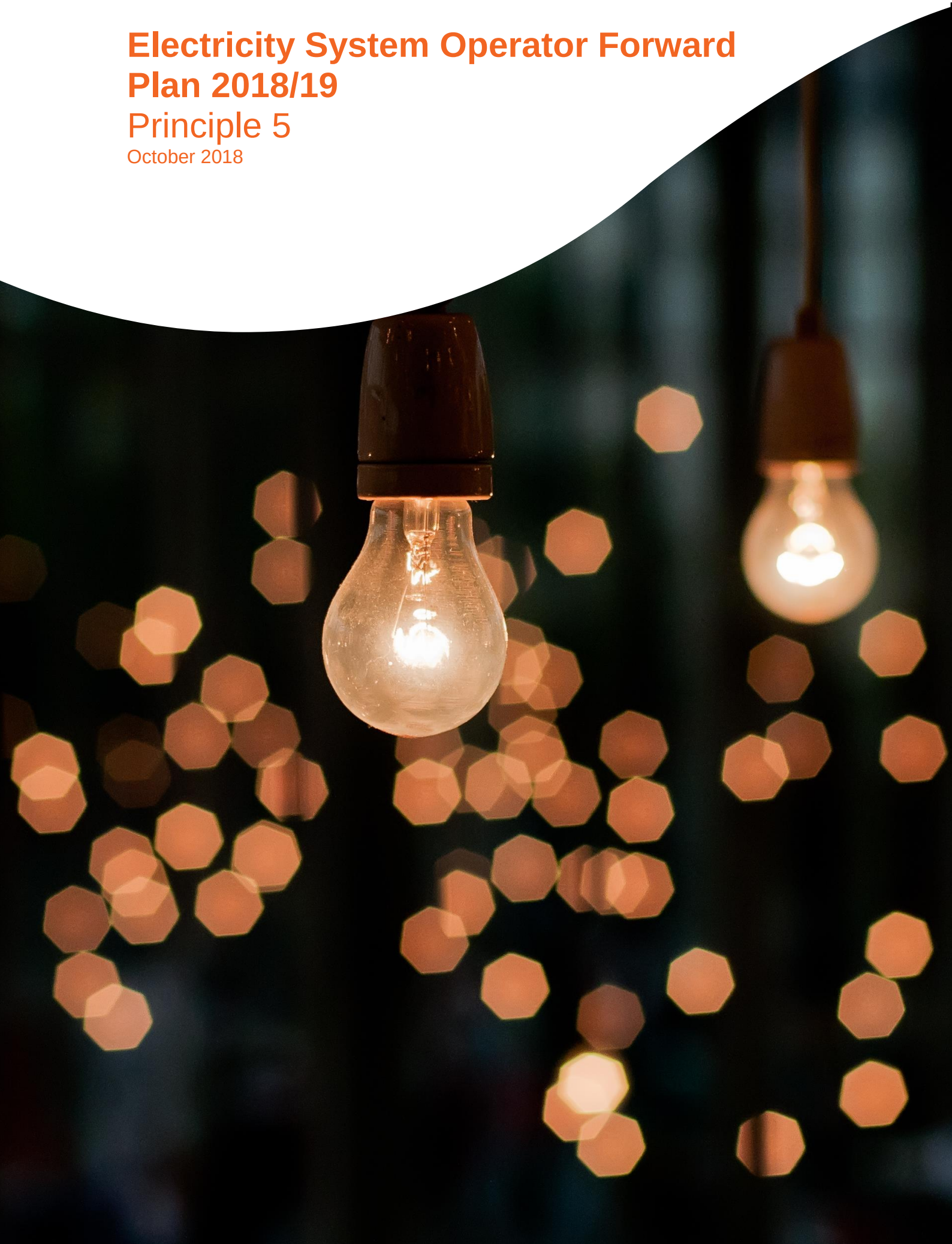
nationalgridESO

Electricity System Operator Forward Plan 2018/19

Principle 5

October 2018



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Foreword

Principle 5: Coordinate across system boundaries to deliver efficient network planning and development

The future of our energy system is digital, decentralised, and decarbonised. Our approach to planning and developing these energy systems needs to evolve to ensure the most efficient options are chosen that will realise value for the end consumer.

