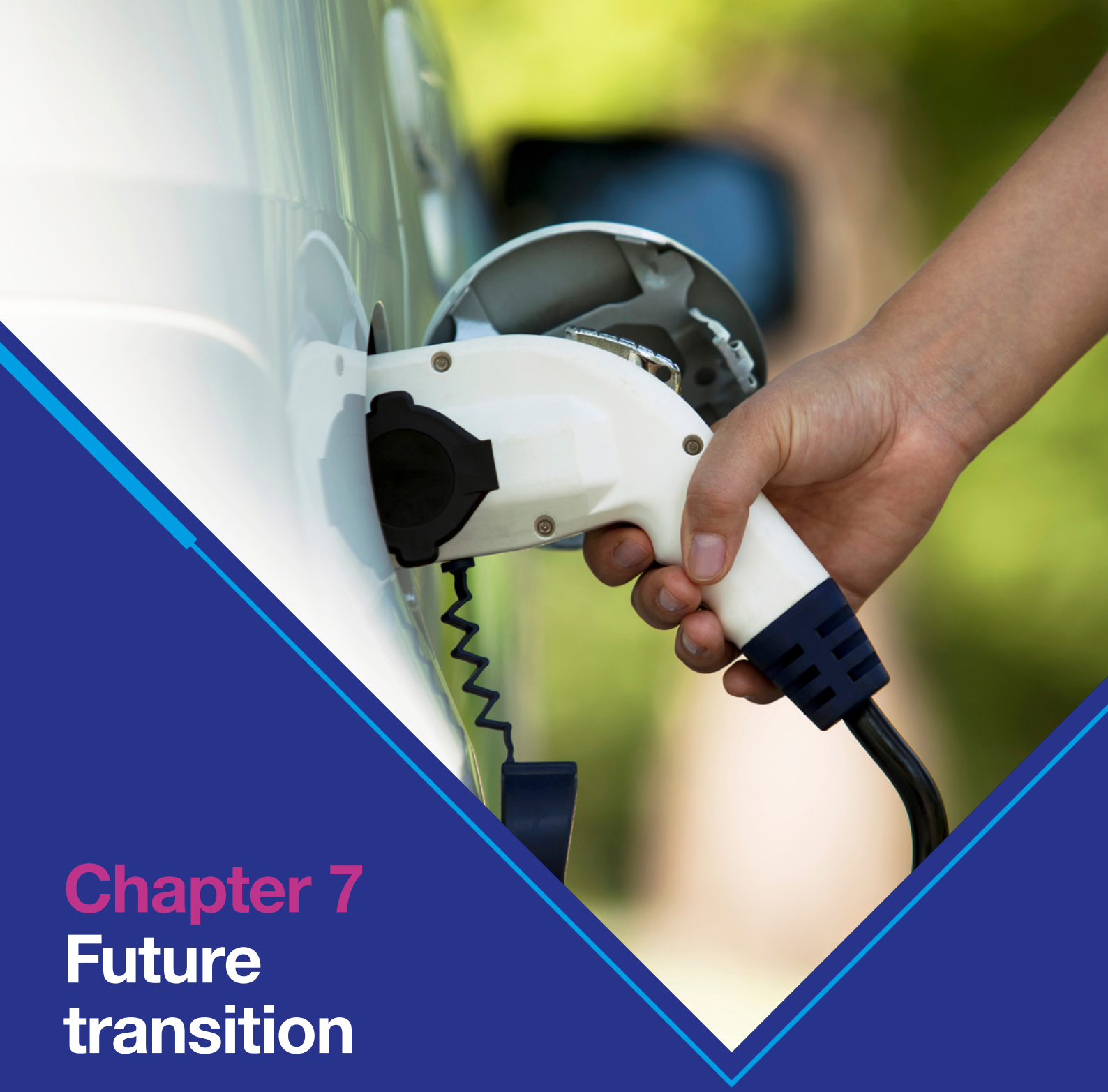

Chapter 7
Future transition

I want you to enable the ongoing transition to the energy system of the future

Electricity Transmission

nationalgrid

7. I want you to enable the ongoing transition to the energy system of the future

What this stakeholder priority is about

We own the high-voltage electricity transmission network in England and Wales. This puts us at the centre of building a future energy system that benefits consumers and all our stakeholders. This priority is all about how we help to advance decarbonisation of the electricity supply, transport and heat; the trend towards more local electricity generation; and the potential of digital technologies.

We will fulfil this important role by working with stakeholders to find innovative technical, regulatory, process and policy solutions that overcome network challenges and capitalise on opportunities. We will also invest in the transmission network, wherever this delivers the best outcome for customers and consumers.

