The Voice of the Networks

Energy Networks Association

Open Networks Project DSO Implementation Plan

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Energy Networks Association

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0.3	03/06/2020		Updated Foreword and sections 1 and 2, following feedback from the reviewers. Drafted section 3.
0.4	09/06/2020		Draft main body and Appendix A for review. Feedback from reviewers has been addressed.
1.0	11/06/2020		Final Draft for WS3 review. Main body and Appendixes A – C are included.
1.1	19/06/2020		Final Draft for SG review.
1.2	29/06/2020	Steering Group	Final Version. SG feedback has been incorporated.
1.2	31/03/2021	Connor Innes	Final Version. No changes made, re-publish to provide guidance for 2021.

Related Documents

Reference 1	Open Networks Project Phase 4 2020 Project Initiation Document
Reference 1	ENA Response to Ofgem/BEIS Open Letter

Change History

Version	Change Reference	Description

Distribution

To be published alongside publication of the online DSO Roadmap at ENA website.

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Foreword

Decarbonisation, decentralisation and digitalisation are transforming the electricity system of the UK and Ireland. The amount of electricity generated by low carbon sources increases every year, and much of this low carbon generation is connected at the distribution network. This transformation will have a great impact on the electricity networks, as system changes are particularly noticeable at transmission and distribution level. As the UK and Ireland move towards a net zero carbon economy, energy networks will need to evolve to meet customers' evolving needs and affordability as well as to meet the Net Zero target.

The Energy Networks Association (ENA) Open Networks Project (ONP)[1] is laying the foundations of the smart net zero grid in the UK and is helping to inform similar developments in Ireland. It is a key initiative to deliver Government policy set out in the Ofgem and BEIS Smart Systems and Flexibility Plan, the Government's Industrial Strategy and the Clean Growth Plan, working in collaboration with Ofgem, BEIS, 10 of UK and Ireland's electricity network operators, and other key stakeholders.

This document has been prepared under Workstream 3[2] of the ENA ONP and provides visibility of actions undertaken by all the electricity networks and system operators to deliver Distribution System Operation (DSO) Transition and net zero ready networks, capable of supporting the transformation of the energy systems, a future low carbon economy and UK's net zero targets.

The DSO Implementation Plan covered in this document focuses on those aspects of DSO that will be delivered by operators and owners. As such, the plan informs, but does not explicitly reflect, relevant activities by other energy industry stakeholders. The ENA will continue to work with all industry representatives to maximise the future benefits of DSO for all GB energy industry stakeholders and customers.

How to use this document

This document should be read in conjunction with the online DSO Roadmap, an interactive tool on the ENA website[3]. The DSO Implementation Plan provides a range of information, starting from a high-level description of the scope right through the design principles of the DSO Roadmap and its individual steps. The following quick links will help you navigate the document:

[1] Project overview: https://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-overview/
[2] Workstream 3 deliverables: https://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products-2020/ws3-dso-transition/products.html
[3] https://www.energynetworks.org/electricity/futures/open-networks-project/dso-implementation-plan.html

Provides step by step guidance on how to navigate and use the online DSO Roadmap on the ENA website.

The document is also accompanied by 8 Appendices which provide details of each step of the DSO Roadmap, grouped per DSO function, and reflect the position at the date that the information was gathered for this publication. Step name, description, progress to date, implementation dates, barriers and interdependencies are provided in these sections. You can access these documents at ENA's website[4].

Who is this document for?

This document is for all stakeholders interested in the implementation of Distribution System Operation functionality to support UK's energy transition. Stakeholders who wish to understand what actions network companies and are undertaking towards Distribution System Operation are encouraged to read this document alongside the online DSO Roadmap, which is published at ENA's website.

What will I learn?

This document will provide a consolidation of outcomes from ONP to set out a clear pathway to the implementation of Distribution System Operation (DSO) functionality in the short, medium and longer term which will help to provide greater visibility to industry. This will also serve as a tool to monitor progress and identify gaps to delivering DSO functionality.

The appendices include a snapshot of the detailed DSO Implementation Plan as at the date that the information was gathered for this publication. ENA ONP will continue monitor the progress of the DSO Roadmap, with the second iteration planned in Q1 2021 to reflect updates from RIIO ED2 business plan submissions amongst other developments. It is expected to be updated every 6 months after the second iteration.

If you want to keep up to date with the latest information from the DSO Implementation Plan Open Networks Project, subscribe to our mailing list.

[4] https://www.energynetworks.org/electricity/futures/open-networks-project/dso-implementation-plan.html

1 Introduction

1.1 About ENA and our members

Energy Networks Association (ENA)[5] represents the "wires and pipes" transmission network operators in the UK and distribution network operators for gas and electricity in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers' homes and businesses.

1.2 Purpose of this Document

This Distribution System Operation (DSO) Implementation Plan has been prepared under Workstream 3 of the ENA Open Networks Project (ONP). It is published alongside the online DSO Roadmap, an interactive tool on the ENA website[6]. Together, the Implementation Plan and online DSO Roadmap aim to provide visibility of actions undertaken by all the electricity networks and system operators to progress the least regrets pathway to DSO to deliver the benefits set out previously in our assessment of Future Worlds[7] and any barriers (regulatory, policy or others) that may affect the transition.

Together, the DSO Implementation Plan and DSO Roadmap will provide insight into DSO functionality already implemented to date, as well as anticipated windows for future implementation. The timeframe of the DSO Roadmap includes short-term activities before 2023, during RIIO ED2, as well as longer term activities. Given the dependency on RIIO2 business planning, the implementation timings are presented as a range across all of the network operators, and should be read as indicative timings. The DSO Implementation Plan and the online DSO Roadmap present a snapshot of the best view at the time of publication and will be updated periodically to reflect new information regarding activities and timings.

Section 2 below provides further detail on the scope and use of the DSO Implementation Plan and DSO Roadmap, as well as the approach of developing the plan.

1.3 Background to Open Networks Project

In December 2016, Energy Networks Association (ENA) members gave their commitment to the Open Networks Project (ONP), a major collaboration that will transform the way that both local Distribution Networks and national Transmission Networks will operate and work for customers.

Launched in January 2017, ENA's ONP has started to lay the foundations of a smart energy grid in the UK. The Open Networks Project has introduced real momentum into the development work required to enable the UK's energy networks to:

- Facilitate our customers' transition to a low carbon future, including the electrification of heat and transport.
- Address the challenges rising from the continued uptake of local generation.
- Evolve to be market enablers for a whole range of new smart energy technologies.
- Reduce costs to customers by contracting for flexibility services alongside investment in traditional and innovative network solutions.
- Play a key role in delivering overall lowest energy system costs for customers.

[5] About ENA: https://www.energynetworks.org/info/about/who-we-are.html
[6] https://www.energynetworks.org/electricity/futures/open-networks-project/dso-implementation-plan.html
[7] https://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products-2020/ws3-dso-transition/future-worlds/future-worlds-impact-assessment.html

The ONP will continue to maintain a transparent approach by making available all outputs from the project and will continue to focus on the implementation and delivery of these outputs.

