer and the economy and can be maximised through a whole system approach. Such an approach will ensure that consumers get the benefit of experience and innovation, unconstrained by out-of-date barriers and so continue to receive safe, secure energy supply at optimal cost.

National Grid, in its role as System Operator, manages the operation of both gas and electricity transmission systems. We recognise that consideration, both between energy sources and also across transmission and distribution systems, needs to be taken in the round. We believe that this can be achieved through whole system consideration of six key areas as shown in the diagram below.



Whilst we have ongoing initiatives that consider Whole System impacts across energy sources (such as evolution of heat) the focus of this paper is the need to consider the Whole Electricity System. We consider 'the Whole Electricity System' includes everything that connects the sockets in consumer's homes through to large transmission connected generators. We believe successful development of whole electricity system outcomes can be delivered through a focus on these six key areas;

- **Markets** - *A whole electricity system view will ensure markets work for all participants increasing fluidity and delivering value for the consumer*
- **Operability –** *Operability of the electricity system as a whole will ensure safety and security of supply.*
- **Innovation –** *Embracing innovation and new technologies will deliver societal benefits*
- **Technology –** *Key enablers (such as data exchanges and artificial intelligence) need to be approached consistently and securely so that they deliver effective outcomes.*
- **Governance –** *Framework arrangements that facilitate all parties and are agile to change in a rapidly evolving environment will ensure fair and accessible markets creating consumer value.*
- **Options Development -** *The design of networks that accounts for a broad range of solutions will deliver value to the consumer.*

Examples of how we are progressing whole system change in these six areas are shown through this report. We believe that through focusing on the consumer benefits of such an approach, successful and efficient outcomes can be achieved. We intend to use these key areas as a starting point for discussion with others and would be interested in your views.

How are we innovating to deliver consumer value?

The ESO is working with Electron, a startup specialising in blockchain and energy, and a number of DNOs to explore a blockchain-based register for flexibility assets. This project aims to provide consistent visibility of assets (such as location, fuel type, capacity) across the whole electricity system.

How are we looking to develop smart deployment and get customers connected?

Collaborating with UKPN through a joint Regional Development Programme, the first such programme in GB, we have released 500MW of capacity on the south coast of England and removed future blockers to connecting new generation.

2 How the ESO is changing to meet the challenges of Whole System collaboration

In our role as ESO, we have traditionally worked with DNOs and larger distribution connected parties to deliver efficient outcomes for the end consumer. Designing and operating an efficient transmission network has also led us to consider distribution network demands and impacts.

With increasing volumes of Distributed Energy Resource these relationships need to deepen and how the ESO collaborates and works with the DNOs, as they transition to Distribution System Operators (DSOs), and other distributed parties needs to evolve. These changes are recognised by Ofgem through our role in 'Facilitating Whole System Outcomes' as a stand-alone ESO. This role requires us to consider how we need to co-ordinate, in order to facilitate both whole system development and operation.

The transition to whole electricity system outcomes is happening now and we are already working with stakeholders to develop our ways of working, Specific examples of how we are achieving this are shown throughout this paper. The tables below compare how we have traditionally worked with distribution parties with how we are changing to deliver whole system outcomes.

How are we developing markets to enable the consideration of options across the whole electricity system?

The ESO procures flexibility services to manage the system nationally and also on a regional transmission basis. The provision of flexibility services from smaller providers connected to distribution networks is of increasing relevance to us in both these areas, sitting alongside our existing provider base of large transmission-connected assets. Through initiatives such as Power Responsive we are seeing an increase in service provision from distribution connected providers, with over 900MW of units recently tendering into our balancing markets.

Facilitating Whole System Outcomes – Co-ordinating across system boundaries to deliver efficient network planning and development

Our traditional role	*How we are changing*
Supported by the requirements of industry codes, we have worked with DNOs to co-ordinate system design between transmission and distribution networks. This has involved a process (Statement of Works) to trigger an investment review as required. Larger distribution connected generators have also been required to register with us, and some smaller distributed generators have also seen a benefit in registration in the wholesale market.	We need to ensure that design arrangements work for all our customers through being agile and consistent between networks, and facilitating customer choice. We are working with DNOs to develop such ways of working both through Regional Development Programmes and also the Open Networks project. We believe that by taking this whole system approach we will optimise overall network design and deliver value for the end consumer.

Facilitating Whole System Outcomes – Co-ordinating effectively to ensure efficient whole system operation and optimal use of resources	
Our traditional role	*How we are changing*
We have traditionally worked with DNOs to co-ordinate access to the system and manage operational needs including under emergency conditions. In efficiently operating the transmission system there has always been some flexibility provided by distribution connected parties that we have dispatched.	Developing efficient operation across the whole electricity system requires the sharing of best practice and common data. Through such efficiencies, coupled with clear responsibilities, we can ensure all systems are operated safely and securely. We are working closely with DNOs to ensure the whole electricity system remains operable and secure. To facilitate this we will develop new ways of working supported by the appropriate infrastructure to allow all system operators to manage networks in real time. More active distribution networks increase the options available to manage the system again driving value. These opportunities may be through optimisation of regulated assets or through the procurement of third party services by either the ESO or DSO. These arrangements need to be fair and transparent. We need to work with all stakeholders to develop such arrangements.

How are we enabling the development of new technologies?

We are developing new ways of working through our innovation projects. One of these, Power Potential, is working towards creating a reactive power market for distributed energy resources (DER) with UKPN.

This project will demonstrate both how a reactive market for DER can work as well as how multiple system operators can work together to procure and dispatch DER. It will also support UKPN's development of DSO functionality.

What is the ENA Open Networks Project?