Summary of what our stakeholders have told us so far

You have told us that you want us to enable the transition to the energy system of the future by:

- Innovating to make the most of our existing network.
- Developing a whole-system approach to meet network challenges, including:
  - facilitating flexible energy solutions to network issues
  - collaborating across the transmission and distribution networks
  - making the decarbonisation of transport and heat possible.
- Investing in transmission network capacity, but only when it is the best solution for customers and consumers. And ensuring transmission network reinforcement options are developed in a way that keeps our options for the future open, at the lowest cost.
- Investing in network solutions that keep electricity supply secure.

Our current performance on enabling the ongoing transition to the energy system of the future

When our engineers face an issue on the transmission network, one option is to invest in new circuits that provide additional network capacity. Some of the other, more innovative tools, such as quadrature boosters, have been available for some time. Others, such as dynamic thermal ratings of circuits, series compensation and other devices that use power electronic technologies, are more recent additions that have been used in the T1 period. The Smart Wires device, which was recently recommended in the ESO's 2019 Network Options Assessment (NOA) process, is another example.

We are working to optimise performance and opportunities across the transmission and distribution networks. We are doing this by co-ordinating with the ESO and relevant DNOs to make changes to contractual arrangements and create a Regional Development Planning approach. We engage with DNOs through regular Joint Technical Planning Meetings and bilateral meetings. Working together, we have been able to accommodate 24 GW of embedded generation on to the electricity distribution network during the T1 period. Our original forecast was 6 GW.

We have been reinforcing the transmission network throughout T1, whenever the consumer benefits of doing so have outweighed the costs, to ensure it can be operated in the most economic and efficient way. Our decisions have been guided by our own analysis and that of the ESO through the NOA process. This models the costs and benefits of network investment and other solutions in solving issues on our network. We forecast we will have spent £2.4bn on network reinforcement during T1.

By reinforcing our network, we have been able to accommodate the increase in low-carbon generation that has occurred. At the same time, we have helped the ESO to maintain security of supply and minimise constraint costs.

We have facilitated a reduction in greenhouse gas emissions from our electricity transmission network during the T1 period. Carbon emissions fell by just over 15% between 2013/14 and 2017/18. As we look towards further decarbonisation, we are engaging with our stakeholders on the transition to electric vehicles. We have set up a trial project to connect rapid charging points at motorway service stations to the transmission network.

During the T1 period, there has been less network reinforcement required than was anticipated at the beginning of the period. This is because the volume of new generation connecting to our network was lower than predicted. Uncertainty mechanisms, which we developed with Ofgem for the T1 period, have automatically adjusted our revenue to reflect this change (see Chapter 11 for more details).

Our direction of travel following stakeholder feedback so far

We are in the process of building our business plan with our stakeholders. In this section, we will playback the feedback we have heard from you – and ask for your views on what we suggest could happen next.

Benefits to consumers

Our plans to enable the transition to the energy system of the future will benefit consumers by:

- Enabling the decarbonisation of electricity, transport and heat.
- Ensuring electricity is there when it is needed.
- Helping to lower wholesale, system operation and network costs.

To enable the transition to the energy system of the future, while keeping consumers' bills low, we need to enhance the capabilities of our network in the most efficient way. This will require us to innovate. It could involve making the best use of our existing capacity; using non-investment options such as flexibility providers' services; investing in the network to lower overall wholesale electricity costs; and minimising our development costs of keeping options open for the future.

Innovating to make the most of the existing network

For the T2 period, we could trial more innovative technologies and operating approaches that help maximise the capacity of the existing network. This would build on the work we have done in the T1 period with innovations such as dynamic thermal ratings of circuits and series compensation devices.

Facilitating flexible energy solutions to network issues

We are currently exploring opportunities with providers of flexible energy, such as batteries and demand-side response. We are looking at how we might either contract directly with them, or develop joint solutions that feed into the NOA process.

Based on our stakeholders' feedback so far, our direction of travel for the T2 period is to ensure we play an active role, innovating to use flexibility services as an alternative to building more network capacity. We could do this by working with our suppliers and the ESO to explore barriers to flexibility. For example, we could look into changing our network development process to be more open to flexibility solutions.

Optimising across the transmission and distribution networks

Our stakeholders have told us that they want us to play a leading role in the transition to the energy system of the future. One way we can do this is by working closely with DNOs to continue decentralising the electricity supply. If we do not do this, consequences could include slower connection times for developers of low-carbon generation. This could result in higher energy prices for consumers.

