Electricity Transmission

nationalgrid

Shaping the electricity transmission system of the future

A playback of what our stakeholders have told us so far and how we might address their feedback as we develop our business plan

February 2019

How to use this document
We want your feedback

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:

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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.

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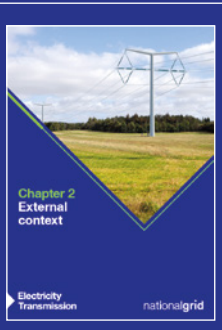

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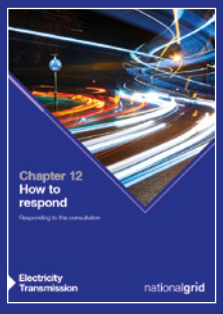

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Foreword

Who we are

We are National Grid Electricity Transmission (NGET). We own and maintain the high-voltage electricity transmission network in England and Wales. We move electricity from where it's generated, down the 'motorway' of the electricity system, to our direct customers and to the distribution companies who deliver that power to homes and businesses.

Introduction

We are building a business plan, led by our stakeholders, for the next RIIO regulatory period from 2021/22 to 2025/26. We will submit this to our regulator, Ofgem, later this year.

The views of our stakeholders are important to us. And this consultation is part of an extensive programme of engagement on our future business plan.

We are playing back what we have heard from our stakeholders through our engagement so far, across all areas of our business. We want to check that we are understanding your views correctly.

We have structured this consultation around your priority areas, based on your feedback. We make some suggestions for what we could include in our business plan in relation to each of them.

We welcome your views on our suggestions, and we will continue to develop them as we hear more from you. We also present some estimated total expenditure (totex) for the T2 period, on which we also welcome your views.

Your responses to this consultation will help inform our business plan. Together, we will shape the electricity transmission system of tomorrow.

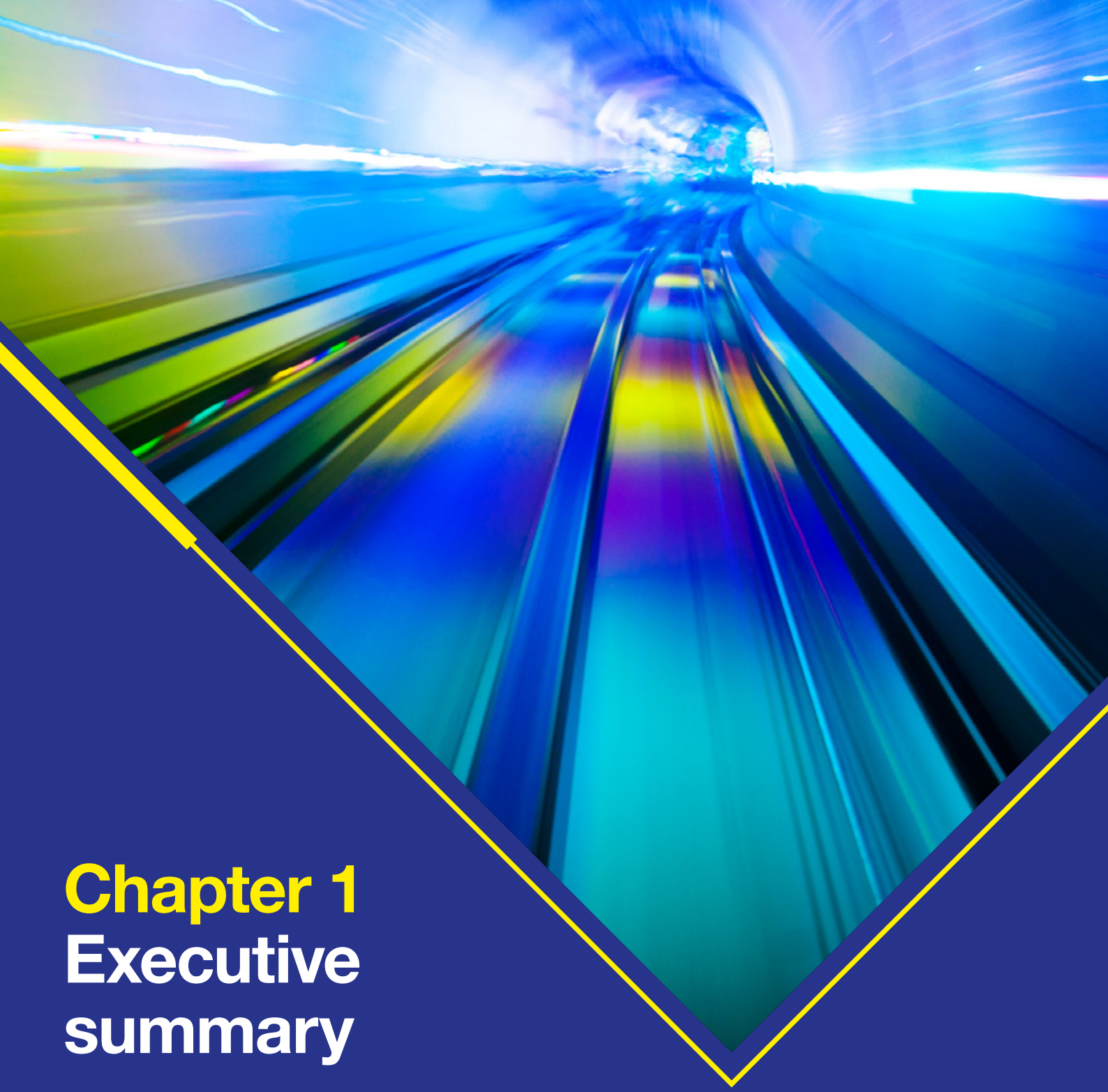
David Wright,
Director of Electricity Transmission

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 8. You may respond to all questions or just those relevant to your specific views.



Chapter 1
Executive summary

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1. Executive summary

Purpose of the consultation

We have been engaging with our stakeholders on our plans for the RIIO-T2 five-year regulatory period (2021/22 to 2025/26) for the past 18 months.

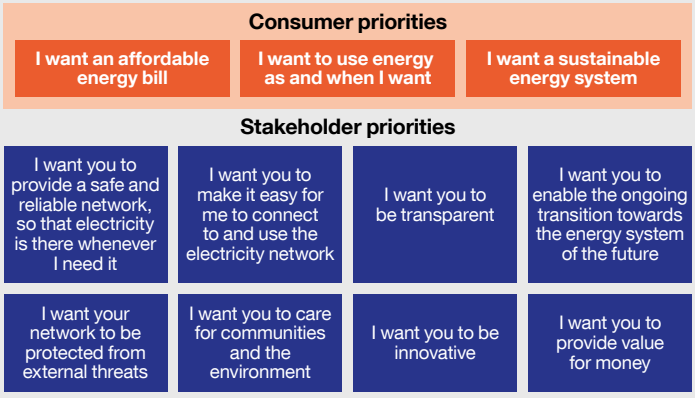
In this consultation, we want to:

1. check that we have understood your feedback correctly; and
2. invite your views on our proposed next steps and check they reflect your feedback.

Structure of the consultation

We've used your feedback to develop three consumer priority statements and eight stakeholder priorities for our business plan. This consultation is built around the eight stakeholder priorities and reflects what matters most to our stakeholders and consumers.

Figure 1.1 Our consumers' and stakeholders' priorities



The consultation begins with two scene-setting chapters. They discuss the external context for the RIIO-T2 period and how we are creating a stakeholder-led plan.

These are followed by eight stakeholder priority chapters. Here, we playback what we have heard from you so far to check we have understood your feedback correctly. Based on what you've told us, we make suggestions for what we could include in our draft business plan in July 2019. We welcome your views on these.

External context

During the T2 period, the energy sector faces two overarching challenges:

1. To help decarbonise Great Britain at the lowest cost possible for consumers.
2. To build greater trust with our stakeholders and consumers by being transparent and acting responsibly.

These challenges reflect our stakeholders' feedback and public debate around the role of network companies. We are creating our stakeholder-led plan to address these challenges.

We're also paying close attention to the needs of our customers: the transition to a low-carbon future; the decentralisation of energy generation; and new business models based on increased digitisation of the electricity sector.

This means our T2 plan will need to take account of issues such as managing greater flows of low-carbon energy on the network, more locally generated electricity, and increased volatility of demand.

Creating a stakeholder-led plan

We want to create a business plan for the period of T2 that meets the needs of our customers and consumers. That's why we have been carrying out an extensive programme of stakeholder engagement to listen to what you want, so we can build our plan collectively.

So far, we have interacted with our stakeholders more than 100 times, engaged with over 800 individuals from our stakeholder organisations and surveyed more than 2,000 household bill payers. This consultation is an important part of our engagement. It allows us to check that what we've heard is correct. We can gather your views, too, on our next steps for the plan's development.

In the next phase of our engagement we are planning to focus on reliability, a whole energy system approach and consumer engagement.

A safe and reliable network

You have told us that a safe and reliable transmission network is a key priority. You want us to maintain our current level of reliability, but we have a question for you.

We expect society to become more dependent on electricity in the future, particularly with the growth of electric vehicles. We'd like to know whether you think this should affect the level of reliability we aim for in the long term.

For the T2 period, we intend to maintain our world-class level of safety. We also plan to maintain our network reliability close to the level we currently provide.

We are developing a new asset management methodology, in consultation with stakeholders and Ofgem. This will allow us to manage maintenance and replacement in a more sophisticated way – and provide value for money for customers and consumers.

Easy to connect to and use the network

We understand that you want us to improve our customer service around connections and network outages. You also want us to predict our charges more accurately.

For the T2 period, we suggest several ways to make further improvements. These include more tailored services and improved customer experiences, and we welcome your views on these. We would also like to hear whether you feel our regulatory framework should change, so we're incentivised to reduce connection costs to customers.

Transparency

Feedback shows you want us to provide more transparency around our financial and operational performance. You want it to be published in an easy to understand and easily accessible format. You also want to be involved, more frequently, in the development of our business plan updates.

In this consultation, we suggest ways to increase stakeholder involvement in both our reporting and the development of our business plan updates. We also recommend keeping our independent Stakeholder Group running after the T2 price review is complete. This will help us provide more transparency around our performance.

Enabling the energy system of the future

You have told us that you want our business to take a leading role in the ongoing transition of the energy system. That means facilitating the decentralisation of electricity supply, helping decarbonise the economy, and ensuring security of supply, while also keeping consumers' bills low.

Our proposed pathway for T2 includes: investigating new ways to make the best use of our network's existing capacity; analysing how to maintain security and quality of supply as the energy system evolves; and working with stakeholders to embed a whole system approach in the UK's power system. This is where traditional barriers between energy businesses are broken down in order to create new opportunities across the whole energy system.

We would welcome your views on how proactively we should invest in network capacity for electric vehicles. The benefits of this could include lower costs for consumers overall and improved air quality in our towns and cities.

Protection from external threats

We understand that you want us to be resilient to incidents such as cyber-attacks, physical attacks and extreme weather. Events like these can threaten our systems, network and our service to consumers.

For the T2 period, we will invest in the appropriate levels of protection against external threats. We will also ensure we have robust arrangements in place for a Black Start recovery from any full or partial shutdown of our network.

The environment and communities

Feedback shows you want us to reduce our greenhouse gas emissions and look after the communities and environment around our assets. Some of you also want us to reduce the visual impact of our assets.

For the T2 period, we have a range of projects in mind to address these priorities. They include making our construction activities carbon neutral, improving the natural environment on non-operational land around our sites, and providing more support to local communities affected by our work.

We intend to continue our policy of identifying new visual impact projects for the T2 period. However, we will only take them forward if there is stakeholder support.

Innovation

You want us to be clearer about the opportunities and barriers surrounding innovation. You also told us you want us to be a leader and enabler in this area.

There are lots of opportunities to respond to this feedback. Not least by pursuing innovations in areas such as further digitalising our network, reducing our environmental impact, and accelerating our implementation of new technologies.

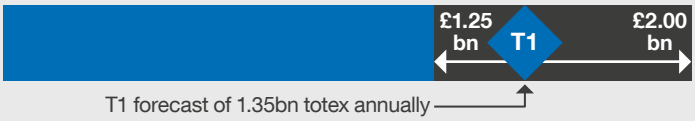
Delivering an overall package that is value for money

We know that you expect us to provide excellent value for money. We will ensure we do this, across all your priority areas, through the extensive use of cost benefit analysis and benchmarking on our T2 projects.

We are providing an early indication of the size of our totex in the T2 period. Our annual indicative totex for the T2 period ranges from a low of £1.25bn to a high of £2.00bn (based on 2017/18 prices). These numbers could change before we submit our draft business plan in July, for example due to changes in the Ofgem regulatory framework or stakeholder feedback.

For context our forecast for annual average totex in T1 (2013/14 to 2020/21) is £1.35bn.

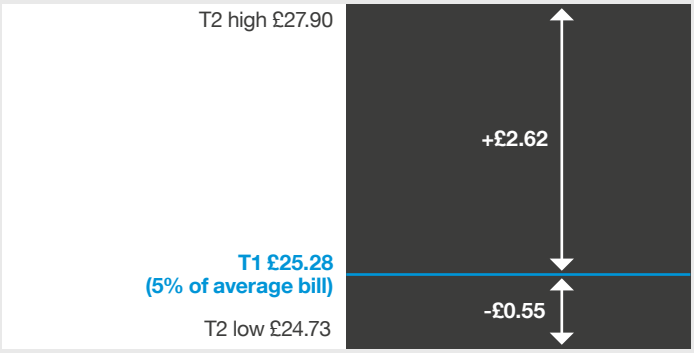
Figure 1.2 Indicative annual totex range for the T2 period



The single biggest driver of this range is different future energy scenarios that affect how many and what type of generators and directly-connected customers we will need to connect to our network – and how much network reinforcement we will need to carry out.

Based on our provisional totex range, the impact on an average household bill for the T2 period would be between a reduction of 55p and an increase of £2.62. This is compared with our forecast average for the T1 period.