In our Forward Plan, we set out the case for change and a plan for the important role National Grid Electricity System Operator (NGESO) has to play in facilitating efficient network planning and development.

This document provides an update on how we are coordinating with other network operators to deliver more efficient network planning and development. As a reminder, our baseline activities are set out to the right and our approach to this relaunch aims to explain how our role delivers on these and can exceed expectations.

Our Key Baseline Activities:

Collating, managing and modelling data to assess the safety and security of the transmission system at the interface with other networks

Working with DNOs to facilitate connection of new users to the distribution networks through the Statement of Works process

Long Term Vision

The focus of system planning is to secure an efficient electricity system 10 plus years into the future. We do this by recommending the most economical network and operability solutions, based on analysis of onshore, offshore and potential cross-border options.

Our long-term vision for network planning and development is that, to design the network we need by 2030, we will be working seamlessly with the DSOs, through new markets and using new processes, to explore all possible solutions for meeting transmission system needs, with these being optimised alongside distribution system needs to deliver best value for consumers – regardless of asset ownership boundaries.

To achieve this, we will have supported the DSO transition at pace through targeted partnerships, such as our Regional Development Programmes, the findings from which will have fed into the ENA's Open Networks project to promote national learning to drive the adoption of common standards and procedures. This will support the development of codes and frameworks to govern these processes.

Currently, efficient transmission network investment planning and development is shaped by the data we hold and the modelling we undertake to provide future transmission system needs information for the industry.

Decentralisation of the electricity system opens up a wider range of approaches across the transmission and distribution systems; to find new and novel solutions to current and future challenges. Effectively meeting those challenges depends on coordination and collaboration across network boundaries.

Work on our whole system approach, conceived within our Regional Development Programmes and informing the Open Networks Project, will be extended by rolling out pathfinding projects in key areas of the country. The aim of these projects is to deliver specific whole-system initiatives with partner DNOs, in a way that allows optimisation of the overall system design and maximises use of existing network capacity. At the same time, it will give network operators a wider range of resources and tools with which to manage their networks; ultimately reducing costs and delivering value for end consumers.

Enabling choices that deliver the most benefit when whole system costs are considered must be at the heart of future developments; and combining new ways of planning and developing energy systems with fit-for-purpose commercial mechanisms that provide revenue streams for distributed energy resources, should support this aim.

Julian Leslie

Head of Networks

Enabling efficient transmission network investment planning and development

1. What do we currently do?

We facilitate efficient transmission network investment planning and development by working with the DNOs to facilitate connection of new users to the distribution networks.

Data exchange

Our current activities to ensure coordination across system boundaries to deliver efficient network planning are set out in the Grid Code Planning Code. They revolve around the exchange of data between network companies to assess the security and safety of the transmission system at the interface with Network Operators. They do this for both operational and investment planning purposes.

The purpose of these processes is to establish whether the system is compliant with the National Electricity Transmission System Security and Quality of Supply Standard (commonly referred to as the NETS SQSS or SQSS) and trigger remedial works if not. TO/SO/DNO investment planning consists of a loop of exchanging data between the parties. Key dates of the process are:

- Week 17: National Grid makes an official request to DNOs for data including single-line diagrams for networks, agreed access periods and times of minimum/maximum GB demand.
- Week 24: DNOs submit requested data to National Grid (DNOs may delay this to week 28)
- Week 42: National Grid submits transmission network data to other network operators
- Week 6: National Grid confirms compliance with SQSS

The week 42 model provided to DNOs by National Grid is used to produce the week 24 data submission for next year.

