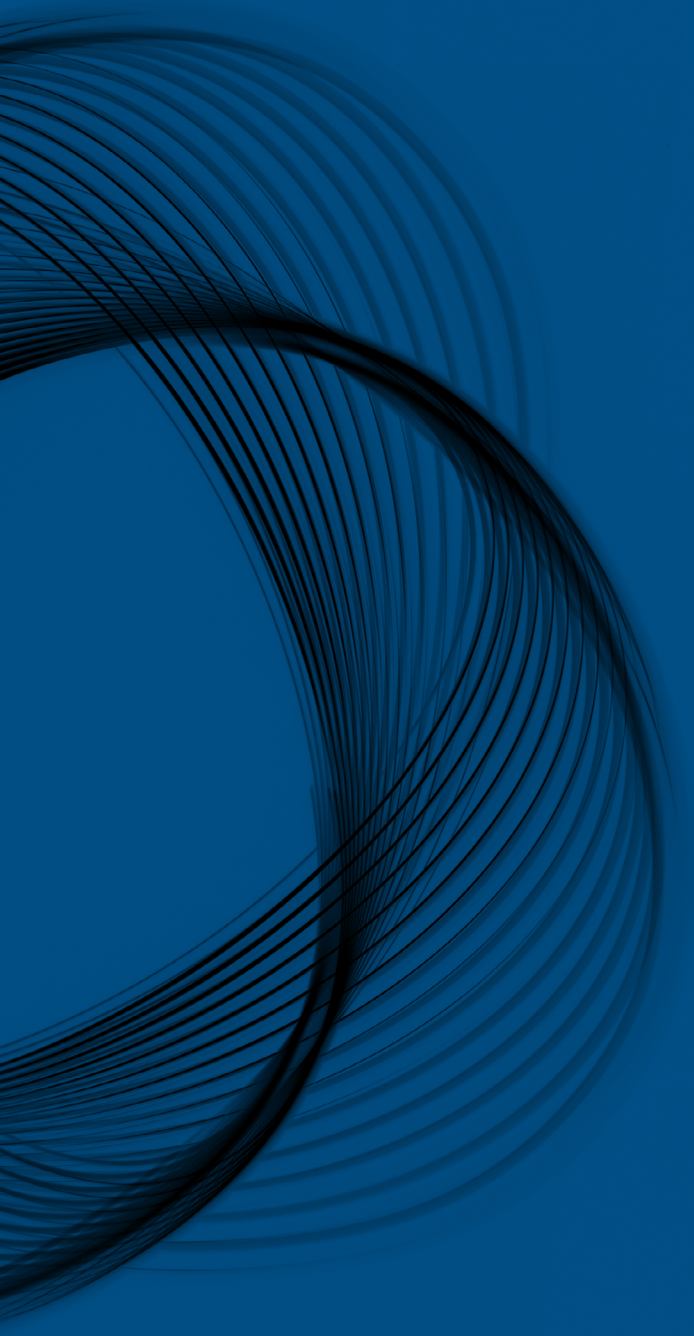
The Voice of the Networks

energynetworks association



Open Networks Project 2018 review

Building a more efficient, smarter, cleaner energy system

Achievements and future direction

Contributing partners

The Open Networks Project brings together Great Britain's (GB) electricity transmission and distribution network companies, including the new National Grid Electricity System Operator (ESO), an independent GB distribution network operator, and distribution operators from Ireland and Northern Ireland.

nationalgridESO

nationalgrid

NORTHERN POWERGRID

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

SP ENERGY NETWORKS

electricity north west
Bringing energy to your door

UK Power Networks
Delivering your electricity

Scottish & Southern Electricity Networks

BUUK infrastructure

ESB NETWORKS

Northern Ireland Electricity Networks

Foreword

Two years ago, we launched the Open Networks Project, an industry-leading initiative that is laying the foundations of the smart grid in GB and informing future developments in Northern Ireland and the Republic of Ireland.

A smart grid – a type of multi-directional electricity supply system underpinned by new digital technologies – is vital for decarbonising and reducing the costs of the UK's energy system, making the Open Networks Project a key industry initiative for delivering Government policy.

It brings together nine GB electricity operators and owners – transmission and distribution – to work closely with distribution operators from: Ireland and Northern Ireland; the Department for Business, Energy and Industrial Strategy (BEIS); the regulator, Ofgem; industry experts; and customer representatives.

Ultimately, with a smarter, more efficient and cleaner energy system, homes and businesses are set to benefit. Research led by the National Infrastructure Commission shows smart technologies which are used to provide services to the electricity grid could save the British public up to £8bn annually by 2030[1].

As the Open Networks Project helps drive us toward this, the public are already gaining better access to secure and affordable low-carbon energy, and more control over how and when they use energy.

Local communities are not only purchasing electric vehicles but are benefitting from sharing or trading their own distributed energy resources, including small-scale solar PV and wind power.

In time, businesses will have access to more consistent, transparent information about local energy markets, making it easier to connect to the grid at a local level and buy, sell or trade electricity.

We continue to collaborate through the Open Networks Project to deliver these short-term improvements, alongside enabling emerging flexibility services markets.

As we look to the future, flexibility services markets are central to facilitating the exchange of technology-based services, such as those provided by battery storage or demand-side response, to keep the costs of the network low for the public, to integrate low-carbon energy and to open up new opportunities for everyone.

Along with our recently announced Flexibility Commitment[2] from GB Distribution Network Operators (DNOs), we have seen flexibility services being connected to the grid and existing flexibility being contracted to support the networks. We can expect a major boost to these emerging markets in 2019.

Through this commitment, the DNOs are openly testing the market to compare relevant reinforcement and market flexibility solutions for all new projects of any significant value.

As this long-term digital transformation takes place, new system roles, responsibilities and market functions are emerging – including the Distribution System Operator (DSO) and Electricity System Operator (ESO) roles. Data is becoming key to unlocking benefits for the public and ENA looks forward to working with the Government's new Energy Data Task Force in realising such benefits.

The Open Networks Project is a key initiative to deliver Government policy set out in BEIS' Industrial Strategy and Clean Growth Strategy Plan, and Ofgem and BEIS' Smart Systems and Flexibility Plan.

Following the Flexibility Commitment made in 2018, we can expect a major boost to flexibility services markets in 2019.

£8bn

National Infrastructure Commission research shows smart technologies providing services to the grid could save the public up to £8bn annually by 2030[1].

[1] https://www.gov.uk/government/news/a-smart-power-revolution-could-save-consumers-8-billion-a-year-adonis
[2] http://www.energynetworks.org/assets/files/ENA%20Flex%20Committment.pdf

The 2018 Future Worlds consultation generated around 50 industry responses to five possible scenarios for the future electricity system, stimulating debate and informing future analysis.

These changes are generating a whole range of different questions about the way our energy system should be run, and it is these questions that the Open Networks Project is answering.

The industry shared its views on these changes through the Future Worlds[3] consultation – a major focus for the project in 2018 – which proposed five possible scenarios for the future electricity system. Taking into account stakeholder feedback, we are progressing an independent impact assessment of the relative costs and benefits of the five scenarios.

The Open Networks Project continues to identify how both our electricity transmission and distribution networks can work most efficiently within the whole electricity system. We will expand upon this in 2019 by looking across the whole energy system: at gas, heat, transport and waste. To-date, we have focused on the electricity system to ensure we have made progress in the highest priority areas.

Widespread stakeholder engagement and input has been key to our work this year – from our industry Advisory Group to public consultations, webinars and events held across GB.

We look forward to continuing to deliver on our vision for a more efficient, cleaner, smarter energy system – for the benefit of everyone.

David Smith
Chief Executive
Energy Networks Association

Peter Emery
Chief Executive Officer
Electricity North West

Paddy Hayes
Managing Director
ESB Networks

Phil Jones
Chief Executive
Northern Powergrid

Clive Linsdell
Chief Executive Officer
BUUK Infrastructure

Frank Mitchell
Chief Executive Officer
Scottish Power Energy Networks

Colin Nicol
Managing Director
Networks Scottish and Southern Electricity Networks

Basil Scarsella
Chief Executive Officer
UK Power Networks

Fintan Slye
Director, UK System Operator
National Grid Electricity System Operator

Paul Stapleton
Managing Director
NIE Networks

Phil Swift
Chief Executive Officer
Western Power Distribution

David Wright
Director, National Grid Electricity Transmission
Group Chief Engineer, National Grid Electricity

[3] http://www.energynetworks.org/electricity/futures/open-networks-project/future-worlds/future-worlds-consultation.html

2018 highlights: in numbers

50

The Advisory Group brings together approximately 50 experts from across the energy industry

05

Advisory Group meetings

100+

Reached 100s of organisations through industry associations

500

The quarterly Open Networks Project newsletter reaches around 500 people

50

Around 50 responses received to the Future Worlds consultation

300

Close to 300 participants in Future Worlds events and webinars across GB

65MW

65 MW flexible generation contracted by GB distribution network operators

7,328MW

7,328 MW of flexibility services used across the GB electricity system for active network management, flexible connections and operational tripping schemes

270MW

270 MW flexible services contracted by GB distribution network operators

The Internet of Energy – transforming the networks

For decades we have invested in our electricity system to serve the public and provide a reliable, secure source of electricity. Now, as the digital transformation of our system takes place – the Internet of Energy – it is enabling us to bring new benefits to the public and businesses. The Open Networks Project is a key initiative in delivering this, through both short-term improvements and longer-term structural changes to the market.

New technologies are becoming central to the way we generate, consume and manage electricity. At home, there is a growing range of new products and services including smart meters, smart thermostats, electric cars and battery storage. In the not-so-distant future, virtual power plants will link homes or businesses together to jointly manage locally-generated energy and artificial intelligence-driven algorithms will improve flows of energy across the system.

This Internet of Energy is not unlike the boom of the Internet in the early 2000s. In the same way, it will change our lives forever – more control and choice, more competitive markets and better deals for the public.

30GW

Since 2007, the local electricity networks have connected 30GW of distributed generation in GB.

Rapid growth of renewable energy

New wind power and solar PV projects have led to record amounts of renewable energy generation being connected at a local electricity network level in GB. In fact, since 2007, the networks have connected 30GW of this distributed generation in GB, with about 85% of it coming from renewable energy. At the same time, the public is adopting new technologies at home, such as electric vehicles.

These two major trends are leading to more intermittent sources of energy on our network. This presents a range of challenges for managing the network, including far less predictable patterns of supply and demand and the need for more frequent and comprehensive data. But as the take-up of these new technologies accelerates, it is also presenting new opportunities for everyone.

The Open Networks Project is finding ways for the electricity networks to work smarter and more efficiently while keeping the lights on.

Our electricity networks are continuing to deliver improvements to the UK's energy system in response to climate change targets and saving the public money. To enable continued investment and innovation in the networks as they evolve and decarbonise, there must be strong alignment between the Government's strategic direction on the energy system and Ofgem's upcoming RIIO-2 price control framework. This applies to both the electricity transmission and distribution networks, starting in 2021 and 2023 respectively, both currently and in the future.

Flexibility services enable networks to avoid building costly new energy infrastructure. For example, using energy from solar panels with battery storage to address local network congestion.

Enabling flexibility services markets

A key aim of the Open Networks Project is to enable the establishment of market places for services provided by new smart energy technologies. This is creating new opportunities for the public and customers to benefit from their connected distributed energy resources (DERs).

Flexibility services markets, as they are known, will increase competition and maximise the Internet of Energy for the benefit of everyone. They will allow supply and demand to be matched at the local level and ensure the most cost-effective investment in the electricity network, such as major upgrades or grid reinforcement.

In a major step forward, the Flexibility Commitment[4] made by GB DNOs in 2018 is helping to establish these markets. For the first time, the electricity distribution network operators are openly testing the market to compare relevant reinforcement and market flexibility solutions for all new projects of significant value.

The GB DNOs have already contracted more than 270 MW in flexibility services, with approximately 65 MW of this flexible generation from DERs, including solar photovoltaic power paired with storage. Across the system, 7,328 MW has been used for active network management, flexible connections and operational tripping schemes. At the same time, network operators have led innovative trials to buy new flexibility services from the market.

The Open Networks Project is also working to ensure that markets – whether for local, regional or national needs – are consistent and compatible, while managing operational requirements across the whole electricity system. Aligning markets at a local and national level is key to promoting maximum value.