Figure 1.3 Indicative consumer bill impact



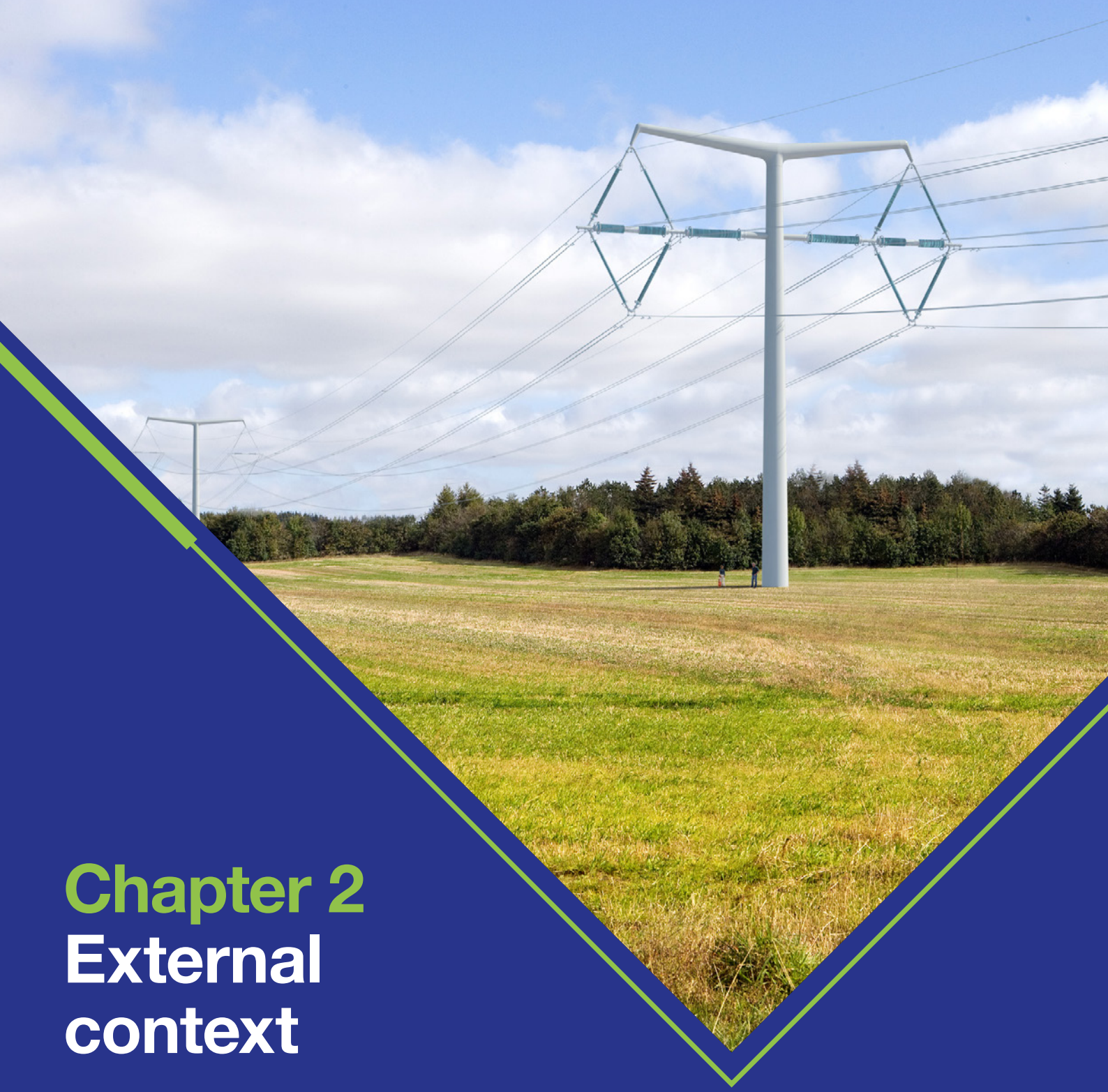
Our calculations here only look at the impact of our T2 totex ranges compared to totex in T1. We have not taken account of other factors than can affect consumer bills, such as the cost of capital for the T2 period or future inflation.

We feel this is the best way to give our stakeholders a clear picture of what our totex ranges for the T2 period could mean for consumer bills.

In Chapter 12, we explain how to respond to this consultation. These are the questions we'll be asking.

Table 1.1 Our questions for you

Question	Chapter
1. Have we understood your feedback and priorities correctly? (Yes / No / Don't know). If no, what would you like us to change?	General
2. Have we reflected your feedback correctly in our direction of travel? (Yes / No / Don't know). If no, what would you like us to change?	General
3. What else would you like to tell us? What have we missed? What should we change?	General
4. What impact do you think our society's dependence on electricity should have on our level of reliability in the future?	Safe and reliable
5. What are your views on our direction of travel in relation to making it easy to connect and use our network?	Connect to and use the system
6. What form of performance reporting and development of our annual business plan do you want to see in the T2 period?	Transparency
7. 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?	Future transition
8. What are your views on our direction of travel and investment drivers in relation to resilience?	Protected
9. What are your views on the level of ambition we should have in relation to the environment and communities in the T2 period?	Communities and the environment
10. What are your views on the level of ambition we should have in relation to innovation in the T2 period?	Innovation
11. What are your views on our indicative ranges for our totex expenditure in the T2 period?	Value for money



Chapter 2
External context

Electricity Transmission

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2. External context

The electricity industry, in which we operate, has made considerable progress in reducing its environmental impact over the past decade. This has occurred amid a backdrop of significant and rapid change.

The energy landscape used to be defined by large, centralised thermal power generation. Energy consumption followed the same patterns, whether prices were high or low. Today, the picture is very different. Supply is more diverse, and demand more flexible, than ever before.

The electricity system, as a result of this transition, is well placed to play a key role in decarbonising other sectors of the economy, such as transport and heat.

Two overarching challenges in the RIIO-2 period

As electricity transmission owner in England and Wales, we sit at the heart of the nation's energy system. We are working with our stakeholders to address the challenges brought about by changes in our industry. We aim to find solutions that maximise the benefits for consumers and society overall.

During the T2 period, the industry faces two overarching challenges:

1. The need to decarbonise at the lowest cost possible for consumers.
2. The need to build trust with our stakeholders and consumers through greater transparency and by taking responsible action.

These challenges reflect our stakeholders' feedback and the public debate about the role of network companies. The first reflects the shifting energy landscape, while the second is a response to changing public attitudes about energy companies and other utilities.

The changing energy landscape – three main trends

The way energy is generated, transported and consumed is changing. This can be summarised by three main trends:

Figure 2.1 The changing energy landscape

Decarbonisation – Britain's electricity system is changing at a rapid pace as we move towards a low-carbon future. This transition is being led by the electricity sector, and particularly low-carbon generation. A 60% reduction in greenhouse gas emissions has been achieved in the past four years alone.

Since 2011, around 15 GW of fossil-fuel-powered generators have closed and been disconnected from the system. This has largely been driven by Government decarbonisation policies.

Looking to the future, the electricity system is likely to play a substantial role in decarbonising both transport and potentially heat. However, exactly how that will happen, and the speed at which it will occur, remain uncertain.

Decentralisation – Traditionally, electricity flowed from large generators, connected to the transmission system, through passive distribution networks to the consumer.

Technology has advanced, particularly in the areas of smaller generation such as solar and small-scale wind farms, and storage. This has created significant changes in supply and demand patterns.

For example, distribution networks are playing a more active role in managing supply and demand regionally because larger amounts of electricity are being produced closer to where it is consumed.

Digitisation – The world is becoming increasingly connected. This is empowering consumers and disrupting traditional business models across almost every sector.

In energy, we are seeing new businesses capitalising on everything from smart meters to the use of sensors, data collection and analytics (otherwise known as the 'internet of things').

These new business models have the potential to transform how we consume electricity. This will increase both the flexibility and volatility of demand.

Drivers behind this change

In our consultation on the Future of Electricity Transmission in September 2018, we identified the main reasons behind decarbonisation, decentralisation and digitisation in the energy sector:

1. **Government policy –** The Climate Change Act 2008 requires Britain to reduce emissions by at least 80% from 1990 levels by 2050. This, combined with consumers becoming more energy efficient, is decarbonising supply and reducing demand for electricity. The Government's Road to Zero Strategy – and its emerging policy direction on the decarbonisation of heat – is likely to lead to an increase in overall electricity demand in the longer term.

2. **Rapid reduction in the cost of distributed generation –** Since 2009, the cost of wind and solar photovoltaic generation has fallen by 66% and 85% respectively. Energy storage solutions (batteries) have seen similar cost reductions. The Government expects these trends to continue (see BEIS Electricity Generation Costs report).

3. **Changes in consumer behaviour and advances in digital technology –** Consumers are having ever closer interaction with the energy system. They're adopting electric vehicles (EVs), and increasingly using in-home technologies and energy management tools, such as Nest and Hive. They have access to new, smart tariffs tied to their smart meters, opportunities to work with demand aggregators, and other new retail business models to exploit.

The changing public debate on utilities

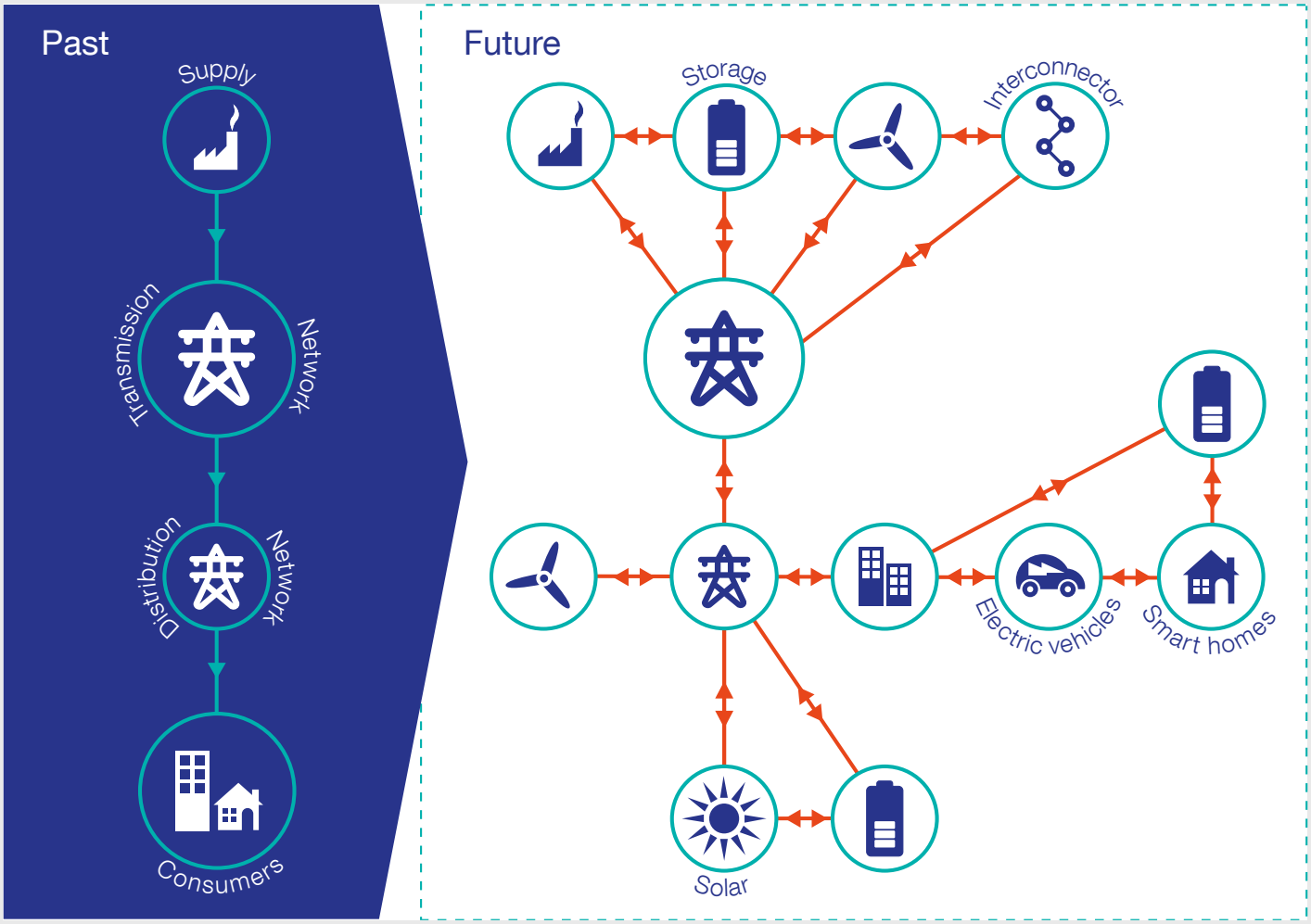
We are seeing increased public scrutiny of the performance of utility companies in the UK. Consumer bodies, regulators and customers care deeply about the integrity of companies' financial returns. They also want to know what companies have done for their consumers to earn those returns.

We have been listening to what you expect us to deliver in this period. You have told us that your expectations are increasingly being shaped by the total impact our activities have on society.

The consequences of the external environment for our future plan

Decarbonisation, decentralisation and digitisation are transforming the electricity system. In the future, electricity will flow far more dynamically between transmission and distribution-connected parties. This will include renewable generators, electric vehicles and battery storage.

Figure 2.2 The transforming electricity system



Greater interconnection – where our own power grid is linked with neighbouring electricity markets via subsea cables – will lead to more volatile flows across the transmission network. This is expected to increase from 4 GW to at least 10 GW in all of the future energy scenarios 2018.

The business plan we will submit this year will reflect the changing external landscape for transmission in the 2020s. We will take account of issues such as:

- The increased uncertainty of future supply and demand.
- The active role demand can play in solving network issues.
- Changing customer numbers, types and needs.
- The increasing need to work across organisations to deliver the best outcomes for consumers.
- The increasing risk of cyber-attacks.
- The greater expectation for transparency about our performance and returns.
- The ongoing need to address our impact on the environment and society.

Chapter 3
Stakeholder engagement

Creating a stakeholder-led plan

Electricity Transmission

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3. Creating a stakeholder-led plan

The importance of stakeholder engagement

It is essential that we understand what our stakeholders, including household consumers, want from our business. We need to fully grasp their needs, challenges and motivations in order to build trust, deliver our services efficiently and effectively, and meet the challenge of decarbonising at the lowest cost.

We are committed at all levels of our business to working more closely with our stakeholders. We engage with them continuously on issues such as improving our customer service and reducing disruption on our construction projects.

For our T2 period business plan, we have been carrying out an extensive programme of stakeholder engagement. We are listening to what our stakeholders want in the T2 period and building our plan with them in a collaborative way.

We have interacted with our stakeholders more than 100 times, engaged with over 800 individuals from our stakeholder organisations and surveyed more than 2,000 household bill payers so far. Our goal is to deliver a truly stakeholder-led plan, as our UK Executive Director, Nicola Shaw, explains in this video on our engagement website, launched in April 2018.

We've developed an extensive approach to engagement. We have achieved this by listening to what our stakeholders want from us, and by building on the experiences of other businesses.

We spoke to regulated businesses in the airport and water sectors, who also carry out engagement processes. We used the lessons we learned to develop an enhanced engagement approach that is consistent with the principles of the AA1000 Stakeholder Engagement Standard.

We have been sharing our thinking with other experts, too, for example, at Ofgem's Consumer Voice workshop in January 2018 and with our independent Stakeholder Group over the course of 2018. Members of these groups have extensive experience of stakeholder engagement and have had a significant impact on shaping our programme.