Managing the impact of distribution generation connections

When a generator that is seeking a connection to a DNO's distribution network may have an impact on the transmission network, the nature of that impact needs to be assessed. DNOs are required under the Connection and Use of System Code (CUSC) to make a request for a Statement of Works (SoW) that may be required on the transmission system to manage the impact of Distributed Energy Resources (DER) wishing to connect to the distribution system. We work with DNOs and TOs to understand the nature of these impacts and the effect they have on DER connection timescales.

The increasing impact of DER in the transmission system led us to work with DNOs to develop a revised process that provided more flexibility in the way capacity could be managed, with no requirement for re-assessment of this capacity until a pre-defined level were to be breached.

Following trials across England, Wales and Scotland, a new SoW process has been agreed, which allows the timescales to give customers certainty around their connection conditions to be greatly reduced. This has reduced timescales, bureaucracy and costs to connect customers and provides greater visibility to us to help manage the transmission network. It also gives visibility to the DNOs of the amount of available capacity within their networks, which enables them to engage with their customers to provide options for a quicker route to market for generation projects, based on the locations of that capacity.

The proposals are an example of how we work with stakeholders to constantly evolve the baseline activities that we undertake to meet the needs of our customers and the DNOs' customers. These changes are being progressed through the standard CUSC modification process.

Further to these changes, we are collaborating with DNOs to develop new ways of getting the most out of our existing assets – further information on this is presented later in the document.

2. How are we seeking to unlock vale for consumers in the way we plan and develop the transmission network?

Regional Development Programmes

The transmission network was built for bulk power transfer from generation centres (often based around coalfields and gas entry points) over distance to demand centres (typically large urban conurbations). The changing generation and load patterns, including the displacement of large synchronous generators by smaller asynchronous renewable generation, such as wind and solar, present us with a range of new regional challenges:

- Large-scale renewable generation tends to be located at network extremities, and therefore remote from demand centres;
- The smaller renewable generation tends to connect at distribution voltages;
- The changing pattern of power flows that results from this affects voltage performance, with a tendency for voltages to drift to higher levels unless controlled;
- At times of high wind/solar output, we are seeing power export from distribution networks onto the transmission network, which can create or exacerbate power flow constraints; and
- As a consequence, the traditional approach of actively managing voltage levels and power flows using transmission-connected resources, with relatively small scale action needed on the distribution networks, is becoming more challenging.

To address these regional challenges requires us to develop new ways of working with DNOs; and new opportunities for DER to provide services to help manage transmission network issues. A key way of doing this is via our Regional Development Programmes (RDPs).

Regional Development Programmes provide detailed analysis of the whole electricity system - covering areas of the transmission and distribution networks with large amounts of Distributed Energy Resources (DER). As a consequence they also cover associated known network interface issues.

Using detailed 'whole-system' analysis, we collaborate with DNOs to innovate and push the boundaries of current thinking, with a "design by doing" approach to resolving issues - investigating more active distribution system operator-type solutions and informing thinking for the Distribution System Operator (DSO) debate.

Our first two RDPs, covering the south-east coast of England (UK Power Networks) and south-west England (Western Power Distribution) have completed their design phases and have progressed during 2018 to delivery. In addition, we are now collaborating in two further RDPs in Dumfries & Galloway, Scotland (Scottish Power Energy Networks) and the West Midlands (Western Power Distribution).

Enhancing our data exchange and modelling approach

We regularly review our approach to managing the exchange of data between ourselves and other network companies to promote efficiency and minimise the need for queries and rework. However the structure of the process, and the detail of the data to be exchanged, is governed by Grid Code change governance which, whilst providing an appropriate level of rigour to the review of change proposals, invariably takes time to conclude.

Through our first two RDPs, we have collaborated with UK Power Networks and Western Power Distribution to enhance our network modelling, and the type of data we share to enable this; so that we can generate new insights into the behaviour of the networks on a whole electricity system basis.

This enhanced modelling allows us to better understand the performance of the networks under both steady-state and fault conditions, which in turn enables us to work with the DNOs to

maximise the use of existing assets across both transmission and distribution, for example by deploying distribution flexibility services in new ways.

