Our customer-led transition to Distribution System Operator (DSO) is well underway – we have been laying the foundations with our ongoing roll-out of smart grid technology and by enhancing data systems to build a future-proof local network around the needs of our customers.

This document now marks the launch of our customer flexibility plan where we are seeking expressions of interest from customers to provide services in nine locations within our region.
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Imagine a world where you can buy electricity generated by your neighbour’s solar panels more cheaply than from your energy company; where you get a discount on power bills for letting your electric car back up the electricity system when it’s not in use; where batteries kick in automatically to keep critical infrastructure and your home running in a power cut.

This is the world of the smart grid and these are just some of the exciting new opportunities that Northern Powergrid’s team is exploring today. Customers will play an active role as more and more homes and businesses acquire solar panels, batteries and electric vehicles. We want to give them the opportunity to make money by using these resources to import or export energy and vary consumption at our request, providing flexibility which helps us to operate the network efficiently and defer or avoid network reinforcement to help keep costs down.

But this is not just about benefits for the people who can afford high-tech devices. We want all our customers to see benefit from a smart system which is more efficient, reliable and cost-effective, allowing us to keep our prices down. New technologies can also deliver better services for our more vulnerable customers. For example, we are trialling the use of repurposed electric vehicle batteries as a back-up for those who rely on electricity to power vital medical equipment.

In the world we envisage, we are our region’s Distribution System Operator (DSO), responsible for the integrity of the system and facilitating the operation of energy markets. This document sets out what we are doing now to become a DSO, our immediate plans for what we are going to do next and our emerging thinking on the potential pathways out to 2030 to build this smart grid around the needs of our customers.

We will use new technology to develop sophisticated ways to manage our system and pioneer new commercial models and markets to source flexibility. We will collaborate closely with other parts of the energy system, Government and Ofgem to ensure that as the regulatory framework evolves, it serves all our customers fairly and well, assigning well-defined roles and responsibilities and preserving clear accountability for delivering a safe and secure service.

A central part of becoming an effective DSO involves developing a market for local flexibility, giving customers the opportunity to take an active part in the energy system by using their energy resources to support the network, and be compensated for it. We hope to make use of commercial generation and domestic solar panels; batteries and electric vehicles – that can import or export energy; and of customers’ ability to reduce the amount of energy they are taking from the network. We will contract with customers to turn up or turn down their electricity demand or use their generation and storage to import or export power to offset the need for network investment.

This year we assessed the network for areas where intervention may be required to manage peak congestion in the period to 2023. Next year, for the first time, we are looking for customers to provide up to 12.5MW of flexible capacity for winter 2019-20 at nine locations on our network. We hope it will be more cost effective to pay them to reduce demand at key times than to spend money on upgrading our network. In the future, customer flexibility could also provide emergency support during power cuts.

This transition is a significant programme of business change for our people. We will be reinforcing the cultural change required by revising our internal roles to provide clarity of purpose that assists our people to deliver a level playing field for customer flexibility solutions to compete fairly and transparently with technical solutions. Further, we will provide data and information that gives stakeholders visibility of our actions and the change in our culture. The blend of regulatory incentives driving the change and the transparency of our approach should build stakeholder trust in the actions we are taking to deliver on our DSO vision.

We have worked with a wide range of our customers and stakeholders to develop the thinking in this document. It captures the outcome of the conversations that we have had so far, and the next stage of the process is for the communities that we serve and wider stakeholders to further shape and define a full plan. Having set out our DSO v1.0 immediate next steps and emerging thinking, we now invite our customers and stakeholders to test and challenge our thinking and to help us address a number of specific questions. Next year we will update our plan informed by this consultation. We then intend to update that detailed plan twice a year. This work will also directly inform our business plan, including the business plan we’ll publish in 2021, which the energy regulator will use in determining our regulatory settlement for the period running from 2023-28.
Executive summary

The need for change
We are in the midst of unprecedented change in the UK’s energy system. Electricity production is moving away from large power stations towards smaller units – local generation on our network is growing rapidly, up from around 1GW to 4GW in a decade. Increasing amounts of electricity are being produced by renewables; intermittent power that ebbs and flows with the sun and wind. The next decade could see millions of homes adopt electric cars and heat pumps as the UK decarbonises its economy – either of these technologies can more than double a home’s peak energy demand.

As patterns of generation and consumption become increasingly complex, we are developing smarter ways to manage the system. Battery storage and rewarding customers for reducing consumption at peak times offer new opportunities to match demand to supply. New technology allows us to manage our network far more efficiently, responding to real time information about power flow, monitoring the condition of our assets remotely, and automating many processes. Using these sources of flexibility enables us to run a more cost-effective network and avoid or delay spending on reinforcement to increase its capacity.

Energy networks have a key role to play in this change
We are already adapting so that we can meet the demands of the future while continuing to deliver a safe, reliable and affordable service to our eight million customers. We are transitioning to a Distribution System Operator (DSO) model, actively managing the network in real time and balancing supply and demand locally. We aim to combine network flexibility solutions with customer flexibility solutions to maximise the use of the existing assets that make up the local grid. Government analysis shows that using flexibility is the best way to develop the electricity system, limiting network upgrades, enabling more renewable generation, and offering UK consumers estimated savings of £17-£40 billion by 2050.

This document sets out what we are doing now to implement DSO v1.0 next steps and our emerging thinking on the transition to future versions of DSO. Our vision for DSO is that our customers extract maximum value from their assets through accessing a range of markets, and through our network we deliver a resilient and cost-effective service. Therefore, we are building a smart, local and cost-effective network around the needs of our customers. This document also sets out the significant progress we have already made with ground-breaking innovation projects that are exploring the potential of new technologies and building our capabilities. It also shows how we are collaborating with other network operators and working to support the government’s Smart Systems and Flexibility Plan2. The transition to DSO will require a complete transformation of the way we operate, and we include potential pathways to 2030 detailing how we propose to acquire the competencies and develop the services we will need.

Pioneering a market for customer flexibility
In the long term, we want flexibility be the default when connecting to our network so that all our customers can financially benefit from offering their flexibility to the system. This flexibility will play into a deep and liquid market with customer flexibility serving both energy markets and network services markets (when the network is congested). When the cost of managing part of our network though flexibility exceeds the alternative cost of a network intervention then a smart network or reinforcement solution will free up flexibility to play into the energy market. But we won't get there overnight. The first phase of our customer flexibility plan aims to move us in the right direction.

Starting in autumn 2018, described in Part 1 of this document, we have assessed the network for areas where intervention may be required to manage peak congestion in the period to 2023. We are now seeking to understand where flexible capacity connected to our network could help us to manage congestion as an alternative to flexible network solutions or system reinforcement. We have published details of nine locations on our network where we are seeking up to 12.5MW of flexible capacity for winter 2019-20, and we are seeking expressions of interest ahead of formal tendering in 2019. Looking further out we will explore how customer flexibility may also assist to manage the risk of power cuts during long duration construction periods and provide emergency support during unplanned power cuts.

We will trial new commercial offerings and contracts and explore platforms on which flexibility will be traded. We will consult with stakeholders to develop and refine processes. We expect our need to procure flexibility to grow over time with increased renewable generation, increasing numbers of EVs and changing consumer behaviour.

1 ‘An analysis of electricity system flexibility for Great Britain’, Imperial College and the Carbon Trust, 2016
2 ‘Upgrading Our Energy System – Smart Systems and Flexibility Plan’, Ofgem, BEIS, 2017
We are committed to a programme of cultural change to offer solutions that include customer flexibility alongside more traditional options of network flexibility and reinforcement. We will be reinforcing this change with clear internal roles for our people that ensure a level playing field when assessing options. Greater transparency will assist the market to see when parts of the network are becoming constrained. We will explain our forecasts for increased demand, how we expect these to affect our network, and which solutions we believe will offer best value: customer flexibility, network flexibility, or conventional network reinforcement.

Customers must be at the heart of the transition to a smart, low carbon energy system
Our proposals are based on wide consultation with our customers, and we will continue to seek their feedback. Our local presence, local knowledge of our customers’ needs and local experience of delivering electricity will help us ensure that we provide the infrastructure and services that are right for them.

We have consulted widely and in response we have built a set of next steps and emerging thinking that addresses our customers’ needs, and follows some guiding principles. Our transition to DSO:
— is led by our customers’ needs;
— provides a compelling value proposition for customers and stakeholders, that promotes sustainability by being efficient, fair and inclusive, and better for the environment;
— requires a right-sized regulated business that can support and enable deep and liquid competitive local markets for flexibility; and
— requires ongoing changes to duties that will optimise the system as the volume of distributed energy resources increases.

We are committed to delivering socially inclusive change which benefits all our customers
Proportions of elderly people and households in extreme poverty are above the national average in our region, and it is important to ensure that we seize opportunities to improve our service to these and other vulnerable customers and identify and mitigate any risks. Our actions will deliver a more reliable network, with fewer power cuts. We will help alleviate fuel poverty by running a cost-effective network and encouraging local energy initiatives. We will help improve the environment and air quality, by developing infrastructure that supports the growth of renewables and the switch to electric vehicles.

Exploring the future through innovation
Our innovation portfolio is central to our transition to becoming a DSO. It helps us to scope the future and develop the methods we will use to manage a smart grid in real time. It also helps us to build understanding of the wide range of skills we will need to introduce processes to coordinate many different functions within our organisation in a planned timescale.

The most cost-effective, resilient and sustainable solutions will come from optimising the whole energy system, not just our own network. Accordingly, our innovation programme is looking for solutions which work for customers, regional and national networks and take into account heat and transport. With Nissan and National Grid, we are running a world-first £9.8 million trial exploring how EV batteries can support the grid when plugged in for charging. e4Future will use 1,000 vehicle-to-grid chargers and evaluate a commercial offer for EV fleet customers. We are collaborating with Northern Gas Networks on InTEGReL, the UK’s first incubator for integrated energy system technology. Amongst other things it is exploring how heating systems can be used to help balance power demand and how gas storage could support the electricity system.