This consultation is another important part of our engagement with stakeholders. We are playing back the themes we have heard from you so far, and asking for your views on where we should go next.

The three phases of turning stakeholder insight into a T2 business plan

We have split our engagement into three overlapping phases that build on each other. These are:

i. Establish the priorities of stakeholders and consumers;
ii. Build plans with stakeholders, our customers and consumers by priority; and
iii. Bring together a holistic business plan with stakeholders, our customers and consumers.

You can see more detail in the diagram and descriptions below.

Figure 3.1 The three phases of our stakeholder engagement

i. Establish the priorities of stakeholders and consumers

We have been building up a picture over time of what our stakeholders' priorities are. We have achieved this by engaging regularly through our day-to-day interactions and by holding meetings, workshops, webinars and online consultations. We also surveyed more than 2,000 household bill payers across the country. This has helped us hear first-hand what their priorities are – and what they expect from us. From the feedback we have gathered, we have established three consumer priorities and eight stakeholder priorities. These are being used to shape the development of our business plan and this consultation (see the end of this chapter for the priorities).

ii. Build plans with stakeholders, our customers and consumers by priority

We are now in the process of building our plans with stakeholders and consumers. We are turning their priorities into specific areas of focus, which we'll then engage on again. This consultation is an important part of building our plans in close collaboration with our stakeholders. We are seeking your views on a proposed direction of travel for how we could meet the eight priorities. We are planning to focus on reliability, a whole energy system approach and consumer engagement next.

We have an independent Stakeholder Group in place to challenge and guide us on how to make this process as effective as possible (see below).

iii. Bring together a holistic business plan with stakeholders, our customers and consumers

There are still plenty of opportunities for stakeholders to influence our plans for the T2 period. Following this consultation, we will begin to prepare our draft proposals. As we develop our draft proposals they will be subject to robust scrutiny from our Stakeholder Group. We will publish a draft plan in the summer. We will ask for our stakeholders' view, before submitting our final RIIO-T2 plan to Ofgem in December 2019.

Once our business plan has been submitted, Ofgem intends to hold an open hearing on all network companies' plans early in 2020. The regulator will scrutinise our plan. It will make initial proposals on any changes that are needed for the T2 period in summer 2020. Final proposals will follow in December 2020.

Independent scrutiny of our engagement and business plans

Regulation for the T2 price review requires two stakeholder groups to scrutinise network companies' engagement processes – and assess whether stakeholder views have been reflected in the resulting business plans. One is a company-specific User Group. The other is the cross-sector Ofgem Challenge Group.

We established our User Group in 2018 and we were keen to include a broad range of stakeholders. We refer to this group as our Stakeholder Group. We wanted to ensure the group had a strong consumer voice and provided a cross-section of perspectives, so we'd be challenged through the process.

Since July 2018, our independent Stakeholder Group has been meeting regularly. Chaired by Trisha McAuley OBE, it is made up of people from consumer, environmental and public interest groups. Large energy users, large-scale and small-scale customers, and distribution networks are also represented.

The group carries out three main roles:

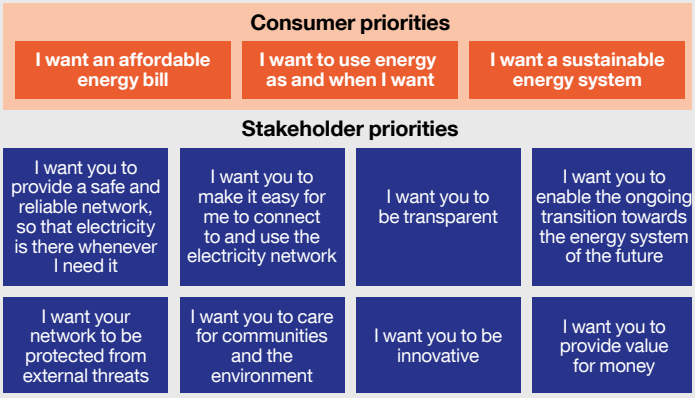
- Challenging and reviewing how we engage with stakeholders in developing our business plan.
- Scrutinising our business plan and checking that our proposals reflect what our stakeholders have told us.
- Reporting to Ofgem with its views on our business plan.

Ofgem set up an independently chaired central RIIO-T2 Challenge Group. Its role will be to challenge Ofgem and network companies. It will also provide a public report on all network companies' business plans from the perspective of energy consumers.

Our consumer and stakeholder priorities

The three consumer priorities and eight stakeholder priorities we have identified through our engagement are shown in the diagram below. Each set of priorities is consistent with the other. So by delivering on our stakeholder priorities, we should also deliver what consumers want. We will, of course, take account of both sets of priorities in developing our business plan.

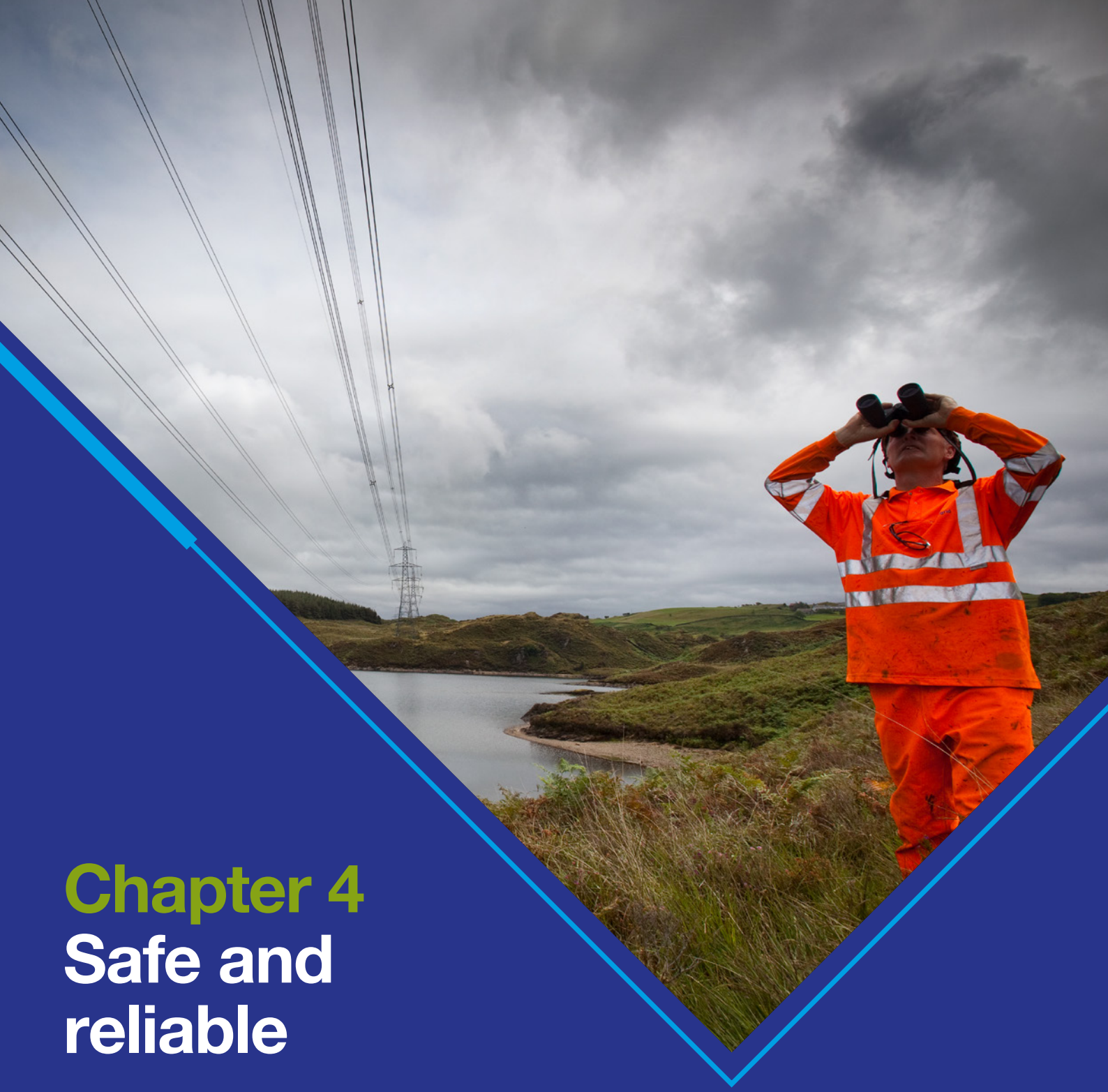
Figure 3.2 Our consumers' and stakeholders' priorities



We have made two changes to the list of stakeholder priorities since our report, How we're listening to our stakeholders, published in June 2018. We moved the theme of 'safety' out of the section on 'protecting the network from external threats' and into 'provide a safe and reliable network'. We did this because through conversations with our stakeholders we recognise safety and reliability fit more closely together.

We also moved the theme of being 'easy to work with' from our transparency priority into the 'connect to and use the network' section where it fits better. These changes continue to deliver all our stakeholders' priorities.

This consultation is designed around the eight stakeholder priorities in the diagram. This allows us to make sure our playback of your feedback – and our plans for how to address it – are clearly aligned with the issues that mean most to you.



Chapter 4
Safe and reliable

I want you to provide a safe and reliable network

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4. I want you to provide a safe and reliable network

What this stakeholder priority is about
Our main responsibility as a transmission owner is to ensure a safe and reliable electricity transmission network. It needs to be available to our customers, when they need it, to enable secure power supplies for consumers.

To fulfil this role, we need to maintain high safety standards that protect our employees, contractors, stakeholders and the public. To achieve the level of reliability expected by our stakeholders, we need to keep our assets in a healthy condition. This means monitoring their condition, and intervening at the right time to maintain, refurbish or replace them.

Summary of what our stakeholders have told us so far
We understand that a safe and reliable electricity transmission network is a key priority for you. Above anything else, you want a reliable network.

You have told us that, for the T2 period, you want us to maintain a level of reliability similar to that which we currently provide. And you want it at a fair cost. You have also told us that our plans should support the future demands on the network. So the decisions we take in the short term do not limit future opportunities.

Our current performance on safety and reliability

Safety is our number one priority and we are committed to the wellbeing of our staff, contractors and the public. Our safety performance is measured by our injury frequency rate (IFR), which counts the number of injuries sustained for every million hours worked. This has improved from an average of 0.15 in the first two years of this price control period to 0.12 in 2017/18. We continue to strive to do even better.

We are maintaining high levels of reliability across our equipment and low levels of energy not supplied (the volume of power that is lost due to faults or failures on the network). The total energy we did not supply in 2017/18 was 39.7MWh, or 0.00002% of all the energy we supply. We are also on track to meet, or exceed, our network output measures. This is the current regulatory benchmark for reliability and means we're in a good position to keep delivering high levels of reliability for consumers in the future.

Over the whole T1 period (2013/14 to 2020/21), we forecast that we will spend an average of £650m a year on safety and reliability. During this time, we have achieved cost efficiencies of around 20% on reliability. One way we have done this is by improving our understanding of the condition of our assets, which has allowed us to better target their replacement. Our innovations have also allowed us to reduce the time and cost involved in repairs and replacements.

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 for reliability will benefit consumers by:
- Ensuring electricity is there when they need it.
- Helping to lower network costs.

Maintaining our world-class safety performance

We are committed to maintaining our world-class safety standards and we aim for zero harm to our employees, contractors, stakeholders and the public.

In our final T2 submission to Ofgem, we plan to propose ambitious outputs at efficient costs for our customers and consumers. They will be fully compatible with providing a safe environment for all our employees, contractors, stakeholders and the public. Our commitment to safety will also contribute to maintaining a reliable network. It will ensure that our workforce can effectively and efficiently do their jobs in a safe environment.

We welcome your feedback on our approach to safety, bearing in mind that it's our top priority.

Maintaining our current reliability

Our stakeholders have told us they want our existing level of transmission network reliability to continue.

To meet this priority, it's our intention to keep network reliability in the T2 period close to the level we currently provide. We will embed efficiencies we have delivered in the T1 period into our T2 plans.

As we discussed earlier, one measure of our reliability performance is the volume of energy not supplied by our network. This occurs when our network fails to deliver electricity, resulting in a volume of power, measured in megawatt hours, not supplied to our customers. These events are often high-impact, but low-probability, and we cannot fully control them. However, we do carry out activities that reduce the likelihood of these events taking place. An example is our process for managing outages that could put demand at risk.

We currently have a regulatory incentive to keep levels of energy not supplied low. This has prompted a culture and internal processes that minimise energy not supplied. In our T2 plan, we will seek to retain this incentive through engagement with Ofgem and our stakeholders. The regulator is currently consulting on whether to retain this for T2: see pages 24-34 of Ofgem's sector-specific methodology consultation annex on electricity consultation.

Ensuring long-term reliability

A large proportion of our spending in the T2 period will be focused on making sure our assets are healthy enough to be reliable in the long term. Work in this area will include monitoring our equipment, and maintaining, refurbishing or replacing it when it's most appropriate to do so.

Our stakeholders have told us they want us to maintain our existing level of transmission network reliability. But we would welcome stakeholders' views on the level we should aim for in the longer term – beyond 2025/26 – as society becomes increasingly reliant on electricity.

Our growing dependence on electricity

We are interested in our stakeholders' views on whether there's a case for higher levels of reliability in the future. Our society will become increasingly dependent on electricity as more electric vehicles arrive on our roads and we control more aspects of our homes and businesses through the internet of things. While stakeholders have told us they want us to maintain our existing level of transmission network reliability, we want to check this specific point with you as we move towards our T2 business plan.

The amount we spend on reliability in the T2 period will affect how much we need to spend after the T2 period. It is important we take account of this, and make sure our plan is fair to both current and future consumers.

We are making an important change in how we measure the health of our assets compared to our previous T1 business plan. For T2, we intend to use a new methodology, developed with Ofgem and the other energy network companies. We have been consulting on this with our stakeholders over the past two years.

The new methodology includes the 'monetisation of risk'. It works by considering the residual level of risk on the transmission network. A higher level of residual risk means lower reliability, while a lower level means higher reliability. Because assets deteriorate over time, the residual level of risk tends to increase unless we invest to reduce it.

The methodology then attributes a financial value to this risk, based on the likelihood and consequence of the failure of our assets.

We are also proposing to improve the coverage of our assets under the methodology. We are proposing to define outputs for smaller secondary assets and deliverables for very large capital schemes.

In our T2 business plan, we are currently planning for a level of spending on activities such as maintenance, refurbishment and replacement that achieves the same level of network risk at the end of T2 that we had at the start of the period. The new methodology will allow us to keep our network at the agreed risk level in the most efficient way – and deliver value for money for our customers and consumers.