The enhanced modelling approach also allows us to investigate asset-based solutions to transmission system issues on a whole electricity system basis – enabling us to identify where non-traditional solutions, such as those at distribution-level, might deliver best value for consumers.

Some of the work we are doing to coordinate across system boundaries to deliver efficient network development is investigating how distribution networks might be able to provide efficient means of managing high volts on the transmission network. This has strong links to the work we are undertaking under Principle 7, which looks at how we facilitate timely, efficient and competitive network investments. To enable us to provide a clearer picture of all our activities in this area, we have moved those activities initially listed in our Forward Plan under Principle 5 so that they now sit within Principle 7. Further information on these activities can be found in the appendix to this document.

Enhancing the way we facilitate DER connections

The efficiencies brought about by the new SoW process need to be supported an effective means of utilising distribution-connected flexibility to manage consequential transmission network flows in real-time, so that we can maximise the availability of existing asset capabilities for further DER connections. Our current approach to procurement of transmission constraint management services does not fully recognise the challenges faced by smaller embedded resources in providing them, so we are collaborating with DNOs to review and implement changes that deliver the necessary technical and commercial approach to optimise the use of flexibility.

- From a technical perspective, we need to ensure sufficient visibility and controllability of DER output to ensure we can continue to operate the system within its capabilities. We are working with our RDP partners to update the Bilateral Connection Agreements we have with them to place proportionate requirements on DER to achieve this;
- We also need to develop the capability to understand the impact the distribution networks might have on DER service delivery – for example we need to collectively manage the risk that instructions given to DER to manage transmission constraints are subsequently undone by schemes that manage DER access to distribution networks; and
- From a commercial perspective, we need to develop our existing transmission constraint management service so that it enables proportionate participation from DER. We are working with our RDP partners to establish the necessary provisions, before socialising these more broadly.

Summary of this year's deliverables to support our aims under Principle 5.

Outcome	2018/19 Deliverables

Improve our cross-industry collaboration for whole system network planning and development	• Publication of the Western Power Distribution and UK Power Networks Regional Development Programme Learnings (Q1)
	• Begin two new RDPs by publishing a bespoke work plan for each region (Q3)
	• Facilitate unlocking of further DER connections through:
	  • Implementation of innovative connections contracts that support the roll-out of revised Statement of Works processes on a national basis and the ability for DER to provide transmission constraint management services in our in-flight RDP areas (Q3)
	  • Implementation of new commercial contracts to allow DER to participate in the provision of transmission constraint management services in our in-flight RDP areas (Q3)
	  • Implementation of enhanced systems and ways of working between transmission and distribution to support provision of transmission services by DER (Q3)

3. Delivering Value in 2018/19

Rolling out further Regional Development Programmes

To tackle further regional challenges on a whole electricity system basis, we will be establishing further RDPs during 2018/19. In general terms the aims of these RDPs will be to better enable delivery of decarbonisation and decentralisation objectives, such as enabling further low carbon DER connections in shorter timescales than would be facilitated were assets required to be built. However, the challenges to enabling those objectives are expected to be different from those covered by our first two RDPs.

The ability of these further RDPs to deliver value within the remainder of the 2018/19 scheme year is likely to be fairly limited; however we would expect the work done within their scope to be tackled in a way that supports the broader delivery of strategic policy objectives. Further details will be contained within specific work plans for the further RDPs

Unlocking Further Connection Capacity for DER

To meet the regional challenge around unlocking further connection capacity for DER, we want to encourage more distribution-connected parties to participate in the provision of transmission constraint management services. By having visibility of their output, and the ability to vary it by instruction, they have the potential to provide Constraint Management Services and we can use them to facilitate further connection of distributed energy resources. So, we are broadening the scope of our thermal transmission constraint services to allow DER to more easily take part.