Deploying innovative network solutions
A smarter network is an essential precursor to a smarter energy system to fully realise the benefits of becoming a DSO. Our £83 million Smart Grid Enablers project is the UK’s most comprehensive network upgrade programme and will transform our ability to monitor, control and communicate with more than 860 substations. It will give us the ability to respond to real time information about power flow on our network, building new capabilities that will enable us to roll out smart grid solutions that could generate up to £350 million of benefits by 20313. This was in our business plan for the 2015-23 period and we are already well on with this implementation.

We are also getting on with the transition by implementing flexible solutions where it makes sense to do so. Our Active Network Management (ANM) solution at Driffield is providing scalable capability to connect more generation at least cost as an alternative to conventional reinforcement. We are planning to roll out further ANM zones, where there is high customer interest in connecting to the network, limited capacity and high reinforcement costs.

3 www.yourpowergridplan.com/#/smarter_powergrid
Plans to develop customer flexibility are just one element in a complex programme to develop DSO capabilities. In Part 2, and in the annex of this document, we describe potential pathways to build on trials and local initiatives to develop processes which we expect to be more standardised across the industry by the end of the next decade. It will involve the development of customer and commercial offerings, technical solutions, and a huge enhancement in our ability to use data from our customers and network for us and others to deliver new or improved services. This process is well underway, and we are already investing ca. £150 million in building blocks that will support our ability to manage a smart, local, cost-effective network.

The current regulatory and legal framework supports Distribution Network Operators (DNOs) like us to procure flexibility as an alternative to reinforcement, but it is largely silent on the wider roles and responsibilities around information provision and system coordination that will be needed to manage a network accommodating millions of new energy resources such as EVs. A key part of our DSO role will be to provide data and information to the market as part of a neutral facilitation service that enables competitive market providers to deliver services to customers.

We believe that DNOs are best placed to deliver these DSO functions
We have an understanding of the needs of our eight million customers and a track record of delivering a safe, stable and reliable network. We have the scale both to engage community energy groups and to champion our customers’ needs at national level. Customers benefit from clear accountability because we own the assets we operate and we are well capitalised, and if we ever make a mistake, our equity shareholders pay for it, not the taxpayer.

As a DNO, the incentives and mandate exist in the current ED1 price control period for us to continue to make the transition to DSO. At the working level we will be making changes to the roles and responsibilities of key individuals so that there is a distinction between individuals’ duties and we will be introducing inherent checks and balances in our organisational structure. In addition, we expect that enhanced reporting and visibility of our actions will provide confidence to our stakeholders that the adoption of new commercial services is being correctly considered. This confidence should have a positive impact on the development of competitive local markets for flexibility.

More generally, we see the scope of DSO changing through time. No changes are required for us to deliver on the current actions necessary to optimise the network through the use of customer flexibility alongside network solutions. The debate required for the forthcoming ED2 price control review is about what new system optimisation duties are required. We support the fact that policy makers need objective evidence to inform decisions on future roles and responsibilities in the energy transition. We are collaborating with other DNOs through the Open Networks project and are committed to make the changes required to support efficient and effective whole system solutions which deliver the best outcomes for customers.
Have your say

New technology and digitalisation are driving unprecedented change in the way energy is created and used as we move to a low carbon economy.

We need to make sure that our network is able to safely and securely support these changes whilst maintaining high standards of reliability for our customers. The industry is responding to this change by transitioning from a traditional DNO to a DSO model. At Northern Powergrid, we are helping to shape this transition to ensure it delivers value for all our customers. In this document we are setting out our intended direction for stakeholder comment.

In Part 1, this document is setting out concrete proposals for those areas where we are confident of the direction required – most importantly, the first phase of our customer flexibility plan roll-out that is widely recognised as core to our DSO transition. But also in Part 2, we are setting out our emerging thinking on what needs doing out to 2030 where we have choices to make and wish to understand stakeholder views.

If you are interested in responding to our expression of interest to provide flexibility services then please follow the guidance in the chapter on our customer flexibility plan.

More generally please tell us what you think about this emerging thinking. We are seeking dialogue in the period to the end of March 2019. Subsequently, we will bring forward an update to our plans in summer 2019.

Send your comments to:
yourpowergrid@northernpowergrid.com

Questions are distributed through this document and we reproduce them here for ease of reference:

Q1. Have you any comments on our phase 1 customer flexibility next steps? (page 18)
We consider these obvious next steps to take.

Q2. What would you like us to prioritise in subsequent phases of our customer flexibility roll-out? (page 18)
Where we go next is open to suggestions on relative priorities.

Q3. What role(s) do you think we should be playing to support the transition to low emission vehicles? (page 23)
A key area of interest for local authorities and significant impact for all our customers.

Q4. Where would you like to see more innovation and what would be the value for our customers? (page 26)
We want to ensure that we are returning most value from the investment.

Q5. Do our guiding principles set the right direction for our DSO transition? (page 30)
Our emerging thinking needs a clear steer.

Q6. Is this view of the future appropriate from a customer’s perspective – focusing sufficiently on customer value and explained in a manner that is likely to engage people? (page 31)
DSO can mean many things to many people – we wish to unpack it and ensure we are all on the same page.

Q7. Is there anything in our views of DSO that you consider missing or needing further consideration? (page 31)
We expect that there will probably be some gaps or blindspots.

Q8. How may we ensure a socially inclusive approach in the changes to the energy system? (page 32)
We expect this will require actions in a number of areas.

Q9. What do you consider are the big unanswered questions on the future scope of DSO that should be explored further? (page 33)
We want to be focusing on the right questions as we work towards our ED2 business plan.

Q10. Where would further development of our potential pathways be helpful to you? (page 34)
We will expand our thinking where it is of most interest.

Q11. Have you any suggestions for improvements we could make to our engagement plan, particularly with less engaged and informed stakeholders? (page 42)
This is a process question as opposed to the questions on content that proceed it.

Q12. Is there a particular aspect of DSO that you would like us to explore in a focused engagement session? (page 42)
We expect to run a number of focused discussions through the first half of 2019.
Unlocking customer value

The traditional ‘fit and forget’ Distribution Network Operator model is no longer appropriate for managing a system with growing amounts of local and intermittent generation, changing patterns of consumption and more complex resultant flows of electricity.

Local generation, including wind and solar farms, biogas plants, combined heat and power systems and rooftop solar panels on thousands of homes, now accounts for more than 4GW of the capacity on our network (see Figure 1) – up from just over 1GW a decade ago.

It is not just customers’ choice of generation that is changing. Our customers are also making the transition to electric vehicles and the broader societal trends of digitalisation and more sustainable use of resources all require a response.

Northern Powergrid, in common with our peers, is adapting to these challenges by transitioning to a DSO model, increasingly actively managing the network in real time and optimising its performance through interaction with our customers. There are a number of unanswered questions on what DSO entails and how it may therefore be delivered. We explore this further in Part 2 of this document. But it is recognised that the procurement of customer flexibility is a key implementation step and we go on to describe what we are doing in that respect in Part 1 of this plan.

Figure 1: Generation connected to our network

Northern Powergrid
Part 1: Launching DSO v1.0 – our next steps

Our DSO v1.0 implementation is well underway, exemplified by the initial phase of customer flexibility announced here that is being rolled out alongside the existing technology and systems upgrade programmes.

In this part of the document, we introduce these next steps we are taking now to deliver DSO v1.0. Following careful engagement, we know our stakeholders agree that these tasks will deliver value to our customers and make sense for any likely future scenario. On this first set of actions, we welcome views around detailed implementation. In particular, in this section, we would welcome comments on our current actions to procure customer flexibility, explore the future through innovation and support the electric vehicle revolution.
1. Our customer flexibility plan

2. Building trust and reinforcing the cultural change

3. Enabling new customer energy practices with smart grids

4. Achieving maximum value from electric vehicles

5. Exploring the future
Part 1: Launching DSO v1.0 – our next steps

1. Our customer flexibility plan

Our strategy is to work with our customers to deliver what they need, provide them with extra value from their energy assets and manage the network in the most cost-efficient manner. This means exploring different options to meet the increasingly complex demands on the network. In particular, using customer flexibility to benefit the energy system where this makes sense compared to the other network intervention options.

In the long term, we want to foster a deep and liquid market for flexibility. In this section of the document we are setting out the short-term action we are taking to work towards that goal through tendering and contracting for flexibility.

We are committed to openly test the market for flexibility solutions as alternatives to reinforcing our network. In this phase 1, we will do this for projects that would involve significant cost to solve with conventional network investment, but we will also market test flexibility solutions for less costly projects where we believe there are viable options. Over time, as technology develops and our capability grows, we aim to assess flexibility as an alternative to all network investment.

Starting in 2018, we are setting out where we have forecast need for additional capacity in response to changing customer energy use, assessing the flexible capacity connected to our network and how these assets could respond to requests from us to adjust their usage. We are not specifying the source of this flexibility. However, we expect it could include commercial generation and domestic solar panels; batteries and electric vehicles, that can import or export energy; and customers with the ability to reduce the amount of energy they are taking from the network.

Product definition

Flexible assets can help us maintain network stability in a number of ways. The services that are of interest to us include procuring flexibility for the three use cases shown in Figure 2.

We are interested in hearing from providers who can offer flexibility services with assets that meet our minimum requirements. We will use this information to evaluate the feasibility of flexibility procurement at each location.

The initial expression of interest (EOI) is seeking flexibility for 2019-20 at certain locations. However, we are interested in hearing from flexibility providers located across our entire network as they may be able to provide services that we will need in the future.

Figure 2: Cases for use of customer flexibility

<table>
<thead>
<tr>
<th>Traditional reinforcement</th>
<th>To defer spending on traditional reinforcement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned maintenance</td>
<td>To manage the risk of power cuts during long duration construction periods.</td>
</tr>
<tr>
<td>Emergency support</td>
<td>To provide emergency support during unplanned power cuts.</td>
</tr>
</tbody>
</table>

1 Information on how this can be done is available on our website at: www.northernpowergrid.com/DSO
Minimum requirements

- For a site to provide flexibility it must be located in the relevant position on the network – this includes voltage level and geographic location. Table 1 contains further information on these locations.
- The asset should be able to reliably adjust its demand import (against a predetermined baseline) or generation export safely and manage this for the duration of a contracted window.