How we will continue to engage with our stakeholders

We welcome your feedback on this consultation topic of safety and reliability. In particular, we're interested in your views on whether society's increased reliance on electricity in the future means we should aim for higher levels of reliability. We'd also like to know how you think we should balance our asset health investments between current and future consumers.

We are continuing to engage with stakeholders on reliability. We're planning engagement activities, including:

- Consumer engagement supported by interactive tools to bring transmission reliability to life.
- A workshop on reliability with a diverse group of stakeholders. We plan to show them options for different network reliability targets, as well as costed options for how we'll deliver against those network reliability targets.
- Holding sessions on our approaches to asset management and reliability with distribution companies and directly connected customers.
- Exploring the case for different levels of reliability for cities. For example, we could do this by providing extra protection for our assets in urban areas.

What it could cost

Low £0.60bn — **T2 annual spend range** — **High £0.75bn**

T1 annual expenditure (forecast) £0.65bn

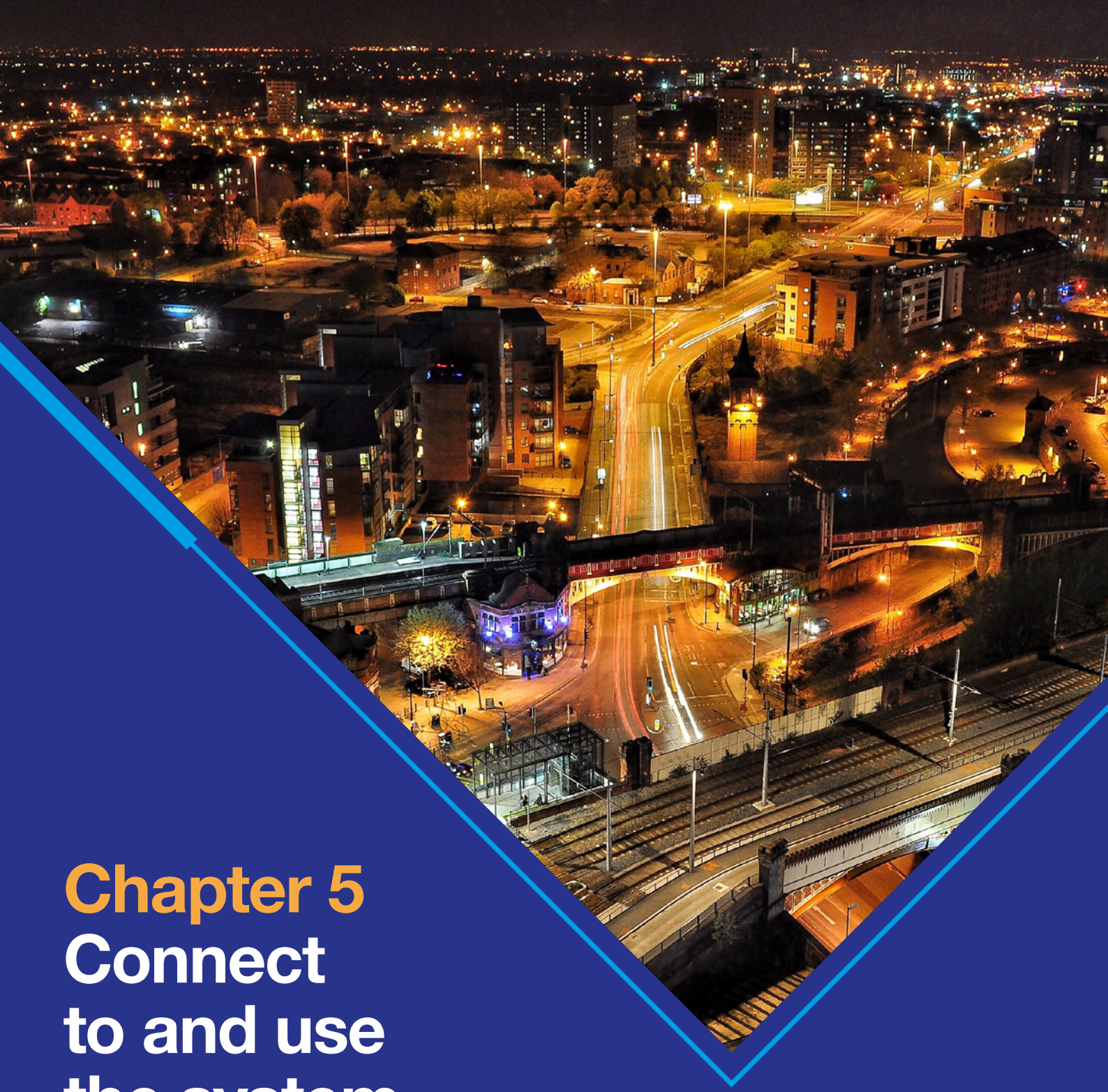
Here, we have provided an indication of what we currently believe our totex to deliver reliability could be in the T2 period. This would allow us to maintain our world-class safety performance, our current reliability and the long-term reliability of our network at broadly current levels.

Ofgem is consulting on its framework for ensuring long-term network asset health. As a result, the ranges could change. We are also talking to our stakeholders about how we can ensure long-term consumer benefits, so there could be further changes to the range.

We welcome your views:

Question:
What impact do you think our society's dependence on electricity should have on our level of reliability in the future?

Submit your feedback online here:



Chapter 5
Connect to and use the system

I want you to make it easy to connect to and use the electricity network

Electricity Transmission

nationalgrid

5. I want you to make it easy to connect to and use the electricity network

What this stakeholder priority is about

We have many customers who want to connect to and use our electricity transmission network. We provide them with network connections, services related to the connection, and ongoing services once they're connected. We also provide network reinforcements for users who are connected through a Distribution Network Operator (DNO).

This stakeholder priority is about making it easier for customers to connect to and use our network. We aim to achieve this by becoming a more customer-centric business.

Summary of what our stakeholders have told us so far

You have told us that you want our business to:

- Provide a simpler, tailored, flexible and co-ordinated approach to connections.
- Provide options for a wider range of services.
- Provide more information and support upfront before you make an investment decision.
- Reduce the volatility and improve the transparency of our charges.
- Provide more information in advance about planned outages on the network – and minimise any changes to them.

Our current performance on making it easy to connect to and use our network

We have made a long-term commitment to improving the experience our customers have with our business. During RIIO-T1, this has helped us move closer to our goal of being a truly customer-centric business. We will continue to build on this in T2, ensuring we stay focused on our customers, across all our activities, while following our central strategic vision. We are proud to be in the process of transforming our business, so we can deliver better services for customers.

We have a licence obligation to provide connections to the network, and we've seen a substantial increase in the number of customers connecting. Our forecast for the eight-year T1 period is that we'll have connected 12.5 GW of generation capacity.

Last year, we had a surge in the number of applications to connect. Of 201 applications in 2018, 99 were new applications, compared to 20 in 2017. Most of these were smaller generators, new to the sector and with less knowledge of the electricity transmission system. This reflects the changing nature and needs of our generation customers.

In serving both our directly connected demand customers and the wider transmission/distribution interface, we forecast that we will have connected 40 new super-grid transformers and 5km of overhead line during the T1 period.

Through listening to stakeholders and gathering customers' feedback, we've improved our customer service, even in the face of rising expectations. Our customer satisfaction rating has increased from 7.4 to 7.7, while our stakeholder satisfaction survey score has risen from 7.7 to 7.9 so far in the T1 period.

We know that we can still do more to improve our focus on customers, and we're doing that across several areas. For connection customers, we've restructured our organisation to help them navigate more easily through the different stages of the connection journey. We also provide a dedicated contact from initial enquiry through to being connected.

We are developing a standardised connection design for storage customers to reduce the time it takes to connect. We're also introducing a cost calculator tool that will help customers estimate the price of connecting to our network.

Additionally, we're in the process of improving the outage experience for customers with multiple connections. They require system access to operate their own networks and we'll continue working with DNOs to ensure we achieve better outcomes for them.

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'll 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 make it easy to connect to and use the network will benefit consumers by:

- Enabling the decarbonisation of the electricity system.
- Helping to lower wholesale electricity costs by providing access to market.

Investing in our network to connect new customers

We have a licence obligation to connect customers. Connecting more generation customers to our transmission network increases competition in the wholesale electricity market and this reduces costs for consumers. By connecting customers as quickly as possible and giving them support through the connection process, we can help maximise these benefits for consumers and support the Government's decarbonisation targets.

The nature of the electricity market is such that there will be more customers who apply to connect to transmission networks than the wholesale electricity market can accommodate. This means that not all customers progress their contract to a connection.

At present, we have 73.5 GW contracted to be connected from the start of T2. Of that figure, 15 GW is of new interconnector capacity. And it's uncertain how many and which of these contracts will result in a connection. This uncertainty is caused by factors such as the rate of uptake of different types of generation; new technologies, such as batteries and electric vehicles; closure of existing plants; the performance of the economy; and government policy. It's our role to facilitate these customers' route to the market. We have successfully managed the connections process in the T1 period, and we propose to refine our approach during T2.

During the T2 period, we expect to invest between £100m and £250m a year, on average, to connect new generation and demand customers. This range is based on the Electricity System Operator's future energy scenarios 2017 (FES 2017) and our own National Grid Electricity Transmission scenarios.

We recognise that this range is very wide. To ensure our funding reflects the actual number of connections our customers will need during the T2 period, we plan to improve our T1 'uncertainty mechanisms'. We will use unit cost allowances to adjust our revenue so customers and consumers only pay for the outputs we deliver (see Chapter 11 for more detail).

Providing tailored solutions for existing and new customers

We have engaged with our customers in immersion sessions and bilateral meetings, as well as through our customer satisfaction survey and our work to improve the electricity connections journey.

You have told us that different customers want different services when connecting to our network. For example:

- Generator customers want more information upfront to help reduce risk on their projects.
- Potential electric vehicle charging customers care about locations.
- Demand customers are interested in system requirements and timelines.

We have seen changes in customer requirements during the T1 period, with trends for more distributed generation and low-carbon generation. As a result, our customers are asking for new services from our network. We expect this trend to grow in the T2 period, for the reasons mapped out in the external context section of this document.

In response to customer feedback, we plan to provide more information and tailored solutions during the T2 period in the following ways:

- Working closely with our customers and using our expertise to help deliver the Development Consent Orders (DCOs) we and our customers both need to move connection projects forward.
- Create a pre-application support framework for engagement, so we can give early guidance to potential customers.
- Provide an online customer portal that will allow customers to design their own tailored solutions for connections. They'll also be able to access real-time information about their projects, at any time.

Improving the network access experience for planned outages

We have to take parts of our network out of service temporarily, which is called an outage. We do this to carry out our work safely, to replace and repair ageing infrastructure and assets, and to complete new connections.

Our customers have told us they want us to provide more information in advance of planned outages and to minimise any changes to them. The issues our stakeholders have raised include: our decisions on outages are not always collaborative; there can be a lack of information on when an outage might end; and we sometimes shift outages incrementally, instead of fully re-planning the work.

We are already acting on our stakeholders' feedback. We will be improving our T1 Network Access Policy (NAP), which enables the Electricity System Operator (ESO) and our business to co-ordinate outages for the benefit of consumers. For customers with multiple connections, our goal is to create an improved outage experience, which our processes and system requirements are linked to.

Based on stakeholder feedback, our direction of travel for the T2 period is to build on the improvements we're already making in the outage experience. It's important that we improve the outage experience for directly connected customers, who typically have single-site connections. In line with our approach to multiple connections, our ambition would be to design and implement an improved outage experience that's linked to our processes and system requirements.

Improving customer and stakeholder satisfaction

As mentioned above, we have improved our customer and stakeholder satisfaction ratings during the T1 period. However, we know there is much more to do. Our goal is to exceed the expectations and needs of our changing base of customers and stakeholders. We're striving to become one of the leading companies in our sector for customer satisfaction.

We are already taking forward many initiatives to improve our systems, customer journeys, customer analytics and our employees' skills. These include a new customer complaints process; a Customer Relation Management tool that helps us understand our customers' businesses better; and improved tools to provide information more quickly to our stakeholders.

Based on our stakeholders' feedback so far, our direction of travel for the T2 period includes the following:

- Developing bespoke, digital customer journeys, including digital options, to improve our customers' experience.
- Developing a multi-channel approach so we can adapt our engagement style to suit our customers.
- Creating a culture where we understand, anticipate and meet our customers' needs.

We are working with Ofgem and our stakeholders to update existing customer satisfaction and engagement regulatory incentives. We want them to provide a strong motivation for us to improve our customer service and engagement in the T2 period. Ofgem set out its consultation proposals on pages 14-24 of Ofgem's sector-specific methodology consultation annex on electricity transmission consultation.

Improving the predictability and transparency of our charges

Through our meetings, seminars and satisfaction survey, some of our customers have told us they are concerned about the volatility of our charges. They have also told us they want us to be clearer about our predicted charges and how likely they are to change.

There are two elements to our charges for customers:

1. **Connection charges –** for assets installed solely for and only capable of use by an individual user.

Customers pay connection charges directly to the ESO. The current charging framework sees us pass our costs through to customers. We would like to know whether stakeholders think we should be incentivised to reduce these connection costs.

2. **Transmission Network Use of System (TNUoS)** charges recover the costs of installing and maintaining the transmission system.

We understand that changes to these charges can have an impact on our customers. There are several reasons why our charges change, including the size and nature of the charging base, the ESO charging methodology itself, and the way the price control operates. Not all of these factors are within our control.

Our direction of travel for the T2 period is to work with the ESO and Ofgem to seek improvements to the price control framework, which will help reduce the volatility of charges. We also consider it would be in our customers' interests for there to be an incentive to reduce connection costs.

We welcome your views:

Question:
What are your views on our direction of travel in relation to making it easy to connect and use our network in the T2 period?

Submit your feedback online here:

What it could cost

Low £0.1bn | **T2 annual spend range** | **High £0.25bn**

T1 annual expenditure (forecast) £0.2bn

Our indicative range of spending – to make it easy to connect to and use the network in the T2 period – is between £0.10bn and £0.25bn a year. This range reflects the different future energy scenarios, along with how many new generators and how much new demand we might need to connect to our network.

Connections are a particularly unpredictable area of our business. We will be working with our stakeholders and Ofgem to propose uncertainty mechanisms that adjust our allowances to the connections we deliver in the T2 period (see Chapter 11 for more information on uncertainty mechanisms).

How we will continue to engage with our stakeholders

We are continuously engaging with our customers about how we can improve our connection services and ongoing services. The feedback we receive will be instrumental in the development of our T2 plan.

We welcome feedback on this chapter of the consultation. In particular, on our direction of travel towards more tailored services, improved customer journeys and whether the regulatory framework should change to incentivise us to reduce connection costs to customers.