The Open Networks Project is providing an evidence base to trial, test and implement what may work in the future, with data being key to operating smarter electricity networks.

Unlocking the potential of data

As the public gains more visibility over their own data and usage patterns, they will be able to make better informed decisions – such as deciding to charge their electric vehicle when prices are lower to reduce their energy bills. Even better, they will be rewarded for returning energy to the grid or reducing their energy consumption.

At the same time, as behaviour becomes much less predictable, data is vital to operating smarter electricity networks. In the future, the networks will need visibility and notification of the location and size of electric vehicle charging points – local and aggregated, real-time and historical data. As smart meter technology continues to gain momentum and provide the data that is needed, this presents exciting opportunities for both the public and the networks.

Business customers will also need more line of sight to network data so that they can better understand where to connect and how to operate to maximise their value; this increased transparency is a key outcome of the Open Networks Project.

Through all of this, the electricity network operators are committed to protecting the privacy and security of public data. The public must benefit from the Internet of Energy, especially those who may be poorer or more vulnerable. In 2018, we started working with a range of experts and organisations, including the Government, to ensure personal data is protected. We are looking forward to working with the Government's Energy Data Task Force[5] in 2019.

2019

We are looking forward to working with the Government's Energy Data Task Force[5] in 2019.

[4] http://www.energynetworks.org/assets/files/ENA%20Flex%20Committment.pdf
[5] https://www.gov.uk/government/groups/energy-data-taskforce

Bringing new benefits

The project is looking at how to make optimal network investment and operational decisions for the whole electricity network, with an increasing focus on how electricity interacts with gas, heat, transport and waste.

In the future, Distribution System Operator (DSO) responsibilities will need to be carried out by a neutral market facilitator – that is, an operator that does not act in a way that could present any conflicts of interest.

To the public

We will continue to deliver secure, reliable electricity to homes and businesses.
Through the Open Networks Project, we will be able to match more varied and less predictable patterns of supply and demand. The latest-generation smart meters are key to providing accurate data so we know what electricity people need, and when they need it. Through all of this, it is critical that the most vulnerable or disadvantaged people are not left behind – they will continue to be supported, as they are today.

A smarter electricity system keeps network costs down for the public.
Through the Open Networks Project, we can replace or supplement more traditional network investment, such as upgrades or reinforcements, with smarter and more cost-efficient ways of investing and operating the grid.

The public is gaining more control and choice over how they use electricity.
Even though much is to be determined about the future electricity system, we know that the public will be more involved than ever. People will be able to generate their own distributed energy, sell to flexibility services markets when it is convenient, or participate in peer-to-peer energy trading within their own community. The Open Networks Project is key to creating these opportunities, including identifying the functions of the emerging DSO role.

To existing and new businesses

It is becoming easier for business customers to connect to the grid.
Through the Open Networks Project, we are simplifying and standardising the connections process and information available to businesses providing distributed energy resources and flexibility services. This includes customers as wide-ranging as local city councils and community energy schemes to industrial and commercial businesses which own solar farms or battery storage facilities.

There will be more competitive market opportunities for businesses.
A growing number of businesses are providing services to the market and together with the right data, these are key to running the network. Whether it be for sustainability reasons, generating a profit or reducing operating costs, these businesses will benefit from new markets and revenue streams. The Open Networks Project is enabling the markets that create these opportunities.

The Open Networks Project will need to adapt and evolve in line with wider energy market developments, which includes making major contributions to key initiatives such as Ofgem's Charging Futures Forum[6] and Significant Code Review[7].

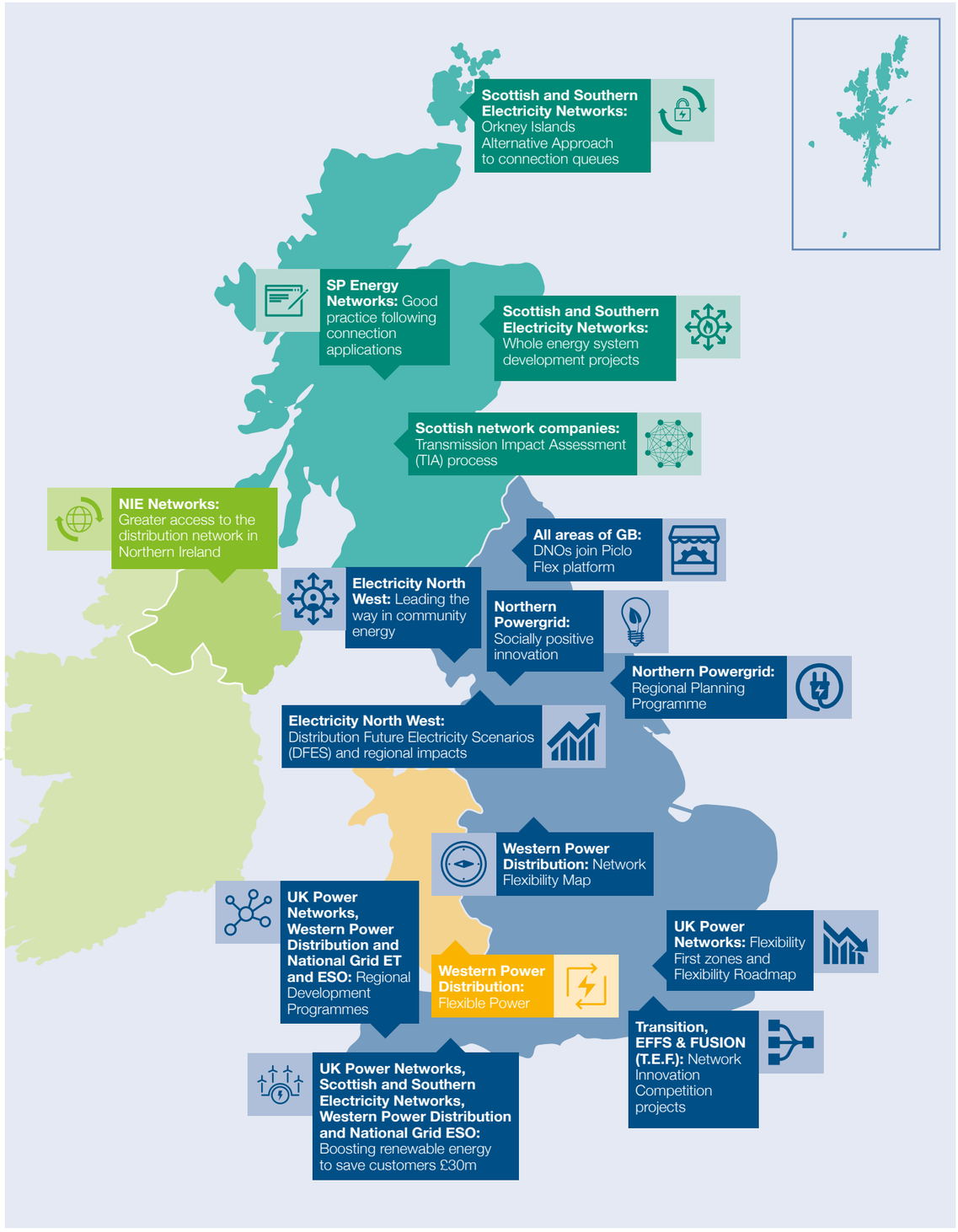
To the UK and globally

We are delivering Government policy to decarbonise the energy system. While future policy and regulatory decisions about how to structure the electricity system will be made by Ofgem and BEIS, the Open Networks Project is key to bringing the industry together. Through it, we are collaborating and building momentum for short and long-term change which contributes not only to the UK's climate targets, but also to global efforts to transition to a low-carbon economy.

The Open Networks Project continues to be highlighted as a key initiative in BEIS and Ofgem's Smart Systems and Flexibility Plan and its outcomes support BEIS' Industrial Strategy and Clean Growth Strategy.

[6] https://www.ofgem.gov.uk/publications-and-updates/charging-futures-forum
[7] https://www.ofgem.gov.uk/electricity/transmission-networks/charging/targeted-charging-review-significant-code-review

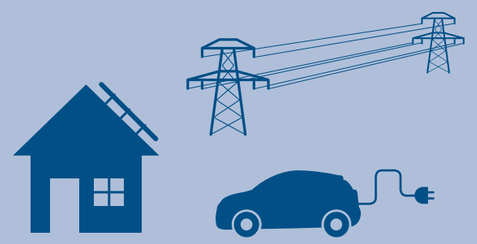
2018 highlights: case studies across GB



2018 highlights: by key themes and publications

Connections and flexibility

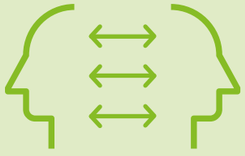
- Key industry learnings on procuring distributed energy resources services
- Consultation on how to treat applications in a queue to be connected to the grid
- Consultation on establishing good practices for connections interactivity and queue management
- Guide outlining processes and products for businesses connecting flexible resources
- Good practice guide on curtailment for flexible connections and active network management
- Good practice guide for providing information to customers when procuring flexibility services
- Guidance for customers on changes to existing grid connections
- End-to-end process report for the definition and procurement of DSO services



Future Worlds

- Future Worlds workshops with industry stakeholders
- Outline of market functions and system requirements for the emerging DSO role
- Key learnings, including benefits and drawbacks, of different electricity market models
- Definition of the emerging DSO role and its potential responsibilities in the market
- Consultation on five possible models – Future Worlds – for the future electricity system, including areas of least regrets for short-term development
- Publication of Future Worlds consultation responses

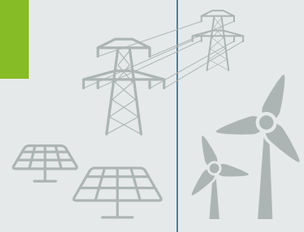
Information and data



- Review of industry projects and how data could be exchanged between market participants
- Terms and definitions used by the Open Networks Project and the industry
- Review and recommendations for a new system-wide register with information for connecting customers
- Good practice guide for networks providing information to connecting customers
- Schedule of electricity network codes used for running the electricity system
- Recommendations for making information available now to distributed energy providers and networks

Whole electricity system

- Identification of common security planning standards, and barriers, across the system
- Review of the similarities and differences between network forecasting for the future
- Key industry learnings for planning investment across the whole electricity system



- Recommendations to improve existing network standards and maximise the usage of flexibility
- Proposed models and processes for whole electricity system investment planning
- Report on current DNO forecasting approaches and the recommended future whole electricity system process
- Interim report on operational data exchanges and control architectures for Regional Development Programmes

Apr – May – Jun – Jul – Sep – Nov – Dec

*Please click on the underlined words to be taken to the appropriate website or link.

In depth: the Open Networks Project

2018 review

Contents

2018 project scope and delivery

The objectives of the Open Networks Project in 2018 were to:

– develop improved transmission and distribution processes around connections, planning, shared ESO-DSO services and operation;

– assess the gaps between our customers' current experience and their expectations, and identify any further changes to close the gaps within the context of a 'level-playing field' and common transmission and distribution approach;

– develop a more detailed view of the required transition to DSO, including the impacts on existing organisational capability; and

– consider the charging requirements of enduring electricity transmission and distribution systems.

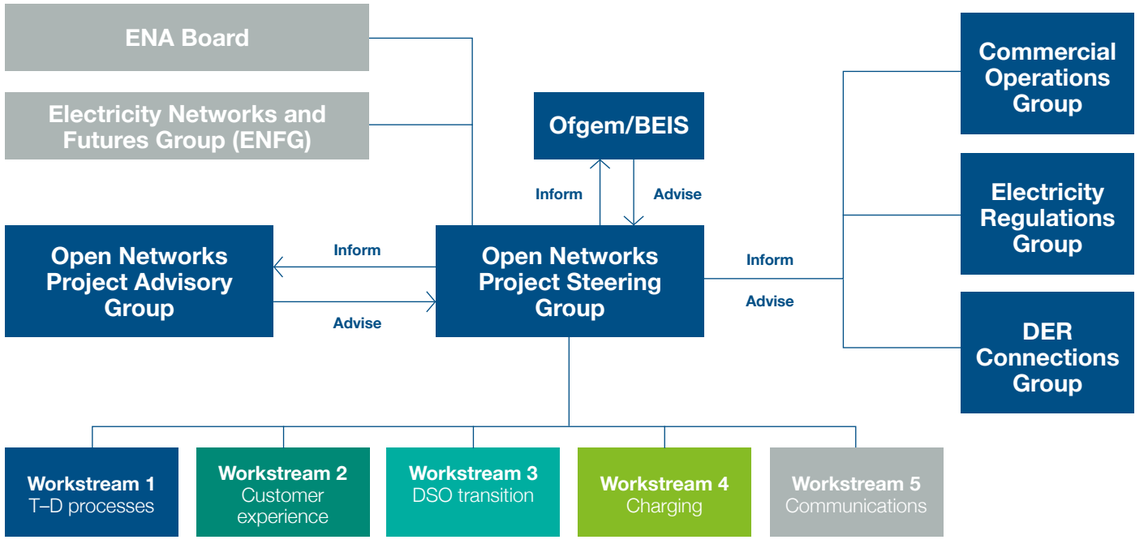
These focus areas are shown in the high-level work plan below, alongside work already completed in 2017 and future work planned for 2019 and beyond.

