

Whole Electricity System thinking

How the ESO can support a transition that delivers consumer value

Executive Summary

Earlier this year we published a paper on 'Facilitating Whole Electricity System Outcomes'¹. This paper described how taking a whole system view of the transforming electricity landscape would result in efficient outcomes for the end consumer and detailed how the ESO role was changing to meet the challenges of the changing electricity landscape.

We promised to provide further context on these views, informed by stakeholder feedback to the Future Worlds consultation² from the Open Networks project, as well as feedback from our own industry events. *(The ESO has been actively involved in the development of the Future Worlds and fully supports the Open Networks project. This paper intends to be complimentary to the work of the Open Networks project using its work to help support the future development of the ESO).*

Our view of the future energy landscape is now based on a world where the ESO works closely with DSOs to ensure routes to local, regional and national markets are aligned and optimised collectively for all participants creating value for the end consumer. We believe that this world provides a credible whole system vision but recognise that there are other potential pathways that need to be considered.

We believe the ESO needs to focus on five specific whole electricity system topics to deliver this future vision:

- Appropriate information and data provision
- Accessible and aligned frameworks
- Consistent and transparent flexibility markets
- Clear and co-ordinated roles and responsibilities for system design and operation
- Managed system risk and resilience

In this paper we explore these five topics, considering how they will affect the ESO role and how we can support their development. We also provide detail of how our collaborative initiatives are supporting their development.

Whilst this paper is not a formal consultation we are interested in your views on the topics presented. We will use your feedback to help shape the development of our activities in 2019/21 as well as our longer term thinking for both the ESO role and also our input and focus within the ENA Open Networks project. This will ensure an efficient transition to a whole electricity future that delivers harmonised national, regional and local flexibility markets, promotes competition, and maximises value for the end consumer- as well as taking into account the increasing need to consider the impact and potential of other energy vectors. We welcome all responses which can be emailed to box.WholeElectricitySystem@nationalgrid.com by 25th January 2019.

¹ <https://www.nationalgrideso.com/sites/eso/files/documents/Whole%20Electricity%20System%20final.pdf>

² <http://www.energynetworks.org/electricity/futures/open-networks-project/future-worlds/future-worlds-consultation.html>

Background – Our thinking to date

Facilitating Whole Electricity System Outcomes

In July we published our 'Facilitating Whole Electricity System Outcomes' paper. This paper described the broader need to consider impacts across the whole energy system and how a focus on six key areas could drive consumer value. We indicated how these six areas were also of relevance to our work on whole electricity system. These areas were introduced as;

- **Technology** – *Key enablers (such as data exchanges and artificial intelligence) that 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 to ensure fair and accessible markets creating consumer value.*
- **Markets** - *A whole system view that ensures markets work for all participants increasing fluidity and delivering value for the consumer*
- **Options Development** – *Co-ordinated whole system design that accounts for a broad range of solutions to deliver value to the consumer.*
- **Operability** – *Operability of the system as a whole to ensure safety and security of supply.*
- **Innovation** – *Embracing innovation and new technologies to deliver societal benefits*

Our 2030 Ambition for Whole Electricity System

In September we shared with stakeholders our new mission for the ESO and our 2030 ambition³. To facilitate whole electricity system outcomes, our ambition is that:

- Planning, development, investment and operation of the GB networks will be optimised on a whole electricity system basis irrespective of ownership boundaries.
- Solutions to system operator challenges will be open to a full range of participants, facilitating both market and asset solutions.
- Best overall value for consumers will be achieved, irrespective of the ESO or DSO performing the analysis.

³<https://www.nationalgrideso.com/sites/eso/files/documents/ESO%202030%20Ambition%20Workshop%20Materials%20Published.pdf>

How your feedback is shaping our Whole Electricity System thinking

Our vision to facilitate Whole Electricity System Outcomes

Our vision is a future where fluid and accessible flexibility markets drive value for the end consumer and provide revenue opportunities for service providers. In this future the ESO will work with DNOs as they transition to DSO to ensure these markets, whether for local, regional or national needs, are consistent and compatible whilst managing operational requirements across the whole electricity system to ensure the lights stay on.