Chapter 6
Transparency

I want you to be transparent

Electricity Transmission

nationalgrid

6. I want you to be transparent

What this stakeholder priority is about

Our stakeholders want us to be clear and open in how we report our financial and operational performance. We need to involve our stakeholders in the design of our reporting to make sure it's helpful for them. And we need to give them the opportunity to challenge our performance when we report it.

Summary of what our stakeholders have told us so far

After many meetings and conversations with you, you have told us you want:

- Easy-to-understand and easily accessible information about our financial and operational performance.
- To have confidence that the revenue we earn is fair – and that it reflects what we accomplish for our customers.
- Stakeholders to be involved, much more frequently, in the development of our business plan.

Our current performance on being transparent in our performance

As a publicly listed and regulated company, we're required to report large amounts of information for the financial markets and regulator, Ofgem. Our most significant reports are:

- Annual Report and Accounts – this details our financial performance, in line with international accounting standards.
- Performance Report – this is published each year to tell our stakeholders how we're performing against our regulatory outputs for the T1 period.
- Our Regulatory Reporting Pack, which we provide to Ofgem every year. This informs Ofgem's RIIO electricity transmission annual report. This provides details of our spending, the outputs we've delivered and our financial returns.

We are currently reviewing all our financial and operational performance reporting. We're looking at how we can develop a new way of reporting that is tailored to our stakeholders' needs and sets out, clearly and simply, what they want to know.

We're working closely with our stakeholders to understand what they need from us, before we propose our changes. Our review also takes account of the cost of reporting. We want to establish whether we can provide better information to our stakeholders, including the regulator, at a lower cost. We may be able to achieve this, simply by focusing more closely on what our stakeholders want to know.

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'll 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 improve transparency will benefit consumers through:

- Building trust in us as a responsible and fair business.
- Providing greater transparency on our performance.

Reporting financial and operational performance

You have told us we need to provide easy-to-understand and easily accessible information on our financial and operational performance. For example, during our summer 2018 environment workshop, stakeholders wanted more clarity on our environmental performance. They wanted to know what our carbon footprint is and what it consists of.

Our business, like others in the energy sector, is also coming under increasing scrutiny from consumer bodies, regulators and customers about the legitimacy of our financial returns. These organisations want to know what we have done for our consumers to earn those returns.

Based on your feedback so far, our intention for the T2 period is to further improve our reporting. We want to make a stronger link between the activities we do, our performance metrics, and the financial reward we receive. By making this link clearer, we can build confidence among stakeholders that our revenue is justifiable and based on what we deliver for our customers. We will consult with our stakeholders to ensure that how we report in the T2 period properly reflects their needs.

Ofgem has asked network companies to consider what ongoing role their stakeholder groups could have in holding them to account. As we mentioned in Chapter 3, we consider there are benefits in our independent Stakeholder Group running after the conclusion of the T2 price review to improve our transparency. We believe we could increase the impact of our annual performance report by presenting it to our Stakeholder Group. They could challenge us on the quality, transparency and accessibility of our reporting as well as our performance. This would build trust with our stakeholders and strengthen our reputation for transparency.

Our current annual reporting to Ofgem, through our Regulatory Reporting Pack (RRP), includes more than 200,000 data points. Many of these are detailed and are of limited interest for stakeholders. We want to engage with Ofgem and our stakeholders to see how we can provide the information they want in a more succinct and cost-effective way.

Involving stakeholders in the development of our business plan

We are carrying out an extensive engagement process, which is helping us build our business plan with our stakeholders for the T2 period. During these conversations, stakeholders have told us they want to be involved much more often in developing our business plans.

We already talk to our stakeholders as part of our day-to-day business activities across a wide range of topics. We would like our stakeholder engagement to be more systematic and better linked to our annual business planning in the future.

If we retain our Stakeholder Group after the T2 price review, the group could hold us firmly to account on whether our annual business plan updates properly reflect what our stakeholders want from us.

We welcome your views:

Question:
What form of performance reporting do you want to see in the T2 period?

Submit your feedback online here:

What it could cost

Cost estimates in this consultation are rounded to the nearest £50m. On that basis, our expenditure on transparency does not register. However, there are costs associated with our annual reporting, stakeholder engagement and running our Stakeholder Group. At present, we estimate these costs to be around £4m a year.

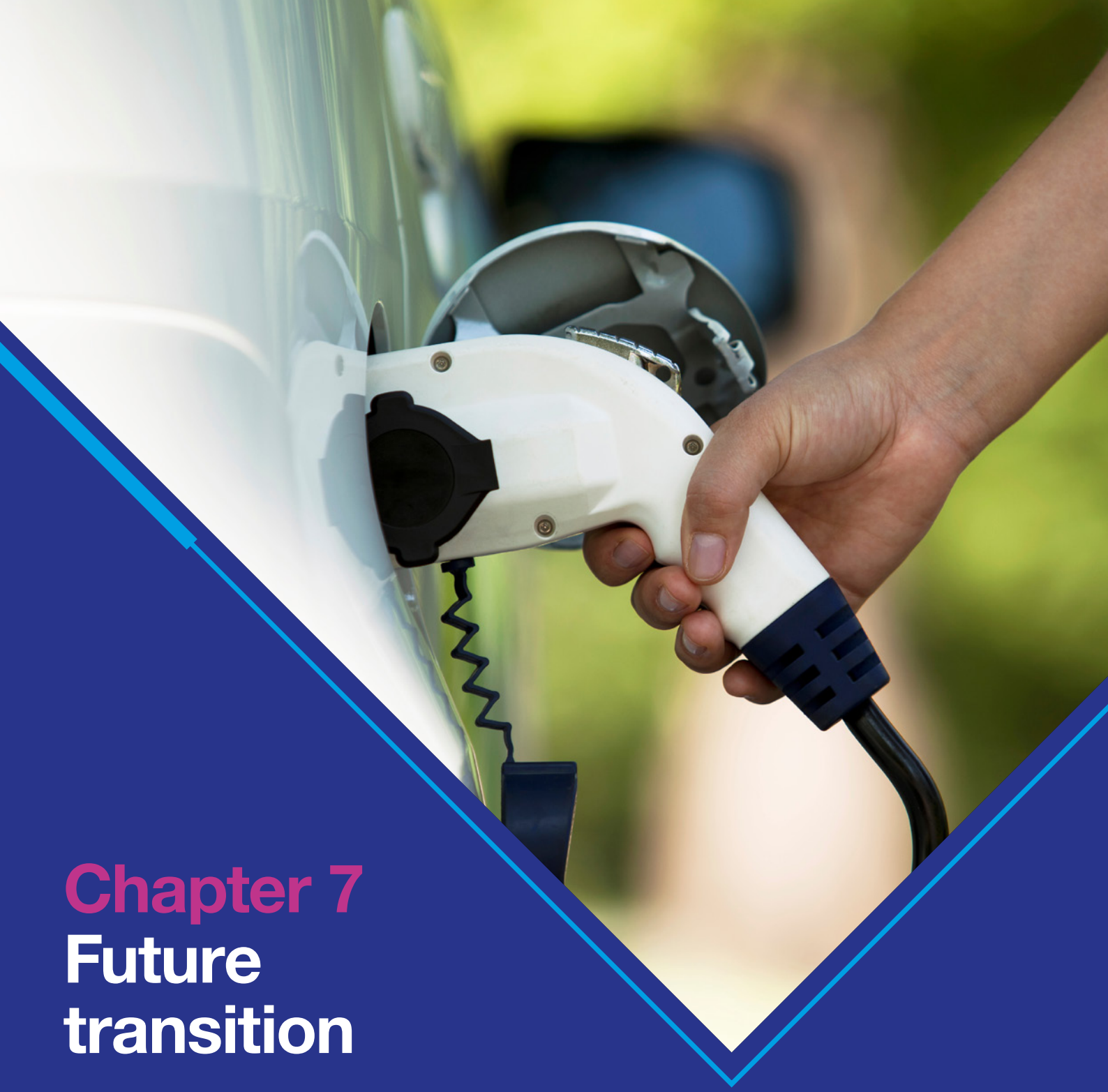
We could save costs compared to our T1 spending if we take a more limited approach to stakeholder engagement in T2 and don't continue with our Stakeholder Group between price reviews. We could also save money by working with Ofgem to refocus our annual reporting on the issues that matter to our stakeholders and the regulator.

If we take a more proactive approach to stakeholder engagement in the T2 period – and continue with our Stakeholder Group – our annual expenditure will be higher. However, we can embed efficiencies we've learned during T1 to keep this extra cost to a minimum.

How we will continue to engage with our stakeholders

We are currently consulting with our stakeholders to understand their needs before we propose changes to our financial and operational performance reporting.

We welcome feedback on this chapter of the consultation. We'd particularly like to hear your views on whether you'd like to see a clearer link between our activities, performance and revenue. We also want to know whether we should keep our independent Stakeholder Group running after the conclusion of the T2 price review. This would allow us to provide more transparency around our performance – and get stakeholders more involved in the annual update to our business plan.



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:

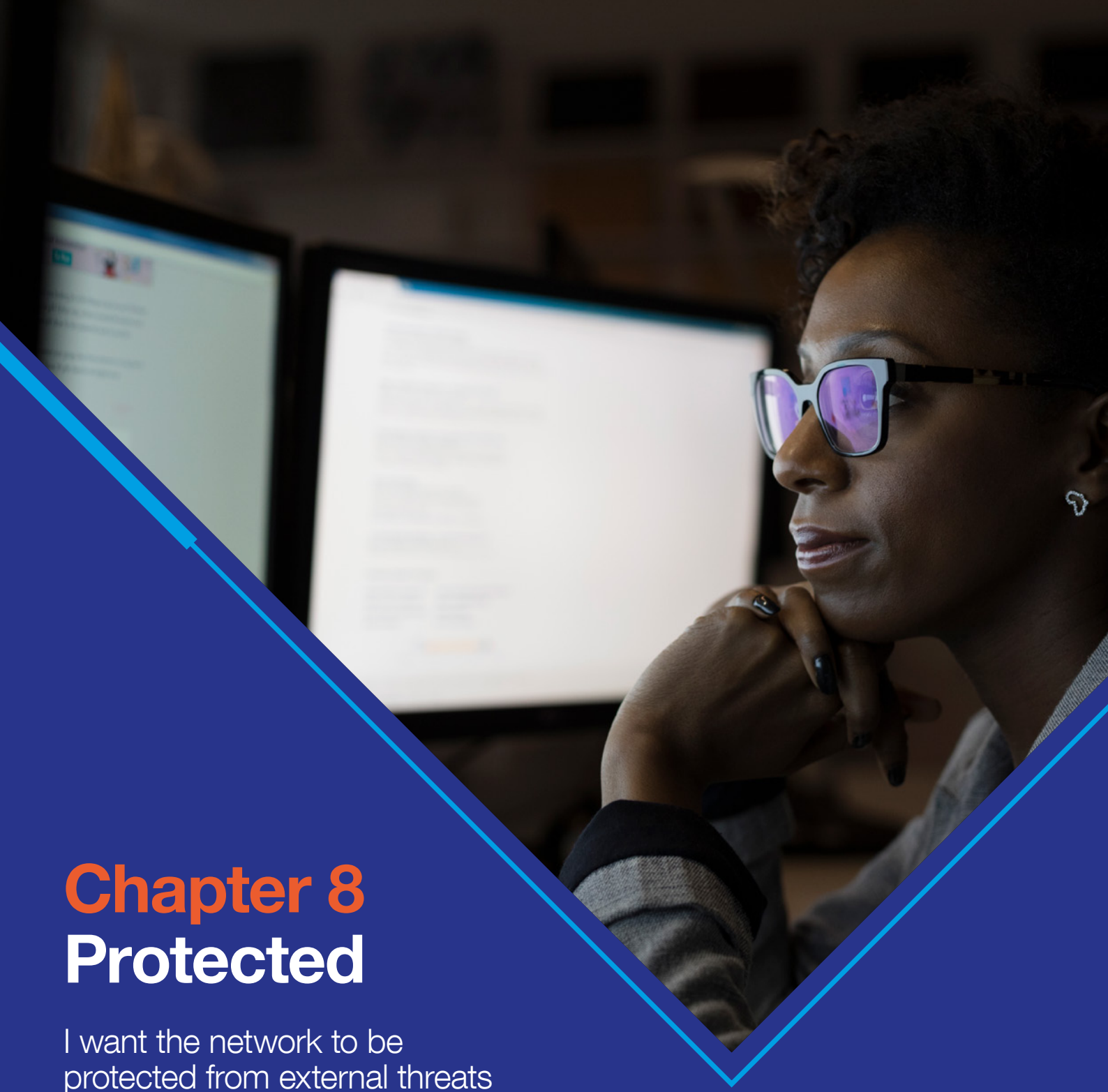
- Working with our suppliers and flexibility providers to explore alternatives to traditional network solutions.
- Workshops and conversations with the DNOs and the ESO to optimise plans across organisations.
- Ongoing conversations with policy makers and key stakeholders to develop solutions that enable 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:



Chapter 8
Protected

I want the network to be protected from external threats

Electricity Transmission

nationalgrid

8. I want the network to be protected from external threats

What this stakeholder priority is about

Our customers and consumers depend on our network to provide a continuous supply of electricity. We have a responsibility to protect the network – and its systems – from a range of threats and to respond to any incidents quickly and effectively.

We want to manage external threats in a way that is supported by the Government, relevant agencies and our stakeholders. We'll continue to invest in protecting our network from cyber-attacks, physical attacks and extreme weather – and to recover from shutdowns.

Summary of what our stakeholders have told us so far

You have told us you want us to protect the electricity transmission network from threats. Incidents that put the performance of our assets and systems in jeopardy, and can have a direct impact on our stakeholders and consumers, include:

- Cyber-attacks.
- Physical attacks.
- Extreme weather.

We also need to recover from incidents if they happen. Therefore, we'll be enhancing our capabilities to recover from a full or partial shutdown of the network, known as a Black Start.

The Government and relevant agencies play an important role in setting minimum requirements for how we manage external threats. There is potential for us to do more, but only if stakeholders want us to. This could become more important as society grows increasingly dependent on electricity in the future.

Our current performance on protecting the network from external threats

At the start of the T1 period, it was unclear how much we would need to invest in protecting the network from external threats. As threats have changed and new ones emerged, we have adapted our plans and invested in effectively protecting our network.

Cyber-threats have changed significantly within the T1 period. The Government has recognised this by introducing new regulations in this area. We forecast we will have invested over £30m in detecting, protecting, responding to and recovering from cyber-attacks during T1. We were not explicitly funded for this in the T1 period. However, we considered it was the right thing to do to protect consumers.