The immediate value that this approach will unlock is to facilitate the ongoing roll-out of low carbon energy resources at distribution voltages whilst maintaining security of supply, whilst also promoting further competition in the provision of transmission constraint management services. Broadening the pool of providers of transmission constraint management services will help to ensure efficient ongoing management of costs and will facilitate DER connections more quickly, as it is expected to defer the need to build assets to reinforce the networks in the quest to enable the same.

In the longer term the additional flexibility that these resources offer can be harnessed through transmission markets for balancing services and emerging distribution markets to support the DSO transition - the visibility and controllability of DER output should provide additional capabilities that DNOs could seek to harness for more active management of their distribution networks.

4. Performance Metrics

We will be able to demonstrate a contribution to the realisation of consumer benefit through improvements in the following metric:

13: 'Whole system, unlocking cross-boundary solutions' – the capacity of DER connected within specific constrained network areas as a result of the RDP approach to unlocking DER connection capacity. This will demonstrate that the RDP approach has successfully delivered the environment within which further distribution connection capacity can be unlocked.

5. Stakeholder Sentiment

Currently:

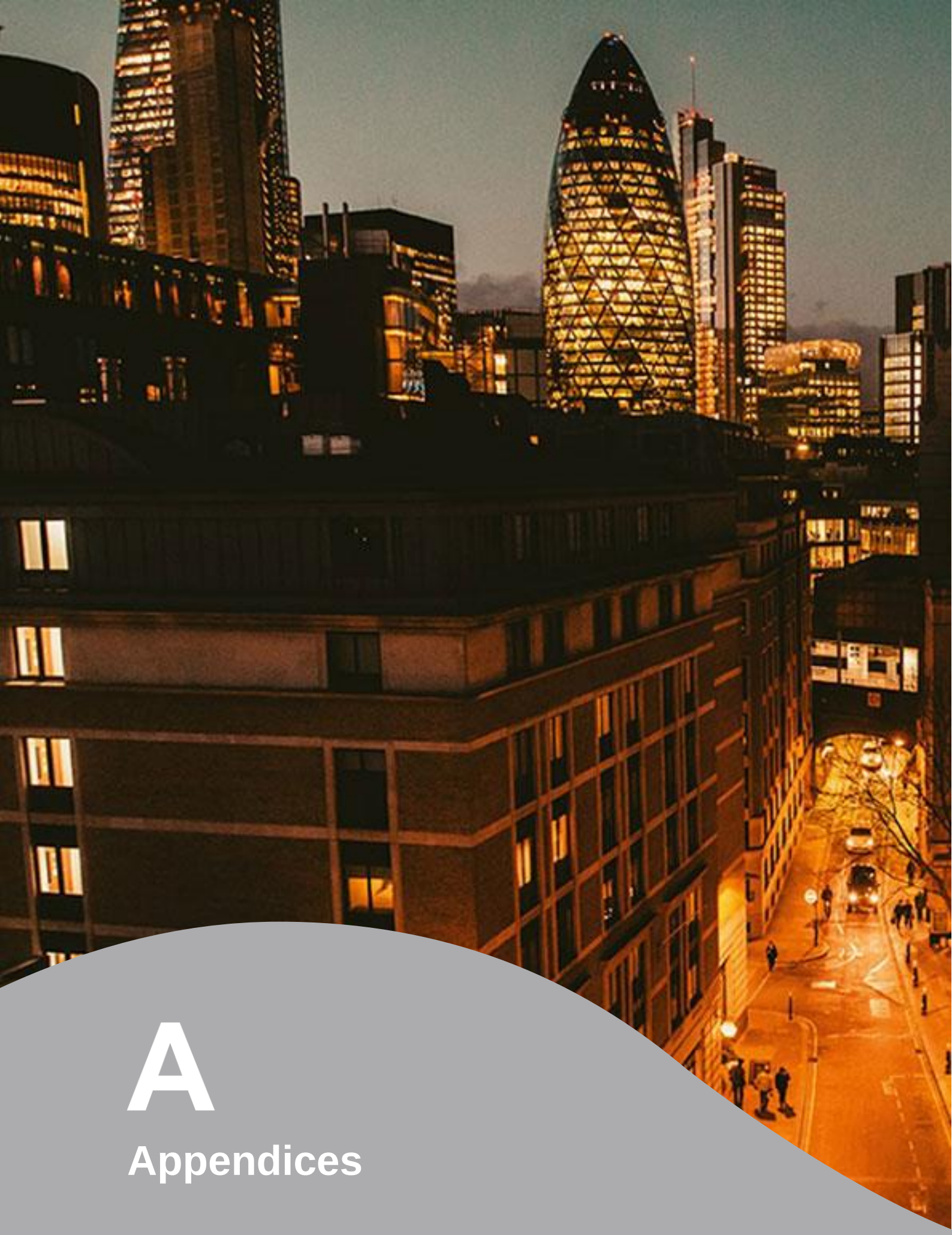
Work within this principle is heavily focused on DNOs, although connectees to distribution networks will also have a keen interest in the work. In general, Stakeholders have told us that whole electricity system is a key topic for our engagement and they are interested in our views and thought leadership. We need to better articulate our views on whole electricity system and how we need to work with all stakeholders to deliver successful outcomes that deliver benefit for consumers.