Through Open Networks governance, the network companies are committed to deliver our outcomes and we will continue to provide visibility to industry on how these outcomes are being implemented by individual network companies.

2 Scope and Approach

2.1 Background to the DSO Implementation Plan

The starting point of the Distribution System Operation (DSO) Implementation Plan and DSO Roadmap is in 2017 with the definition of Distribution System Operation and the preliminary DSO Roadmap to 2030.[8] The updated definition of Distribution System Operation which underpins our work and forms the basis of the Implementation Plan is shown below:

> Distribution System Operation is a set of functions and services that need to happen to run a smart electricity distribution network. This does not focus on a single party as an operator, but recognises roles for a range of parties to deliver DSO.

In May 2018 the "Functional and System Requirements" report defined the core DSO functions and activities associated with DSO.[9] We then translated these functions and activities into a more detailed view of processes and data exchanges and captured this view into a Smart Grid Architecture Modelling (SGAM) tool and undertook an analysis of what the options might be for Future Worlds which focused on who took responsibility for what activities to deliver DSO. We defined 5 different Future Worlds with different attribution of roles and responsibilities for DSO functions and we subjected these options to an Impact Assessment and public consultation. [10]

In the conclusions to that consultation[11], we set out a pathway to Distribution System Operation which sets the direction of travel in the short term on a model of stronger co-ordination between DNOs and ESO (World B in our consultation, but also incorporating price-driven flexibility as described in World C) and allows for future changes to roles and responsibilities to deliver the most effective future DSO in the future.

This transition path to DSO is represented in the below diagram and more information to support the description of these worlds can be found in the supporting material referenced above:

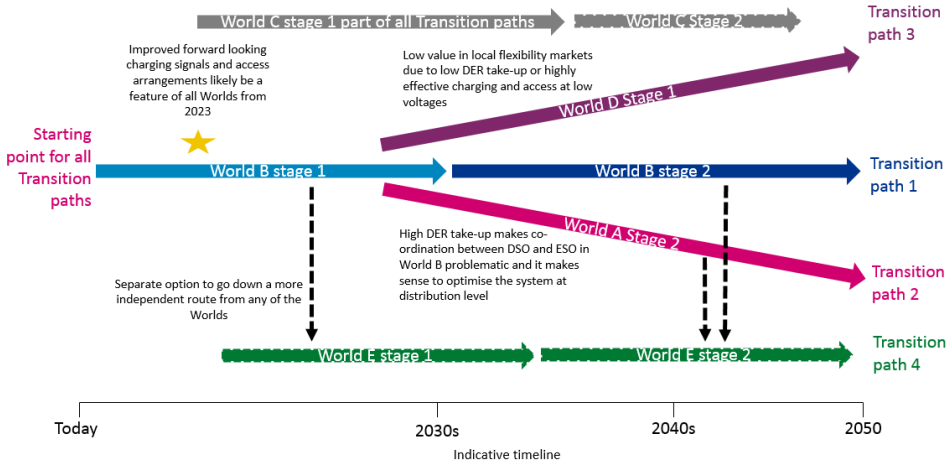


Figure 1 The Transition Path to DSO

[8] https://www.energynetworks.org/assets/files/electricity/futures/Open_Networks/DSO%20Roadmap%20v6.0.pdf
[9] https://www.energynetworks.org/assets/files/ON-WS3-P2%20DSO%20Functional%20Requirements.pdf
[10] http://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products/ws3-dso-transition/future-worlds/future-worlds-impact-assessment.html
[11] https://www.energynetworks.org/assets/files/Impact%20Assessment%20Consultation%20-%20ONP%20Response.pdf

The key next steps for Open Networks in delivering Distribution System Operation is turning completed ENA ONP work and the Future Worlds into an action and implementation plan to deliver against. Seeing when networks will deliver tangible change is a high priority for Ofgem and BEIS and was a focus of their open letter to ENA on Open Networks.[12]

The DSO Implementation Plan will be a key input to RIIO2 business planning for DNOs, as it will identify the necessary action network companies need to take. It is important that Open Networks take a whole system view on DSO implementation, therefore it is essential that the plan also includes activities, outputs and business change for the ESO and the Transmission Owners as part of the DSO Implementation Plan.

This reflects currently planned activities for network companies along the pathway identified in the conclusions to Future Worlds Impact Assessment consultation. This version of the DSO Implementation Plan reflects the position at the date that the information was gathered for this publication and will change as development plans adapt.

The scope of the DSO Implementation Plan is limited to GB and does not include developments of Distribution System Operation in Ireland.

2.2 Responding to your feedback

In July 2019, Ofgem and BEIS wrote an Open Letter to the ENA[13] to recognise the progress made to date on Open Networks and to highlight priorities and actions for the project and network companies. A key area of priority for Ofgem and BEIS was for us to build on our work and to turn it into a tangible action plan that sets out how and when least regrets actions will be progressed.

Based on this feedback (and as noted in our response to this letter), we made a decision to enhance the scope of our work in the DSO Transition Workstream (WS3) and deliver this DSO Implementation Plan. Our decision was widely supported by our stakeholders and was recognised as a move to provide greater visibility of how we are implementing DSO functionality in the short to medium term, bringing stakeholders and customers along the DSO Transition journey. In addition, the DSO Implementation Plan supports the principle of open data and information, which is a key priority for the digitalisation of the energy system.

This DSO Implementation Plan is a key project deliverable for 2020 and stakeholders have reiterated their support for this product through their responses to our workplan consultation[14] for this year and have and have flagged it as an area of high priority.

[12] https://www.ofgem.gov.uk/publications-and-updates/open-letter-ena-open-networks-project-ofgem-and-beis
[13] The Open Letter from Ofgem and BEIS and the ENA response to this letter can be found here: https://www.gov.uk/government/publications/open-networks-project-letter-from-beis-and-ofgem-to-the-energy-networks-association-ena
[14] In Q1 2020, Open Networks consulted on the workplan for the year. The responses to this consultation and the key next steps can be found here: https://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products-2020/ws3-dso-transition/future-worlds/future-worlds-impact-assessment.html

2.3 Monitoring Implementation through the DSO Implementation Plan

Our monitoring implementation activity is essential in holding ourselves to account for delivery of the outcomes and tangible changes defined within Open Networks, including:

- Good practice guidelines published by the ENA ONP
- System implementation
- Flexibility Commitment Next Steps
- Potential conflicts of interest and unintended consequences

Going forward, we will continue to monitor the above as well as the rollout and implementation of completed products across network companies to have visibility of the progress being made and understand any barriers to deployment of consistent approaches across networks. We have decided that we will use the DSO Implementation Plan to continue reporting implementation progress to provide a more holistic view of all ON as well as other DNO initiatives that are progressing the transition to DSO.

We will monitor progress on bi-annual basis with input from the network company representatives on the relevant workstreams. The next publication of the DSO Implementation Plan is planned in Q1 2021 to reflect updates from RIIO ED2 developments in 2020 amongst other developments.