In terms of protecting our network from physical attack, we're on track to deliver our RIIO-T1 Physical Security Upgrade Programme (PSUP). We have invested around £200m in improving the physical security of our sites to levels agreed with the Department for Business, Energy and Industrial Strategy (BEIS) and the Centre for the Protection of National Infrastructure (CPNI).

We are expecting to invest around £100m in installing flood defences at 50 sites in the T1 period. This is part of a co-ordinated approach by the energy sector based on thorough flood risk assessments and prioritisation of flood defence investment.

We continue to maintain the capability to respond to a full or partial shutdown of the network, known as a Black Start event. We've carried out extensive tests and exercises involving our control room and field staff. This ensured we have the skills and plans in place for an effective recovery.

We have been closely monitoring how the threats we face have changed during the T1 period. We have been engaging with key stakeholders, such as BEIS, CPNI and the National Cyber Security Centre (NCSC), as well as using the latest threat intelligence from other external organisations. It's important we continue to be flexible in this area. We need to constantly assess whether our plans are appropriate, so we can protect our stakeholders and consumers from emerging and changing threats.

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'll playback the feedback we have heard from you – and ask for your views on what we suggest could happen next.

The benefits to consumers
Our plans for making the network more resilient will benefit consumers by:
- Building trust that we are a responsible business.
- Ensuring electricity is there when needed.

Based on what our stakeholders have told us, this section looks at different aspects of resilience in the T2 period. We worked with BEIS, the Environment Agency, the Welsh Government, the National Infrastructure Committee, other energy companies, universities and research councils on the Energy Research Partnership's recent report on the Future Resilience of the UK Electricity System. The report found that society and businesses are becoming increasingly dependent on electricity, and networks are increasingly at risk of cyber, physical and climate-change threats.

Enhancing our cyber resilience

You have told us that you want us to protect our network from cyber-attacks. In recent years, there have been several notable cyber-attacks, which have demonstrated the tenacity of would-be attackers and the potential impact a successful attack could have on critical networks. The 2015 attack on the Ukraine energy network was one example.

In response to this growing threat, the UK Government has published its first two National Cyber Security Strategy documents and adopted new regulations around security, called Network and Information Systems (NIS) regulations.

The NIS regulations came into effect in May 2018. They aim to minimise the risk of cyber-attacks and the resulting impact on the UK's Critical National Infrastructure (CNI) and economy. As an Operator of an Essential Service (OES), we have obligations under the NIS regulations. These include ensuring we have appropriate security measures in place to protect our networks and information systems from cyber-security incidents. We are in the process of agreeing the appropriate level of security for our electricity transmission systems with the Government.

With all of that in mind, our intention for the T2 period is to make sure we have appropriate levels of cyber resilience, agreed with the Government. We'll continue to work with the Government, CPNI and Ofgem to establish levels of security that align with the NIS regulations. We'll then develop a process for responding to these changes in requirements during the T2 period. Our stakeholders have told us they are satisfied with the approach we are taking.

We plan to continually assess both the threat and levels of security on our network and systems. This includes monitoring live threats and attacks against our network. We will continue to improve our cyber security capabilities, where necessary, to meet agreed levels of resilience with the Government.

The landscape for cyber threats is changing rapidly. So we must be ready to consider further investment as and when new risks arise. We will work with the Government to agree an approach to effectively respond to any changes in our threat and resilience requirements.

To meet the cost of our cyber-resilience plans, we intend to request a baseline allowance from Ofgem for the work we know is required. We will also work with Ofgem to find the best way to adjust our allowance during the T2 period, should there be any changes in our resilience requirements. Due to the sensitive nature of our plans for cyber resilience, we won't be able to share these with stakeholders. However, we will provide transparency about our costs where we can.

Enhancing our physical security

Physical attacks are another key threat we need to protect our assets against. The PSUP is a Government-supported programme to protect the UK's critical infrastructure. The CPNI has worked with BEIS to identify and prioritise spending on PSUP assets.

Our intention for the T2 period is to continue working with the Government to agree the appropriate levels of physical resilience for our sites and equipment. The majority of PSUP upgrades are due to be completed within the T1 period. Only a small amount of additional investment will be required in T2 to complete this.

With the introduction of new NIS regulations, we will also work with Ofgem and BEIS to ensure our investment in physical resilience meets the Government's requirements for cyber security.

The threat of a physical attack, as well as the Government's requirements for physical security, can change quickly. So we must be ready to consider further investment should it be needed. Our plans for the T2 period are based on the threats we currently face. We plan to request a baseline allowance from Ofgem for the work we know is required. We will engage with Ofgem to find the best way to adjust our allowance during the T2 period to effectively respond to any changes in our requirements.

Protection from extreme weather

We are also aiming to increase our resilience to natural hazards. One example is our project to introduce and enhance flood defences. Our current plans for the T2 period include investing around £60m to protect our assets from surface water flooding. We will also develop a strategy to understand what long-term measures we need to put in place to address wider natural hazards.

Recovery from a shutdown event – Black Start

You have told us that a resilient network is important to you. An important part of that is making sure energy supplies can be restored following any loss of electricity. A Black Start is the recovery from a full or partial shutdown of the network. It could be either national or regional. While such events are rare, the South Australian blackout of September 2016, which was caused by storm damage, left almost the entire state without its electricity supply.

A cross-industry working group is developing a GB Black Start Restoration Standard. This will define a time limit for restoring electricity demand following a network shut down. BEIS will oversee the standard, ensuring it continues to meet resilience requirements. We are currently working with key stakeholders such as BEIS to understand both the desired, and realistic, timescales in which demand can be fully restored. Any proposals made through this workgroup will be subject to consultation. Following this, it's likely that we will be required to meet its target timescale for a Black Start recovery.

Based on BEIS's direction, we envisage increasing some of our asset performance targets, and reviewing the availability of our workforce. This will be built into our plans for T2.

We will adjust our plans to reflect the GB Black Start Restoration Standard when it is issued following a consultation later this year. The best place for stakeholders to share their views is through the cross-industry group's consultation on the standard.

What it could cost

Low £0.10bn | **T2 annual spend range** | **Higher if required**

T1 annual expenditure (forecast) £0.05bn

We estimate that our minimum expenditure on resilience for T2 will be £0.10bn a year. Much of this will be spent on cyber security. This reflects both the increasing threat of cyber-attacks and the fact we have already invested significant amounts in improving our resilience to physical attacks and extreme weather during the T1 period.

We are also interested in stakeholders' views on whether we should invest beyond the Government's current requirements for resilience. You might see benefit in this, particularly as society is expected to become more dependent on electricity in the future.

If stakeholders do see benefit in this, then our costs will be above the minimum annual expenditure.

There is uncertainty over our upper spend on resilience, because it depends what threats emerge over the period. We will continue to work with the Government and relevant agencies on any new requirements. We will also work with Ofgem and our stakeholders on appropriate mechanisms for adjusting our baseline funding. This could be required if we need to spend more on resilience in the T2 period than expected at the start.

How we will continue to engage with our stakeholders

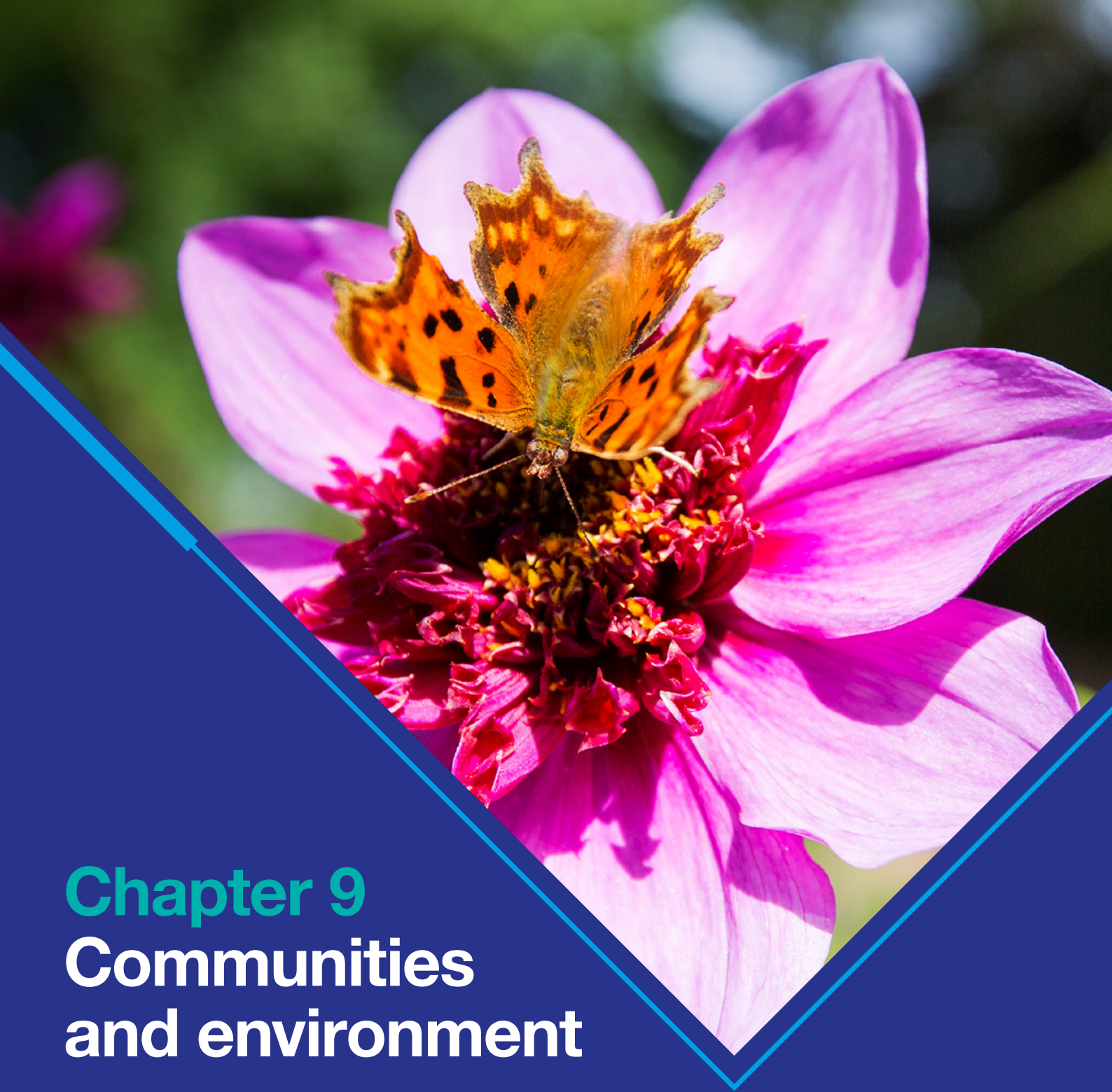
We welcome feedback on this chapter of the consultation, including whether we have identified all the main threats to our network.

We are also interested in stakeholders' views on whether we should be investing beyond the Government's current requirements for resilience. One possible case for this would be society's anticipated growth in electricity dependency in the future.

We welcome your views:

Question:
What are your views on our direction of travel and investment drivers in relation to resilience in the T2 period?

Submit your feedback online here:



Chapter 9
Communities and environment

I want you to care for the environment and communities

Electricity Transmission

nationalgrid

9. I want you to care for the environment and communities

What this stakeholder priority is about

National Grid plays a vital role in building a sustainable energy sector for Great Britain. The process of transmitting electricity for our customers and consumers has an impact on the environment and our communities. Stakeholders want us to reduce our impact. We also need to balance that with our customers' need for energy security and affordable charges. We want to make a positive contribution to our society.

Summary of what our stakeholders have told us so far

You have told us that you want us to reduce our impact on the environment and make a positive difference to our communities by:

- Lowering our greenhouse gas emissions.
- Making our activities carbon neutral, which could include offsetting.
- Looking after and improving the natural environment around our sites.
- Supporting the communities we work in.

Some stakeholders want us to:

- Improve the visual impact of our assets in protected landscapes.

Our current performance on the environment and communities

We have facilitated a continual reduction in the greenhouse gas emissions from our electricity transmission network during the T1 period. Our carbon emissions fell by just over 15% between 2013/14 and 2017/18. A large proportion of these emissions come from transmission losses. These losses occur as a natural result of transmitting power over long distances, so they are largely out of our control.

The carbon emissions we can control largely come from energy use in our buildings, transport and leaks of insulating gases. In 2017/18, this contributed about 14% of our network's total emissions. We reduced our direct emissions by 12% between 2012/13 and 2017/18.

Through our Natural Grid programme, we are on track to recognise and enhance the value of our natural assets on at least 50 sites by the end of 2020/21. Thirty of these should be electricity transmission sites. We are also on target to reuse or recycle 100% of our recovered assets by 2020. This refers to equipment that has reached the end of its operational life.

We carefully consider the visual impact of all proposed new overhead line routes. To obtain Development Consent Orders wherever they are required, we need to balance a range of factors laid down by the Planning Act. For example, for our Richborough connection in Kent, the 20km route avoids protected areas of the countryside, known as nationally designated areas.

We are working closely with our stakeholders to understand their priorities for reducing the visual impact of our existing transmission equipment. We need to consider what is technically feasible, and whether consumers are willing to pay for the work.

In Dorset, we have planning permission for our first Visual Impact Provision project. This will put around 8km of overhead line underground and remove 22 towers. Ofgem recently approved £116m of funding for the scheme.

Figure 9.1 Dorset area of outstanding natural beauty

During 2017/18, our UK electricity and gas businesses' community initiatives contributed a social value of £66m. This included the first part of our £150m Warm Homes Fund to tackle fuel poverty, which we funded from the sale of our gas distribution business. Our UK Community Grant Programme awarded more than £214,000 to local community projects across the country in 2017/18, particularly to those affected by our construction projects.

Our UK electricity and gas employees, along with charity partners, have carried out more than 2,500 one-hour sessions with young people, to inspire their interest in science, technology, engineering and maths (STEM) subjects.

We have also been working with our supply chain to improve their social and environmental impact. The Business and Human Rights Resource Centre recently identified National Grid as part of a small cluster of leaders tackling modern slavery and human trafficking.

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'll playback the feedback we have heard from you – and ask for your views on what we suggest could happen next.

The benefits to consumers

Our plans for supporting the environment and our communities will benefit consumers by:

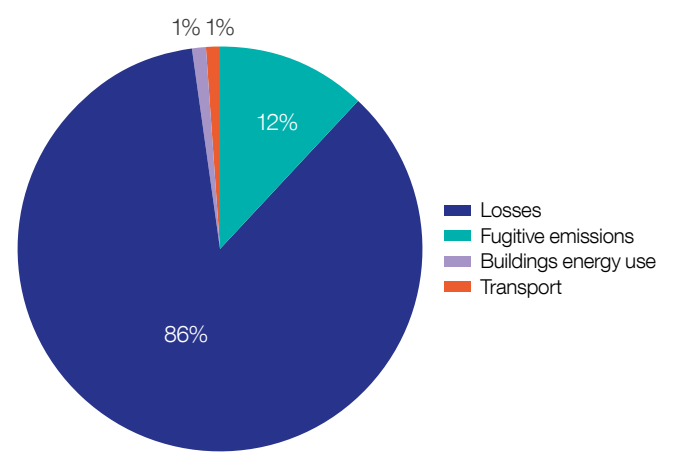
- Building trust that we are a responsible business.
- Enabling the decarbonisation of the electricity system.
- Providing more transparency about our performance.