From a DNO perspective, we have had feedback via the Open Networks project that they would like us to be more transparent regarding work we are doing, and to ensure Open Networks is appropriately involved where relevant. We have acknowledged this and already taken steps to address concerns, for example through the launch on 12th July 2018 of our 'Facilitating Whole Electricity System Outcomes' paper, with an associated blog[1] published on 3rd October 2018. We also remain keen to see reciprocal activity in this regard.

End-of-year goal:

We want stakeholders to understand and support the ESO role in developing whole system outcomes and welcome the value we add. We want them to be happy with how we have collaborated with them in our development of processes to allow significant progress towards realising a whole electricity system approach in this area. We want them to be happy with the role we are playing to facilitate collaboration across the transmission-distribution boundary, including our contribution to the ENA Open Networks Project. We want them to be satisfied that our activities in this area are creating a level playing field for different types of solution and will drive outcomes that deliver the best value for consumers.

[1] https://www.nationalgrideso.com/news/shaping-whole-electricity-system-future



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Appendices

Appendix 1: Content Moved from Principle 5 to Principle 7

The following content has been moved from within Principle 5 to Principle 7 (Facilitate timely, efficient and competitive network investments). It is felt that, given that the work is a key enabler for the Network Development Roadmap set out under P7, , it represents a better fit with the rest of that principle.

1. What do we currently do?

Supporting efficient development and investment in the transmission network through the Electricity Ten Year Statement (ETYS) and Network Options Assessment (NOA) processes

For transmission, network development is currently achieved through the ETYS and NOA processes. We identify and publish future transmission system needs, invite options from Transmission Owners to meet those needs, then deliver a recommendation for each boundary about whether to invest to enhance capability, or to manage constraints by adjusting generation output and demand consumption. The process includes analysis of both onshore and offshore options to meet network needs, as well as an assessment of the level of cross-border interconnection that might provide optimal consumer benefit.

This process relies on efficient collation, management and modelling of transmission system data. It begins with our Future Energy Scenarios, the generation and demand patterns of which are applied geographically to understand the resulting power transfers across network boundaries. The capabilities of these boundaries stem from the Electricity Ten Year Statement process; and the assessment of power transfers gives an indication of which boundaries require reinforcement. Options for reinforcement are sought from TOs – these might involve enhancing existing asset capabilities or building new assets. Also, the TOs and the SO can propose 'reduced build' options which seek to utilise existing assets in innovative new ways; and the SO can propose non-asset-type solutions, such as those involving intertrips or SMART technologies, seeking to minimise the need for further assets.

We assess these options by calculating the cost of constraints without the reinforcements; and then with the reinforcements, which are selected through a combination of engineering and economic assessment - balanced against the capital cost of those reinforcements. We identify those options and combinations of options that produce the best overall result – these options form the recommendations that are published in the NOA report each January.