Figure 1. High-level work plan 2017–2019 and beyond

2017: DSO definition and improvement principles	2018: detailed DSO assessment and improvement development	2019: support policy decisions and improvement implementation	2020 onwards: regulatory enactment and implementation
– Commercial principles and pathways for procuring flexibility – Detailed modelling of Future Worlds – Development of whole system processes across T-D – Implementation of short-term T-D improvements – Information provision for connections	– Detailed modelling of Future Worlds – Independent impact assessment of Future Worlds – Development of whole system processes across T-D – DSO flexibility products and end-to-end process – Implementation of short-term T-D improvements – Best practices for connections	– Impact assessment publication and consultation – Development and implementation of improvements – Convergence of flexibility services – Assess and design flexibility platforms – Trials to test DSO functionality – Further detailed modelling of short-listed Future Worlds – Scoping whole energy system developments	– Regulatory changes to allow implementation of preferred Future World/s – Ongoing DSO trials – Implementation of preferred Future World/s – Ongoing convergence of DSO flexibility services – Implementation of flexibility platforms – Continuous improvement

In 2018 our work was split into five workstreams to align with these objectives and the workstreams have all played a part in progressing the delivery of improvements for customers. The governance structure we have adopted is shown on the following page, with input from external stakeholders on the Open Network Project's Advisory Group, the DER Connections Steering Group, engagement and guidance from BEIS and Ofgem, and input from the electricity networks' commercial and regulatory experts.

Figure 2. 2018 governance structure



2018 project scope and delivery – the Irish context

Consultation in Northern Ireland

Call for evidence issued July 2018

Industry workshop Sept 2018

Consultation issued Q1 2019

Case study

Greater access to the distribution network in Northern Ireland

NIE Networks is building on learnings gained from being a part of the Open Networks Project by carrying out a consultation in Northern Ireland in early 2019. Recognising that the electricity system and market is different from GB, NIE Networks will seek industry views on the evolution of the market, including the emerging role of DSOs.

NIE Networks is also adopting a 'Least Regrets' approach by developing smart solutions, outlined below, which will be rolled out as business-as-usual activities over the coming years.

- Smart Asset Monitoring: Using real-time thermal ratings of 33kV overhead lines and enhanced thermal modelling of 33/11kV primary transformers to facilitate increased loading of assets and defer the need for network reinforcement.
- Demand-Side Response: Incentivising industrial and commercial customers to vary their demand at peak times, in order to improve utilisation of the distribution network and allow further demand and generation to be connected.
- Low-Voltage Active Network Management: By investigating meshing and controlling the low voltage network remotely and automatically, it will reduce network constraints, help facilitate the electrification of heat and transport, and allow for faster fault restoration times.
- Voltage Management: Through the use of Static Synchronous Compensators on the 11kV network and demand reduction through voltage control, NIE networks will actively manage network voltage to unlock network capacity to connect further demand and generation.
- Facilitation of Energy Storage Services: Facilitating the integration of third-party energy storage within the distribution system, from both a regulatory and contractual perspective.

ESB Networks (ESBN) continues to take a keen interest in the Open Networks Project and contribute to the work being undertaken by different project workstreams. The ongoing activities and discussions are provoking significant debate about the future direction of travel for ESBN as it prepares for its forthcoming regulatory price review.

Stakeholder engagement and feedback

Stakeholder engagement activities continue to be very important to the project and, in 2018, we engaged even more widely to ensure extensive industry and stakeholder input into our work. We also focused on ensuring interested stakeholders were kept well-informed of progress and opportunities to be involved in the project, where possible.

Key stakeholder groups

We have continued to present our work to the project's Advisory Group for feedback in 2018. This key stakeholder group comprises approximately 50 experts from across the energy industry including suppliers, aggregators, Independent Distribution Network Operators (IDNOs), industry groups, academia, generators, consumer groups, the gas industry, Government, Ofgem and other industry parties. With many industry associations participating in our Advisory Group, we are able to reach hundreds of organisations beyond our immediate Advisory Group attendees.

In addition, we expanded the Advisory Group in 2018 by adding new members in response to requests from within the energy industry for wider stakeholder representation. A list of current members[8] and related materials are available online. We have also gained valuable input from the DER Connections Steering Group, as a key representative group for businesses developing projects as well as those already connected to the electricity grid.

Wider industry engagement

We have also worked with industry stakeholders beyond these key groups to encourage wider engagement with the Open Networks Project, with some examples outlined below.

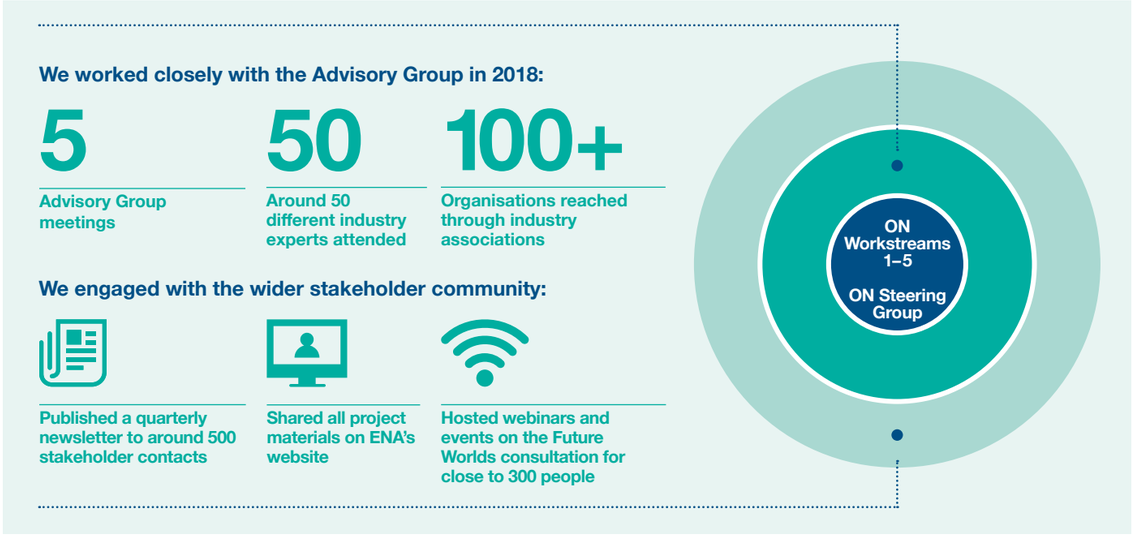
- Held detailed modelling workshops with wide representation from across the industry to help us accurately capture the Future Worlds scenarios in our Smart Grid Architecture Model (SGAM) models.
- Presented at community energy events in Scotland and Wales; held a series of DSO and ESO-led events across GB; and presented at various Westminster-based energy forums.
- Hosted a major parliamentary panel on transforming our electricity networks and how the public is benefiting from Britain's 'Internet of Energy'.
- Project representatives attended industry committee meetings at industry trade associations.
- Hosted face-to-face workshops with stakeholders in Edinburgh and London to gain detailed feedback on the Future Worlds consultation and scenarios.
- Requested expert input from members of the project's Advisory Group to review and provide feedback on the Future Worlds consultation, including relevant actor insights.
- Hosted online webinars for stakeholders to hear about key areas of the project and ask questions, including the Whole System Future Energy Scenarios, Queue Management and the Future Worlds consultation.
- Led opportunities for stakeholders to participate in the development of project workstream products, as a result of revised project terms of reference.
- Presented on the project at ENA's Low Carbon Networks and Innovation Conference (LCNI) and met with delegates to hear feedback on the project.
- Continued to publish a quarterly newsletter to provide updates on the project and make stakeholders aware of opportunities to be involved.

With many industry associations participating in our Advisory Group, we are able to reach hundreds of organisations beyond our immediate project stakeholder groups.

If you would like to join our mailing list to receive regular updates on the project, please email us at **opennetworks @energynetworks.org**

[8] http://www.energynetworks.org/assets/files/ON-PRJ-SG%20AG%20Distribution%20List%20v.2.pdf

Figure 3. 2018 stakeholder engagement highlights



Consultations

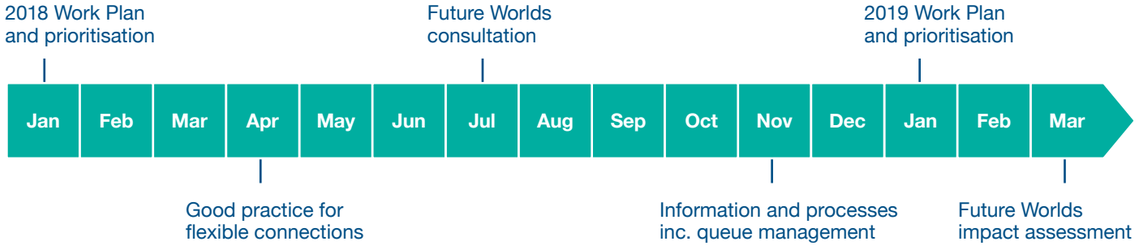
During 2018 we have held a series of consultations, including a major consultation on the five Future Worlds scenarios. We improved on our approach from the previous year by not only continuing to consult on key project outputs, but extending our consultation windows to allow more time for interested stakeholders to respond and added webinars to support engagement.

Our key consultations from 2018 and into early 2019 are outlined below. We adapted the approach to some consultations during the year to ensure we were not overloading stakeholders or creating consultation fatigue. The project's Steering Group also made the decision to delay two planned consultations:

- Future Options for Whole System Investment and DER Solutions, to allow the project to focus on making improvements in the short term; and
- Position and Proposals for Capacity Recycling, to allow Ofgem to continue to develop its proposals for access within the Charging Futures Forum which overlaps with this work.

A number of consultations will be held early in 2019, including a consultation on our 2019 Work Plan from January 2019, our Future Worlds Impact Assessment in March 2019 and other key activities throughout 2019.

Figure 4. Consultations from 2018 to early 2019



You said, we did

Stakeholder feedback
Stakeholder feedback is vital to the success of the Open Networks Project and, specifically, in meeting short and long-term objectives. Below is a summary of how we addressed stakeholder feedback in 2018. More detailed stakeholder feedback[9] is available on the ENA website where documents are published following stakeholder feedback and consultations, and questions and answers raised during our events and webinars.

You said:	We did:
'There should be more transparency within the project.'	Due to the nature and scale of the project, the Open Networks Project should put more effort into making work and progress more visible and transparent to the public.	Our communications and project teams increased social media activity, support for public events and the frequency of the Open Networks Project newsletter, which is now shared quarterly. The newsletter reaches around 500 people, providing information such as upcoming events and developments, recently published documents and appropriate links to more information.
'Improved access to event, meeting and consultation material etc.'	To further increase transparency, there should be an increased level of access to the Open Networks Project materials to improve visibility and for increased practicality.	We upload newly published project materials on to the ENA website and provide the links to relevant stakeholders. We have maintained and used both internal and external email distribution lists to ensure that information is available to all those who have noted their interest in the project's work.
'It would be good to see an increase in stakeholder engagement – i.e. webinars, dissemination events and specific product workshops.'	You wanted to see more opportunities for meaningful stakeholder engagement and input into the direction of work, providing greater transparency and increasing the effectiveness of stakeholder engagement.	We have held a variety of dissemination events, workshops, forums and webinars, in addition to ongoing engagement with the project's Advisory Group. Webinars have been especially successful due to the flexibility they offer to stakeholders in different geographic locations. At the same time, events were held in different locations around GB, including Scotland and regional England, to accommodate stakeholders unable to commute to London.
'We would like to see an extended window for stakeholders to respond to consultations.'	Given project work, deadlines and other industry consultations, you asked for more consultation timelines to be extended to allow stakeholders to provide higher-quality, more detailed responses.	We have increased our standard consultation window from four weeks to six weeks and most recently, allowing eight weeks for responses to the Future Worlds consultation. This has resulted in double the previous number of consultation responses, as stakeholders have more time to respond while managing other priorities.