- Each site must have minute-by-minute metering.
- Should the site provide the service, this must not trigger the participant to breach any other contractual agreement the site may have in place e.g. increasing connection agreement.
- Minimum size of flexibility available must be 100kW (note this is flexible capability not site capacity). If assets are being bid in as an aggregated portfolio, the minimum portfolio size should be 200kW.
Part 1: Launching DSO v1.0 – our next steps

1. Our customer flexibility plan

Flexibility requirements

We use scenario analysis to identify the range of potential capacity requirements for the network in the forthcoming years. It is these projections that are informing the assessments of sites that will require some form of intervention – either a customer solution (procuring flexibility) or a network solution (load transfers or reinforcement). We are seeking expressions of interest for customer flexibility so that the solutions may compete to arrive at the optimal outcome for our customers.

Figure 3 and Table 1 identify the areas where we are interested in finding out what assets may be able to provide us with flexibility in the short term, from October 2019. We are looking for customers in the specified post codes that may either reduce their demand or increase their generation to reduce the peak load on our network by up to the maximum power stated.

Figure 4: Scenario based modelling informing our load-related investment plan

Gross peak demand projections

<table>
<thead>
<tr>
<th>Year</th>
<th>RIIO-ED1</th>
<th>RIIO-ED2</th>
</tr>
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<tbody>
<tr>
<td>2017</td>
<td>4,000</td>
<td>4,000</td>
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<tr>
<td>2018</td>
<td>5,000</td>
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<td>2019</td>
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<tr>
<td>2024</td>
<td>11,000</td>
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</tr>
<tr>
<td>2025</td>
<td>12,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

MW
We estimate that our requirement for procuring flexibility will grow over the next few years. We expect this growth as a result of a number of factors including the uptake of electric vehicles, increased deployment in renewables and changing consumer behaviour.

As this growth continues (Figure 5), we expect to be procuring more flexibility across a greater number of locations.
Part 1: Launching DSO v1.0 – our next steps

1. Our customer flexibility plan

Our estimate is that, from 2023 to 2030, the number of locations where we may look to implement measures to prevent a substation exceeding its capacity could increase by up to three times the requirement we had for the ED1 period (2015 to 2023). In each case, we will assess the potential for flexibility procurement into our appraisal strategy. It will be assessed alongside making better use of existing network infrastructure and enhancing the infrastructure with a view to establishing the most economic solution.

Figure 5: Expected growth in peak congestion solutions

2019-2023
Capacity required for flexibility up to 14 sites, 16MW

2023-30
Capacity required for up to ca. 40MW
Next steps

1 Expression of interest (EOI) publication
2 EOI period closes
3 Northern Powergrid to assess EOI response
4 If appropriate, launch competitive tenders
5 Close competitive tender process
6 Successful bidders notified
7 Utilisation of flexibility

Northern Powergrid will assess the responses received from asset operators and evaluate these against network requirements.

How to respond

This publication gives a high-level outline of our requirements for asset operators and aggregators looking to participate in providing flexibility services in the winter of 2019-2020. They should express their interest by completing our questionnaire by 25 February 2019.

We would also encourage operators to complete the questionnaire if they are unable to provide services at this time but believe they can provide them in the future.

You can access the questionnaire online from: www.northernpowergrid.com/DSO
2. Building trust and reinforcing the cultural change

As a DNO, the incentives and mandate exist in the current price control period for us to continue to make the transition to DSO. No changes are required to deliver on the current actions necessary to optimise the network through the use of customer flexibility alongside network solutions. The debate required for the forthcoming ED2 price control review is about what new system optimisation duties are required. We explore this further in Part 2 of this document, this is emerging thinking and it would be useful to understand stakeholder views on these points.

The RIIO regulatory regime incentivises us (and other DNOs) to find lower-cost ways of meeting the required outputs, and to the extent they do — they share the benefits with the customers. These incentives have proved very effective in the past — and there is every reason to expect them to apply to the use of flexible market solutions as an alternative to traditional network reinforcement. If any company is slow to capture these opportunities, their performance is compared directly with their competitors in the sector and their price control settlement factors in the greater efficiency demonstrated by others.

At the working level we are seeking to reinforce these company-level incentives with changes to our structure and processes. We are introducing changes to provide clear direction for our people and provide visibility that builds trust with our stakeholders that we are delivering the changes required:

— Clear definition of roles within our teams: we will be making changes to the roles and responsibilities of key individuals so that there is a distinction between individuals’ duties and we will be introducing inherent checks and balances in our organisational structure. In practice, this means that we will not be asking the same person in our team to design a network solution and evaluate the customer flexibility market alternative.

— Reporting and visibility of our actions: to provide enhanced transparency we will introduce visibility of the operation of processes that allows competition between network and commercial market solutions to address network need. This will not only include the outcomes of our investment decisions but also the working we use to arrive at those decisions.

We expect these steps will provide confidence to our stakeholders that the adoption of new commercial services is being correctly considered. This confidence should have a positive impact on the development of competitive local markets for flexibility.

Q1 Have you any comments on our phase 1 customer flexibility next steps?
We consider these obvious next steps to take.

Q2 What would you like us to prioritise in subsequent phases of our customer flexibility roll-out?
Where we go next is open to suggestions on relative priorities.
3. Enabling new customer energy practices with smart grids

The implementation of smart network technology to introduce more flexibility and capacity in the network is taking place alongside our market testing to procure customer flexibility. Our objective is to maximise sustainability by making the most from our existing extensive asset base to enable customers at least cost to connect more generation and increase or change their pattern of energy use – in particular with electric vehicles and electrical heating. In summary, our actions include:

— Our £83m Smart Grid Enablers programme was a key pillar of our ED1 business plan and remains a key enabler for our transition to the role of DSO.

— We have 408MW of contracted flexibility in our existing three Active Network Management (ANM) zones, and in addition the Driffield site is set to go live in 2019.

— We have also reviewed our network design policies to incorporate new technologies, release capacity and incorporate learning from our innovation projects.

— Our major substation voltage reduction initiative has released over 1.65GW of capacity on local networks.

Although the national smart meter roll-out programme is running behind, we are well set to use the data it has started to provide to deliver benefits for our customers through improved services and network planning. We connected to the national central smart meter system (operated by the Data Communications Company) in November 2017 and our systems and processes are in place, making use of smart meter data from the second generation (SMETS2) meters installed in our region so far.

Our Smart Grid Enablers programme is preparing our network for rapid growth of electric vehicles, domestic heat pumps and renewable power

It is the UK’s most comprehensive network upgrade programme, creating the backbone of a smart grid, supporting the North’s ambitions to put low carbon technology at the centre of its economy, and enabling solutions that could generate up to £350 million of benefits by 2031.

Our programme is upgrading the control units in our substations to make the network compatible with modern digital communications, along with establishing the communication network from our control centres to those units. This investment will give us greater ability to control and analyse how our network is operating in real time to respond to the uptake in low carbon technologies.

Ultimately, the programme introduces network flexibility, by allowing us to operate it with smarter, more efficient and cost-effective practices and technologies (explained in Table 2).

Table 2: Smart grid practices and technologies

<table>
<thead>
<tr>
<th>Primary network</th>
<th>Local network</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Self-healing networks</td>
<td>✓ Time-of-use demand data</td>
</tr>
<tr>
<td>✓ Real time capacity management</td>
<td>✓ Remote monitoring of LV circuit power flow</td>
</tr>
<tr>
<td>✓ Two-way power flow monitoring</td>
<td>✓ Automated control of voltage</td>
</tr>
<tr>
<td>✓ Advanced substation control devices</td>
<td>✓ Fault prediction and smart “fuses”</td>
</tr>
<tr>
<td>✓ Wideband flexible communications (IP-based)</td>
<td>✓ Wideband communications</td>
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<td>✓ Harvesting network data from existing HV devices</td>
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In summer 2018, we announced that we were starting a £15 million investment programme, in the next generation of substation controller, to replace the substation Remote Terminal Unit (RTU) equipment in more than 860 substations. The RTU acts as an interface (information and control commands) between the electrical plant and the control engineers.

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2 For more information on our ‘Voltage reduction at primary’ initiative, refer to our ‘Environment report 2018’.
3 www.yourpowergridplan.com/index.cfm#!smarter_powergrid
4 www.northernpowergrid.com/news/next-stage-of-83m-smart-grid-enablers-project-begins
Active Network Management creates capacity for more large-scale generation

ANM is an important part of our future plans. We are installing technology on our network that provides real-time information on the levels of electricity demand and generation that is coming on to the network, providing intelligence on how close the distribution network is to its capacity limits. If the network begins to approach its limits, our ANM system limits the amount of generation to within safe working limits. To enable this, we agree contracts with our generation customers that allow us to limit their generation when required; in return we are able to offer them more cost-effective connections as we avoid the need to invest in reinforcing our network through traditional means, which has traditionally involved installing new cables and substations.

Our ANM scheme in Driffield is on a 66kV section of our network that is considered to be operating at full capacity in relation to embedded generation connections. However, through ANM we are able to actively manage exports from generation customers in order to provide them with cost-effective connections to the distribution network. This scheme is ground-breaking for us, as it is our first replicable scheme, meaning that we now have a standardised solution that we can roll out anywhere this situation occurs on our network.

The majority of this site’s installation works are near completion and the immediate next steps prior to expected go live in Q1 2019 are:
— the installation of control equipment at our control centre in Leeds;
— factory and site acceptance testing; and
— whole scheme commissioning.
4. Achieving maximum value from electric vehicles

The transition to electric vehicles is one of the most significant changes for the energy system and provides opportunities for all our customers. In this section, we set out our views on what is changing and the role we need to play. We are interested in stakeholders’ views on whether our current plans and actions are appropriately targeted.