2.4 Development and Contributions

In January 2020, we engaged consultants DNV GL to develop the DSO Implementation Plan and online DSO Roadmap. As part of this engagement, DNV GL has met with all GB electricity network and system operators individually as well as collectively to source and refine the necessary information. Participating companies include:

- Distribution Network Operators (DNOs): Electricity North West Limited (ENWL), Northern Powergrid (NPg), Scottish and Southern Electricity Networks (SSEN), Scottish Power Energy Networks Distribution (SPEN-D), UK Power Networks (UKPN), Western Power Distribution (WPD);
- Transmission Operators (TOs): National Grid Electricity Transmission (NGET), Scottish and Southern Electricity Networks (SSEN-T), Scottish Power Transmission Limited (SPTL); and
- National Grid Electricity System Operator (NG ESO).

As part of the development of the DSO Implementation Plan and DSO Roadmap, DNV GL has met with the ENA ONP Advisory Group (AG) and Steering Group (SG) and incorporated relevant feedback into the development process.

To capture the perspective of an independent DNO (IDNO), inputs were sought from GTC. Following discussion with GTC, it was agreed that as their flexibility strategy is currently under review, they were unable to participate fully during this development phase. It was decided that information and data from GTC will be introduced to the live online DSO Roadmap at a later date.

In addition to the electricity network and system operators, the DSO Implementation Plan and DSO Roadmap explicitly reflect information from the three 2017 NIC projects collectively known as the T.E.F. innovation projects (TRANSITION, EFFS and FUSION). [15] The T.E.F. projects are delivered in close coordination with the ENA ONP and each considers different aspects of DSO, taking a consultative role for network companies in the delivery of DSO. Other innovation projects may be

[15] Network Innovation Competition.

reflected implicitly, depending on their immediate relevance to activities reflected in the DSO Roadmap. More generally, the ENA and its members recognise the importance of innovation projects in enabling the DSO transition, and section 2.8 below provides a high level mapping of innovation projects against DSO functions to show where innovation projects feed into DSO Roadmap.

Lastly, DNV GL has engaged with representatives of the ENA, Ofgem and BEIS to capture information from collaborative industry efforts, governance, regulatory and policy-related developments into the Implementation Plan and DSO Roadmap.

2.5 Our Approach

The DSO Implementation Plan and DSO Roadmap have been developed under ENA ONP Workstream 3 (DSO Transition). Figure 2 summarises our approach to develop the DSO Implementation Plan and DSO Roadmap which consists of 6 stages. Engagement and Analysis are iterative processes as we were constantly engaging with network companies and T.E.F. representatives to update and refine our outcomes.

Figure 2 Our Approach for the development of the DSO Implementation Plan

2.6 DSO Roadmap Structure

In May 2018 the "Functional and System Requirements" report defined the following 8 core DSO functions which form the basis of the current DSO Implementation Plan: System Coordination, Network Operation, Investment Planning, Connections & Connection Rights, System Defence & Restoration, Services/ Market Facilitation, Service Optimisation and Charging. [16]

These functions are different from Ofgem's 19 DSO Functions, which were introduced at Ofgem's DSO position paper.[17] In their DSO Position Paper Ofgem took a more granular approach and identified 19 DSO Functions using the ENA ONP 8 core functions as their source. These 8 core functions were identified with input from a wide range of industry stakeholders, so we have decided to continue with this stable baseline of functions in our development and adapt them as required as we progress through the transition to DSO.

Each DSO Function consists of a set of underlying activities. Underneath each of these activities sits a body of more granular work, i.e. specific steps undertaken by different stakeholders to develop and define, implement or adopt, and to regulate or govern DSO functionality. The DSO Implementation Plan and DSO Roadmap therefore consider three layers of information, and provide insight into each layer to describe the activity, the current status, and (anticipated) timing.

Figure 3 below illustrates the structure of the DSO Implementation Plan and DSO Roadmap.

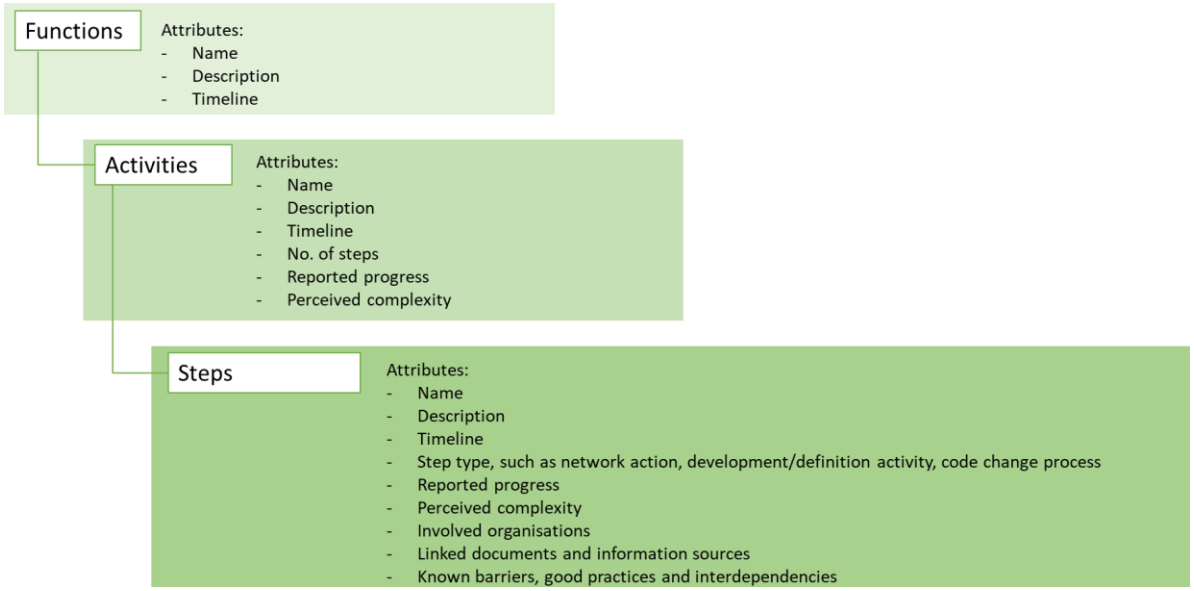


Figure 3 DSO Roadmap Structure

With the 8 DSO functions and underlying activities predefined by the ENA ONP, the development of the DSO Implementation Plan and Roadmap has focused on the development and definition of steps (the 3rd layer of information) based on (anticipated) actions and outcomes from the following:

- Relevant ENA ONP Workstreams and Products, including (among others)
    - the 2019 Least Regrets Analysis (updated);[18]
    - the 2019 Conflicts of Interest and Unintended Consequences log;[19]

[16] https://www.energynetworks.org/assets/files/ON-WS3-P2%20DSO%20Functional%20Requirements.pdf
[17] https://www.ofgem.gov.uk/system/files/docs/2019/08/position_paper_on_distribution_system_operation.pdf
[18] https://www.energynetworks.org/assets/files/ON-WS3-2018%20P7%20Update%20on%20Least%20Regrets-v1.pdf
[19] https://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products-2020/ws3-dso-transition/products.html

- Flexibility Next Steps (and underlying commitments);[20] and
- ENA ONP Good Practices and recommendations (various products).