[9] http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-stakeholder-engagement/events.html

Case study

Electricity North West: Leading the way in community energy

New research from Electricity North West reveals 70% of British consumers believe they have a role to play in the UK's energy infrastructure, but 55% stated they did not know how to get involved.

Commissioned to explore the British public's understanding and interest in engaging with community and local energy, the survey of 1,413 UK consumers highlighted that only 2% of people are actively participating in a community energy group, despite 63% admitting they would be interested if they could save money. When asked what aspects of community energy involvement appeal to them, the top motivator was money saving (63%), followed by increasing energy efficiency (45%) and reducing their carbon footprint (41%).

Carbon Coop is a North-West based community energy group that works to help householders and communities make big reductions in their energy use and carbon emissions. Its CEO, Jonathan Atkinson, added: "In those communities where local energy groups are already active, the benefits are tangible so we're keen to continue our collaborative work to ensure more people can see the advantages community involvement can bring, not just locally, but nationally also. We're understandably excited for the future of Britain's energy infrastructure and the key role community and local energy groups will increasingly play in this."

Alongside this research, Electricity North West has launched its Community and Local Energy Strategy[10].

[10] https://www.enwl.co.uk/globalassets/community-and-local-energy/documents/enwl-community-and-local-energy-strategy.pdf

Case study

Northern Powergrid: Socially positive innovation

As low-carbon energy sources and technologies grow, there are often concerns that their intermittent nature will reduce reliability or increase costs. The electricity networks want to ensure that the public, especially the most vulnerable members of society, will be protected from this.

Northern Powergrid has developed a suite of projects aimed at ensuring low-carbon technologies address these concerns and improve the service provided to all customers. These include:

– MicroResilience, which looks to redefine parts of Northern Powergrid's low-voltage network as distributor-owned resilient micro-grids, encouraging peer-to-peer and community energy schemes which ensure people have access to secure, reliable energy.

– Silent Power uses a mobile, battery-balanced micro-grid in fault situations instead of traditional diesel generation to ensure reliable energy while allowing people to continue to use their own local generation, such as rooftop solar PV power. This preserves the income stream for customers while reducing noise levels and reduces Northern Powergrid's emissions by using less diesel generation.

– Resilient-Homes is an innovative project using second-life electric vehicle (EV) batteries to help customers who are medically-dependent on electricity for energy. The lifecycle of electric vehicles means that these batteries will become plentiful in the near future. Through this trial, Northern Powergrid installs batteries in these customers' homes to provide additional support, while encouraging recycling and avoiding electric vehicle batteries becoming the 'asbestos of the future'.

3.0 – Enabling flexibility services markets

GB DNOs made a new commitment in 2018 – named the Flexibility Commitment[11] – to openly test the market for flexibility services and have already procured a range of these services. This commitment allows for flexibility services options to be compared with traditional grid reinforcement in areas of constraint to help connect customers.

During the year, we completed work to develop and define the types of flexibility services that could be procured by DNOs and, in the future, by the DSO. This built on the experience of National Grid ESO, specifically drawing on their System Needs and Product Strategy (SNAPS) to rationalise and improve services and flexibility tenders offered by DNOs.

The Open Networks Project's philosophy is to 'learn by doing' and the evidence of progress in the market demonstrates this is working.

Through the Flexibility Commitment, Britain's DNOs are now committed to:
– Opening up requirements for building significant new electricity network infrastructure to include smart flexibility service markets as part of day-to-day operations. This covers all new relevant projects of significant value, where local electricity operators face congestion in grid infrastructure that results from increased electricity demand and/or distributed energy projects being connected to the grid.
– Openly test the market to compare relevant reinforcement and market flexibility solutions for all new projects of any significant value.
– Working with Ofgem and other stakeholders to develop the forthcoming RIIO-2 price control framework to ensure that the financial incentives that network companies receive are fully aligned with the greater use of flexibility services and do not favour the building of new infrastructure where these services are more efficient.

3.0.1 – Active power flexibility services

We initially considered a range of new flexibility services in 2018, with the decision to focus on potential active power services for networks because local network congestion is a high priority issue. Reactive power and other ancillary services will be considered in 2019.

The outcome of this work was a new, standardised set of active power flexibility services which could be procured by the DSO – these are outlined below. The DNOs are now looking to adopt these services as standard and to use consistent terminology to refer to these services in future tenders.

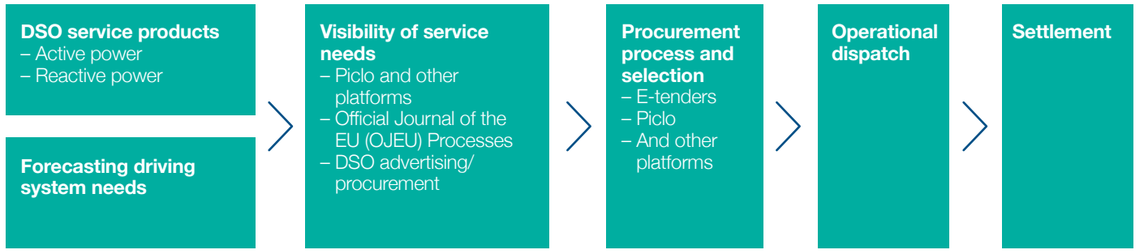
Figure 5. Standardised active power flexibility services

Service characteristics	Scheduled constraint management	Pre-fault constraint management	Post-fault constraint management	Restoration support
When to act	Pre-fault	Pre-fault	Post-fault	Post-fault
Triggering action	Time	DSO forecast; or asset loading	Network fault	Network fault
Certainty of utilisation	Very certain	Uncertain	Uncertain	Very uncertain
Efficiency of utilisation	Low	Medium	High	Low
Risk to network assets	Low	Medium	High	Low
Frequency of use	High	Medium	Low	Low

[11] http://www.energynetworks.org/assets/files/ENA%20Flex%20Committment.pdf

We are now looking at how we can further standardise and converge practices across DNOs for the end-to-end process of procuring DSO services. A representation of the end-to-end process for commissioning flexible services is shown below.

Figure 6. End-to-end process for DSO services



Case study

UK Power Networks: Flexibility First zones and Flexibility Roadmap

UK Power Networks has announced plans to procure more than 100 MW of flexibility from DER, as part of its recently launched Flexibility Roadmap. The company will lower energy costs for the public by delivering a stronger, more resilient electricity network and better managing electricity demand at peak times.

These flexible energy services will be procured across 25 so-called 'Flexibility First' zones within UK Power Networks' three licence areas: London; the South East; and East of England. The tender went live on the Piclo platform – an online marketplace for buying and selling flexible services – before the end of October 2018. The zones[12] can be viewed live online.

In its Flexibility Roadmap, UK Power Networks has made a major commitment through until 2023 to test the market for flexibility that can be used in place of new load-related grid reinforcement. This work will begin with the higher-voltage parts of the network, but commercial solutions for accessing flexibility on the lower-voltage networks are also being explored. In addition, flexibility will be used to manage planned maintenance and unplanned interruptions from 2019 onwards.

The Flexibility Roadmap[13] is available online and interested customers can register their interest online to participate in upcoming tenders.

Flexibility products		Reinforcement deferral	Planned maintenance	Unplanned interruptions	
				Pre-fault response	Post-fault response
Value drivers		The present value of deferring capital expenditure	Managing unplanned interruption risk during planned maintenance	Customer Interruption (CI) and Minutes Lost (CML) incentives	Avoid cost of temporary generation and potentially CML's
2023 flexibility potential (MW)		206	Available to eligible DER capacity		
High-level requirements	Location specific	Yes			
	Response time	30 mins maximum		<10 mins preferred, 30 mins maximum	
	Response duration	Full available window – case dependent. Pro-rated payment if available for part of window		3 hours Pro-rated payment if available for part of window	
	DER type	Generation, storage and load reduction			Generation and storage
Contracting principles	Procurement type	Competitive tenders or administratively set prices if low liquidity		Framework agreement Optional updating of pricing through contract	
	Procurement lead time	6 months ahead and 18 months ahead	Case specific 1–12 months	DER applies if eligible	
	Payment	Availability and utilisation		Utilisation only	
	Contract team	1– 4 years	Monthly or seasonal	Framework agreement	

[12] https://picloflex.com/dashboard
[13] http://futuresmart.ukpowernetworks.co.uk/wp-content/themes/ukpnfuturesmart/assets/pdf/futuresmart-flexibility-roadmap.pdf

Case study

Western Power Distribution: Flexible Power

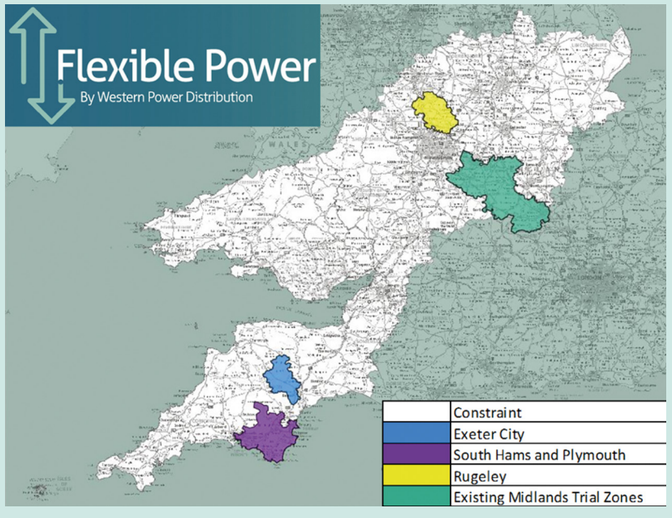
Western Power Distribution's Flexible Power brand is simplifying complex, demand-side flexibility solutions for the electricity network, forming part of the company's ongoing work to transition to a DSO.

Where these flexible solutions will work, customers will sign a contract with Western Power Distribution to shift or alter their electricity usage at certain times. Not only will this generate revenue for customers, it will help Western Power Distribution to manage the system and avoid investment in substations and cables, which is costly and time-consuming.

To enable this to happen, Western Power Distribution is developing a new tool which addresses some of the contractual complexities related to demand-side flexibility services and instead delivers a simple service so customers can sign up and maximise their revenue.

Flexible Power is continuing to expand into new zones within Western Power Distribution's licence areas, with the company committing to consider such demand-side flexibility services for major network upgrades. During summer, in 16 out of 18 zones such services were identified as being suitable for overcoming network constraints and were progressed on to procurement.

During a trial in the Midlands zone, Western Power Distribution received expressions of interest for 121.47 MW of flexibility services while a second follow-up call resulted in more than double the number of services offered.



Case study

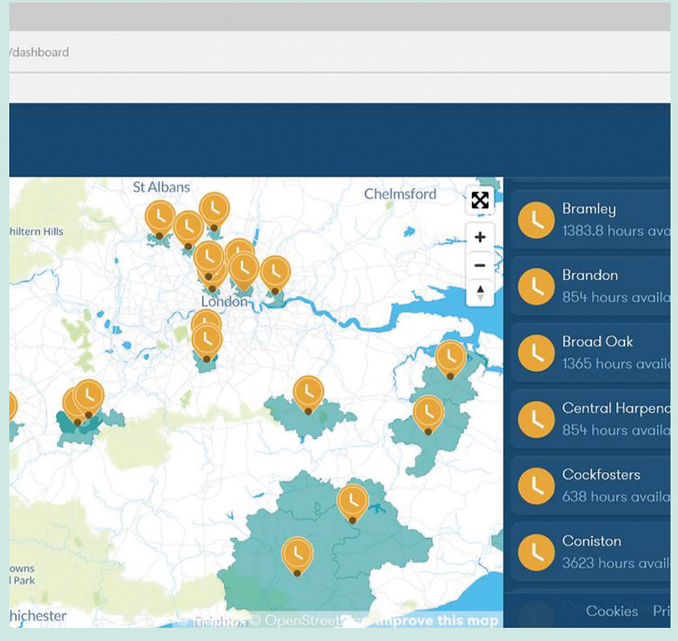
All areas of GB: DNOs join Piclo Flex platform

All six UK DNOs have taken another step toward identifying how DSOs might interact with a marketplace for flexibility services in the future by signing up to trial the new Piclo Flex platform.