Switching to electric vehicles (EVs) is vital to cut the UK’s carbon emissions and improve its air quality. The government’s Road to Zero strategy set out its plans for an EV revolution, aiming for at least half of new cars to be ultra-low emissions by 2030 with an end to sales of new conventional petrol and diesel cars by 2040. There could be 11 million EVs on UK roads by 2030 and 36 million by 2040, according to National Grid. There are currently about 17,700 charging points across the UK and a massive expansion will be needed. Local authorities will play a key role in supporting the development of this infrastructure and encouraging buses, taxis and commercial fleets, as well as the public, to switch to EVs.

At Northern Powergrid, we already have 3,000 charging points on our network and we are experiencing a significant uptake in applications to connect all types of EV projects. We are also witnessing a change from requests for single chargers from individual homeowners to requests for larger, multiple connections from businesses, land owners and housing developers.

We believe that, on top of the benefits to carbon emissions and air quality, the roll-out of EVs and EV charging should also benefit network customers. As a sustainability principle, we support the use of existing assets ahead of building new. With EVs, customers invest in vehicles for mobility but then have an asset which may benefit the energy system. We are interested in exploring how we can return value to customers for this secondary use and how this may offset additional need for customer or network assets to manage the electricity system. This offers value to EV owners, local generators and general electricity customers by minimising the costs of running the network.

Properly managed, charging of EVs provides flexible load, which can take part in local energy and network markets. This requires vehicles to be plugged in when not in use. As such we are exploring the concept of a network charging infrastructure that is part of a connected system that benefits all customers. This is the opposite to uncontrolled charging which could be detrimental to both the network and our customers.

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5 'Future Energy Scenarios', National Grid, July 2018
6 https://www.zap-map.com/live/
Many of our innovation projects are designed to support this change and ensure our network is fit for the future.

**e4Future**
With Nissan and National Grid we are running a ‘world-first’ £9.8 million trial using 1,000 vehicle-to-grid (V2G) chargers. It will test how EV batteries can support the grid when plugged in for charging and will evaluate a commercial offer for EV fleet customers. The e4Future project was announced by BEIS as part of a drive to fully integrate EVs, increase UK renewable energy generation and alleviate pressure on the grid.

**Silent power**
We are working with two dynamic UK SMEs, Hyperdrive Innovation and Offgrid Energy, to develop a new electric response vehicle with an onboard energy storage system (ESS) to power homes while their electricity supply is being restored. The project offers a quieter, cleaner alternative to the diesel-powered generators currently used. It can absorb power as well as generate, critical for a world where consumers with solar power are becoming active participants in the power and flexibility markets.

**Electrifying our fleet**
We have announced three key initiatives to give our 2,500 employees the chance to engage with EV technology. We are installing charging points at 11 of our sites, including a number of V2G chargers. We aim to encourage employees to go electric and we are starting to electrify our own fleet. We will observe how our employees interact with EVs and the impact on the network.

**Gamification**
Our Activating Community Engagement trial explored how a mobile game could incentivise households to reduce consumption at peak times. The lessons of GenGame are now being used in a follow-up GenDrive project, which will explore how mobile games can incentivise EV drivers to use their vehicles to support the UK energy grid.

We are committed to helping local authorities deploy their plans for low emission transportation successfully. Our teams work closely with officers to optimise the options at the time of a connection enquiry. We have also carried out an EV workshop in October 2018 to share best practice, and collect feedback to inform our EV strategy due for publication in 2019. Despite having mapped out these specific next steps for EVs we recognise that there remain a number of uncertainties and we are interested in stakeholders’ views on what more we can do.

**Q3 What role(s) do you think we should be playing to support the transition to low emission vehicles?**
A key area of interest for local authorities and significant impact for all our customers.
Part 1: Launching DSO v1.0 – our next steps

5. Exploring the future

Our innovation portfolio is central to our transition to becoming a Distribution System Operator. It is leading our thinking on the open questions that define what DSO is and how it will benefit our customers. As well as scoping the future, it is providing input for us to close the gap in making the transition by developing the methods we will need to manage a smarter powergrid in real time. It also helps us to understand the wide range of skills essential to the transition and develop processes to coordinate many different functions within our organisation. The question for stakeholders is whether there are gaps in our thinking or our project portfolio that we need to be filling.

Our innovation strategy

Our innovation programme plays a vital role in how we respond to external changes, new demands and emerging risks. Its impact can be seen right across our business, improving services and reducing costs for customers.

We have four core innovation priorities and each is relevant to the transition to DSO:

- Developing a smarter and more flexible power grid
- Delivering benefits from smart meters
- Continuing our move to web-based and digital enabled services
- Maintaining an affordable service

Key innovation projects benefitting our DSO transition

‘Customer-Led Distribution System’: exploring the impact of markets on our services

The CLDS project aims to identify and demonstrate the most appropriate market design (what is traded, when and where) and industry structure (the institutional arrangements for how contracting for flexibility is organised). Working with researchers at the University of Bath and Newcastle University, we will:
- enable the optimisation of network and distributed energy resources;
- enable third party providers to realise maximum value of distributed energy resources through market-enabled energy and network products; and
- enable the uncertainty and complexity of the supply system to be substantially reduced by a distributed and coordinated market as well as by network solutions.

‘Distributed solar storage study’: building our battery storage understanding

We have teamed up with Moixa and Energise Barnsley in a ground-breaking trial to demonstrate how home energy storage and solar PV can save customers money and reduce network constraints. We have installed smart batteries in 40 homes with solar panels near Barnsley and linked them in a virtual power plant. On sunny days when generation is high and local demand is low, the batteries will be able to store energy rather than export it onto the electricity network. We expect this solution to halve residents’ energy bills, enable more solar power to be installed without upgrading the local network, and save millions in the cost of running the UK’s electricity system.

‘Microresilience’: using DER to maintain power to critical infrastructure

Our Microresilience project will show how batteries and local generation can maintain electricity supplies to isolated communities and critical infrastructure in the event of a power cut. We are trialling solutions at four sites with different needs:
- two lifeboat stations, which are at greatest risk of losing power in storms when their services are needed most;
- a remote village supplied by a single 60km overhead line, which is vulnerable to high winds; and
- Newcastle Swing Bridge, which requires a dedicated power source when it is open.

The project will trial systems which can switch seamlessly from the National Grid to a microgrid without any interruption in supply.

Overall, in the period to 2023 we are investing over £10m in innovation projects related to the transition to DSO. We have significantly expanded our innovation portfolio since the start of the ED1 period. In 2017-18 we invested all of our £4.1m Network Innovation Allowance (NIA) across a portfolio of 26 projects.

7 For more information about our Innovation strategy, and the recent progress made, refer to our Environment and Innovation report 2017-18
‘Improving demand forecasting’: identifying future network constraints
Following a successful innovation project, we have adopted a new methodology to forecast the future load at our grid and primary substations. We run scenarios related to the growth of new technology such as electric vehicles and small-scale solar generation, determine the impact on our substations, and forecast future load-related network constraints. This creates the background for our annual network planning exercise, which identifies investment requirements. Traditionally we have reinforced the network to cope with expected load, but we are now able to deploy DNO-driven flexibility solutions, such as industrial demand side response, or smart charging of electric vehicles. This new methodology responds to the need for greater understanding of load on our network at a local level and for more targeted investment planning. Previously we had to make sweeping assumptions to plan network investments, for example, our forecasts for the 2015-23 RIIO-ED period were based on 0.5% growth on our high voltage and extra high voltage networks and on scenarios based on government models for the low voltage network.

‘Activating Community Energy’: gaming as a way to engage customers in flexibility
We ran the world’s first trial to show how a mobile game could be used to incentivise households to reduce their consumption at times of peak demand. More than 2,000 customers took part in GenGame, competing for cash prizes by turning off washing machines, televisions, lights and other home devices. The three-year project demonstrated that players could be encouraged to cut their electricity consumption by an average 11%.

Domestic customers are an important potential source of flexibility. Homes account for 95% of our customers and 35% of the electricity we distribute, and domestic energy use will grow as electric vehicles and heat pumps are adopted more widely. The Activating Community Engagement (ACE) project generated important insights into how to recruit customers to provide flexibility, how to maintain their engagement and how to use gaming technology to maximise results. It also helped us understand important demographic issues such as which types of customers are most likely to take part and which can deliver the most flexibility.

Domestic DSR could compete in the new flexibility markets that are being developed, but it would require an aggregator to achieve the necessary scale. By testing a technology that enables domestic DSR, ACE is helping an emerging market diversify its offering. Community energy groups have told us they need support to kick-start this market and level the playing field on providing flexibility services. A market in domestic DSR will ultimately benefit our customers, by giving them more choice, and the energy system, by providing more competition for flexibility tenders.

‘Resilient Homes’: bringing stored electricity to customers in vulnerable situations
Power cuts cause problems for all of us, but they can seriously affect the health and wellbeing of particularly vulnerable customers. Even a short power cut can make a significant impact on customers who are on the Priority Services Register (PSR) or who rely on electrically powered medical equipment. This is compounded by the worry caused to these customers, and their carers, about how to cope in the event of a power outage.

Northern Powergrid aims to deliver a low-cost solution using re-purposed electric vehicle batteries to maintain power in the event of a temporary break in supply. Subject to a confirmed feasibility study, we plan to install 30 Nissan batteries into the homes of customers relying on electricity to power critical medical equipment so we can assess their viability and effectiveness.

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8 ‘Improving Demand Forecasting’ which ran from October 2016 to October 2017.
9 More information on the findings from ACE: www.northernpowergrid.com/innovation/projects/activating-community-engagement-nia-npg-005
Part 1: Launching DSO v1.0 – our next steps

5. Exploring the future

‘Integrated Transport Electricity and Gas Research Laboratory: delivering whole system solutions’

InTEGReL is a whole energy system demonstrator built as a collaboration between Northern Gas Networks, Northern Powergrid and Newcastle University to explore and test new energy technologies, strategies and processes which bring transport, electricity and gas together. It is the UK’s first incubator for cutting edge whole energy systems technology, allowing forward-thinking businesses to test their ideas in real-world conditions, and at a large scale.