- Initial RIIO-T2 business plans by NG ESO, NGET, SSEN Transmission and SPTL; and
- Ofgem and BEIS work programmes and consultations as well as other relevant work undertaken by the ENA and other stakeholders (such as T.E.F. projects).

All of the above sources have served as the initial basis for the development of steps, which have subsequently been refined through bilateral interviews with relevant stakeholders as well as plenary discussions under Workstream 3 (Stages 2 and 3 of Our Approach).

In addition to steps derived from the sources above, further steps have been developed based on proposals by individual network companies and vetted through plenary discussions under Workstream 3 as well as in consultation with individual stakeholders (Stage 4 of Our Approach).

2.7 Development Principles

2.7.1 Aggregation and Company-Specific Reporting

At the time of developing the DSO Implementation Plan and Roadmap, the electricity network and system operators are all working towards the next price control period. The TOs and ESO have submitted business plans to Ofgem for RIIO-T2 (01 April 2021), and the DNOs have commenced development of their business plans for RIIO-ED2 (01 April 2023). Given that the price control review for RIIO-T2 is ongoing, and that DNO business plans for RIIO-ED2 are in development, it is not appropriate to present implementation status and timings on a company by company basis within the Open Networks DSO Implementation Plan, and therefore the DSO Implementation Plan and Roadmap provide an aggregate view for steps undertaken by network companies.

For example:

- Implementation steps for DNOs are shown with an aggregate status and timeline for all six DNOs;
- Implementation steps for TOs are shown with an aggregate status and timeline for all three TOs;
- Implementation steps that are common for DNOs, TOs and ESO are shown with an aggregate status and timeline for all three company types.

There are three exceptions to this principle:

- implementation steps undertaken by the ESO only are considered of common relevance and shown explicitly, meaning that the step is identifiable as a step for the ESO;
- we have previously reported DNO progress against ONP product outputs, Flexibility Next Steps and underlying Flexibility Commitments on a company-specific basis, as such the Roadmap will follow the same principle; and
- network companies' progress in adopting recommendations, Good Practices and implementation plans, developed under ENA ONP products, will continue to be reported on a company-specific basis.

[20] https://www.energynetworks.org/assets/files/ON-PRJ-DNO%20Implementation%20of%20Flexibility%20Next%20Steps%20-%20Final.pdf

Section 2.7.2 below explains different concepts and terms used in the DSO Implementation Plan and Roadmap, as well as explaining how the aggregation principle has been applied.

2.7.2 Types of steps

Table 1 provides an overview of the steps' types and their treatment in the DSO Roadmap. The field "Relevance" indicates whether the step is relevant to the wider industry (Common Step) or whether the step is required for individual organisation to implement DSO functionality (Individual Step).

Step type	Description	Relevance	Aggregation
Development/ Definition Step	Involves the central development of DSO functionality or definition of principles/standards to be used by all network companies. Typically this step is implemented by the ENA (ONP), T.E.F. projects, and sometimes Ofgem/BEIS or network companies.	Common	No
Network Action	Involves the implementation, adoption or delivery of DSO functionality and/or principles/standards by DNOs and/or TOs and/or ESO. These steps are aggregated into a single step capturing the aggregate status and timeline across network companies. Exceptions as in section 2.7.1 above.	Common	Yes, with some exceptions as per section 2.7.1.
Network Action	Involves steps required for individual DNOs or TOs to implement DSO functionality, but which have no wider industry relevance. These steps are aggregated into a single generic step combining all individual network actions and described only at a high-level, anonymised basis.	Individual	Yes
Code Change Process	Reflects a step that will lead to a change of an industry code (e.g. DCUSA, CUSC, STC). This step type typically captures the code modification processes of the relevant working group to deliver a change in the industry code.	Common	No
Enablers/ Dependencies/ Barriers	Typically reflect anticipated regulation/governance outcomes/decisions by Ofgem or BEIS. Sometimes reflects network companies, delivering a common enabler.	Common	No

Table 1 – Step Types and Treatment

2.7.3 Reported Progress

The progress of each step is reported at 4 levels:

- Level 1: "Not currently planned for implementation". Level 1 reflects progress of steps that have been considered by the organisation but are not currently planned for further implementation. For example, a common step might be required for some DNOs to develop their DSO functionality while other DNOs do not consider it relevant. In the latter case the progress of this step is "Not currently planned for implementation".
- Level 2: "Initiated". This progress level indicates steps that are planned for implementation. Organisations may have already considered implementation dates for these steps, or these steps may be at conceptual phase, meaning that organisations plan to implement the step but they don't know yet the timescales of implementation.
- Level 3: "Implementing". Level 3 reflects all the steps, of which implementation has started. Network companies typically have provided an estimated completion date for all the steps that are being implemented.
- Level 4: "Completed". This progress level reflects all the steps that are now completed, and no further action is required by the organisation. This progress level includes also steps that are now part of normal operations and embedded in management system procedures or similar. In addition, this progress level includes steps which are under an optimisation process. For example, the organisation may be applying a structured process to collect feedback and lessons learned to further improve the implementation of the step.

The DSO Implementation Plan and Roadmap provide an indication of the progress of each function and activity, based on the reported progress of the associated steps.

2.7.4 Perceived Complexity

The DSO Implementation Plan and Roadmap have also considered the expected level of complexity and the resulting risks for not meeting deadlines or achieving full functionality of each step. Three levels of perceived complexity have been reported:

- Low Complexity;
- Medium Complexity; and
- High Complexity.

The DSO Implementation Plan and Roadmap provide an indication of the complexity level of each function and activity, based on the perceived complexity of the associated steps.

2.8 Role of Network Innovation

Network innovation is part and parcel of the development and delivery of DSO capability in the GB energy industry. As set out in section 2.6 above, the Implementation Plan and Roadmap reflect information from the three T.E.F. innovation projects (TRANSITION, EFFS and FUSION), which are delivered in close coordination with the ENA ONP. The T.E.F. projects consider different aspects of DSO, connecting with several current and future ONP Products, and take a concrete consultative role for network companies in the delivery of specific DSO functions and underlying activities. For this reason, the Roadmap shows specific steps associated with T.E.F. projects, but generally does not cover steps associated with other innovation projects.

In December 2019, ENA ONP Workstream 3 Product 5 published a report that sought to identify future DSO innovation opportunities through a gap analysis of 1,333 relevant innovation projects. The development of each of the DSO functions is informed by innovation projects in various places, but the precise relevance and impact varies from project to project. For this reason, as well as for practical reasons, the Implementation Plan and Roadmap do not explicitly show all relevant innovation projects – although where innovation projects are a key vehicle to delivery DSO functionality, this is made clear in the description of the relevant step(s).

Stakeholders interested in further details on the role of innovation projects in developing DSO functions can download the full ENA ONP Workstream 3 Product 5 on the ENA website.[21]

As a broad indicator of the importance of innovation to the development of DSO capability, Figure 4 below shows the number of innovation projects against each of the DSO functions as at December 2019 (figure 5 in the aforementioned ENA ONP report).