The five specific topics that enable this vision

Building on the Whole Energy System key areas our engagement with stakeholders has identified five specific topics for the ESO to deliver this future.

- **Technology; Appropriate information and data provision** - Data is exchanged between network organisations and market participants for the purposes of operating the system, forecasting, developing networks etc. These exchanges will increase and evolve in response to the needs of markets, operability and the development of network and non-network options.
- **Governance; Accessible and aligned frameworks** – With increasing interaction between transmission and distribution systems the driver for aligned or combined industry frameworks increases. This also provides opportunities to reduce complexity in codes facilitating more agile governance arrangements and therefore meet the needs of markets and system operation.
- **Markets; Consistent and transparent flexibility markets** - Well designed flexibility markets will stimulate competition thus creating consumer value. Responses to the Future Worlds consultation have recognised the importance of routes to market and the role of flexibility platforms in facilitating these routes. Service providers have told us they value consistent accessible approaches to markets for both national and local needs.
- **Options Development; Clear and co-ordinated roles and responsibilities for system operation** – Roles and responsibilities for system operation need to evolve to account for the changing energy landscape. These need to be appropriately aligned to ensure co-ordinated operability and efficient development of the whole electricity system with clear accountabilities.
- **Operability; Managed system risk and resilience** - Responses to the Future Worlds consultation have recognised the ESO's role in overall management of the national electricity system including in times of system stress and emergencies. With the challenges of decarbonisation, decentralisation and digitisation, system risks are evolving and we need to work with other system operators, as they manage their networks, to ensure overall system operability.

For each of these topics we also recognise the importance of;

- An environment that stimulates innovation, the sixth key area, including the development of new ways of working and technologies
- The need to balance national consistency with regional requirements. This is particularly important during a period of sustained change where communities will transition at different rates and in potentially different ways.

Topic 1: Appropriate information and data provision

What is this topic?

Data is exchanged between network organisations and market participants to facilitate efficient system design and operation. These exchanges will increase and evolve in response to the needs of markets, operability and the development of network and non-network options.

Why is this topic important for Whole Electricity System?

Stakeholders have told us that;

- More data and information is available today than ever before; using it will aid the development of new efficiencies for the end consumer through optimised networks and market facilitation
- Efficient use of data reduces the overall cost to the consumer
- Common approaches ease access to data for service providers facilitating markets
- Consistent data formatting will facilitate innovative applications for use by consumers and service providers
- Appropriate support should be provided to allow data to be understandable and usable
- Appropriate arrangements need to be put in place to safeguard individuals

Why is this topic relevant for the ESO?

We provide data and information to market participants to support their investment and operational decisions and we use data and information provided to inform our planning and operational functions. We also share data and information with network owners and operators to make informed planning and operational decisions.

How could this topic shape the ESO role?

We will see an increased need to share data as we approach RIIO-2 and there will also be an increased number of market participants that we will need to exchange data and information with. As a result there could be a need to develop new codified arrangements and systems for data transfer, particularly with DNOs.

How can the ESO help the development of this topic?

We will continue to;

- Increase the transparency of our data and publish information in an accessible manner
- Facilitate appropriate information exchange between parties.
- Work with DNOs as they transition to DSO and through Open Networks project to ensure best practice sharing of data and information
- Develop new and innovative ways to share data with network organisations and market participants

We are interested in your views on;

- The appropriate balance in providing accessible data in a consistent format with providing information to support stakeholders.
- How this topic could affect you and how the ESO needs to evolve to support this

Topic 2: Accessible and aligned frameworks

What is this topic?

With increasing interaction between transmission and distribution systems the driver for aligned or combined industry frameworks increases. This also provides opportunities to reduce complexity in codes, facilitating more agile governance arrangements and therefore meeting the needs of markets and system operators.