InTEGReL will tackle the UK’s energy challenges head on, with teams of academics and engineers working to deliver breakthroughs in the decarbonisation of heat, energy storage and transport.

We are building an integrated test network to explore how to make these systems work together and how to optimise the outputs across them with the following assets:

- power and heat storage (electro-chemical and thermal batteries);
- vehicle to grid chargers; and
- an electrolysis plant, H2 storage and a fuel cell to allow transfer between energy vectors.

The objective is to identify the most affordable and practical solutions to moving customers onto low carbon, low cost energy.

‘Foresight’: using data intelligence to avoid power cuts

The transition to DSO includes making use of intelligence from data to develop increasingly active networks that deliver high levels of reliability and availability for customers. Identifying and preventing potential power cuts before they happen will help us deliver on this customer-focused ambition. We can do so by improving our understanding of our network’s status through data analysis. Foresight is a three-year project that will enable us to spot the tell-tale signals on the network before a fault happens. It will improve our understanding of indicative pre-fault behaviour of low-voltage cable networks and our ability to develop management options for it.

A greater understanding of fault types will support a radical change in our approach to replacement works and will improve network reliability, efficiency and maintenance programmes, which will benefit our customers and result in less physical disruption on the network and roads. If we can fix faults in advance, we will keep the power flowing to all of our customers and not only play our part in resource conservation by saving materials, but minimise digging up roads and causing traffic disruption for local businesses and householders. Northern Powergrid currently has a policy that sees 250 metre sections replaced after four faults. With Foresight completed, the company will be able to minimise the time taken on cable replacement programmes by only replacing short faulty sections.

Q4 Where would you like to see more innovation and what would be the value for our customers?

We want to ensure that we are returning most value from the investment.
Part 2: Potential pathways – our emerging thinking

In this section, we set out our emerging thinking on the direction we are proposing to 2030 in our transition to DSO. We then set out our view of the future, and the potential pathways we could take, as the basis for a conversation with our stakeholders.

There is still much uncertainty here, views of the future differ, and there are trade-offs still to be made. We are therefore consulting on a set of proposals here, ahead of firming up this part of our plans.

We are also interested in views on whether we have got our starting principles right, if we have been sufficiently clear and whether or not the priorities and actions are appropriate.
Part 2: Potential pathways – our emerging thinking

1. Guiding principles

Firstly, it is appropriate for us to share the guiding principles that are informing our more specific draft proposals.

In our planning and in the proposed execution of our next steps, we are guided by the belief that our transition to DSO:

— is led by our customers’ needs;
— provides a compelling value proposition for customers and stakeholders that promotes sustainability by being efficient, fair and inclusive, and better for the environment;
— requires a right-sized regulated business that can support and enable deep and liquid competitive local markets for flexibility; and
— requires ongoing changes to duties that will optimise the system as the volume of distributed energy resources increase.

Q5 Do our guiding principles set the right direction for our DSO transition?

Our emerging thinking needs a clear steer.

2. Making sense of DSO

The DSO operates at a regional level, in collaboration with the national Electricity System Operator (ESO) whose role includes balancing the national electricity grid on a second-by-second basis and is accountable for the frequency of the interconnected system. The shift away from large generation means that the SO has to look to new control paradigms, whilst in parallel, at a local level, we are developing our services to connect increasing quantities of generation and load.

Our proposal for how this all comes together for the customer is set out in Figure 7:

— New local energy markets will provide the energy customer with services that go beyond supplying units of electricity: energy management, light and heat will be the traded commodities instead. We expect these local energy markets to be provided by competitive market actors, competing to provide services that customers with increasingly more flexible energy resources (like electric vehicles) value. As DSO we expect to support these markets by providing network data that can be used by third parties to provide these services.

— As a DSO, we anticipate rewarding and enabling customers to play a much more active role in supporting the network by flexing demand or generation load. These are network services provided to the DSO to help manage the system and deliver our core services to all customers cost effectively. Prices, smart technology and new commercial services will encourage and enable them to be flexible in their energy demand, using electricity when it is in abundance (when the wind is blowing, or the sun is shining) and reducing consumption at times of high demand. For example, a domestic customer could be rewarded for allowing their washing machine to start later in the day. A commercial customer could be paid for allowing their fleet of electric cars to discharge their batteries onto the network to help with a local surge of electricity demand. A generator of electricity may be constrained temporarily, according to criteria agreed at the time of their connection.

— From our primary duty to keep the lights on, it is also our ambition that, as we get more out of our existing network infrastructure, customers will receive a more efficient service through the introduction of new technology to monitor, control and communicate with our substations. For example, we will be able to dynamically alter network voltages, providing headroom for more generation or reducing demand to help balance the system. By monitoring the actual load on key equipment we will be able to save money by taking a much more accurate approach to investment in upgrades.
Figure 6: DSO interfaces – other DSOs and the SO

- Competitive market providers deliver new services to customers
- Customers paid to provide a service
-Providing connections
- Flexing demand and generation
- Keeping the lights on
- Data and information provision

Figure 7: What DSO means for our customers

- Data and information provision
- Keeping the lights on
- Providing connections

DSO – today

- Customers pay for receiving a service

DSO – future

- Data and information provision
- Keeping the lights on
- Providing connections
- Flexing demand and generation
- Local energy markets

- Customers pay for receiving a service, less than without DSO
- Customers paid to provide a service
- Competitive market providers deliver new services to customers

Q6 Is this view of the future appropriate from a customer’s perspective – focusing sufficiently on customer value and explained in a manner that is likely to engage people?

Q7 Is there anything in our views of DSO that you consider missing or needing further consideration?

We expect that there will probably be some gaps or blindspots.

DSO can mean many things to many people – we wish to unpack it and ensure we are all on the same page.
Part 2: Potential pathways – our emerging thinking

2. Making sense of DSO

Ensuring an inclusive transition for all people in our region

When planning for our future energy needs it is important to take into account the demographics of the eight million people we serve across the North East, Yorkshire and the Humber.

Our vulnerability strategy takes these factors into account and recognises that many customers may require extra assistance in a power cut. But in the context of planning for a transition to a DSO, we also recognise that some of our customers may find it difficult to engage with the new technologies and services that are emerging in the energy transition. It is our duty to ensure these customers are not left behind as the market and regulations develop, mitigating risks and seeking to make opportunities available for them.

Improving the resilience of our network through the use of flexibility increases, in turn, the resilience of our communities. The energy system is changing to allow for more participation of local actors in renewable energy generation, supply, aggregation, storage and energy efficiency services. This will benefit our customers by providing a better environment, alleviating fuel poverty and giving them an opportunity to participate in local energy initiatives. Evidence1 shows that such locally-led initiatives, also referred to as community energy, bring benefits to people and communities beyond financial ones, as they develop skills, strengthen the community cohesion, and educate on sustainability issues. Government has recently highlighted many of the criteria and policy issues that need consideration to determine a way forward for energy efficiency2, which is key to ending fuel poverty, and which is struggling to make progress3. Our view is that new policy decisions on the matter should not be made in isolation of the more fundamental market reviews being carried out in parallel and the ongoing transition to a smart flexible energy system.

Local government acts as a catalyst for energy system change

The transition to a smarter, more cost-effective, low carbon energy system offers huge opportunities for the country’s economy and to improve people’s lives. Decisions about energy policy and investment are now increasingly taken at a regional level which allows them to respond better to local needs.

Local government is gaining more direct power over energy through national processes such as devolution deals, the Northern Powerhouse and energy hubs led by Local Enterprise Partnerships (LEPs). Central government is also pushing ahead with its Industrial Strategy by securing local growth plans (such as for Greater Grimsby4) to address regional differences on economic growth, transport connectivity and education. Suitable energy infrastructure is a key success factor for these regional initiatives. All LEPs have been offered funding by central government to develop an energy strategy.

Energy plays a key role in local strategies to reduce fuel poverty, tackle air pollution, and make places more resilient and attractive to residents and businesses. For example, clean air plans drive uptake of electric vehicles and catalyse deployment of charging infrastructure. Local authorities also make decisions on how to make best use of available resources: an energy-from-waste plant can become the centre of a heat network serving local housing estates. Across our region, 22 out of 30 local authorities are considering building or extending a district heating network with the support of government funding.

Q8 How may we ensure a socially inclusive approach in the changes to the energy system?

We expect this will require actions in a number of areas.

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1 ‘State of the sector report 2018’, Community Energy England, June 2018; and
2 ‘Community Energy research’, Northern Powergrid, January 2016
3 ‘Building a market for energy efficiency: call for evidence’, BEIS, October 2017
4 ‘Annual Fuel Poverty Debate Joint briefing by the All Party Parliamentary Fuel Poverty & Energy Efficiency Group (FPEEG) and National Energy Action (NEA)’, FPEEG and NEA, December 2018
5 In July 2018, government unveiled a new deal with the greater Grimsby Project Board to support regeneration: www.gov.uk/government/news/government-announces-landmark-town-deal-for-greater-grimsby
3. Developing our thinking

The industry is actively developing detailed understanding of what DSO is and how this will change services for customers. Responses to this emerging thinking consultation and wider dialogue will undoubtedly refine the definition of DSO through time as detail is added and consensus reached.

The mandate for DNOs transitioning to DSOs is provided by the current duties and incentives, supported by the Smart Systems and Flexibility Plan. The current phase regards network optimisation – i.e. seeking the optimal solution for customers from the range of customer flexibility, network flexibility or asset investment options. The discussion at the next price control review in 2019 to 2022 (for the five-year period starting in 2023) should involve consideration of additional duties that consider the extent to which DSOs take on more of a system optimisation role.