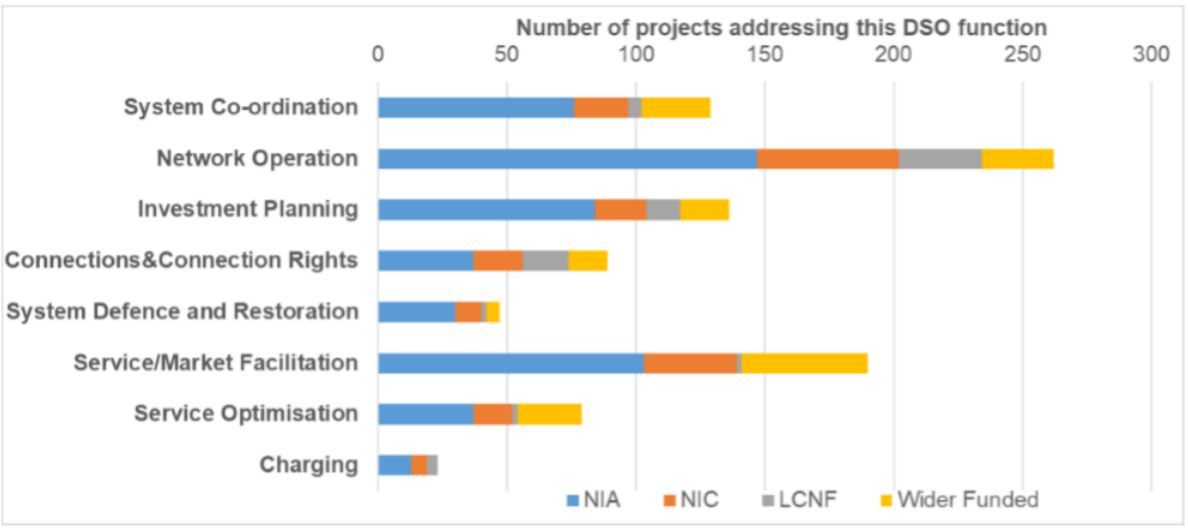


Figure 4 Quantified Level of Innovation Activities in DSO Functions

[21] https://www.energynetworks.org/assets/files/ONP-WS3-Innovation%20Trials%20Final%20Report-PUBLISHED.pdf

3 DSO Implementation Plan – Overview

3.1 Introduction to this section

This section provides an overview of the context and the high-level implementation plan towards the completion of each DSO Function. As a reader, you will get a clear picture on where network companies will focus their activities in the upcoming years to facilitate the UK energy transition and net zero grids, by enabling DSO.

The DSO Implementation Plan includes mainly steps that have been prioritised by network companies for completion within ED1 (i.e. April 2023). Information on ED2 actions is limited at this point as it will be further informed by RIIO-2 business plans. As such, although most included steps will be actioned and completed within ED1, this is only indicative of organisations' short-term plans. For example, although some steps will start and become operational within ED1, their deployment at scale will not take place until ED2. In addition, new steps and actions will arise, for instance through the RIIO-2 transmission and distribution price control reviews, or due to other emerging requirements and capabilities. It should also be noted that a high number of steps, which have been included in the DSO Implementation Plan, are at a primary development stage with unknown implementation dates. The timescale of these steps is not shown and is highly likely that will be part of long-term planning (e.g. ED2 timeframe).

The section does not cover individual steps; detailed information of each step as a snapshot of the latest available position can be found in Appendixes A-H to this document.

3.2 Function 1 – System Coordination

DSO Function 1 "System Coordination" focuses on how network companies will operate local and regional areas and co-ordinate energy and power with other networks and systems to enable whole system planning, operation and optimisation across different timescales. The "System Co-ordination" Function involves local actions to support thermal, voltage and frequency management across networks including actions to minimise losses, manage constraints and provide capability.

Activities that sit under the "System Coordination" DSO Function include coordination between the DSO and the ESO, the DSO and other DSOs/IDSOs, coordination with local energy systems and of local network services as well as coordination of networks to enable cross-vector energy exchange. The majority of current actions and development activities will be advanced within RIIO–ED1. However, this is not a definite timeframe, as new steps and actions may arise during this period, for instance through the RIIO-2 transmission and distribution price control reviews, or due to other emerging requirements.

Network companies are targeting their efforts towards the DSO-ESO coordination, such as efforts related to the regional development programmes (RDPs), the co-ordinated use of Distributed Energy Resources (DER) and reactive power as well as the real-time data exchange. DSO-ESO coordination functionality is seen as a priority area and intended to be delivered early on in the process.

The ENA itself supports the development of the "System Coordination" Function with several development activities through the ENA ONP that mainly focus on whole system coordination and cross-vector energy exchange. In addition, several T.E.F. outcomes are relevant for the implementation of this functionality. All these development activities will inform next steps for the DNOs, the ESO and the TOs, who will turn ENA ONP outcomes and recommendations into action.

The Flexibility Commitment "Work together towards whole energy system outcomes" is also relevant to this function with network companies and ENA ONP progressing this commitment within RIIO ED-1.

3.3 Function 2 – Network Operation

DSO Function 2 "Network Operation" refers to operation of the electricity distribution networks to maintain a safe and secure system. It covers a range of aspects, from ensuring the network power flows remain within thermal limits to minimising losses and managing future risks.

Network companies have highlighted that network operations and processes to maintain a safe and secure system are already in place and are part of their business-as-usual activities. The new steps related to this functionality are mainly driven by the digitalisation of the energy system, the need for enhanced data flows among network companies and the requirements for increased transparency and visibility of network operations and outages. All these factors combined will lead to optimising network operations, minimising losses, improving network performance and power quality that will respond to customer needs.

The majority of planned or implementing network actions and development activities under this function will be advanced within RIIO – ED1. Approximately one third of the steps were still at a primary development stage at first publication with unknown implementation dates. As such, it is highly likely that these steps will be further developed in the medium-term (e.g. ED2 timeframe). It is worth mentioning that only few steps under this function are led by the ENA ONP or reflect ENA ONP outcomes. Most steps are driven by DNOs, TOs and the ESO and T.E.F. projects. During the development of the DSO Plan and the Function Surgeries, network companies acknowledged that key modifications and/or enhancements to internal business processes are common across network companies and relevant DSO enablers for the wider energy industry.

3.4 Function 3 – Investment Planning

DSO Function 3 "Investment Planning" involves network companies' steps to identify capacity requirements on the distribution network and secure the most efficient means of capacity provision to customers. The activities that sit under the "Investment Planning" Function range from traditional investment planning, to co-ordination between the DSOs, the ESO and the TOs to identify whole electricity system options, including commercial DER options as well as distribution network investment.

Network companies and ENA ONP are targeting their efforts towards traditional investment planning, whole system and non-traditional investment planning. The majority of the steps are related to the coordination of national and regional Future Energy Scenarios (FES), data exchange in planning timescales across DSOs, the ESO and the TOs as well as steps related to the regional Network Options Assessment (NOA). The majority of Function 3 actions are driven by ENA ONP outcomes.