Reducing our greenhouse gas emissions

The British Government set a legally binding target to reduce the nation's carbon emissions by 80% before 2050 in its 2008 Climate Change Act. This is compared to a baseline figure for 1990. Achieving this requires a significant change in how Britain produces, delivers and uses energy.

Our greenhouse gas emissions come from four main sources.

Figure 9.2 England and Wales electricity transmission greenhouse gases emissions by source



The largest source of carbon emissions is from transmission line losses. We factor these losses into our Whole Life Value framework, which is the method we use to select investments that are economically justified. There is a limited amount we can do to reduce transmission losses because they are mostly caused by the distance over which electricity travels. As electricity generation continues to decarbonise, these losses will create lower carbon emissions. That is because the lost electricity will be of a lower carbon intensity. We are helping this happen by linking more low-carbon sources to our network.

Our intention for the T2 period is to improve how we report what we are doing about transmission losses. We could also report annually to our Stakeholder Group as we continue to meet our stakeholders' need to be more transparent (see Chapter 6).

The biggest source of emissions, that is in our control, is insulating gases. We use the gas SF_6 in some of our high-voltage equipment because it is the most cost-effective insulating gas commercially available. Unfortunately, SF_6 has a high global warming potential and, when it leaks, contributes to climate change. For the T2 period, we could continue to investigate and test alternative insulating gases. We could also build the environmental costs of SF_6 fully into our investment decisions.

We are discussing with Ofgem what funding will be available in the T2 period for research and development projects on alternatives to SF_6. Ofgem is also consulting on how the regulatory incentive for reducing SF_6 leaks could work for the T2 period. See pages 43 to 47 of Ofgem's sector-specific methodology consultation annex on electricity consultation.

We are considering other approaches we could take on carbon emissions in the T2 period, such as:

- Making our construction activities carbon neutral, which could include offsetting. We estimate this would add between 2 and 4 pence a year on consumers' bills.
- Adopting the British Standard Institute's standard PAS 2080 on carbon management in infrastructure.
- Reducing the carbon intensity of our construction projects by using new technologies that reduce waste. We could also use more low-carbon materials;
- Working with Ofgem and our stakeholders to design incentives for reducing carbon emissions. These could include reducing controllable carbon from our vehicle fleet and other energy uses;
- Publishing and reporting our controllable and uncontrollable carbon footprint to our Stakeholder Group.
- Encouraging our suppliers to report their carbon emissions through the Carbon Disclosure Project. This helps organisations measure and manage their environmental impact.

Reducing our impact on the local environment

Our activities and sites can have an impact on the areas surrounding them. You have told us that you want us to look after these natural environments. To respond to your feedback, our aim for the T2 period is to continue working with third parties to introduce more sustainable ways to use and manage our resources.

Some activities we could include in our T2 period plans are to:

- Expand our Natural Grid scheme. This improves the natural environment at sites on non-operational land around our energy assets. We estimate we could roll the scheme out to around 25 sites – or an extra 75 hectares – for less than half a penny a year on consumers' bills.
- Make sure we deliver an overall environmental gain on our construction projects.
- Increase the number of sites with Sustainable Action Plans to improve stakeholder engagement on environmental improvements.
- Reduce the amount of waste we create.
- Reduce the waste intensity of our construction projects.
- Educate the public more about environmental issues through our education centres and community events. We estimate we could create a new environmental education centre for less than half a penny a year on consumers' bills.
- Engage more widely with businesses about advancing the electrification of transport. This could help reduce local air pollution and global climate change.

Reducing the visual impact of our existing assets

Some of our stakeholders are concerned about the visual impact of our sites and equipment. This is particularly the case for transmission lines in National Parks and Areas of Outstanding Natural Beauty.

The current price control provides funding of up to £500m over eight years to reduce the visual impact of existing electricity infrastructure in nationally designated landscapes. This money is available for National Grid and the two Scottish TOs.

We have worked closely with stakeholders during T1. Together, we have created a policy and process that prioritises sections of overhead lines that would deliver the most benefit if they were placed underground. We consulted on and updated our Visual Impact Provision (VIP) policy in 2017/18. We established an independent advisory group in 2014 to guide our decisions on VIP projects. We also appointed an independent landscape expert to create our Landscape and Visual Impact Methodology. As a result of this, and following engagement with local stakeholders, we prioritised four major projects to place our cables underground. These are set out in our Fourth Annual Report on VIP along with a list of smaller Landscape Enhancement Initiatives.

Our Stakeholder Group has told us that we should continue our existing policy and process for identifying visual impact projects during T2. These schemes will only become reality if consumers accept to spread their cost across all electricity bills.

Supporting the communities we work in

Our stakeholders want us to support the communities we work in. Our intention during T2 is to continue to encourage our employees to volunteer in their local communities on a wide range of projects. We also plan to further support community initiatives and relationships across our operations. We want to continue with our UK Community Grant Programme, which supports local charity projects and community groups.

We are dedicated to working with young people, who are the future of our business – and our country. The Engineering UK 2018 report showed that engineering companies will need 203,000 more people with Level 3+ engineering skills every year, to meet demand up to 2024. Based on our stakeholder feedback, our plan for T2 is to build on our current initiatives to engage with schools, parents and children. We will promote engineering as a modern, dynamic and desirable career with a great future. Our intention is to continue to support our employees, who can act as education ambassadors. They can volunteer their time for a range of activities, including careers education and work experience.

Promoting social responsibility through our procurement

We would like to hear our stakeholders' views on how we could promote social responsibility through our procurement. For example, we could create more diversity among our suppliers, by encouraging more small and medium-sized enterprises to apply for our tenders. We could also encourage our suppliers to report on their carbon emissions, to pay the living wage and to combat modern slavery beyond legal requirements.

Our consultation on forward-looking outputs

We recognise the growing importance of environmental and social issues to our stakeholders. This is evident in the discussion paper we published in December 2018 on forward-looking outputs. We suggested some possible improvements we could deliver in the 2020s in terms of: reducing carbon emissions, improving the environment, contributing to local communities, increasing social value, promoting sustainable procurement, and increasing legitimacy and trust in our business.

We welcome your views on whether we:

- Have missed any important outputs.
- Should report our performance on some of these outputs as part of the regulatory framework.
- Should have a financial incentive to improve our performance in some of these areas for consumers or the wider public interest.

What it could cost

Low £0.05bn | **T2 annual spend range** | **High £0.15bn**

T1 annual expenditure (forecast) £0.05bn

Our range of predicted spending for T2 on the environment and communities is largely driven by the cost of visual impact schemes. Our lower range reflects us continuing only with the four existing T1 period VIP schemes. Whether we take forward new VIP projects in T2 depends on whether stakeholders and consumers are willing to pay for them. We are currently prioritising new projects, but until we have fully engaged, we do not know how many projects there might be. In the meantime, we have included the possibility of up to £500m of new VIP projects in the upper range to assess the potential impact for household bills.

How we will continue to engage with our stakeholders

We welcome feedback on this chapter of the consultation. In particular, we are keen to hear your views on what our level of ambition should be for the environment and communities in the T2 period. We will continue to engage with our stakeholders on specific projects or incentives we could take forward during T2.

We will continue to listen to our stakeholders' views on the visual impact of our assets, such as overhead lines.

We are also asking for views on our separate discussion paper, Forward-looking outputs.

We welcome your views:

Question:
What are your views on the level of ambition we should have in relation to the environment and communities in the T2 period?

Submit your feedback online here:

Chapter 10
Innovation

I want you to be innovative

Electricity Transmission

nationalgrid

10. I want you to be innovative

What this stakeholder priority is about

This chapter focuses on the innovation, research and development work we are doing. It is about creating new and improved technologies, systems and services that make things better for our customers and consumers in the future.

These initiatives are also about driving culture change and different ways of working within our organisation and our partners. This will help to increase the speed at which we, as an industry, move with the environment around us.

Ofgem is consulting on the innovation incentives and funding for T2. In this chapter we are assuming that the T2 regulatory framework will still provide the strong incentives and funding required to drive innovation.

Summary of what our stakeholders have told us so far

You have told us that you want us to:

- Proactively engage with you and be clear about the opportunities and barriers around innovation.
- Be a leader and co-ordinator of innovation.
- Develop new approaches that help us continue to provide high-quality services as the energy system changes.
- Help small and medium-sized enterprises (SMEs) develop and implement their innovative products.
- Lead the way on energy decarbonisation by developing a future network that meets the UK's economic and environmental goals.
- Deliver low-carbon and low-cost solutions for our customers so that they can be set up easily, efficiently and quickly.
- Contribute to academic research projects both financially and by providing our skilled people.
- Support the development of future engineers by giving them the right skills and experience.

Types of innovation

We are focused on three types of innovation:

- Core innovations involve short-duration projects to create value within the current price control. They aim to improve existing processes, assets or technology; to reduce costs; and/or improve the quality of services for our customers and consumers.
- Adjacent innovations create value for customers and consumers in future price controls. These innovations are higher risk because we make assumptions around the regulatory framework of the future and social and usage trends.
- Transformational innovations involve developing and inventing breakthrough technologies to create value for the customer and consumer of the future. These projects are high risk because we need to make significant assumptions around the future market needs.

These types of innovation help us improve performance for our customers, consumers and drive wealth across the nation. This chapter focuses on our research and development into adjacent and transformational innovations.

Our current performance on innovation

In the current T1 period there are several innovation allowances and incentives in place for electricity network companies. Ofgem introduced these to encourage network companies to develop innovation projects that benefit consumers and the environment, which would not otherwise happen under the core RIIO framework. In other words, they are important incentives for us to drive innovation.

We have responded to these incentives. For example, during 2017/18 some 85 researchers and engineers spent more than 14,000 hours on NIA and Network Innovation Competition (NIC) projects. We also closed 34 projects during 2017/18.

We presently have 48 active projects under way, in which we collaborate with SMEs, equipment manufacturers, contractors and academic institutions.

One example is the conclusion of a 3-year project into extending the life of our overhead line fittings. We now have a better understanding of how the environment affects our overhead lines. We are using what we have learned to fine-tune our plans for when assets are replaced. We can now focus our spending on the assets with the highest risk of developing faults and failures. So far, by analysing 480km of overhead lines, we have reduced our T1 period spending by £20m. Other utilities are now carrying out this work to help them improve their asset management.

We have also created a test centre for new transmission technologies: the Deeside Innovation Centre. This five-year innovation programme began in January 2016. It aims to research, deliver and demonstrate a platform for moving useful, innovative technologies into our business faster than ever before. It will allow us to bring benefits to consumers more quickly and will also help us explore more complex, disruptive innovations with less financial and operational risk.

You can find out more about our innovation work by downloading our Network Innovation Annual Summary.

The need for innovation funding

Our ability to innovate depends on there being sufficient innovation funding available to incentivise long-term, high-risk investments spanning several price controls. After consultation with our stakeholders, we believe a lack of funding stifles innovation for various reasons:

- Radical innovation involves significant technological development and considerable changes in business models which take time to develop and implement.
- It is very hard to achieve long-term, risky and uncertain innovation within short price control periods. They do not provide a sufficient payback period to fund these innovations. Also, cost savings resulting from innovations are shared with consumers reducing the incentive to innovate further.
- Innovations lead to lower cost allowances in future price controls reducing the incentive to innovate if there is not dedicated funding.

Ofgem discusses the T2 regulatory framework for innovation funding on pages 65 to 75 of its RIIO-2 sector-specific methodology consultation. We consider there needs to be more innovation funding available for us than Ofgem currently proposes if we are to pursue the innovation themes below in the T2 period. We are engaging with Ofgem and our stakeholders about the level of innovation funding for the T2 period.

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.

The benefits to consumers

Our plans for innovation during T2 will benefit consumers by:

- Enabling the decarbonisation of the energy system.
- Helping to lower costs across all electricity networks.

During T2, we will become even more transparent about the potential barriers and opportunities for innovation that we see. We will work collaboratively with partners, including SMEs, academia and government organisations to expand our innovation ideas and find solutions to the barriers that stand in their way.

Here are six innovation themes we would focus on during the T2 period, should there be appropriate innovation incentives and funding available:

Digitising our network

You want us to be a leader in innovation and to play a central role in making it possible. The future energy system will have more renewable generation, while electricity, gas and transport networks will interact more than ever before. Our stakeholders also believe the energy market will be more dynamic, with trading possibly taking place every five minutes or less.

To respond to these challenges and your feedback, our direction of travel for the T2 period is to transform our business through digitisation. To do this we could:

- Develop sensors, technologies and artificial intelligence algorithms that provide the data needed to operate the electricity network of the future.
- Use this data to understand how an integrated energy network, combining electricity, gas, heat and transport, could work.
- Develop a joined-up programme of work, or support an existing one, to study how different technologies might support an integrated energy system that has a zero-carbon footprint by 2050.

These innovations would benefit consumers in several significant ways. The future energy system would operate more efficiently, costs would be lower, and Great Britain would transition to a low-carbon energy sector.

Reducing our environmental impact

Our stakeholders want us to lead the way on decarbonising energy. As discussed in Chapter 9, we have a significant carbon footprint. Innovation will be vital in reducing the impact we have on the environment.

Our intention for the T2 period is to promote the development of:

- Alternative technologies that mean we no longer have to buy equipment that uses SF_6 (a potent greenhouse gas) as an insulating gas.
- Alternative technologies that help us reduce the SF_6 gas already installed on our network.

These innovations would allow us to reduce carbon emissions from our network more cost-effectively, which would benefit consumers.

Working together to decarbonise industrial processes

Industry in the UK is responsible for around 17% of total delivered energy and 20% of CO_2 emissions. Just six sub-sectors account for 71% of those emissions: steel (25%), chemicals (19%), cement (8%), food and drink (7%), paper (6%) and plastics (6%).

Our aim for the T2 period is to:

- Engage with key members of the industrial sector who want to decarbonise their processes.
- Support the development of innovation projects that help to decarbonise those processes.

These innovations would benefit consumers by helping the sector find more cost-effective solutions to reducing carbon emissions.

Improving the management of our assets and remaining reliable

As we move towards the energy system of the future, we also need to provide a reliable service for our customers and consumers. To do this, we need to get the best out of our existing assets, and run today's network with the future in mind. We also need to research and develop new equipment and systems that can be replaced, added and modified quickly, so we can manage unexpected events or needs on the network.