As a sign of how the industry is changing, it is a new online marketplace for everyone – including aggregators, energy suppliers, communities and even electric vehicle charging operators – to buy and sell flexibility services. As neutral market facilitators, platforms such as Piclo Flex will be valuable in helping to lower barriers and increase participation in these markets as they grow.

The Piclo Flex platform takes the proven model of running flexibility auctions and enhances it with the latest web design and matching algorithms. The result is a smart and easy-to-use platform which makes network congestion areas visible ahead of time, helping flexible services businesses to plan for future opportunities.

This pilot shows how, in the future, market players could access available flexibility tenders on a single platform, with streamlined procurement, auction, contracting and settlement processes. It builds on the continued work of the DNOs to improve the information available and accessibility for parties looking to be involved in flexibility services markets.



3.0.2 – A system-wide resource register

Providing information on DER available in the market at any given time will enable the increased deployment of customer flexibility to benefit the system.

In line with this, we have developed an outline of what type of system resource information could ideally be made available to customers and carried out a feasibility study on a proposed format for a system-wide resource register. We have also produced recommendations for how we may improve or add to existing information sources to benefit all customers. The next stage of this work is to understand how we can close gaps in this available information.

As part of this work, we undertook a survey to understand what information is currently available from DNOs, with a summary of this shown in Figure 7 below. We subsequently worked with stakeholders to understand what they might want to see included in a system-wide resource register and this is shown in Figure 8 below. There are still many challenges to overcome in making some of this data available, including confidentiality, but we have taken the approach of starting with which data would provide the most value and exploring if it is possible to make this available. This work will continue during 2019.

Figure 7. Summary of information available from DNOs

DNOs	Descriptor of information
Asset data*	Information on assets.
Capacity maps (dynamic)	The availability of traditional capacity. This is determined by finding the difference between asset rating and peak loading for a number of assets. The minimum permitted generation and demand is calculated at a Primary level and all assets above.
Heat maps (static)	Fault level, thermal overload and voltage exceedance data is captured from Primary System Design and formatted into a table. This information is then translated into a coloured, highlighted geographic overlay onto the Extra High Voltage (EHV) network.
DNO contracted volumes	Contracted volumes for generation are aggregated by Primary/Bulk Supply Point/Grid Supply Point. Level of detail varies across DNOs.
DSOF	Distribution System Operability Framework which details and describes the top operability issues to influence industry into creating/developing solutions.
Flexibility requirements	Analysis of curent and future distribution flexibility requirements is undertaken and quantified. Forecasted information on Month and Hour MW/MWh requirements are collated per nominated constraint.

Figure 8. Proposed format for a system-wide resource register

GB-wide resource register – proposed format

Customer name	Project site	Connection site (GSP)	Supply point	Primary	MW connected	MW contracted	Export MW capacity	MW change (+/-)	Effective date MW change	Type of connection	Date connected	Licence area	Plant type	Service provider Y/N	Type of service	Contract duration	Exclusivity Y/N

Reinforcement works register – proposed format

Customer name	Works description	Works completion date	Driver (generation/ demand)	Licence area	T/D	Customer name	Customer site	GSP	Customer completion date	Queue position

3.1 – Improvements to grid connections processes

Within our Customer Experience Workstream, we have been looking at how we can improve the end-to-end connections process and converge on good practice to improve our customers' experiences.

This has included a programme of detailed customer and stakeholder engagement to deliver a comprehensive understanding of service needs by specific customer group. This will be key in informing DNO policies and investment plans for the RIIO-2 price control period, starting in 2023 for the electricity distribution network operators.

We have developed a baseline understanding on the current delivery of today's services, recognising the changes taking place as a result of the transition to DSO, such as increasing amounts of flexibility services, and allowing for a comparison by highlighting good practice across network operators.

As shown in Figure 9 below, we have considered the end-to-end connections process and then assessed where we can make improvements.

Figure 9. The end-to-end connections process

Network connection process stage	Application management Pre-application	Offer management Post-application Pre-offer	Interactivity management Post-offer Pre-acceptance	Queue management Post-acceptance Pre-connection	Operational management Post-connection
Network capacity	**Visibility**	**Required**	**Offered**	**Contracted**	**Utilised**

The feedback from stakeholders at the 2018 LCNI conference was that we should focus on the visibility of network capacity early in the connections process. In accordance with this priority, one of the key products we have delivered in 2018 is the Good Practice for Applications Guide. This sets out good practice that is and will be made available to customers, including:

– surgeries and meetings pre-application;
– good practice for heat maps and information provision to customers;
– potential for "Optioneering" to identify multiple options for connection;
  – allow customers to submit a number of different capacities for the same site;
  – receive budget costs; and to
  – progress the chosen option to a formal offer based on the original submission date.

3.2 – Flexibility in the connections queue

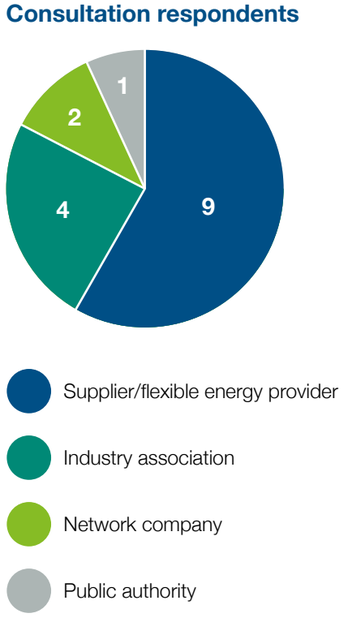
Ofgem and BEIS' Smart Systems and Flexibility Plan asked the Open Networks Project to consider if flexibility services could be promoted up the connections queue to free up capacity in the network for other connections. Licences and new connections processes were originally written with traditional demand and generation in mind, but penetration and variety of non-traditional DER has increased over time, giving us the opportunity to do more to improve the opportunities for connection.

Issue	Action
Network connection rules were not designed with storage in mind, which can lead to a number of issues, including a lack of understanding of how storage connections should be treated (by both network operators and connecting customers) and the cost and time of connecting.	We expect network operators and industry to continue to improve network connections for storage – in particular, acting now to clarify the connection process (including for domestic and co-located storage), increasing transparency about where to connect, and implementing better queue management. Ofgem willl use the Incentive on Connections Engagement, an incentive developed under the RIIO framework, to assess if distribution network operators are addressing these issues and ensure they are engaging with connection stakeholders and responding to their needs.

Figure 10. Summary of queue management consultation responses

In 2018, we consulted with stakeholders on if and how we might promote flexibility providers, including storage, within the connection queue. A summary of consultation respondents is shown in Figure 10. Some of the key consultation views are summarised below.

- A clear transparent process is needed, with well-defined principles and tests.
- The importance of certainty on connection timescales and possible impacts if flexible resources are promoted.
- Differences between how DNOs manage queues at present; queue position is key and could make or break projects.
- Continued importance of physical network reinforcement.
- Several respondents raised concerns on DER behaviour and whether the promotion of flexible resources would continue to provide benefits over time.
- Use of flexible resources to unblock queues should be linked to wider service opportunities for flexible resources.
- Trials or real examples should be included in the Open Networks Project's good practice guides.
- Respondents were supportive that Facilitating Connections (WS1 P11), Good Practice ahead of Connection Applications (WS2 P2) and Queue & Interactivity Management (WS2 P5) focused on the right issues.

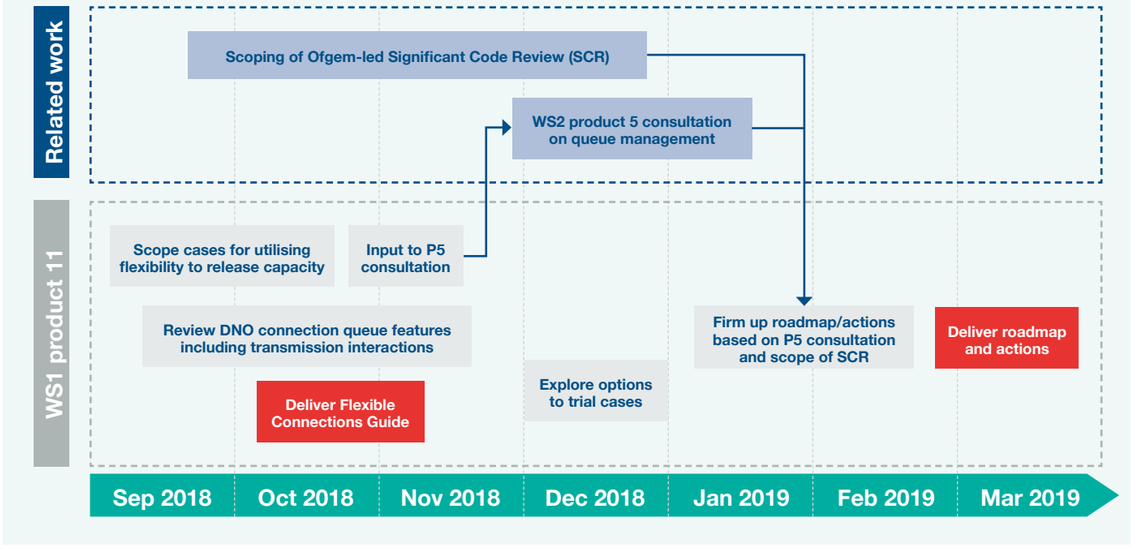


The core actions planned in response to the consultation feedback were as outlined below.

- While direct support for promotion in the queue was mixed, almost all respondents supported the work by the Open Networks Project and the Charging Futures Forum in this area. To more clearly communicate the concepts and alleviate some of the concerns, the Facilitating Connections (WS1 P11) product shall now be used to develop a set of examples, drawing on some of the ideas shared by stakeholders through their consultation responses. This set of example scenarios will be based on real cases where possible.
- Stakeholders now have the opportunity to feed back and comment on the newly added examples through the pre-acceptance section within the Queue Management[14] (WS2 P5) consultation published in November 2018.
- Given the potential impact of the Ofgem Significant Code Review on access and charging (SCR) work on the connections process, the phasing of the detailed roadmap and report shall be altered slightly to facilitate incorporation of CFF consultation responses and planned actions. The output will be staged, delivered in part through the Queue Management consultation and then in full at the end of the year.

We have consulted further on queue management in November 2018, alongside our consideration of interactivity. Given the inconclusive nature of the responses to our first consultation, we will be looking to further develop queue management proposals as part of our 2019 Work Plan, as shown in Figure 11. Beyond this timeline we expect to be conducting a further consultation later in 2019.

Figure 11. 2019 planned work on queue management proposals



[14] http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-stakeholder-engagement/public-consultations.html

Case study

SP Energy Networks: Good practice following connection applications

The electricity networks are finding new ways to manage DER connections in processing queues, with an Open Networks Project-led good practice guide used by SP Energy Networks to launch its queue management policy in some network areas.

SP Energy Networks has experienced high volumes of connection applications for DER, which have led to the formation of contracted queues, as well as having a knock-on impact on timescales for connection, interactivity, connection costs and the transmission system. This was further exacerbated by the principle of reserving capacity on a first-come, first-served basis, rather than taking into account the ability of projects to be progressed more or less quickly.

To address these issues, SP Energy Networks worked with customers and stakeholders to develop a queue management policy for its SP Distribution (SPD) and SP Manweb (SPM) network areas. As a result of this work, since mid-2018, 189 MW of capacity has been handed back to the distribution network, providing more opportunities for particular connections to be progressed.

Taking advantage of the learnings from this pilot, roll-out plans have now been developed and some implemented across SP Energy Network's 10 remaining SPD and SPM districts. The learnings are also being shared with the wider industry through the Open Networks Project.

More information on SP Energy Network's Queue Management Policy[15] is available online.

[15] https://www.spenergynetworks.co.uk/userfiles/file/Queue_Mgt_Policy_Communication_Dec_2016v3.pdf

Case study

Scottish and Southern Electricity Networks: Orkney Islands Alternative Approach to connection queues

Alternative Approach is helping to unlock the enormous renewable energy potential on the Orkney Islands in Scotland by overcoming barriers that have long prevented new connections to the grid. The three main barriers stopping connections have included: a fixed capacity queue; misalignment of times; and securities and liabilities.