There are a number of ways such change could be progressed. An incremental approach, based on the current process for framework change, could deliver the required end results. An alternative approach would involve fundamental change, potentially aligning with the speech delivered by the Business Secretary on 15th November 2018⁴.

Why is this topic important for Whole Electricity System?

Stakeholders have told us that;

- Harmonising or amalgamating codes and standards will;
 - create efficiencies of scale reducing the workload for all parties that engage on codes
 - Remove distortions between arrangements.
- Clear and understandable frameworks and consistent standards across GB will facilitate new and smaller parties entering markets
- There is already much Ofgem led work considering reform to charging and access arrangements across the whole electricity system. There may be value in similar consideration of technical codes and standards

Why is this topic relevant for the ESO?

We have existing roles in transmission code and standard development and governance of these arrangements. Codified arrangements support efficient operation and development of the system and therefore drive consumer value.

How could this topic shape the ESO role?

We welcome the Government and Ofgem decision to launch a review into the rules that govern our energy system⁵. We recognise that any revision of frameworks is unlikely before the start of RIIO-2. However clarification of whether incremental harmonisation, or a more fundamental approach, is preferred ahead of RIIO-2 would support our development of a robust business plan in this area.

How can the ESO help the development of this topic?

We will continue to;

- Develop our thinking and seek stakeholder views on the need for aligned technical frameworks across the whole electricity system
- Provide thought leadership into the Government and Ofgem Energy Codes Review to enable governance arrangements that are appropriately agile and frameworks that are accessible to a broad range of stakeholders

We are interested in your views on;

- The codified relationship between the ESO and DNOs in their transition to DSO
- Whether accessible and aligned frameworks are better progressed through incremental or fundamental change

⁴ <https://www.gov.uk/government/speeches/after-the-trilemma-4-principles-for-the-power-sector>

⁵ <https://www.ofgem.gov.uk/publications-and-updates/energy-codes-review>

Topic 3: Consistent and transparent flexibility markets

What is this topic?

Well designed flexibility markets will stimulate competition thus creating consumer value. Responses to the Future Worlds consultation have recognised the importance of routes to market and the role of flexibility platforms in facilitating these routes. Service providers have told us they value consistent approaches to markets and the need for accessible routes. We need to ensure technology and innovation support this development.

Why is this topic important for Whole Electricity System?

Stakeholders have told us that;

- Transparent markets will aid the development of new products and services and facilitate new entrants into markets
- Markets need to develop in a way that facilitates participation. This includes;
 - Appropriate standardisation between markets for different DSO and ESO needs
 - The opportunity to enter multiple complimentary markets to provide services locally, nationally or even internationally
 - The choice for consumers to enter markets via multiple routes with protection if they do not want to participate
 - The development of decision support tools to allow service providers to make informed choices

Why is this topic relevant for the ESO?

We facilitate flexibility markets for participants across the whole electricity system both to;

- Undertake our role as residual balancer of energy
- Allow continued system operability through balancing services for both national and regional transmission needs

How could this topic shape the ESO role?

Building on our experience in facilitating locational and non-locational services and managing their interactions, we will work with DNOs as they transition to DSO to facilitate multiple routes to market. We will ensure that service providers are informed of potential new revenue opportunities and that markets grow, improving liquidity and releasing consumer value. Supporting this, we could be a specifier of market requirements, championing a consistent approach to flexibility frameworks for both transmission and distribution needs, and supporting innovative design and development of markets and platforms..

How can the ESO help the development of this topic?

We will continue to;

- Engage with potential new providers through vehicles such as Power Responsive to increase market participation
- Support development of standardised European products that provide opportunities for GB participant access to wider markets, as well as increasing competition for GB services
- Work with DNOs and the Open Networks project to ensure stakeholders are aware of the broader opportunities to provide services for both local and national flexibility markets

We are interested in your views on;

- The need for consistent and transparent flexibility markets
- The appropriate route to develop consistent markets across the whole electricity system

Topic 4: Clear and co-ordinated roles and responsibilities for system design and operation

What is this topic?