The ENA Open Networks project brings together the main network owners and operators of electricity systems in the UK to develop thinking on whole electricity system. Open Networks creates a collaborative environment to share innovation and best practice and brings together experts to develop potential arrangements that deliver new revenue opportunities for stakeholders and value for the end consumer.

The Open Networks Project is a key initiative to deliver Government policy set out in the Ofgem and BEIS Smart Systems and Flexibility Plan, the Government's Industrial Strategy and the Clean Growth Plan. As such it will support the enablement of a whole range of new energy technologies that generate, consume and manage electricity, delivering low carbon energy for the UK.

Given the breadth of transformation, our other roles as a stand-alone ESO (to facilitate competitive markets, manage system balancing and support competition in networks) are also influenced by whole system developments. Our traditional ways of working with distribution entities are shown below, alongside how we are working with stakeholders to deliver an efficient whole system approach.

Facilitating competitive markets	
Our traditional role	*How we are changing*
We have always considered flexibility services for both national and regional requirements from distribution connected parties. However this has been relatively small and easy to accommodate. Our roles in code development have primarily seen us focus on transmission led documents such as the CUSC and the Grid Code. Our interface with distribution parties has therefore been limited to ensuring these codes work for these parties.	There is now a much higher level of service provision from smaller distributed parties. Through programmes such as Power Responsive, we will ensure that arrangements remain appropriate for a much higher number of participants - recognising that many of these parties are smaller and new entrants. As local and regional markets evolve to provide flexibility services for distribution networks, we will ensure that parties wishing to enter such markets can still provide national services and that there is appropriate standardisation between markets. Such approaches will increase market fluidity, facilitate appropriate value stacking across markets and deliver consumer value. These principles are not limited to service procurement but also areas such as settlements. It is important that system operators should be neutral parties and we support the Open Networks project in their clarification of this point. In order to develop effective markets that drive consumer value commercial arrangements need to be developed in collaboration with all relevant stakeholders. We will work with all stakeholders in the development of existing and future markets. Code development needs to take a whole system approach such as that being taken by Charging Futures. In developing and evolving frameworks, the change process needs to be agile ultimately resulting in codes which are clear, accessible and consistent across transmission and distribution.

How are we taking a whole system approach to operability?

System events on the transmission network can have a ripple effect through the whole electricity system. Our analysis, with other stakeholders, has identified one particular area of concern known as 'vector shift'.

We have worked with DNOs and other stakeholders in the south of England to develop a commercial solution which ensures continued whole system operability and delivers consumer value.

Managing system balancing and operability	
Our traditional role	*How we are changing*
Operability discussions have largely focused on the interface between transmission and distribution. Our focus has primarily been on national or regional concerns whilst DNOs have focused on more local issues. Our operational and planning forecasts have always considered distribution impacts and the demand on distribution networks. This has also involved the transfer of information with other network companies. Similarly our Future Energy Scenarios (FES) has forecast the level of demand and Distributed Energy Resource (DER) such as generation and storage.	There is an increased need to consider distribution effects and options when considering system operability and the need to take a whole system view. This is evidenced in our collaborative work with other stakeholders in areas such as vector shift protection. This collaboration needs to further deepen recognising the need to manage regional differences. Forecasting demand is becoming much more complex with increased volumes of DER including microgeneration. We are working with other parties to develop tools and processes to handle this - we will need to share information and develop best practice with DNOs. We recognise that information provision is also critical for distribution connected parties to allow them to make efficient investment and operational decisions. We are increasingly taking a whole system view of the FES analysis and working with Open Networks to consider regional requirements.

Supporting competition in networks	
Our traditional role	*How we are changing*
Our focus on competition in networks has traditionally been by highlighting transmission system needs and potential build and non-build alternatives through the Network Options Assessment process.	Future development of the transmission system needs to be done through a transparent assessment process that considers a range of network and non-network solutions to deliver efficient outcomes for the end consumer. Through our Network Development Roadmap we are looking to create such a whole system approach to network design.

How do governance arrangements need to evolve?

Technical codes exist as discrete documents. Creating greater alignment between these bodies could create a powerful transparent framework that would provide consistent information to stakeholders.

Our work with Charging Futures presents a potential blueprint for taking a whole system view of framework arrangements.

Our Deliverables in 2018/19

Earlier this year we published the ESO Forward Plan, setting out detailed deliverables for whole electricity system outcomes. Further details can be found on our dedicated webpage; https://www.nationalgrid.com/uk/about-grid/our-role-industry/future-electricity-system-operator.

Stakeholders have told us that we need provide more visibility of our role to 'facilitate whole system outcomes'. This paper provides part of this narrative, but our Forward Plan quarterly update later this month will also provide further detail on our 2018/19 deliverables in this area.

3 Next Steps

The focus of this paper has primarily been about how the ESO is changing in the near term in response to the challenges of the whole electricity system. We are still at an early stage of this energy system transformation and significant further reform is needed over the next decade or so.

The longer term need for change is the subject of an upcoming Open Networks project consultation. The 'Future Worlds' consultation will describe a range of potential future states in which industry 'actors' have evolved to meet the challenges of decarbonisation, decentralisation and digitisation. The Open Networks project is interested in your views on these worlds and how it should assess the worlds prior to presenting all options to BEIS and Ofgem as an evidence pack.

We want to use your responses to the Future Worlds consultation, along with insights from our direct engagement with you, to inform how the ESO needs to evolve in the longer term and the roles, principles and areas of focus we should take to deliver successful whole electricity system outcomes for the end consumer. This will inform the development of our RIIO-2 thinking including our engagement plan and we intend to publish further thinking in this area later in the year.