"Investment Planning" Function is also linked to the update of the Long-Term Development Statement (LTDS) Reform, led by Ofgem, and the future implementation of it by the DNOs. The development of processes which will allow DNOs to choose among optioneering flexibility, ANM and traditional reinforcement is also key to the "Investment Planning" Function. In addition, the completion of this functionality is dependent on several code modifications, such as code modifications for enhanced planning-data exchange and IDNO-DNO data exchange. [22] [23]

[22] Code modification (GC0139): Enhanced Planning-Data Exchange to Facilitate Whole System Planning
[23] Code proposal for IDNO to DNO and inter-DNO data exchange

The implementation of this DSO functionality covers the period of both RIIO – ED1 and RIIO – 2. Most steps that are planned for completion post-2023 are linked to the LTDS Implementation, NOA processes and/or include a second and third phase of implementation.

3.5 Function 4 – Connections and Connection Rights

The development of DSO Function 4 "Connections & Connection Rights" aims to provide fair and cost-effective distribution network access that includes a range of connection options that meet customer requirements and system needs efficiently. The function covers "traditional" DNO activities directly related to the provision of distribution network connections and to managing ongoing access to the distribution network as well as activities that have emerged in the recent years, such as the management of increasing demand for connection to areas of distribution networks (e.g. Queue Management, Commercial Agreements for Constraints).

Most of the steps that sit under this function are DNO-led steps, driven by ENA ONP developments and Good Practice with regard to connection agreements, connection access and queue management. DNOs have already completed a wide range of steps, particularly steps related to their Business-As-Usual (BAU) activities. DNOs have focused their actions on providing connections for customers with defined terms and conditions, through transparent processes and increased provision of connection information.

As part of the DSO Implementation Plan, DNOs, the ESO and the TOs are planning to enhance their Queue Management and Interactivity processes. These actions will require DCUSA, STC and CUSC Modifications as well as changes to internal systems to support the implementation of Queue Management processes. Most steps related to Queue Management and Interactivity are taken forward within RIIO – ED1. Future steps are more likely to be linked to mechanisms for managing network constraints through commercial means.

3.6 Function 5 – System Defence and Restoration

The DSO Function 5 "System Defence and Restoration" recognises that distribution networks and resources can play an increasing role in overall electricity system resilience and in the re-establishment of networks following a major system incident. Activities that sit under this function include network contingency planning against high consequence events with low probability, design and operation of "islanding" and Black Start arrangements as well as design of loss of mains and other protection arrangements.

The DSO Implementation Plan has focused on the implementation of steps that will ensure DER resilience to system disturbances and the risk management of networks with high volume of connected DER. For instance, these steps include short term-term contingency planning between DNOs and the ESO, the ongoing regional development programmes (RDPs) and the delivery of accelerated loss of mains protection change programme. As part of this DSO functionality the DNOs and the ESO are exploring the use of DER for power-restoration in a "black-out" events and DNOs are planning to review their DNO Blackstart plans to incorporate Active Network Management (ANM), Low Carbon Technologies (LCT) and flexible services.

Steps in this function are mainly driven by DNOs, TOs and the ESO, outside the ENA ONP workstreams. The implementation of this DSO functionality covers the period of both RIIO – ED1 and RIIO – 2; several steps are at primary stage of development and new steps may be added based on future needs (for instance, steps that will be identified by the review of DNOs' Black Start Plans).

3.7 Function 6 – Services and Market Facilitation

The DSO Function 6 "Services and Market Facilitation" is a broad ranging function to define distribution network service requirements and support the market arrangements put in place to provide these and other services. Underlying activities of this function include assessing the value of flexibility, defining new services and supporting the operation of the markets and systems needed to provide these services. DSO's would also need to support the market participants through information provision.

Function 6 has the highest number of steps, which is indicative of the efforts of ENA ONP and network companies to facilitate flexibility services and enable DER access in wider services for whole system optimisation. The high number of steps also reflects that this DSO functionality was at primary development, when DSO transition started. Most of the steps within this function are driven by ENA ONP outcomes and Best Practices.

Network companies have focused their efforts on developing a more co-ordinated approach to operation of services and markets to enable whole system outcomes though Transmission and Distribution visibility, co-ordination and control. These efforts, for instance, include the ongoing regional development plans (RDPs), the development of common contracts for flexibility services and the standardisation of communication exchange and protocols for flexibility services.

In addition, this DSO functionality is subject to completion of steps that align and standardise the DSO flexibility services and associated processes, such as standardisation of active power service parameters, implementation of Good Practices for flexibility procurement services, the implementation of the system wide resource register (SWRR) and alignment of dispatch and settlement processes. Development, definition and procurement of new and non-DSO services are also relevant to this function.

The implementation of this DSO functionality will be progressed within RIIO-ED1. As already discussed, this is not a definite timeframe, as new steps and actions may arise during this period, for instance through the RIIO-2 transmission and distribution price control reviews, or due to other emerging requirements.

Lastly, the completion of Function 6 is dependent on the progress of the following flexibility commitments: "Champion a Level Playing Field", "Ensure Visibility and Accessibility", "Provide regular, consistent and transparent reporting" and "Work together towards whole energy system outcomes".[24]

3.8 Function 7 – Service Optimisation

The DSO Function 7 "Service Optimisation" is a function to ensure that system needs can be efficiently met across all timescales. Activities include the identification of network requirements, understanding the limitations of network assets and the facilitation of flexibility services through smart use of networks and DER solutions. Activities under Function 7 will ensure whole system optimisation and resilience through the optimal selection of flexibility services.

During the development process of the DSO Implementation Plan, network companies and ENA ONP highlighted that there are a lot of similarities between Function 6 and 7. As such, there is an overlap of the steps that sit under these two functions. Function 7 includes also a high number of

[24] https://www.energynetworks.org/assets/files/ENA%20Flexibility%20Commitment%20Our%20Six%20Steps%20for%20Delivering%20Flexibility%20Services.pdf

steps which indicate the focus of the industry on ensuring that flexibility services are available to support networks and wider system operation.

The DSO Implementation Plan to date shows that the network companies and ENA ONP have targeted their actions towards service selection in order to provide transparency of decisions and actions when choosing the optimal selection of flexibility services. Most of their efforts are driven by their Flexibility Commitments to "Conduct procurement in an open and transparent manner" and to "Provide clarity on the dispatch of Services" as well as by ENA ONP outcomes. For instance, the ENA ONP has provided Good Practices for the dispatch and settlement process, which DNOs have considered and planned for implementation.

In addition to developing service selection processes, network companies and ENA ONP are focusing on the coordination between Transmission and Distribution to develop solutions that enable efficient whole system outcomes. These solutions include but are not limited to conflict management and co-optimisation processes, the ongoing RDPs and the development of whole system approach to reactive power services. The development of processes which will allow DNOs to choose among optioneering flexibility, ANM and traditional reinforcement is also key to the "Service Optimisation" Function.