Roles and responsibilities for system design and operation need to evolve to account for the changing energy landscape. For example more active distribution networks present new opportunities for DNOs as they transition to DSO to take a greater role in voltage support. Changes to roles and responsibilities need to be clear across both transmission and distribution, and work together to ensure co-ordinated operability and future development of the whole electricity system.

Why is this topic important for Whole Electricity System?

Stakeholders have told us that;

- Clear roles and responsibilities will ensure continued efficient operation and development of safe and secure networks
- Aligned roles and responsibilities will facilitate efficient whole electricity system outcomes
- System operator incentives will drive consumer value when appropriately aligned across the whole electricity system

Why is this topic relevant for the ESO?

Common with other industry parties, the ESO needs clear roles and responsibilities to efficiently carry out its functions (designing and operating the system) and build its business plan including incentives to support delivery of consumer value on a whole system basis.

How could this topic shape the ESO role?

Changes to system design and operation roles and responsibilities should be considered on their merits ensuring there is overall value to the consumer from any change. To deliver this, we will need to ensure any relevant changes to system operator roles and responsibilities - emerging from whole electricity system thinking - are discussed with the broad stakeholder base through open governance arrangements.

How can the ESO help the development of this topic?

We will continue to;

- Trial different ways of working with DNOs and other stakeholders to understand the costs and benefits of different approaches without setting precedents
- Work with the Open Networks project to share the learnings from such activities and develop aligned roles and responsibilities

We are interested in your views on;

- The need for clear and co-ordinated roles and responsibilities for system design and operation
- Areas where there may be a need to better clarify or evolve the roles and responsibilities for system design and operation
- How best to progress the development of clear and co-ordinated system design and operation roles and responsibilities ensuring all impacted stakeholders are involved

Topic 5: Managed system risk and resilience

What is this topic?

Responses to the Future Worlds consultation have recognised our role in overall management of the national electricity system, including at times of system stress and emergencies. With the challenges of decarbonisation, decentralisation and digitisation, system risks are evolving. We need to work with other system operators, as they manage their networks, to ensure risks are identified and managed to facilitate continued system operability.

Why is this topic important for Whole Electricity System?

Stakeholders have told us that;

- The challenges of decarbonisation, decentralisation and digitisation are changing the nature of risk on the system. These risks need to be understood and managed
- Contingency planning for system events needs co-ordination across the whole electricity system such that power interruptions can be minimised and supplies restored safely

Why is this topic relevant for the ESO?

We have a recognised role in managing risk and resilience to the national electricity system. This includes our critical role as residual balancer. With overall national visibility of the GB electricity system, we are therefore best placed to ensure overall co-ordination of system operation and management of associated risks.

How could it shape the ESO role?

We believe that we will continue to have a pivotal role in managing risks and resilience to the national electricity system including acting as residual balancer.

How can the ESO help the development of this topic?

We will continue to;

- Ensure continued management of national electricity system risk and resilience through a period of significant industry change
- Facilitate industry thinking on how system risks are evolving. We will identify and put in place measures to manage these risks
- Work with DNOs as they transition to DSO to ensure a co-ordinated approach and through trials such as our black start project

We are interested in your views on;

- How system risks are evolving with the challenges of decarbonisation, decentralisation and digitisation
- How the ESO can manage GB system risks in an increasingly decentralised and digitised future

How we are delivering Whole Electricity System outcomes today

We recognise that the transition to the decarbonised, decentralised and digitised world of the future is happening now. In parallel with developing our longer term thoughts, we are already working to deliver whole electricity system outcomes. Using both our dedicated innovation projects, as well as other business initiatives, we are collaborating with a range of stakeholders to deliver whole electricity system benefits which are helping to shape the industry. These activities will also inform thinking for the five specific topics discussed in this paper and we are keen to share learnings from our projects with other stakeholders including the Open Networks project.