Alternative Approach has involved reinforcing the network in incremental stages and allocating capacity on a 'ready to connect' basis. This has allowed reinforcement to progress on a trial basis, with agreement from National Grid ESO and Ofgem, and to meet the needs of renewable generators wishing to connect.

Successful stakeholder consultation has facilitated the agreement of important contractual changes, including:

– ensuring timescales associated with milestones take into account island weather conditions;
– introducing a simple 'tolerance period' to provide flexibility, which was then extended; and
– introducing a new milestone 'order placed for plant' which recognised the challenges of using milestones for queue management across transmission and distribution.

The Open Networks Project's work on queue management and interactive applications has informed this approach and led to better information being made available to customers. At the same time, Alternative Approach has provided further learnings on queue management to the Open Networks Project and industry.

3.3 – Capacity management

We had planned to work on developments to improve capacity management in the distribution systems in 2018, but given the work underway by Ofgem to review access and network charges we have reassessed our work in this area; it has been re-scoped to align with the charging work explained towards the end of this report. There is an important role for ENA experts in providing input to that work and helping customers to understand the options being considered. This support is planned to continue in 2019 through the process that Ofgem determines, as described in a later section below.

3.4 – Information provision

Another key element of the Customer Experience workstream has been the analysis of information available to customers now and how we make improvements to maximise the utilisation of DER and support the re-tasking of existing customer assets, as well as the connection of new flexibility resources.

Within the project we are developing early recommendations to improve connections for customers, including:

– DNOs should point customers towards industry practices for them to be familiar with these and make it easier for them to follow the connections process;
– connection agreements need to be fully reflective of the equipment installed and hours of operation of customers' equipment on the connected site;
– DNO websites need to provide more easily accessible information to customers considering making changes to an existing installation; and
– DNO application forms need to be amended to make the process clearer and easier.

We have published a reference and myth-buster[16] document for stakeholders to help them navigate the myriad of industry terms and conditions that are used within the electricity system. This will be maintained and updated.

For example, the inability of a network to enable all resources to operate at the same time leads to **'constraints'** in network capacity and **'constraints connection'** arrangements. The reductions in output that then result for certain customers are referred to as **'curtailment'** and network companies will often carry out **'curtailment assessment'** when they are developing connection arrangements for customers.

[16] http://www.energynetworks.org/assets/files/180723%20ON-PRJ-WS2%20-%20P3%20Terms%20and%20Definitions%20V1.1%20(published).pdf

Case study

Western Power Distribution: Network Flexibility Map

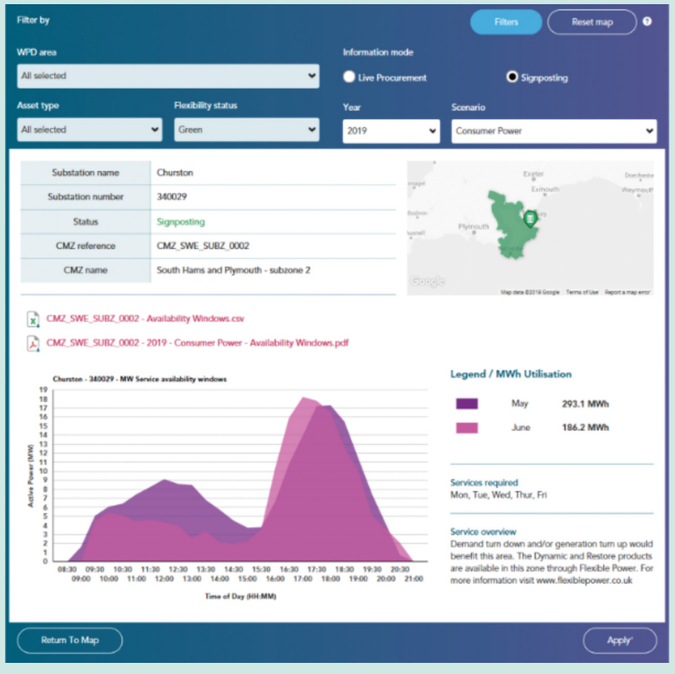
Whilst markets for flexibility services already exist at a national level, the markets for flexible services at distribution level are in their infancy – this means DNOs are having to find solutions for needs that have never existed before.

Western Power Distribution has now launched a signposting service, known as its Network Flexibility Map, which provides flexibility services providers with direction on future network needs and allows flexibility to be used to its full potential. Specifically, it describes Western Power Distribution's predicted system needs in a geographic area over a five-year period, drawing on four future energy scenarios that are co-ordinated with National Grid but have a regional focus. It includes detail on system needs at times of the day, week and year, and how many MW or MWh might be required.

The Network Flexibility Map is developed on the basis of neutral market facilitation, which is key to ensuring equal access for all flexibility service providers on the market, whether they choose to contract directly with DNOs or through another party such as an aggregator.

Not only is this new service essential to driving performance and efficiency for Western Power Distribution's network in the future, but it is ensuring the operator can meet the future energy demands of the public while providing new opportunities to customers.

The Network Flexibility Map[17] can be viewed online.



[17] https://www.westernpower.co.uk/network-flexibility-map

3.5 – Whole system investment planning

The Network Options Assessment (NOA) process aims to ensure co-ordinated, economic and efficient development of the National Electricity Transmission System.

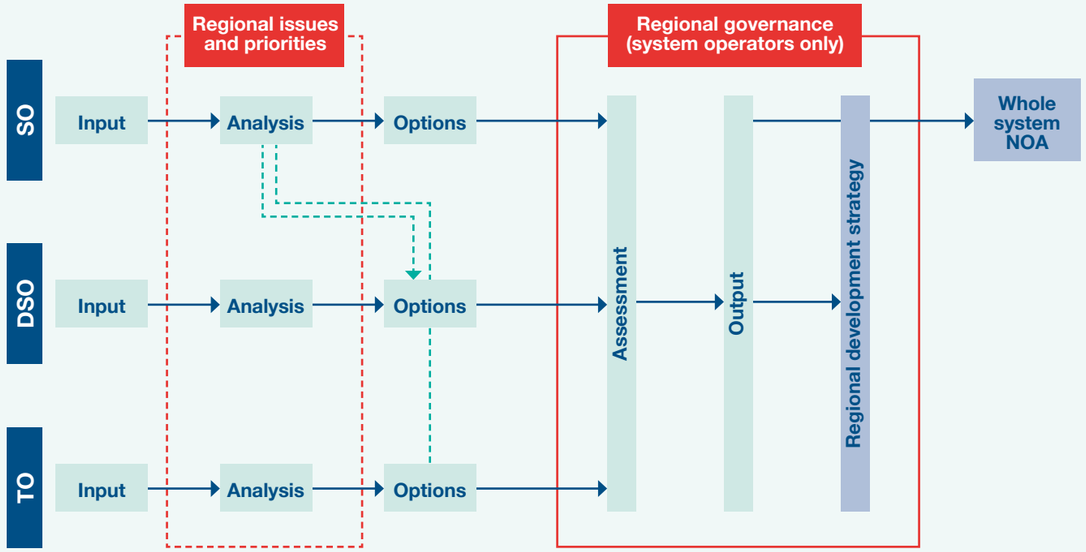
Currently, the NOA's scope is focused on bulk power transfer and moving MWs across system boundaries, with an assessment of peak winter requirements which are then scaled up or down to reflect other year-round conditions. Historically, planning for managing winter peak periods ensured a year-round compliant system, however, with changes in the energy mix, the system is experiencing additional challenging system needs at other times of the year, such as high-voltage issues during summer minimum periods.

Over the last two years we have looked to understand the shortfalls in the existing distribution and transmission planning interfaces and processes. This work began in 2017 with compiling an understanding of how the system currently works. We then carried out a gap analysis, taking into account the evolving nature of the electricity system and the more active role of DSOs.

The outputs from this informed an improved NOA process which takes into account regional issues for whole electricity system investment planning. This improved process, shown in Figure 12 below, is being applied to a high-voltage case study in the Pennine region within the Open Networks Project's Workstream 1, Product 1.

We are now developing a roadmap for further improvements to investment planning processes, learning from case studies and existing issues. We are also considering options for how funding is routed between transmission and distribution companies, where action is taken on different networks to mitigate issues such as constraints.

Figure 12. Improved NOA process for whole system investment planning



Case study

UK Power Networks, Western Power Distribution, National Grid ET and National Grid ESO: Regional Development Programmes

UK Power Networks, Western Power Distribution, National Grid ET and National Grid ESO have all been involved in the launch of new services which release additional network capacity for DER in the South East and South West of England, areas with some of the most dynamic electricity networks in Europe. These activities are part of what have been named Regional Development Programmes.

Significant amounts of renewable energy generation, a nuclear power station and interconnecting cables to Europe are factors which make managing electricity flows in these areas complex for both transmission and distribution network companies. Further, new distributed energy generators in some of these areas have often faced significant costs to reinforce the grid before they can connect.

To overcome these challenges, the two DNOs have worked with National Grid ET and National Grid ESO to develop detailed network models, identified data flows and established new connections processes. Overall, it has led to the implementation of a framework in these areas, which is providing greater visibility, co-ordination and control across the whole network. It has been successful in facilitating increased capacity and new connections.

In the South East, the service is operational in a region spanning from Bolney in Sussex to Canterbury in Kent, with over 1.8GW of DER and 3.6GW of transmission-connected generation. Western Power Distribution and National Grid are providing the service in the South West, with plans to expand it into the West Midlands where energy storage is increasingly popular.

3.6 – Whole system security planning standards

We have published a review of current versions of the distribution and transmission security planning standards which identifies common elements between how these standards are approached.

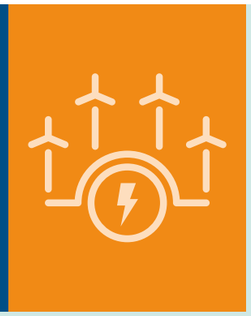
As part of this review, any planned changes are also reviewed to understand the trajectory of changes given our focus on whole system planning. We have sought to ensure any barriers to meeting whole electricity system planning requirements are identified and that we outline further work required to best facilitate planning across the transmission and distribution boundary.

There are differences between the distribution P2 and transmission SQSS planning standards, however these differences are not perceived to prevent whole electricity system planning. The planning standards themselves will not be the key catalysts for whole system planning. Processes contained within other codes (e.g. Grid Code and CUSC) should be the correct route to allow this to happen.

Any future modifications to SQSS and P2 must be viewed through the lens of whole system planning to ensure they would not create a barrier in the future. We will be careful to identify any future modifications needed to P2 and SQSS sufficiently early, so that the two independent lengthy governance processes do not pose an issue.

Case study

UK Power Networks, Scottish and Southern Electricity Networks, Western Power Distribution and National Grid ESO: Boosting renewable energy to save customers £30m



A joint venture between UK Power Networks, Scottish and Southern Electricity Networks, Western Power Distribution and National Grid ESO has led to new market measures that are keeping the lights on and accommodating growing volumes of renewable energy in the South of England.

The four companies moved quickly to respond to potential network disturbances impacting energy supply and DER connections, such as wind or solar, ahead of summer 2018. They worked together with strategically-located electricity generators, offering funding to increase their standard protection systems to more resilient modes of protection. These protection systems safeguard the generator and the electricity network from interruptions on the local system, also preventing distributed generation from being disconnected due to an interruption on the wider network.

The operators identified this opportunity after modelling was undertaken by National Grid ESO which showed that an existing system of protection, known as Vector Shift, was highly sensitive to disturbances in the wider network and could cause some generators to stop exporting power unnecessarily.

It was also identified that across the South Coast there was a risk that one of these disturbances could significantly destabilise the system over the summer period, when solar power was at its peak. The ongoing cost of resolving such sudden changes to the amount of electricity on the network would have cost up to £30m for a single year across this area.

The project's goal was to install this new mode of protection for up to 800 MW of distributed generation. The consortium reached the target in good time and completed all the upgrade work at a total of 70 sites.

3.7 – Whole System Future Energy Scenarios

The development of the Whole System Future Energy Scenarios (FES) framework is intended to facilitate the production of scenarios which are developed with the same underlying and consistent building blocks.