Outcomes of the T.E.F. projects will inform future actions for DNOs, the ESO and the TO, mainly in the area of service selection, T-D coordination and service access management. It should also be noted that Ofgem's decision on the regulatory treatment of provision of flexibility services from DNOs' network assets (e.g. CLASS) is relevant to Function 7 and the enablement of flexibility services through novel utilisation of exiting network complements.

The majority of current actions and development activities will be progressed within RIIO–ED1. This timeframe is only indicative of organisations' short-term plans. For example, although some steps will start and be operational within ED1, their application to a bigger scale will most likely be part of ED2 timeframe.

3.9 Function 8 - Charging

The DSO Function 8 "Charging" recognises a potential DSO role in setting charges for the connection and use of distribution networks. Increasingly this will require a whole system view and close interaction between network owners and operators to design and operate efficient and equitable network charging arrangements.

Underlying activities of Function 8 include the development of Distribution Use of System prices for the local network, the design of capacity increase on the network, the development of transmission charges and distribution costs in whole system charges and the management of transmission costs at the Grid Supply Point (GSP).

The development of Charging functionality is highly dependent on the Targeted Charging Review: Significant Code Review and on the Reform of network access and forward-looking charges. The Implementation Plan has been informed by Ofgem, while it is expected that network companies will align with the implementation dates that have been set out by the regulator. All the existing steps under this function will be advanced within the RIIO-ED1 period. Future actions and developments in this area will update the implementation plan of Charging Function.

4 Next Steps

4.1 Next steps for the ENA ONP

The purpose of the DSO Implementation and Roadmap is to provide insights into DSO functionality already implemented to date, as well as anticipated windows for future implementation. They show a clear pathway to the implementation of Distribution System Operation in the short, medium and longer term which will help to provide greater visibility to industry as well serve as a tool to monitor progress and identify gaps to delivering DSO functionality.

The DSO Roadmap is not a static plan, as it will continue to evolve as DSO functionality will be delivered and our collective insight progresses. In addition to driving the delivery of DSO through our workstreams, we will continue to monitor the progress of the DSO Roadmap, with the second iteration planned in Q1 2021 to reflect updates from RIIO ED2 business plan submissions amongst other developments. The DSO Roadmap is expected to be updated every 6 months thereafter.

4.2 Next steps for network companies

Network companies will continue the joint effort to deliver DSO functionality set out in the DSO Roadmap in collaboration with Ofgem, BEIS and the wider community of energy industry stakeholders. They will use the Implementation Plan to monitor their progress against activities and steps for DSO transition and will update their inputs every 6 months.

Distribution network operators will use the DSO Implementation Plan as a key input to RIIO ED2 business planning, working with Ofgem to identify the most efficient way of delivering DSO alongside other regulatory outputs, ensuring value for money for our current and future customers.

4.3 Next steps for ENA's stakeholders

We will hold webinars to introduce the DSO Implementation Plan and Roadmap to our stakeholders. In these webinars, you will also have the opportunity to ask questions and clarifications on the DSO Roadmap.

Stakeholders who wish to keep up to date with the latest information from the DSO Implementation Plan Open Networks Project are invited to subscribe to our mailing list.

We will continue to announce relevant stakeholder events/webinars on the Open Networks Events page.

Appendix A - Guidance for Online DSO Roadmap

This appendix provides a guidance for using the Online DSO Roadmap which can be accessed at ENA's website[25].

Navigation

This online tool provides three views of the roadmap with increased level of details:

- **Roadmap view** displays all the 8 functions.
- **Function view** displays the activities within a function.
- **Activity view** displays all the steps within an activity, and progress monitoring information if available.

To navigate across the different views, please select the desired view at the top of the page (please see the figure below).

Figure 5 Options for navigation across the online DSO Roadmap

Displaying additional information

In each view, additional information about the function, activity or step will be provided by hovering or clicking on the relevant bar. Please read the following sections for more information.

Selecting the timeframe

All views can be shown in 3 different timeframes using the drop-down box at the right side of the window (please see the figure below):

- **Short term** displays the timescale of functions, activities or steps from the last 2 months to 2 years ahead;
- **Medium term** displays the timescale of functions, activities or steps from the last year to 5 years ahead;
- **Long term** displays the relevant functions, activities or steps from 2020 until the end of the last reported step.

The earliest date that will be shown is 1st January 2020. Functions, activities or steps that have been completed before the start date of the selected time frame are displayed as a narrow band at the start date of the view. Functions, activities or steps that start after the end date of the selected time-frame view or functions, activities and steps without planning dates are displayed as a narrow band at the end date of the view. The start and end dates are shown when hovering over this narrow band.

[25] https://www.energynetworks.org/electricity/futures/open-networks-project/dso-implementation-plan.html

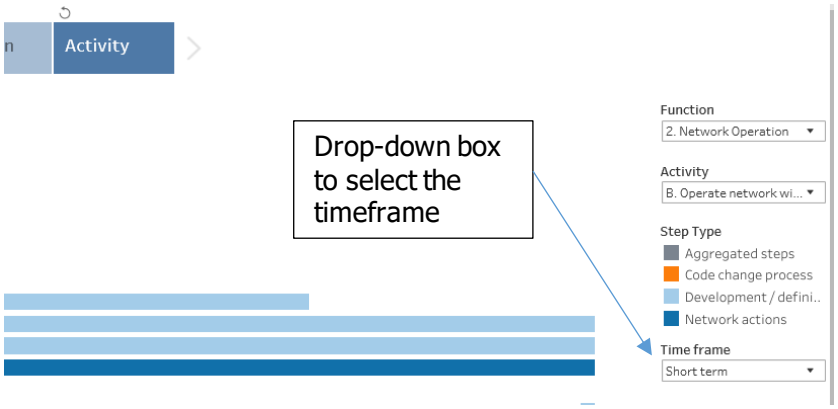


Figure 6 How to select the timeframe

Selecting functions and activities

Functions and activities can be selected using the drop-down box at the right side of the window. Please note that when selecting a new function in the activity view, you also need to select an activity which sits under this function, so that meaningful information is displayed. (please see the figure below)

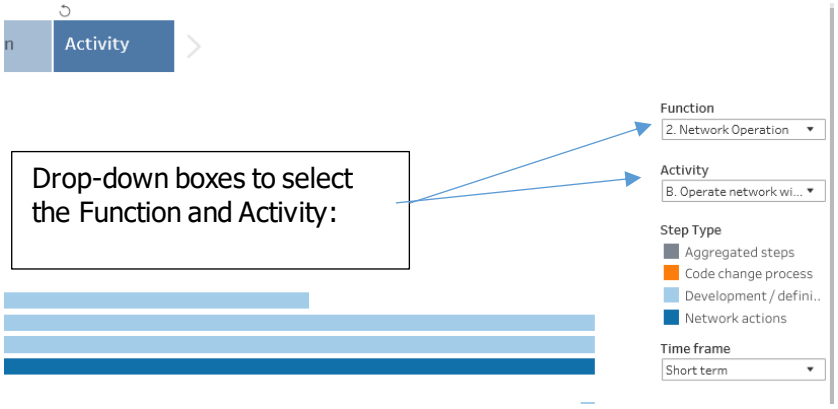


Figure 7 How to select the Function and Activity

Information in the pop-up window for Functions and Activities

A pop-up window with additional information appears when a function or activity bar is selected (please see the figure below):

- **Purpose**: the purpose of the function or activity, as defined by ENA ONP.
- **Implementation period**: The implementation period based on the current available data, calculated as the period that starts with the first step and ends with the last step related to the function or activity.
- **Unique steps**: The number of unique steps in the function or activity. Unique steps may be performed by multiple organisations.
- **Contributions by participating organisations**: Participating organisations contribute to the implementation of the unique steps with their own steps/progress/implementation dates. This field shows the number of individual organisations' network actions/development activities etc. that contribute towards the completion of the function or the activity.