Given future uncertainty when planning major transmission investments, the NOA process mitigates risk by finding the least regrets of options and repeating the process annually.

The current NOA methodology, agreed with Ofgem, does not explicitly seek whole-system solutions to transmission boundary problems, however National Grid's electricity transmission licence includes reference to the need to liaise with DNOs on possible distribution system solutions to transmission boundary capability enhancement. In our recently-published Network Development Roadmap , we set out our thoughts on how the NOA methodology may develop to address this issue.

2. How are we seeking to unlock vale for consumers in the way we plan and develop the transmission network?

Meeting Regional Transmission System Needs – Pathfinding Projects to manage High Volts

The changing electricity system has caused reactive power demand on the transmission network to evolve over time, with a trend towards an increasing requirement for the absorption of MVArs. Whilst we take what actions we can to optimise transmission system configuration and use of transmission-connected reactive compensation equipment, we also rely on reactive power from

generators - we currently spend £100m per annum on reactive power services from generation already running, and a further £50m in constrained areas for additional generation to run, so that it can provide such services.

The current NOA process is not designed to tackle regional challenges such as management of high volts. To unlock further value in this area, we will use pathfinding projects, a “learning by doing” approach to develop new regional approaches to meet these challenges, in part through the Open Networks project. These approaches will consider the costs and benefits of a broader range of transmission and distribution options for high-volts management, thereby enhancing the efficiency of the resulting recommendations.

Across the areas identified as potentially suitable for pathfinding projects, the spend on reactive power services in 17/18 for the management of voltage was around £30m. Through the development of robust whole-system processes, we aim to consider a wider range of asset and operability options across transmission and distribution, so that we can form a more complete view of the most economical solutions, to drive this spend down and deliver value for consumers.

To meet the regional challenges mentioned previously the pathfinding projects represent an integrated approach covering both transmission and distribution. The approach recognises the impact that embedded generation and distribution network configuration are a key driver behind this new system behaviour, and might therefore form part of the solution.

The first pathfinding projects cover areas where we are currently incurring significant spend on managing high volts; in some areas we see the potential for future non-compliance with criteria set out in the Security and Quality of Supply Standards, in others we are assessing whether going beyond those requirements will drive better outcomes for consumers. We are developing a NOA-type approach so that it can operate on a regional whole-system basis to consider what the most efficient approach to managing high volts might be in those areas.

Our pathfinding projects aim to develop new processes for a whole-system approach to meeting transmission system needs. We will need to develop processes and ways of working with a wider range of participants. Developing efficient whole-system processes for a broader assessment of options to meet transmission system needs will provide greater certainty that the most efficient options are being taken forward, for the ultimate benefit of consumers. Testing the pathfinding project approach for high-volts will generate learning to support a similar approach in future for other regional system issues.