A list of ongoing initiatives is shown in the table below together with how they are informing learning on the topics. We would like to hear from you if there are other areas you believe we should be progressing or if you have a good idea for a project we could support.

Title	Info	Markets	Codes	Operability	Roles
Vector Shift Initial Performance Assessment					
Assessment of operation of small-scale inverter connected PV generation during under-voltage and voltage vector shift conditions					
Black Start from Distributed Energy Resources 2018 NIC project					
Solar PV Monitoring Phase 3					
Virtual Synchronous Machines Demonstrator					
Critical Weather Types for Wind and Solar Power Forecasts in the UK					
DESERT (hybrid battery and solar enhanced frequency control)					
Weather forecast data optimisation					
Enhanced Frequency Control Capability (EFCC)					
System Impacts of Embedded Storage					
Power Potential					
Residential Response					
EFCC Monitoring and Control System (MCS) demonstrator					
Black Start Capabilities from Non-Traditional Technologies					
RecorDER (blockchain asset register)					
Development of GB electric vehicle charging profiles					
Enhancing Energy Flexibility from Wastewater Catchments through a Whole System Approach					
UKPN Regional Development Programme					
WPD Regional Development Programme					
SPEN Regional Development Programme					
Network Development Pathfinder Projects					

Next Steps

We are conscious of the need to deliver changes to facilitate whole electricity outcomes in a timely manner that meets stakeholder expectations and maximises consumer value. We believe that this needs to be achieved through a focus on both shorter term deliverables, building on our work through innovation projects and other business initiatives, along with the longer term need to develop industry thinking and inform our business plan.

Shorter term – Progressing innovation and Forward Plan deliverables

The next two years are critical in the development of whole system thinking. We recognise the need to continue the work we are doing and progress industry change in a timely manner. We will do this through;

- *Delivering on our 2018/21 commitments.* We are incentivised to ‘facilitate whole system outcomes’. We will continue to provide updates on our progress against our 2018/19 Forward Plan deliverables and will shortly publish the consultation for our 2019/21 Forward Plan.
- *Progressing our innovation pipeline.* We will continue to progress our innovation pipeline through initiatives such as Power Potential. We will ensure that learnings from these initiatives feed into our broader thinking and also the collaborative work we do with the Open Networks project.
- *Collaborating with industry.* We will continue to engage with you on whole electricity system matters. We will also continue to play a valued role in the ENA Open Networks project ensuring that its shorter term deliverables take a whole system focus and provide value for the end consumer.

Longer term – Developing industry thinking and informing our business plan

We recognise that the transition to the future energy landscape will still be ongoing at the start of the next ESO RIIO price control period in April 2021. We believe that the topics discussed in this paper will be of relevance for our business plan for this price control period to inform both;

- How our role will change in an increasingly decentralised, digitised and decarbonised energy landscape
- How we need to support the transition to this future energy landscape

We will be publishing our outline business plan for RIIO-2 early next year and we will use the content of this paper, along with your feedback, to inform our submission.

We also want to use your feedback to help shape our longer term thinking for both the ESO role and also our input and focus within the ENA Open Networks project. This will ensure an efficient transition to a whole electricity system future that delivers harmonised national, regional and local flexibility markets, promotes competition, and maximises consumer value - as well as taking into account the increasing need to consider the impact and potential of other energy vectors.

We're interested in your views

Whilst this paper is not a formal consultation we are interested in your views. Through this paper we have invited responses to specific questions which will further our work and our input into the Open Networks project. In addition for each topic we are also interested in hearing;

- How this topic could affect you?
- How the ESO will need to evolve to support you in this area?
- What benefits this would bring to you?

We welcome all responses which can be emailed to box.WholeElectricitySystem@nationalgrid.com by 25th January 2019.