- **Progress**: a bar chart that displays an overview of the implementation status of all steps by all participating organisations in this function or activity.
- **Perceived complexity**: a bar chart that provides an overview on the reported complexity; the relative fraction of steps reported as "Low", "Medium" or "High" complexity.

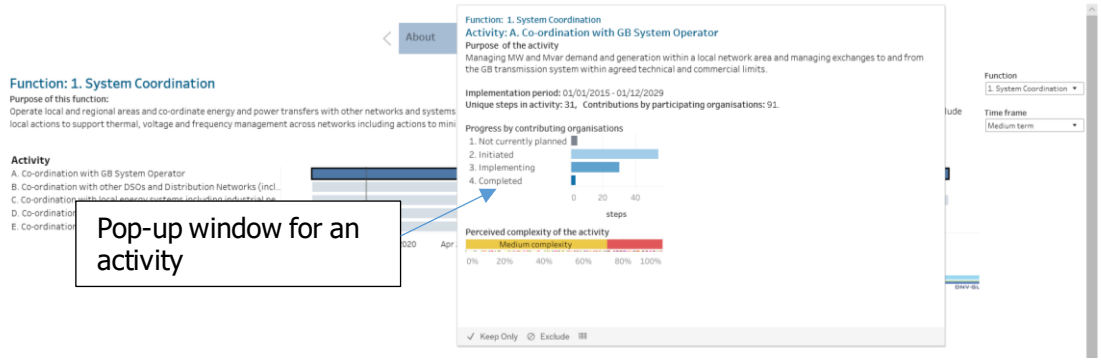


Figure 8 Example of a pop-up window for an activity

Information in the popup window for Steps

This popup provides information about the organisations involved and their status in implementing the step. If a related ENA ONP product exists, a link will be provided (please see the figure below).

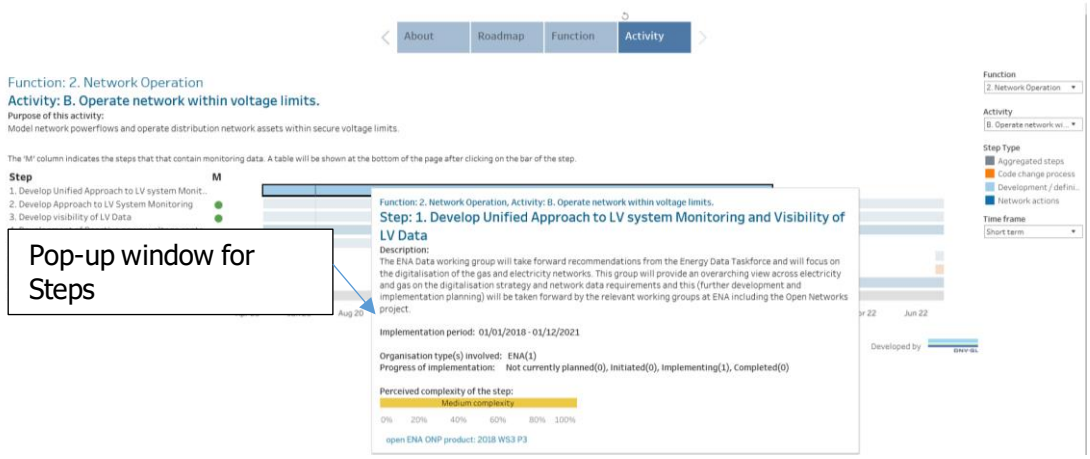
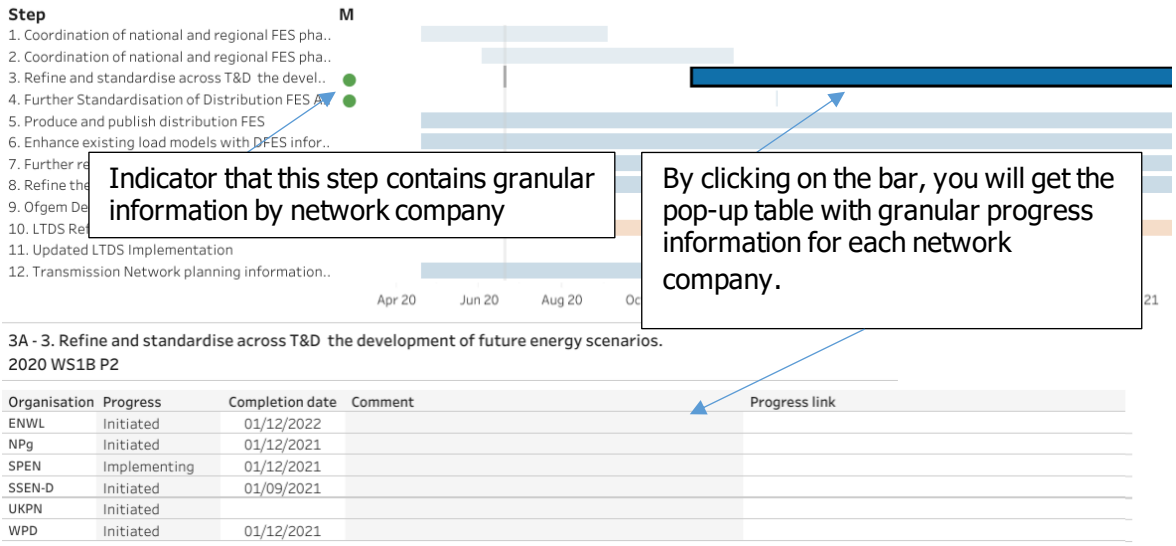


Figure 9 Example of a pop-up window for a step

Steps with granular data by network company

When you are at the Activity view, the "M" column identifies steps that have been identified for implementation within the Open Networks Project and contain granular data on implementation timescales by network company to monitor their progress. A table will be shown at the end of the page, when you click on the bar of the step. (please see the figure below)



3A - 3. Refine and standardise across T&D the development of future energy scenarios.
2020 WS1B P2

Organisation	Progress	Completion date	Comment	Progress link
ENWL	Initiated	01/12/2022		
NPg	Initiated	01/12/2021		
SPEN	Implementing	01/12/2021		
SSEN-D	Initiated	01/09/2021		
UKPN	Initiated			
WPD	Initiated	01/12/2021		

Figure 10 How to view granular information of a step