There are some key open questions on future DSO duties being considered by Northern Powergrid and others:

— Platform for resource optimisation that minimises carbon: coordinate and optimise the regional development of the infrastructure supporting the heat, transport or generation needs, with a view to benefit customers and minimise carbon. This could involve an increased stakeholder engagement function and a new energy optimisation role.

— Providing universal services (e.g. data provision) to competitive service providers: provide data and information about the network to all customers and market players, to allow for a competitive energy market to flourish in our region. We already share a lot of data (e.g. network congestion in heat maps) but this would be done with a heightened level of governance and accessibility (while recognising required compliance with the ethics and legal requirements of sharing data such as the General Data Protection Regulation – GDPR).

— Optimising system operation by minimising net power flow: design and operate the electricity network in a way that maximises the use of locally produced electricity within an area of network and minimises the net import; reducing whole system electrical losses.

— Lowering customer bills overall by benefitting the wider system: generation costs may be reduced by increasing network expenditure or electrical losses on the local powergrid. These are so-called “whole energy system” efficient solutions.

To address these important issues we are already:
— engaged in dialogue such as this consultation with our customers and stakeholders;
— collaborating with the industry through the ENA Open Networks project;
— discussing with Ofgem and the Department for Business Energy and Industrial Strategy (BEIS) to update the Smart Systems and Flexibility Plan through time; and
— innovating with our own projects and others engaged in the energy system.

Q9 What do you consider are the big unanswered questions on the future scope of DSO that should be explored further?

We want to be focusing on the right questions as we work towards our ED2 business plan.

*Upgrading Our Energy System – Smart Systems and Flexibility Plan*, Ofgem, BEIS, 2017
Part 2: Potential pathways – our emerging thinking

4. Our potential pathways explained

We have built our draft proposals around three categories that reflect the drivers for change of the energy systems for which we need to cater: Customer and Commercial Development, Technical Development, and Data and Systems Development. To aid navigation and comparison for stakeholders the pathways structure also echoes that used by the Open Networks programme.

In Customer and Commercial Development, we deliver on the visible, tangible aspects of DSO that support our customers’ needs: the uptake of local, renewable generation, and of storage; and the change to consumption patterns caused by the decarbonisation of heat and transport, by energy efficiency and by a raising awareness for sustainability. Co-ordinated actions with customers and the sector will support the development of a deep and liquid flexibility market. Delivering on our customers’ needs will require understanding their behaviour, bringing them on board with our new services, and standardising our approach with industry.

For Technical Development, we focus on the network implications of our transition. In the context of a changing energy environment, we seek to improve network and system reliability and resilience in a cost-efficient way. We plan to deal with an uncertain future thanks to our long-term forecasting, and through the introduction of more flexibility in our use of network assets.

In the Data and Systems Development category, we build the foundations that will enable a number of the other changes. Digitalisation is transforming all sectors of the economy, including utilities. Smart technology allows us to manage our network much more efficiently, responding to real time information about power flow, monitoring the condition of our assets remotely, and automating many processes. It also gives us new possibilities to interact with customers and service providers. We propose to harness these possibilities by investing in IT building blocks.

Our choice of the time periods for this draft thinking has been determined by natural planning horizons as well as regulatory price control periods. We start by setting out the current actions we are taking, followed by those that we are considering in the near term as high priority (2019/20). The medium term takes us to the end of the current ED1 price control period in 2023 and we then have a longer-term set of actions that take us to 2030 (i.e. just beyond the end of the ED2 price control period that ends in 2028). In an annex to this document we set out our emerging thinking on potential pathways in more detail.

Q10 Where would further development of our potential pathways be helpful to you?

We will expand our thinking where it is of most interest.
# Part 2: Potential pathways – our emerging thinking

## 5. Our potential pathways

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<th>DSO Vision and Strategy</th>
<th>Current</th>
<th>Short term (2019/20)</th>
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<td><strong>Customer and Commercial Development</strong></td>
<td>Flexible connections offering</td>
<td>Wider roll-out of ANM schemes</td>
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<td>Flexibility services: building our competency</td>
<td>Refined approach to customer vulnerability</td>
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<td>Understanding customer behaviour and technologies</td>
<td>Enhanced methodology for calculation of network charges</td>
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<td><strong>Data and Systems Development</strong></td>
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<td>Investment in digitalisation</td>
<td>Investment in IT and OT enablers</td>
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<td>Cyber security: stepping up IT security defences for the long term</td>
<td>Upgrading our network design tools</td>
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<td>Sharing network data</td>
<td>Smart meter data integration</td>
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<td>Data analytics in support of network management</td>
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<td><strong>Revision of technical standards, company policy and training</strong></td>
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<td><strong>Technical Development</strong></td>
<td>Operation of constrained generation connections</td>
<td>Wider roll-out of regional planning in collaboration with the ESO</td>
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<td>Collaboration with ESO</td>
<td>Trialling forecasting options</td>
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<td>Scenario-based demand forecasting</td>
<td>Technology trials to support resilience</td>
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<td>Improve visibility on our investment decisions</td>
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<td><strong>Trialling and local initiatives</strong></td>
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**Medium term (2020–23)**

- Embedding smart meters in DSO
- Network charges: seeking fair and efficient charges for a changed system
- Flexibility services: utilise, integrate and converge
- Network flexibility solutions deployed
- Improved network flexibility, tracking and optioneering capability
- Smart grid enablers deployed
- Data strategy in place
- Growing our data analytics abilities and functions
- Upgrading of our network management system
- New data to support competitive local energy markets

**Beyond ED1 – long term (2024–30)**

- Standardisation of processes across the industry
- Operating as regional DSO
- DSO Commercial
- Operations becoming core business capability
- Active management of the energy system
- Provision of flexible services to ESO and other DSOs
- Whole system planning
- Extensive use of data analytics to support the operation of the energy system
Our stakeholder engagement

Working with our customers and stakeholders to prepare for a successful transition into a DSO is one of our priorities for 2018-2019.

Our objectives
As we plan our transition into a distribution system operator, our aim is to maintain an active dialogue with our diverse customers and stakeholders. They have told us that they want to be actively involved and we would like them to feel as involved as partners, supporting the development of a network and energy system that meets current and future needs. We aspire for them to share their priorities, guide our decisions and help us ensure that customers are at the heart of our approach to DSO.

We have a responsibility to communicate with our customers and stakeholders in an accessible and straightforward way so that they understand this complex agenda and its importance. This will allow them to engage with our plans and influence them.

Listening and having an open dialogue
We work to ensure that the style of our stakeholder events is open and informative and we are in listening mode. We pose open, challenging questions and take care not to ask participants to make superficial votes on closed, specific parts of a complex, interlinked agenda. We take comments and questions on board and consider them in our plans.
Our emerging thinking is generated from stakeholder insight

The conversation continues – our plan for future engagement

How to contribute to the conversation
Our stakeholder engagement

1. Our emerging thinking is generated from stakeholder insight

A wide-reaching conversation
Starting in 2017, we have sought ideas from all corners of industry and from our diverse customer base to help set our direction for the transition into a DSO. We have held events tailored for different audiences and increased our reach through webcasting.

Specific feedback received in past engagement

Northern Powergrid should prioritise its customer flexibility plans when planning for the future

You said
Northern Powergrid should prioritise its customer flexibility plans when planning for the future

We did
Starting in November 2018, we will share where we expect capacity constraints on our network and test the market by asking for expressions of interest in providing DSR.

There is a perception of many barriers to providing customer flexibility – can Northern Powergrid help keep things simple?

You said
There is a perception of many barriers to providing customer flexibility – can Northern Powergrid help keep things simple?

We did
By acting as a single solution integrator for the local electricity system, the role of the system operator is to simplify.

Our customer flexibility plan is published in this document and we have done our best to keep it simple. We are keen to get stakeholder feedback.

How does Northern Powergrid expect to solve the issue of electric vehicle charging?

You said
How does Northern Powergrid expect to solve the issue of electric vehicle charging?

We did
There is clear appetite for engagement on this topic and we are consulting stakeholders. We held a workshop focused on EVs in October 2018 where participants from local authorities, businesses, developers and consultants joined us to debate the opportunities and challenges ahead. We will run a series of workshops aimed at local authorities in 2019.

Expert engagement

Through engagement with industry experts, we are ensuring our DSO vision meets the needs of our customers. Expert engagement acts as a ‘critical friend’ performing three key roles:

- **Challenge**
  Does the evidence support our belief that DNOs will be a big part of the transition to DSO?

- **Quality**
  Are we asking the right questions? Is the evidence sufficiently strong to guide the changes required for DNOs and inform policy?

- **Clarity**
  Are we communicating clearly about this complex agenda and its importance?
2. The conversation continues – our plan for future engagement

**DSO research objectives**

Research will play an important role in supporting our engagement over DSO, ensuring it is inclusive and reaches general customers who may not necessarily offer their views or are hard to reach.

We propose to carry out the following research into our customers and stakeholders:
— to better understand their views about the role Northern Powergrid should play with regard to DSO;
— to better understand their priorities and how these will be addressed in the transition to DSO; and
— to understand what drivers will enable them to become both producers and consumers – enabling customer access, customer choice and great customer service – and the barriers which need to be considered and overcome.

**Engagement to support specific parts of the DSO emerging thinking**

Feedback from the Open Networks projects has informed our engagement strategy: it asked for a mixture of high-level reviews of progress and more technical sessions that focus on just one aspect of DSO. So, in our next steps and emerging thinking, we are proposing to hold focused conversations on key themes, including electric vehicles, data and customer flexibility procurement. Putting customers at the heart of the transition is a theme that will run through all these conversations.
Our stakeholder engagement

3. How to contribute to the conversation

We would appreciate your views on our emerging thinking by the end of March 2019. The full list of questions contained within this document is shown on page 7.

We are planning to discuss some of the themes in this document at a number of stakeholder events in Q1 2019. This feedback will then inform a revised plan that is expected to be issued in summer 2019.