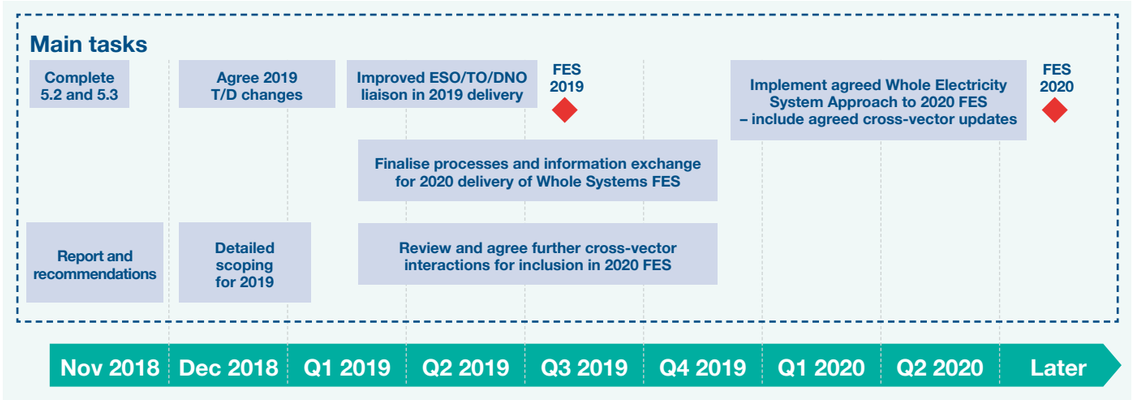
The Whole System FES will:

– provide a consistent view of possible energy futures across network ownership boundaries;
– facilitate whole system thinking within the industry;
– allow whole system requirements to be identified;
– facilitate whole system outcomes in the provision and implementation of solutions to address system requirements;
– facilitate third party participation in system development and operation; and
– provide a platform for coordinated stakeholder engagement.

We are proposing to adopt a 'Hybrid Model' to Whole System FES. In consultation with the TOs, DNOs and the wider stakeholder community, the ESO sets out FES building blocks upon which the ESO, TOs and DNOs can then base their FES scenarios, and any additional scenarios as required by the parties to better represent regional views. This option will use common building blocks to allow information sharing between parties and will contribute to more effective cross-network planning for the RIIO-2 process.

Our proposed plan for development of the Whole System FES is shown in Figure 13 below.

Figure 13. Proposed plan for development of Whole System FES



Case study

Scottish and Southern Electricity Networks: Whole energy system development projects

Scottish and Southern Electricity Networks is currently undertaking work with colleagues in the gas industry to grow the industry's understanding of what a 'Whole Energy System' approach to system planning might mean in a cross-vector context.

In Scotland, Scottish and Southern Electricity Networks have focused on an off-gas area, where fuel poverty is an issue due to the cost of alternative heating solutions. In this location, the operator is modelling a whole-system approach that would maximise consumer benefit and assess the appropriate decision-making process.

In the South of England, Scottish and Southern Electricity Networks is working with gas network operator Wales and West Utilities on its Green City Vision project, based in Swindon. This work seeks to model future cross-vector scenarios of energy growth.

Both of these projects are raising interesting questions about where the responsibility for key decisions about cross-vector network investment should sit and about the role of local strategic planning bodies. These projects will provide input to the new Whole Energy Systems workstream in the Open Networks Project in 2019.

Case study

Electricity North West: Distribution Future Electricity Scenarios (DFES) and regional impacts

Electricity North West has completed the ATLAS project – short for Architecture of Tools for Load Scenarios – through which they developed and implemented a revised methodology for producing annual demand scenarios.

From this important work, five credible views of the future were produced which indicate how different factors and influences can change electrical demand and generation on the Electricity North West's distribution network in the North West of England.

Electricity North West takes seriously its responsibility to plan for the future, supporting communities through economic development and transitioning to a low-carbon future. It also recognised that sharing this information with customers could be very beneficial for both parties, which led to Electricity North West publishing this information for the very first time in November 2018.

The operator also shared their own regional insights into potential future impacts, to help stakeholders with planning, encourage collaboration and inspire new flexible approaches in the market. To do this, Electricity North West's network was divided into four regions and an analysis from its 'Central Outlook future electricity scenario' highlighted the impact of projected demand and generation up to 2050.

The Distribution Electricity Scenarios and Regional Insights[18] document can be viewed online.

[18] https://www.enwl.co.uk/globalassets/get-connected/network-information/dfes/distribution-future-electricity-scenarios-and-regional-insights_november_2018.pdf

Case study

Northern Powergrid: Regional Planning Programme

The projected influx of new electric vehicles will require local authorities across GB to plan for and develop a huge number of new charging points. Northern Powergrid has rolled out an enhanced Regional Planning Programme (RPP) to facilitate this transition in its licence areas.

The aim of the programme has been to ensure a smooth and consistent line of communication between Northern Powergrid and local authorities, and to enable new electric vehicle connections to be rolled out in a strategic, affordable and efficient way.

Northern Powergrid has met with local authorities through events and 1:1 meetings to demonstrate how it can provide support to them throughout the transition. This includes end-to-end support, from event gatherings with their executive teams to one-on-one local support including:

– advice before, during and after electric vehicle charging point connection applications are received;
– making visits to proposed electric vehicle sites in order to help determine the best approaches;
– leading workshops on new electric vehicle connections, tailored to the specific needs of local authorities; and
– providing technical support for any and all stages of the connection process.

By the end of the year, Northern Powergrid had met with a wide range of local authorities from across its area.

3.8 – Control centre operational interface improvements

A key element of the Regional Development Programmes – collaborative development projects between some DNOs, National Grid ESO and National Grid ET – has been to develop transmission and distribution network control centres.

The aim of this work is to allow for the accommodation of additional capacity for DER ahead of major network reinforcements and to enhance transmission and distribution system coordination and control. It is the enhanced coordination and control that will provide us with the learnings for improved transmission-distribution interfaces.

3.9 – Implementation of the Transmission Impact Assessment process

Last year, we reported on the improvements proposed in the new Transmission Impact Assessment process which is intended to resolve customer connection issues with the previous Statement of Works process. This process is followed in situations where transmission investment is required to make a connection to the distribution network.

Case study

Scottish network companies: Transmission Impact Assessment (TIA) process

A number of steps were taken by transmission and distribution companies in Scotland in 2018 to implement the new TIA process, as developed by the industry's Open Networks Project. Priority has been given to Grid Supply Points where the process is most needed. These steps have included:

– a review of the initial rollout and results in England and Wales, and learnings from a SP Energy Networks trial on the TIA process;
– lessons learnt have been incorporated into discussions between Scottish TOs, DNOs and ESO for rollout;
– gained agreement that large generators (>10 MW in SHET, the SSEN transmission area (Northern Scotland) and >30 MW in SPT, the SPEN Transmission area (Southern Scotland) will be included on a trial basis as the current scope of the Transmission Impact Assessment (TIA) excludes 'large' from inclusion within TIA/Appendix G process for access;
– commercial framework between National Grid ESO and Scottish and Southern Electricity Networks and SP Energy Networks TOs has now been agreed as a basis for implementation; and
– revised form of Appendix G developed between SP Energy Networks Transmission and National Grid ESO to be adopted by all TOs.

Next steps will further address outstanding activities and amendments will be incorporated into the System Operator – Transmission Owner Code (STC).

These include:
– data requirements;
– roles and responsibilities;
– planning limits;
– application of queue management and interactivity once work under WS2 P5 has concluded;
– application fees;
– securities and liabilities; and
– connection types.

4.0 – Developing Future Worlds

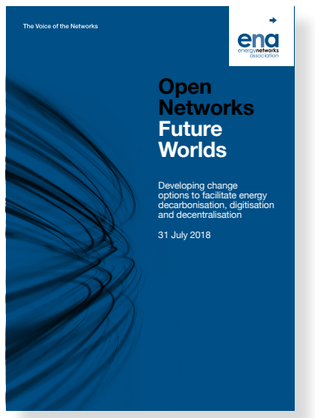
A focus for the Open Networks Project in 2018 was finalising the development of SGAM for potential future industry structures and consulting on these in our Future Worlds consultation.

Through the consultation, stakeholders provided feedback on five scenarios – known as Future Worlds – for the future electricity system. In direct response to feedback on the SGAM work, we expanded the number of Future Worlds from three to five.

In addition to the five Future Worlds, we also consulted on:
– the principle of neutral market facilitation;
– key enablers for the transition;
– market agnostic elements of the transition that we should progress; and
– how the future world scenarios should be independently assessed.

At the same time, we have continued to progress along a timeline, as shown in Figure 14, to outline market functions and activities for the future electricity system.

Figure 14. A timeline for delivering the DSO



Stakeholder feedback from the Future Worlds consultation – around 50 responses[19] which are available to be viewed online – is now being used for a relative impact assessment.

Led by independent economic consultants, the impact assessment involves comparing the relative costs and benefits of the five worlds, alongside other factors such as degrees of complexity. We will consult on the results of this impact assessment in Q1 2019, with the overall aim to continue providing evidence that can be used to progress areas of Least Regret, as set out in Figure 17, as well as continuing to support any potential future decision-making by BEIS and Ofgem.

An overview of the Future Worlds is shown in Figure 16 and a breakdown of the types of respondents to the consultation is shown in Figure 17.

[19] http://www.energynetworks.org/electricity/futures/open-networks-project/future-worlds/future-worlds-consultation.html

Figure 15. Breakdown of Future Worlds consultation respondents

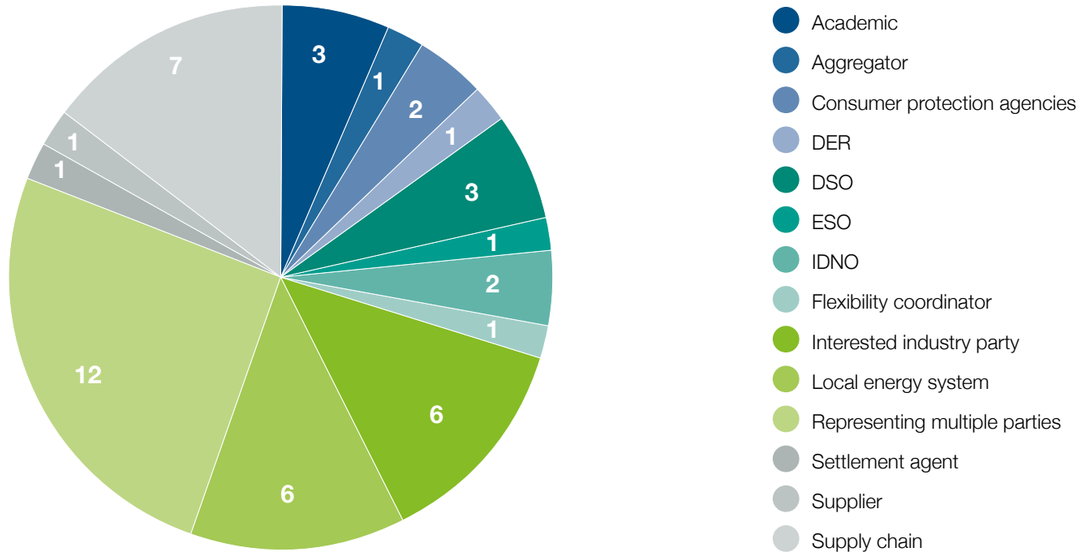


Figure 16. Overview of the five proposed Future Worlds

World A

DSO Coordinates – a World where the DSO acts as the neutral market facilitator for all DER and provides services on a locational basis to National Grid in its role as the ESO.

World B

Coordinated DSO-ESO Procurement and Dispatch – a World where the DSO and ESO work together to efficiently manage networks through coordinated procurement and dispatch of flexibility resource.

World C

Price-driven Flexibility – a World where changes developed through Ofgem's reform of electricity network access and forward-looking charges have improved access arrangements and forward-looking signals for customers.

World D

ESO Coordinate(s) – a World where the ESO is the counterparty for DER with DSOs informing the ESO of their requirements.

World E

Flexibility Coordinator(s) – a World where a new national (or potentially regional) third party acts as the neutral market facilitator for DER providing efficient services to the ESO and/or DSO as required.

We expect that our pathway to the delivery of DSO will evolve over time as knowledge of the networks increases and the industry evolves. Key to this learning is defining and learning from network trials, particularly trials on opening markets for flexibility services.