We have always co-ordinated our high-voltage, inter-regional transmission network with the lower-voltage regional distribution networks. However, the rapid decentralisation of the electricity supply and the changing role of DNOs in today's energy landscape means we need to co-operate even more.

Our direction of travel for the T2 period is to work with our stakeholders, particularly DNOs, to embed a robust, whole-system approach in our network development process. We could work closely with DNOs and the ESO to find the best outcome for consumers when resolving network issues. We could also engage more with developers seeking to connect to the distribution network, so we better understand what they need.

Ofgem consulted on options for incentivising better whole-system co-ordination on pages 32 to 39 of Ofgem's RIIO-2 sector-specific methodology consultation. Along with our stakeholders, we are now looking at which of these would deliver the most benefit for consumers.

Making the decarbonisation of transport and heat possible

We engage widely to gain insight and provide potential solutions in support of the decarbonisation of transport and heat. We have engaged with stakeholders on the Government's Carbon Budgets and the Road to Zero strategy for transport. We have worked on publications on the future of heat and gained insights from hundreds of stakeholders through the ESO's future energy scenarios. We have also been engaging directly with key stakeholders to understand the role we might play.

Stakeholders have told us it is important to them that we build a sustainable future energy system that meets government targets. They expect us to find innovative solutions, including for the electrification of transport. However, the uncertainty around the pathway to decarbonising heat leaves the role of electricity networks too unclear for us to make any proposals in this area.

The electrification of transport, and any future electrification of heat, will change the demand for electricity on the networks. While both will increase the overall annual demand, the exact impact on this – and therefore on electricity networks – is unclear. For electric vehicles, both the pace of uptake and the extent to which their batteries can be used to provide vehicle-to-grid services (such as shifting demand between different times of the day) remain uncertain.

We carried out detailed analysis on the implications of a rapid uptake of electric vehicles. We found that, despite some need for investment, the electricity transmission network is unlikely to be a barrier to the market's progress during the T2 period. However, in order to actively encourage a large-scale transition to electric vehicles, an affordable and reliable charging infrastructure will be needed. The Government's vision, as stated in its Road to Zero document, is to have one of the best electric vehicle charging infrastructures in the world. Most charging is expected to occur where people live and park their vehicles overnight. However, analysis in 2018 by the Committee on Climate Change found the number of rapid chargers located near the major roads network must expand from 460 in 2016 to 1,170 by 2030 to meet demand during long-distance journeys.

Based on our stakeholders' feedback, our direction of travel for the T2 period is to continue actively engaging with vehicle manufacturers, policy makers, the ESO and DNOs. This will make sure we have the latest data on consumers' demand for power, allowing us to deliver the required infrastructure. We intend to continue creating the technical, commercial and regulatory innovation required to bring forward solutions that support the electrification of transport in line with government targets.

One way we could accommodate the growth in electric vehicles during the T2 period is through developing our uncertainty mechanisms so that funding would be available if additional demand occurred that required us to invest in the network. However, this would be a passive way of dealing with the growth of electric vehicles.

A more active approach might be more appropriate. Ofgem's sector-specific consultation notes that: 'When future need is accurately forecast, anticipatory investment can generate large savings for network consumers'. We welcome your views on whether we should actively invest in network capacity for electric vehicles, to reduce overall costs to consumers in the long term. We are also interested in your thoughts on whether network capacity for electric vehicles should be funded through consumer bills or in some other way, such as by electric vehicle users and/or the Government.

For information on how we could help our industrial customers decarbonise their businesses, see Chapter 10 on innovation.

Investing in network operability

You have told us that you want us to protect the quality and security of supply as the nature of generation and flows on the network change.

Because the power system is complex, challenges such as voltage, harmonics, fault levels, inertia and stability issues occur. Safe operating limits are set out in the Security and Quality of Supply Standards (SQSS) and the Grid Code.

Further decentralisation of generation, combined with the introduction of more wind and solar generation and high-voltage direct current (HVDC) connections, will make operating the network more challenging.

Based on your feedback so far, our intention for the T2 period is to innovate to find transmission network solutions that keep the system secure and operable at the least cost to consumers. They can be divided into three categories:

- Investment to maintain security and quality of supply standards, such as to maintain voltage levels within certain limits.
- Investment providing a service to the ESO over and above the requirements set out in the SQSS. This would help minimise the overall cost of operating the network by providing inertia, for example.
- Investment in harmonic filtering equipment to minimise the overall cost of addressing harmonic voltage distortion. This can be caused by intermittent sources of energy, such as wind and solar on the electricity network. At present, the industry codes require our customers to provide harmonic filtering equipment themselves. However, we could carry out harmonic filtering for our customers and, by aggregating their needs, we could reduce the overall cost of doing so in the T2 period. We are interested in whether our stakeholders see a case for pursuing a code change that saves them money on harmonic filtering.