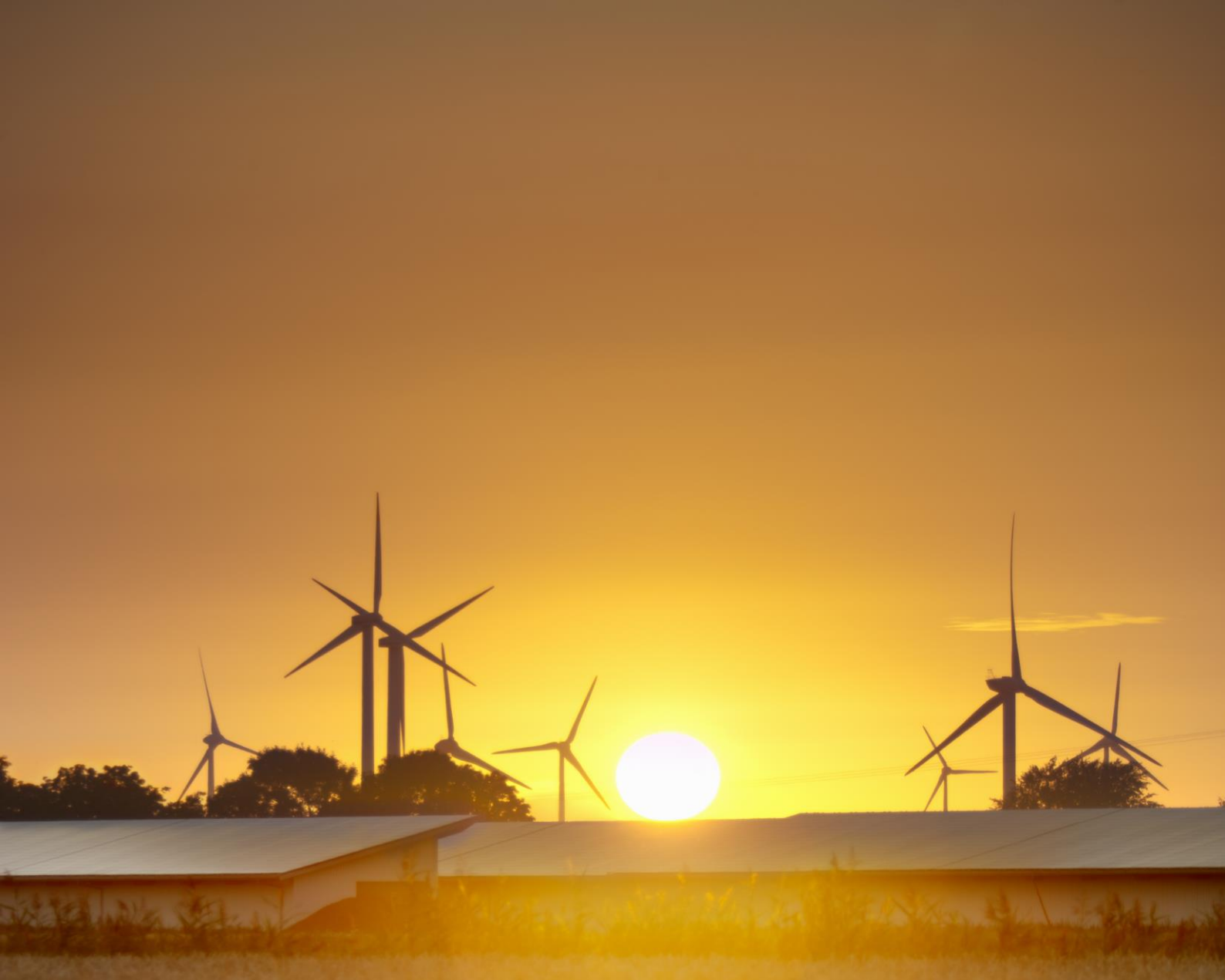
Deliverables transferring from Principle 5 to Principle 7:

Outcome	2018/19 Deliverables
Develop a whole-system approach to meeting regional transmission system needs	• Upgrade and develop the models we use in the NOA process to better accommodate the changing characteristics of the whole electricity system, so that they can assess non-transmission solutions to regional transmission system issues as part of the high-volts pathfinding projects (Q3) • Develop new ways of working with DNOs and other solution providers to support development of the NOA methodology and analysis (Q4) • Publish the results of the NOA pathfinding projects; and a plan to update the NOA methodology to incorporate lessons learnt (Q3) • Work with regulatory experts within the distribution and transmission network owners to develop a recommendation to address any funding issues that arise from the NOA pathfinding projects, so that blockers to the delivery of its recommendations can be removed (aiming for Q4 for recommendation; delivery to be linked to RIIO-2 timescales)

3. Performance Metrics

We will be able to demonstrate a contribution to the realisation of consumer benefit through improvements in the following metrics:

12: 'Whole system optionality' – the number of credible distribution-led investment options and non-network options that are modelled in the Regional NOA CBA process, alongside traditional transmission-based options, to support transmission system needs. This will demonstrate that the process is accessible and understandable by the new parties.



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