The email to use: yourpowergrid@northernpowergrid.com

The webpage to visit: www.northernpowergrid.com/DSO

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Q11 Have you any suggestions for improvements we could make to our engagement plan, particularly with less engaged and informed stakeholders?

This is a process question as opposed to the questions on content that proceed it.

Q12 Is there a particular aspect of DSO that you would like us to explore in a focused engagement session?

We expect to run a number of focused discussions through the first half of 2019.

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Attend one of our upcoming events.

Register for our newsletter by emailing us, so we can keep you informed of opportunities to hear about progress updates and give us your feedback.

Tell us what you think about this document by email. We have suggested a list of initial questions below but are happy to receive feedback on any aspect.
In this annex, we set out our emerging thinking to 2030. Specifically, the actions we are considering in the current, short/medium and long-term time horizons. We have set out our thinking as a series of sequential steps but we consider these to be in draft form. They are shared to support dialogue with our stakeholders so that we may have a discussion and then either change or firm up these proposals in the next iteration that we expect to publish in summer 2019.
1 Customer and Commercial Development

2 Technical Development

3 Data and Systems Development
## 1. Customer and Commercial Development

### Current

| Flexible generation connections | — We offer flexible connections to the growing numbers of customers who want to connect new generation to our network. These allow customers to connect faster and at less cost than using firm connections. | — In return, customers allow us to limit generation from their asset if this is necessary to maintain a stable network. |
| Flexibility services: building our competency | Building on the learning from our Customer-Led Network Revolution project, we are developing our ability to use customer flexibility services in several ways: | — Trading platform: Our market testing for flexibility procurement uses a platform that will allow trading of flexibility assets across our network. — Storage: We have developed our understanding of the storage market by using a 2.5MW (5MWh) battery in Darlington to provide balancing services to National Grid. We have been running this project in partnership with Kiwi Power since September 2017, and we will evolve its use in compliance with new regulatory requirements being introduced on the topic1. |
| Understanding customer behaviour and technologies | — Customers are driving the transition to a smart, flexible energy system by using new technologies to change the way they use and produce energy. We are building our understanding of how these trends may evolve and affect our network by observing how customers are using energy now and considering how this may change in a range of future scenarios. | — Our Customer-Led Network Revolution (CLNR)2 and Activating Community Energy (ACE)3 projects were important in understanding how to introduce more capacity at least cost. They also show that people’s energy practices reflect their circumstances and lifestyles in ways that cannot be predicted by simple economic analysis. |

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2. [www.networkrevolution.co.uk/conclusions/](http://www.networkrevolution.co.uk/conclusions/)
3. [www.northernpowergrid.com/ACE](http://www.northernpowergrid.com/ACE)
Short term – 2019-20

Changes to licence, industry codes, legislation
— The definition of the DSO role will develop through time.
— In the near term, the blend of regulation and incentives is well set to support the transition but there is a debate required for the ED2 price control review on the role of DSO and the incentives required to support system optimisation.
— Regulation and industry codes will need to adapt.

Wider roll-out of ANM schemes
— We expect the penetration of constrained or flexible connections to grow, pushed by the deployment of new distributed generation.
— ANM is a form of flexible connection where typically generators may receive a quicker and cheaper connection in return for agreeing to flex their output if live monitoring on the network indicates that safe operational limits would be exceeded without intervention.
— We are currently identifying a roll-out plan for more ANM zones in parallel with implementing the project in Driffield that is providing a replicable model for other areas.
— The targeted roll-out will start in areas that give the most benefits: with high customer interest in a connection, limited capacity, and high reinforcement costs. It is providing scalable capability to connect more generation at least cost as an alternative to conventional reinforcement.

Refined approach to customer vulnerability
— We will work with industry experts to refine our understanding of how a smart flexible energy system may provide most benefit and avoid disadvantage to customers in vulnerable situations.
— The aim is to create a trusted, well-documented framework that can guide our development of DSO in-house and contribute to industry-wide work.

Enhanced methodology for calculation of network charges
— As part of the technical development of our roadmap, we are planning to adopt a new methodology for ‘scenario-based demand forecasting’ to inform our network planning.
— We will consider aligning the key assumptions used in the forecast methodology, relating to the deployment of low carbon technologies, with those used in our cost recovery calculations. This will lead to increased consistency in how we use scenarios in the company.
Short term – 2019-20

Network charges: seeking fair and efficient charges for a changed system

— We consider that a holistic review of network charging is required which considers connection charges, ongoing usage charges as well as flexibility contracting.

— We are actively contributing to Ofgem’s network charging reform\(^4\) that is seeking to align policies and methodologies with the smart flexible uses of energy and introduce appropriate cost signals for efficient use of network capacity.

Flexibility services: exploring and making recommendations on markets design

— A new market in customer flexibility is emerging and commercial providers are already recruiting new customers even though the market design and industry structure are at an early stage: we are still defining what is traded, how and where, and the roles of the parties involved.

— Various route-to-market (RTM) models are being trialled to align transmission and distribution system needs.

— Our Customer-Led Distribution System (CLDS)\(^5\) project is exploring how to accommodate large volumes of new technologies, such as local generation and electric vehicles, at least cost while at the same time enabling customers to earn income by selling energy or services to balance the network. It will make recommendations on the market design and industry structure, and contribute to our roadmap for transition.

Flexibility services: stimulating the market

— We are seeking expressions of interest to provide flexibility services from winter 2019/20.

— We consider that we have a role to play in stimulating what is still an emerging market. We will raise awareness of this and explain to our customers how they could become a service provider and the benefits of doing so.

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\(^4\) Targeted charging review’ and ‘Charging futures’.

\(^5\) For more information: www.northernpowergrid.com/innovation/projects/customer-led-distribution-system-nia-npg-19
Medium term – 2020-23

Embedding smart meters in DSO

— Widespread roll-out of smart meters and the associated introduction of half hourly settlement and time of use tariffs should open up new opportunities for customers.

— Our objective is to provide customers with opportunities to make the best use of their assets like solar panels, electric vehicles and battery storage to either reduce their energy bills or earn revenue by contributing flexibility to aid the wider system and the other customers connected to it.

— The pricing strategy that we will use to stimulate such flexibility is not straightforward as some customers remain unengaged with their energy bills, and because network charges are not visible to the majority of bill payers. This is something that the industry will need to consider.

Flexibility services: utilise, integrate and converge

— We will start using any contracted customer flexibility from winter 2019-20. We are developing our end-to-end capabilities required for its operation. This includes the commercial offerings, contracts, dispatch, verification, and settlement functions.

— Building on previous experience gained from our CLNR, the market operation of the 2.5MW battery, our 2018-19 experience and customer feedback, we propose to simplify our flexibility services, increase transparency around system needs, and drive convergence of procurement methods across DNOs in order to develop consistent and best practice experience for customers.

— We will explore various platforms on which flexibility can be traded and which may provide the required back-office functions.

— We expect to create a level playing field for all technologies and business models providing solutions to capacity constraints. Customer technologies will compete on their merits.

— In order to integrate customer flexibility solutions with other network management processes, we will need to gain visibility in ANM-enabled areas on the impact of the dispatch by any of the contracted parties of flexibility resources. This will require information sharing across transmission and distribution.
Beyond ED1 – long term – 2024-30

Operating a regional DSO
— We expect that the increase in flexible DERs will introduce both the business case and capability for integrating more customer flexibility into our operations.
— We will produce our own regional energy forecast, procure a full suite of balancing services, and coordinate fully with other system operators in GB (ESO, DSOs).

DSO commercial operations becoming core business capability
— The regulation and incentives will change in order to drive the most value from the DSO role in terms of system optimisation supporting increased connection and use of DERs.
— By this time, we expect to be able to access services on behalf of others or provide services to others where doing so is necessary to maximise whole system efficiency and protects competition.

1. Customer and Commercial Development
2. Technical Development

Current

Operation of constrained generation connection

— Over the last decades we have been controlling distributed generation export through simple single generator inter-trip schemes, operated through control arrangements, and involving no financial transactions.

— In the last few years, we have also used ANM schemes to mitigate constraints whilst connecting generation on our network at three locations: Seals Sands, Blyth and East Roos. We are standardising the technology based on the Driffield implementation to use as the need arises at future locations.

Collaboration with the national Electricity System Operator

— Ensuring that the needs of both distribution and transmission systems are taken into account when we connect new generation and adopt new solutions based on dynamic constraint management and customer flexibility is important.

— We are helping to define the new relationship between DNOs and the SO that will make this possible by taking part in a High Volts case study, as part of the ENA Open Networks project.

Scenario-based load forecasting

— The challenge we face in formulating our smart grid development plan is that the growth and location of low carbon technologies (LCTs) is highly uncertain, and many of the smart technologies we plan to use to manage their impact on our network are still in their relative infancy.

— Our objective is to ensure that LCTs can be speedily connected, while keeping costs for customers as low as possible, and maintaining high levels of network reliability.

— As a result, we have adopted a new forecast modelling ability to more accurately predict LCT uptake and load growth in our secondary and primary substations and supply points.

Revision of technical standards, company policy and training

— We are embedding innovation into our organisation by capturing new learning and requirements in technical standards, company policy, codes of practice, and training. This will be an ongoing process through to 2030. This is mainly led by our Smart Grid Implementation team who then work in conjunction with our operations Field Change function.

— We typically collaborate with other network operators through the Energy Networks Association to agree a new industry standard, such as the security standard P2.
Wider roll-out of regional planning

We will collaborate further with the SO in a more systematic way, aiming towards a whole system approach and driven by data exchange around ANM schemes, scenario assumptions, and DER availability. Typically, this activity will be guided by the Open Networks programme.

Trialling forecasting options

— As an input into our scenario-based load forecast, which we plan to refresh on a yearly basis, we will pilot our preferred selection of forecast scenarios which sit alongside the national electricity system operator’s Forecast Energy Scenarios. It will serve our network planning processes and identify our flexibility requirements.
— Regional economic development plans of local stakeholders are built into the new forecasting model. This dialogue with local authorities is likely to increase in importance for further roll-out of electric vehicle charging, low carbon heat and electricity generation projects.
— Depending on how we initiate flexibility, we may need also to develop short-term forecasting models for day-ahead network operation.