Investing in transmission network capacity

There will be times when we have considered all our options and decided that investment in network capacity is the most cost-effective solution across the range of future energy scenarios. As mentioned above, the ESO runs the NOA process to model the costs and benefits of network investment and other solutions to solve issues on the transmission network. The majority of investment decisions on our wider, interconnected network are the result of a recommendation from the NOA process.

Based on your feedback so far, our intention for the T2 period is to be ready to invest between £0.3bn and £0.65bn a year in additional network capacity. This will depend on how the electricity market develops in future and in line with the annual NOA recommendations.

Given the uncertainty over our future level of investment, one approach would be to have a baseline allowance consisting only of investments that are most certain. This would require us to build on the uncertainty mechanisms in place for T1, which adjust our allowance automatically based on the output we are required to deliver (see Chapter 11 for more information on uncertainty mechanisms).

The NOA process operates on a ‘least regrets’ basis across a number of different future scenarios. This means that NOA sometimes recommends we carry out development work that leaves options open to keep future costs down for consumers. Sometimes these investments later turn out to be unnecessary because of how the electricity system changes over time. To keep bills low for customers, our direction of travel for T2 is to examine whether there is more we can do to keep our spending in this area as low as possible.

What it could cost

Low £0.3bn | **T2 annual spend range** | **High £0.65bn**

T1 annual expenditure (forecast) £0.3bn

Our indicative range of costs for enabling the ongoing transition to the energy system of the future in the T2 period is between £0.30bn and £0.65bn a year. The uncertainty in this range is because different future energy scenarios will affect how much work we need to do. For example, on reinforcement of the network to provide additional capacity, protecting the security and quality of supply, and lowering the cost of operating our transmission network.

This is an unpredictable area of our business. That is why we will be working with our stakeholders and Ofgem to propose uncertainty mechanisms that adjust our allowances appropriately and reflect what our customers want in the T2 period (see Chapter 11 for more information on the uncertainty mechanism).

How we will continue to engage with our stakeholders

We welcome feedback on this chapter of the consultation. In particular, we would like to know whether you think network capacity for electric vehicles should be funded through consumer bills. And whether we should be actively investing in network capacity for electric vehicles to reduce overall costs to consumers in the long term.

We would also be interested in your opinions on whether we should pursue a code change to allow us to carry out harmonic filtering for our customers and save them costs in the T2 period.

We continue to build our whole-system plans with stakeholders in this area through:

- Working with our suppliers and flexibility providers to explore alternatives to traditional network solutions.
- Workshops and conversations with the DNOs and the ESO to optimise plans across organisations.
- Ongoing conversations with policy makers and key stakeholders to develop solutions that enable the decarbonisation of transport.
- A consultation document and associated events on the range of energy futures we are using when planning to deliver the network you need.

If you would like to get involved in any of these areas, we would be very interested to hear from you.

We welcome your views:

Question:
What is your view on whether we are considering the right drivers and right level of investment to facilitate the ongoing transition to the energy system of the future?

Submit your feedback online here:

How to use this document
We want your feedback

Who is this consultation aimed at?

We are interested in the views of all stakeholders who are impacted by what we do or interested in shaping the future of electricity transmission. This includes the views of all users of our network, government, regulatory bodies and energy industry professionals.

Tell us what you think

This consultation is open until 31 March 2019. You may give us feedback in the ways outlined below. We particularly seek your views in response to the specific questions we have posed. These are summarised on page 9. You may respond to all questions or just those relevant to your specific views.

Ways to feedback:

Make notes

Throughout the document, we have provided space for you to read and make notes at the start of each chapter (opposite). Use the section numbering as a way to reference accurately. You can then type up your notes and send them in an email or submit them online.

Interactive pdf notes

Alternatively, we will be sending out editable pdf versions of this document with note fields for you to type directly into.

Email

We have a dedicated email address specifically for your feedback to this document. We welcome your thoughts at: **gary.stokes@nationalgrid.com**

Alternatively, you can put your thoughts in writing and send to: **Gary Stokes, National Grid House, Warwick Technology Park, Gallows Hill, Warwick CV34 6DA.**

Online

You can go directly to the website and submit your comments here.

You can learn more about how we are working with stakeholders by visiting our website. This site makes it easy to follow our progress and shows you how to get involved.

Please share your thoughts:

Type here>