We believe that all parties facilitating flexibility services markets will need to adopt the principle of neutral market facilitation and this remains an essential principle underpinning all of our work on the DSO role.

Case study

Transition, EFFS & FUSION (T.E.F.): Network Innovation Competition projects

Three key industry projects are progressing, which support the emergence of a DSO role in the market, after they were approved by the industry regulator in the 2017 Network Innovation Competition.

The three projects are summarised below.

– TRANSITION, submitted by Scottish and Southern Electricity Networks and Electricity North West, which is trialling the Open Networks Project's Future Worlds in 2 locations.
– Electricity Flexibility and Forecasting Systems (EFFS), submitted by Western Power Distribution, which is developing new forecasting algorithms to determine operational requirements and deploy flexibility more effectively.
– FUSION, submitted by SP Energy Networks, which is using flexible resources to make more efficient use of the network systems in Fife.

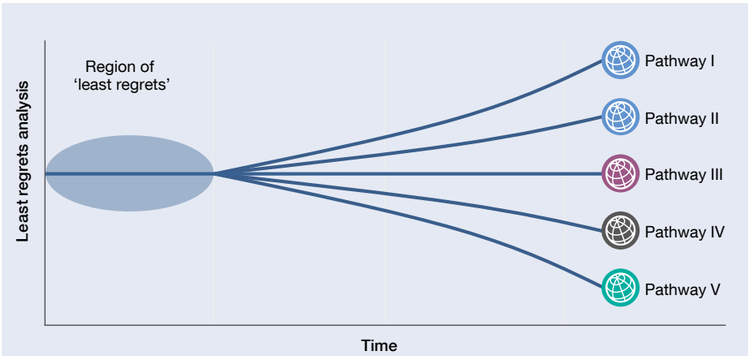
The three projects are looking at different aspects of the DSO transition with differing aims and areas of focus. At the same time, under the direction of Ofgem, they are collaborating closely to reduce the risk of unnecessary duplication, improve delivery efficiency and ensure the projects deliver complementary learnings.

The projects have now been aligned into a common governance structure and the inputs and outputs to the Open Networks Project have been identified and continue to be developed. These trials are key to the Open Networks Project philosophy of 'learning by doing'.

4.1 – Least regrets analysis

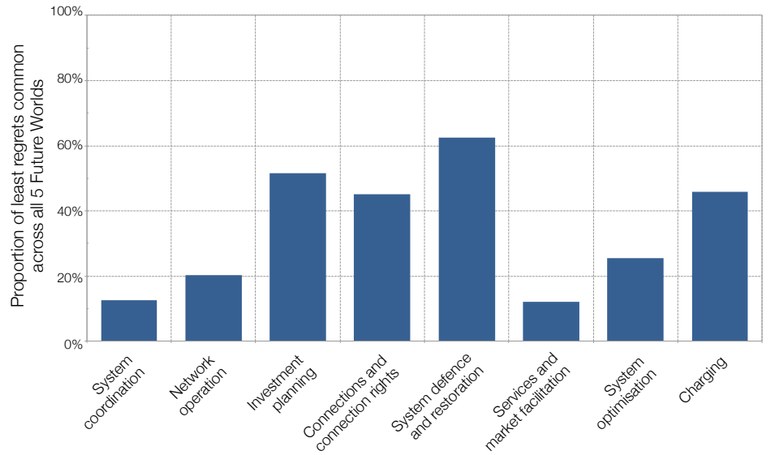
As part of the work to model the five Future Worlds, the project has identified areas of functionality that are common across all of the worlds. This functionality – considered to be 'least regrets' – presents opportunities to implement aspects of a smart grid now, without waiting for the conclusions of the Future Worlds work. It identifies tactical steps that we can take toward the DSO transition which are required regardless of the final structure of the system, as shown in Figure 17.

Figure 17. Least regret developments



Areas of least regrets are typically aligned with achieving whole-system objectives through long-term planning and established regulatory frameworks, which is what we were expecting. This is shown in more detail in Figure 18.

Figure 18. Areas of least regrets across the five Future Worlds



Once we identified the 'least regrets' functionality, we held workshops to assess where these areas were already covered by the Open Networks Project or other industry initiatives. This confirmed that our work to date was prioritising the right tactical developments to progress the transition to DSO and it provided us with input to identify development work for the 2019 work plan. An example of this analysis is shown below in Figure 19.

Figure 19. Excerpt of working group analysis focusing on 'least regrets' functionality

Function	Current ON products	Other working groups
Network operation	**WS1 2** DER Services Procurement **WS1 7** ANM Information **WS1 13** Operational Data & Control Architectures	– Common Network Asset Indices Methodology (CNAIM) – Electricity Networks and Futures Group (ENFG) – Enhanced Frequency Control Capability (EFCC) Project – G89 and G99 – Low Carbon Technology Group – management of LCT – NG EFR EFCC – National Grid Enhanced Frequency Response (EFR) – Rate of Change of Frequency (RoCoF) – Requirements for Generators (RfG) – Smart Metering Data – Thermal and voltage – Business as usual by DNO

4.2 – Independent impact assessment

Following the conclusion of the Future Worlds consultation, we commissioned independent consultants to develop a relative impact assessment of the five Future Worlds. This assessment has been based on the Government Green Book methodology and has used a number of qualitative and quantitative criteria. These criteria were informed by stakeholder feedback from the Future Worlds consultation.

These criteria included:
– Cost
– Financial Benefit
– Regulatory Compliance
– Security of Supply
– Customer Impact
– Complexity

There will be a consultation on the results of this independent analysis from March 2019.

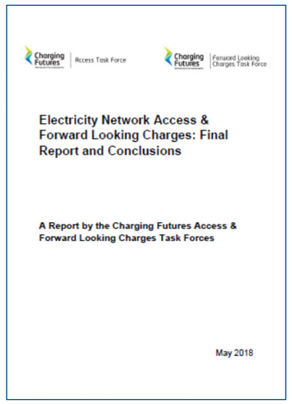
5.0 – 2018 charging development work

To date, ENA and the network companies have contributed significant resources to date to the Ofgem programme of work to develop thinking on access and forward-looking charges under the Charging Futures Forum, Charging Delivery Board and related Task Forces.

ENA has acted as the Secretariat to the Task Forces for this work and has been driving the delivery of key papers for Ofgem development. This has been content and delivery-focused and more than a traditional secretariat role, translating the results from the CFF into manageable actions and ensuring their delivery. This has included collaborative development with a wide range of stakeholders.

We have convened a number of development groups within the Charging workstream of the Open Networks Project to develop the analysis of options for access and charging and to consider specific issues, such as how to recover network costs incurred in the provision of flexible and active network management connections. Finally, we have developed recommendations to remove inefficient signals in charging and remuneration of TSO/DSO services.

Our work has been delivered to a high standard and on time and has been a major contributing factor to the success of the charging development work to date. We have contributed significantly to the delivery of the Electricity Network Access and Forward Looking Charges: Final Report and Conclusions report delivered under the CFF Task Forces.



5.1 – 2019 support to Ofgem Significant Code Review

Ofgem's Significant Code Review (SCR) was launched in December 2018 and will take forward the development of reforms to access and forward looking charges in response to the consultation published in 2018.

It is likely this will require an increased level of support from network companies to provide resource into development workstreams and working groups and the industry is preparing for this work. We need to understand what role the Open Networks Project will have to play in the SCR and, further, how this work will be taken into account in the Open Networks Project.

Looking forward to 2019 and beyond

A number of inputs have been considered in developing the work plan for 2019, including:

– continuation of development work underway from 2018;
– new areas of development based on 2018 products;
– implementation of 2018 products;
– priority areas identified in the Future Worlds least regrets analysis, including facilitation of markets for flexibility;
– progression towards the future world(s) from the Workstream 3 DSO Roadmap;
– actions defined in the updated BEIS and Ofgem's Smart Systems and Flexibility Plan;
– output from the Ofgem Charging Futures Forum; and
– introducing thinking cross-vector for whole energy system developments.

We will also consider future feedback from stakeholder responses to our 2019 Work Plan consultation.

These inputs are also shown below in Figure 20.

Figure 20. Input to 2019 Work Plan

We expect that the overall volume of work will be broadly the same as 2018 and we will prioritise our work accordingly. We have discussed with stakeholders the areas that they would like to see prioritised and we will reflect that in our 2019 work plan which we will consult on in Q1 2019, as highlighted above.

In 2019, we have split short-term improvements into three distinct workstreams so that there is sufficient focus on the different areas and so we engage the appropriate experts in the Open Networks Project. There are some key dependencies with the project which will require input and output. Trials will continue to be key to our philosophy of learning by doing.

A more general development plan for future years has been shown in Section 1 in Figure 1.

Glossary of terms and further information

All ENA Open Networks Project information can be found at the following link:

www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-overview/

An electronic copy of the 2018 Review with hyperlinks can be found at the following link:

http://www.energynetworks.org/electricity/futures/open-networks-project/eoy-report-2017.html

Term	Definition
Aggregator	An entity who acts as intermediator between electricity generators and users with Distributed Energy Resources and those power system participants who wish to use these services.
Customer	A person who is the owner or occupier of premises that are connected to the Distribution or Transmission Network.
Distributed Energy Resources (DER)	Electricity generators or users that are connected to Distribution Networks. These include electricity storage developments.
Distributed Generation (DG)	A generator, including a customer with own generation, whose generation sets are directly connected to the DNO's Distribution Network or to another authorised distributor connected to the DNO's Distribution Network.
Distribution Network	The network operated by a DNO and used for the distribution of electricity between Grid Supply Points or Generation Sets or other Entry Points to Customers and any electrical plant and meters and metering equipment owned or operated by the DNO in connection with the distribution of electricity.
Distribution Network Operator (DNO)	The person or legal entity named in Part 1 of the Distribution Licence and any permitted legal assigns or successors in title of the named party.
Distribution System Operator (DSO)	A Distribution System Operator (DSO) securely operates and develops an active distribution system comprising networks, demand, generation and other flexible distributed energy resources (DER). As a neutral facilitator of an open and accessible market it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole system optimisation. A DSO enables customers to be both producers and consumers, enabling customer access to networks and markets, customer choice and great customer service.
ED1; ED2	The period covered by an agreed set of regulatory arrangements for electricity DNOs. For example, ED1 covers the 8-year period from April 2015 to March 2023.
Generator	A person who generates electricity under licence or exemption under the Electricity Act 1989 (as amended by the Utilities Act 2000 and the Energy Act 2004).
Independent Distribution Network Operators	Independent Distribution Network Operators (IDNOs) develop, operate and maintain local electricity distribution networks. iDNO networks are directly connected to the Distribution Network Operator (DNO) networks or indirectly to the DNO via another iDNO. iDNO networks are mainly extensions to the DNO networks serving new housing and commercial developments.
Electricity System Operator (ESO)	National Grid in its capacity as operator of the National Transmission System in GB, balancing electricity supply and demand in real time.
Networks Options Assessment (NOA)	The NOA is a licence obligation under National Grid's ESO role comprising a process and methodology to compare and select solutions to address transmission system capacity requirements.
RIIO-1; RIIO-2	RIIO (Revenue = Incentives + Innovation + Outputs) price controls – Ofgem's framework for determining the allowed expenditure and associated revenues, for the monopoly electricity and gas network companies for TOs. For example, RIIO-1 covers the 8-year period from April 2013 to March 2021.
Smart Grid Architecture Model (SGAM)	From CEN-CENELEC-ETSI Smart Grid Coordination Group, December 2014: The Smart Grid Architecture Model (SGAM) is a reference model to analyse and visualise smart grid use cases in respect to interoperability, domains and zones.
Supplier	Grid Code definition: (a) A person supplying electricity under an Electricity Supply Licence; or (b) A person supplying electricity under exemption under the Act; in each case acting in its capacity as a supplier of electricity to Customers in GB.
Transmission Network	The network of high voltage lines and plant owned by the holder of a Transmission Licence and operated by the ESO, which interconnects power stations and substations.
Transmission Operator (TO)	Transmission Operators (TOs) are licensed to develop, operate and maintain the high voltage system within their own distinct onshore transmission areas.

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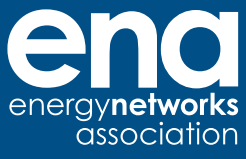

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