Technology trials to support resilience

We are looking for new ways to strengthen the resilience of our network through innovation projects that focus on helping electrically dependent customers (ResilientHomes), that examine the potential of micro-grids (MicroResilience), and that trial vehicle-to-grid technology and commercial models (e4Future).

Improve visibility on our investment decisions

— In order to demonstrate that potential conflicts of interest between various parts of our organisations are being managed, we will publish more data to enable greater transparency on how customer solutions are being considered alongside network solutions to increase capacity.
— We already publish data that our stakeholders find useful describing capacity available on the system (as shown in Table 1), but this commitment is to increase the available data to offer increased visibility and understanding.
Medium term – 2020-23

Network flexibility solutions deployed
We will continue delivering the commitments in our ED1 business plan to introduce more network flexibility by:
— rolling out technology that increases the amount of headroom on our network, and enables us to connect more generation and to service increasing demand from existing customers.
— taking action to prevent voltage rising to excessive levels at times of high solar PV generation.

Improved network flexibility, tracking and optimeering capability
We expect that in the next few years, an industry-wide demand side response framework will be developed to:
— start standardising and ultimately coordinating flexibility procurement;
— give visibility on distributed energy resources contracts;
— resolve conflicts (ESO-DNO or DNO-DNO or DNO-other); and
— optimise the service across both transmission, and distribution networks.
This framework will underpin our control room’s future distributed energy resource management systems.

Smart grid enablers deployed
— We have launched an £83 million Smart Grid Enablers programme, which is transforming our ability to monitor, control and communicate with more than 860 substations, enabling us to respond to real time information about power flow on our network.
— By 2023 we will have a state-of-the-art command and control system, which will allow us to implement smart grid solutions that could generate up to £350 million of benefits by 2031.
2. Technical Development

Beyond ED1 – long term – 2024-30

Active management of the energy system
As a DSO, we will have technical capability to manage balancing services and despatch as well as constraint management. Deployment will depend on roles and responsibilities. We will share or co-ordinate access to data with the ESO to manage the whole system efficiently.

Provision of flexible products to the ESO and other DSOs
Technology will enable the release of flexible services for both the ESO and other DSOs to resolve network issues in all parts of the system. Enterprise-scale interfaces and messaging hubs are in place to facilitate such activities.

Whole system planning
Regional planning will be undertaken across transmission and distribution networks according to common methodologies. This will ensure whole system efficient outcomes and improve customer connection processes in areas of constrained networks.
3. Data and Systems Development

Current

Data and system assessment

— Our vision for DSO gives new roles and responsibilities to our organisation, and this can be interpreted in IT terms as requirements for a revised data and system architecture. Our objective is to integrate the information technology and operational technology plans to maximise sustainability of investments and efficiency of operations.

— We seek industry synergies and standardisation by taking into consideration the government’s Energy Data taskforce, and the Midata programme in the energy sector.

Investment in digitalisation

Investment in our customer service and network asset management systems has laid important foundations in three areas.

— The eAM programme has consolidated a number of different data sets into a single asset register and geographical information system. Our records have been updated and repositioned against the new Ordnance Survey MasterMap backgrounds. We can now share information with other utilities and key stakeholders that operate similar record management systems.

— Since 2015, we have been progressively implementing Oracle Customer Relationship Management (CRM) across our key service lines. Our aim for 2018 is to provide a fully-integrated service across all communication channels and create a single record of customer information.

— We connected to the national central smart meter system (operated by the Data Communications Company or DCC) in November 2017. This satisfies the Smart Energy Code (SEC) requirements to comply with licence conditions for handling smart metering data. The Gateway is the enabler for benefits realisation. In 2019 we will build the IT capability to use the data in our operational processes.

Our total investment in data and systems that supports the transition to DSO in the period to 2023 is over £50m.

Cyber security: stepping up IT security defences for the long term

— Over the last two years, we have significantly stepped up our IT security defences and the teams that support them. We have established partnerships with class-leading advisory organisations and we work closely with UK agencies to maintain high standards of protection.

— Because our network is classed as critical national infrastructure, we have a duty to protect it, so cyber security investment will keep pace with increased network automation.

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6 The taskforce was launched in November 2018 to deliver recommendations for how industry and the public sector can work together to reduce costs and facilitate competition, innovation and new business models in the energy sector, through improving data availability and transparency.
3. Data and Systems Development

Current

Sharing network data

In an effort to be transparent and helpful to our stakeholders, we share a large amount of data about the network, current and future. The data that is freely available online today is shown in Table 1 below.

<table>
<thead>
<tr>
<th><strong>Table 1: Data and information we currently share</strong></th>
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<tbody>
<tr>
<td><strong>Power cuts</strong></td>
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<tr>
<td><strong>Generation availability</strong></td>
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<tr>
<td><strong>Demand availability</strong></td>
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<tr>
<td><strong>Long-term development statements</strong></td>
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<tr>
<td><strong>Investment</strong></td>
</tr>
<tr>
<td><strong>Contracted Capacity Register</strong></td>
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<tr>
<td><strong>Flexibility requirement</strong></td>
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</tbody>
</table>

Data analytics in support of network management

— Our operations rely on a set of applications that use the data to assist with network planning, design and operation.

— In order to identify investment needs, we perform a variety of data analytics tasks such as on load estimates, asset health indices, and fault analysis.

1 www.northernpowergrid.com/power-cuts
2 www.northernpowergrid.com/generation-availability-map
3 www.northernpowergrid.com/demand-availability-map
4 www.northernpowergrid.com/long-term-development-statement
5 www.northernpowergrid.com/investments-in-your-area
6 www.northernpowergrid.com/contracted-capacity-register
Investment in information technology and operation technology enablers

— We plan to lay down the foundation for our future data and system architecture. This includes upgrading or scaling up some key applications in our operational toolkit (such as the load forecasting tool), deploying new design tools and installing high-bandwidth digital communications links to substations, replacing old analogue links.

Upgrading our network design tools

We will replace existing power system analysis packages with the next generation of network design tools (from 132kV down to LV) that allow for greater flexibility in automated analysis (for example, constraint analysis for flexible customer connections).

Smart meter data integration

In 2019, we are planning to go live on a number of new system integration applications that will allow us to make use of smart meter data in our outage management processes (maps, information for customers, single source of truth), and in our design processes.
Annex – exploring potential pathways for the DSO transition

3. Data and Systems Development

Medium term – 2020-23

Data strategy in place

— Data is an increasingly important asset for the business as digitisation and technology enable us to transform our customer service and network management capability.
— The introduction of smart meters, as well as a key gateway linking customer and network data, have led us to initiate some work on data in order to move from the manual and historical to the automated and predictive.
— There are other priorities associated with sharing data internally for improved decision making. For example, we need to explore a method for sharing non-critical data between operating technology and information technology systems in a safe and secure way.
— A data strategy for our transition to DSO will ensure that we manage and use data like an asset. The strategy will create a common set of goals across the business, defining how data can enable our business objectives. How we ensure data security, privacy, integrity, quality, regulatory compliance and governance of data, as well as how we optimise data analytics, modelling, visualisation, transformation and enrichment will grow in requirement with DSO. Growing the capability in data management, as well as standardising it across networks will be an essential enabler.
— The Open Network’s Smart Grid Architecture Model will provide a useful contribution to our strategy as it maps all information flows that are required between parties to execute certain functions.

Growing our data analytics abilities and functions

The deployment of network monitoring equipment will generate data from our assets out in our region, which we will make available for future decision support tools and/or data analytics. Access to more data sets and IT processing power will support more sophisticated analysis.

Upgrading of our network management system

— To support active network management, we will need to manage information flows and control systems. We will also need to grow the ability to undertake real time power system analysis, respond to smart meter alarms, manage demand side response contracts and infrastructure, and manage the active network management equipment.
— We may consider for instance expanding the existing control support function with capability for active power flow management and short-term forecasting.

New data to support competitive local energy markets

— Data provision will be a core DSO function, as it facilitates the emergence of new energy markets, and because it supports our commitment to transparency.
— There is a need for us to define what data we could provide to the marketplace to assist others to deliver enhanced services in the competitive market. As a result, the data that could be shared is to be re-assessed and will grow in line with stakeholders’ needs.
Beyond ED1 – long term – 2024-30

**Extensive use of data analytics to support the operation of the energy system**

We envisage our control room to be equipped with an algorithm-driven dispatch automation model that is able to recommend and execute optimal solutions based on DER information, network information, and a series of other factors influencing the use of customer flexibility (weather forecast, time of day, etc.).

The information on DER across distribution and transmission will evolve from being available in static format to being dynamic and real time:

- Store and transfer asset data, network data and DER data between our operating technology and information technology applications;
- Transfer real time DER information between ESO, and DSOs.
### Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>DER</td>
<td>Distributed energy resource</td>
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<tr>
<td>DG</td>
<td>Distributed generation</td>
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<tr>
<td>DNO</td>
<td>Distribution network operator</td>
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<tr>
<td>DSO</td>
<td>Distribution system operator</td>
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<tr>
<td>DSR</td>
<td>Demand side response</td>
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<tr>
<td>EHV</td>
<td>Extra high voltage</td>
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<tr>
<td>ESO</td>
<td>Electricity system operator</td>
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<td>EV</td>
<td>Electric vehicle</td>
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<td>HV</td>
<td>High voltage</td>
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<td>LV</td>
<td>Low voltage</td>
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<tr>
<td>LCTs</td>
<td>Low carbon technologies</td>
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<tr>
<td>RIIO-ED1 or ED1</td>
<td>The current price control which runs from 1 April 2015 to 31 March 2023</td>
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<tr>
<td>RIIO-ED2 or ED2</td>
<td>The next price control which will run from 1 April 2023 to 31 March 2028</td>
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<tr>
<td>V2G</td>
<td>Vehicle-to-grid</td>
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