Our direction of travel for the T2 period is to develop innovation projects that help us understand how the performance of our assets declines over time. With this information, we will be able to make the best decisions about when to intervene and we will develop technologies that help us do this.

These innovations would benefit consumers in the long term by allowing us to keep our network reliable at a lower cost.

Improving how we make decisions under increased uncertainty

Our stakeholders want us to develop ways to keep delivering high-quality services as the energy system changes. We regularly make both investment and operational decisions under uncertain conditions. We do this by using data, information and expert engineering judgement. Going forward, we expect the number of decisions we have to make to increase – but to have less time to make them. This is because the system is growing ever more complex, as more local generation and more interconnection on the system creates more variable flows of energy.

In this landscape, it's important we improve our data and decision-making models. The importance of adequate data modelling for large infrastructure organisations was underlined by the case of the West Coast Main Line rail franchise. Its collapse in 2012 was due to incorrect and misused model outputs. This ultimately cost the taxpayer more than £50m.

To respond to this challenge, our intention for the T2 period is to improve the data and models that we rely on to make major decisions.

These innovations would benefit consumers by allowing us to improve the decisions our business makes. This would improve the quality of our services and/or lower costs in the long term.

Creating a testbed to trial and accelerate the use of new technologies

The energy sector is developing an increasing number of original technologies, including those that support the shift to a low-carbon energy system. However, these technologies can only be implemented when they've been shown to work in practice.

Our aim for the T2 period in this area is to:

- Expand our Deeside Innovation Centre to include a facility to trial gas (hydrogen and liquefied natural gas) integration, electric transport technologies, and novel zero-carbon generation technologies.
- Work with our stakeholders to develop an agreed programme of work for understanding the effectiveness and performance of new technologies.
- Provide the facilities for UK academia and SMEs to test their technologies that could benefit energy consumers.
- Share our findings annually and publish suggestions and calls for technologies that we believe are required to fill gaps.
- Support the commercial journey of technologies in the UK, where appropriate.

These innovations would benefit consumers by speeding up the use of new technologies, and bringing forward better service quality and cost savings.

Embedding innovation into our everyday business

Our stakeholders have told us they want us to be a leader in innovation, as well as providing value for money. We consider that strong incentives to drive down costs and improve service are critical to embed an innovative culture.

One of the challenges of disruptive innovation is that it can involve changing processes that are already working well. To make the most of disruptive innovations we need to properly establish them into our day-to-day operations. We aim to create an even stronger culture of embedding innovation during T2 by:

- Putting more emphasis on identifying and quantifying the benefits of each innovation during the development stage.
- Changing the way we report our business plan to make innovations more visible and spell out the benefits they have brought for consumers.
- Taking on more risk, so we succeed, or fail, fast – and learn more quickly.

These approaches would benefit consumers by helping us realise the full potential of innovation. When new innovations are properly established, any cost saving or boost to service standards will be maximised.

Support for innovation through regulatory incentives

Currently, three regulatory incentives are in place to stimulate longer-term and transformational innovation in network companies:

- The Network Innovation Allowance (NIA).
- The Network Innovation Competition (NIC).
- The Innovation Roll-Out Mechanism (IRM).

There are also output incentives and a strong totex incentive mechanism (TIM) to stimulate core innovations that lower costs or improve services during a price control period.

Together, these incentives encourage innovation for the benefit of consumers. Without them, network companies would not have a strong reason to pursue innovation projects.

What it could cost

Our current average annual spending on innovation is around £20m. This comes from innovation allowances and incentives, as well as our totex allowance. The data we are presenting in this consultation is rounded to the nearest £0.05bn, as a result, £20m rounds to zero.

Whether we include innovation costs in our business plan depends on Ofgem's approach to innovation for the T2 period, which it is currently consulting on. In other words, innovation might be funded in T2 through a different route than our current allowance.

For the T2 period, Ofgem has signalled it wants to continue offering innovation incentives. The regulator wants to focus this funding on supporting the transition to a future energy system and aims to co-ordinate these funds with other public sector innovation funding. It is also looking to increase the role of other energy third parties in supporting innovation funding.

Our stakeholders tell us it is important to them that there is certainty around the availability of innovation funding in T2. We'll continue to engage with Ofgem and our stakeholders on what will deliver the most benefits for consumers.

How we will continue to engage with our stakeholders

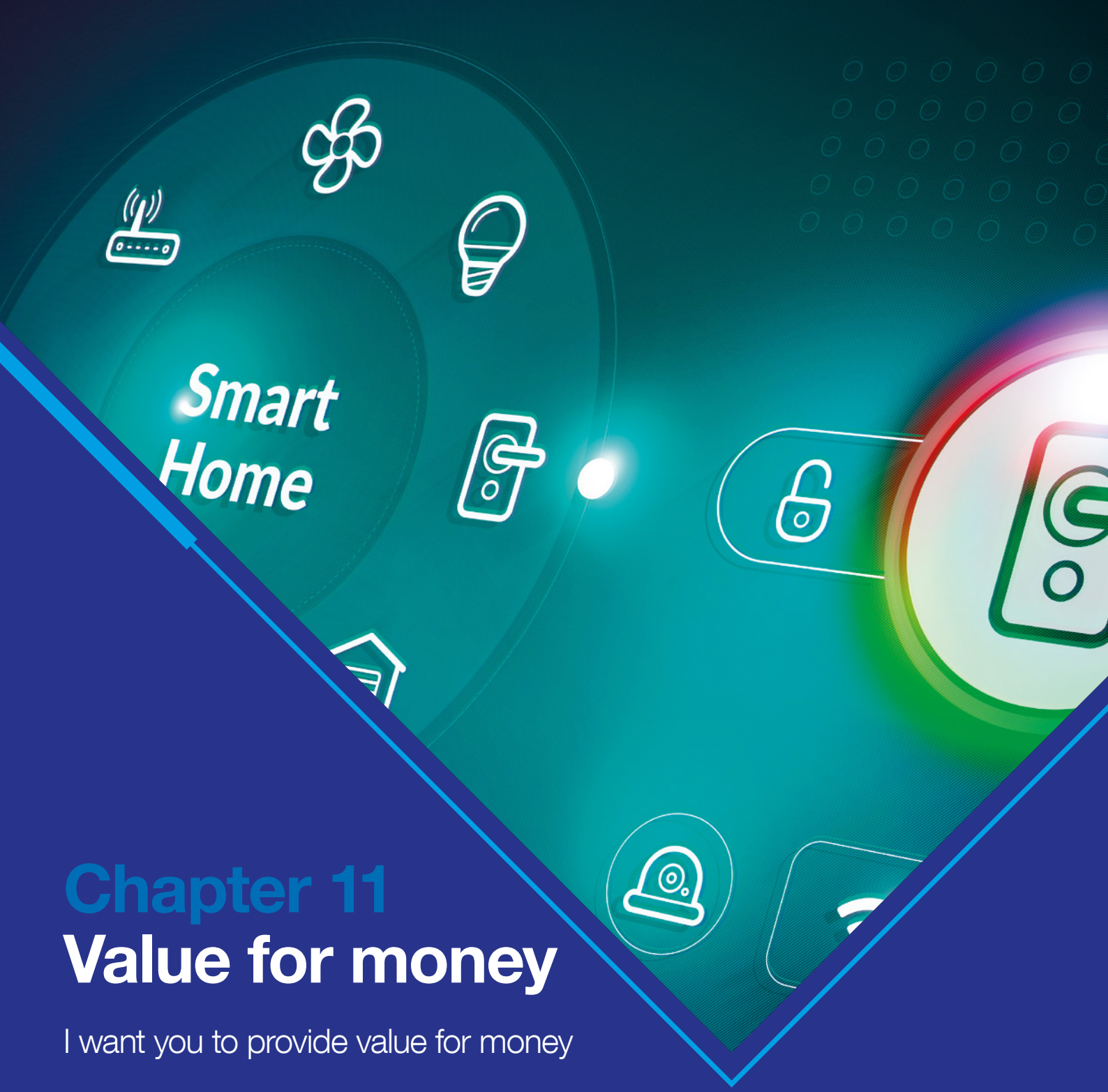
We welcome feedback on this chapter on innovation. In particular, we would like to know your thoughts on our suggested areas of research and development for the T2 period. We also welcome your feedback on what our level of ambition for innovation should be for T2 and what the appropriate methods of funding should be.

We will continue to collaborate with our research partners from academia and other businesses and listen to their ideas for innovation in the future. We are continuing to engage with our suppliers, at both national and international level, on our approach to innovation. We are holding an innovation workshop with our stakeholders in February.

We welcome your views:

Question:
How ambitious should we be in relation to innovation in the T2 period?

Submit your feedback online here:



Chapter 11
Value for money

I want you to provide value for money

Electricity
Transmission

nationalgrid

11. I want you to provide value for money

What this stakeholder priority is about

Our electricity transmission network delivers an essential service across England and Wales. To meet the challenges of the future, our business needs to evolve.

We need to have a greater focus on our customers, be more resilient to external threats, and play a central role in decarbonising the energy system. All of this needs to be balanced with ensuring energy bills are affordable for consumers.

We have a strong focus on cost efficiency and delivering value for money. This ensures we help to drive down bills for current and future consumers.

Summary of what our stakeholders have told us so far

You expect us to meet your priorities efficiently. And to deliver value for money.

You have also said you expect to see a strong link between our performance for customers and the returns we earn for investors.

Our current performance on delivering value for money

In the eight-year T1 period, we expect to invest £10.4bn in our network.

When our customers' requirements changed during the T1 period, it meant we did not invest exactly what we had originally planned. Through uncertainty mechanisms, our allowances were adjusted to reflect those changes. We expect our original allowance of £14.4bn to be reduced by £2.2bn in the T1 period. This includes £0.6bn of our allowances that we voluntarily handed back to consumers for investment that we deferred. This has adjusted our allowance to £12.2bn.

We have provided value for money during the T1 period by delivering better services than predicted at the start of T1 – and at a lower cost. For example, we have saved 14% of our costs compared to our adjusted allowance through finding more efficient ways of achieving outputs for customers. We expect this to result in £1.8bn of savings by the end of the T1 period. We are sharing just over half of these savings with consumers as soon as possible and including them all in our business plan for the T2 period. Our efficiency performance reflects the strong incentives for us to make cost savings in Ofgem's T1 regulatory framework.

At the same time as making cost savings for consumers, we have improved our service performance. For example, we have beaten our target for energy not being supplied each year so far in the T1 period. Our customer and stakeholder satisfaction have increased and we have beaten our target leakage rate of the insulating gas SF_6.

We also expect to have connected 12.5 GW of new generation during the T1 period. By doing so, we have provided new generators with a route to market. This has helped put downward pressure on wholesale prices, which make up 33% of consumers' electricity bills. By investing in our network, we have been saving consumers money.

In terms of the annual average domestic electricity bill, National Grid Electricity Transmission costs consumers £25.40 a year. This is under 50p per week for £10.4bn of investment in our network over an eight-year period.

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 stakeholders – and ask for your views on what we suggest could happen next.

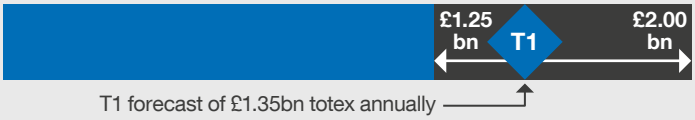
The benefits to consumers

Our plans to create value for money will benefit consumers by:

- Building trust that we are a responsible business.
- Helping to lower network costs.

In Chapters 4 to 10 we discussed how we could respond to our stakeholders' feedback as we develop our business plan for the T2 period. We also showed estimated ranges of totex for T2. The diagram below summarises our overall annual totex range for the T2 period.

Figure 11.1 Indicative annual totex range for the T2 period



The table below shows our indicative totex ranges for each stakeholder priority and then provides a total. We are providing this information to give an early indication of the potential scale of our totex during T2. These numbers could change before we submit our draft business plan in July, for example due to changes in the Ofgem regulatory framework or stakeholder feedback.

Table 11.1 Annual indicative totex ranges by stakeholder priority and in total

	Estimated totex in £bn			
Indicative average annual controllable totex by stakeholder priority in £bn (to nearest £0.05bn)	**T1 annual average**	**T2 low annual average**	**T2 high annual average**	**Basis of range**
1. I want you to provide a safe and reliable network.	0.65	0.6	0.75	This is the range within which we expect to reach an asset health plan that is optimised for network risk and short- and long-term deliverability. We are assuming we target end of T1 levels of network risk for T2.
2. I want you to make it easy to connect to and use the electricity network.	0.20	0.10	0.25	This range is based on the extremes of transmission investment driven by the four FES 2017 energy scenarios, which are being updated for FES 2018. The scale of this range shows why uncertainty mechanisms are important.
3. I want you to be transparent.	–	–	–	Costs are less than the £50m a year threshold.
4. I want you to enable the ongoing transition towards the energy system of the future.	0.30	0.30	0.65	The range is based on the extremes of transmission investment driven by the four FES 2017 energy scenarios, which are being updated for FES 2018. The scale of this range shows why uncertainty mechanisms are important.
5. I want your network to be protected from external threats.	0.05	0.10	0.10*	This is an estimated minimum based on areas we have currently identified to improve our resilience; there is the potential for new requirements and new threats to be identified as we work with the Government and relevant agencies.
6. I want you to care for communities and the environment.	0.05	0.05	0.15	The range reflects stakeholder views and is largely driven by an estimate of potential future visual impact projects.
7. I want you to be innovative.	–	–	–	Costs are less than the £50m a year threshold.
8. I want you to provide value for money	–	–	–	Our activities to drive efficiencies are in the other stakeholder priorities.
9. Electricity transmission totex	**1.25**	**1.15**	**1.90**	
10. Business support costs	0.10	0.10	0.10	Range is within £50m a year threshold.
11. Annual average total	**1.35**	**1.25**	**2.00**	
5-year total (5 x row 11)	**6.75**	**6.25**	**10.00**	

Our forecast for our average yearly totex for T1 (2013/14 to 2020/21) is £1.35bn. Our range for our indicative yearly totex for T2 is from a low of £1.25bn to a high of £2.00bn. The main factors driving this range are the different future energy scenarios. Each one alters how many new generators and how much new demand we will need to connect to our network. They also impact how much network reinforcement we will need to carry out.

Several elements underpin our figures. We have included the efficiencies we have achieved in the T1 period into our T2 totex ranges. However, we have not included real price effects. This refers to the difference between the changes in the price of inputs that transmission owners purchase relative to economy-wide inflation. Neither have we included inflation or any assumptions about future efficiency changes. Also, these ranges only relate to controllable expenditure. There are some elements of our funding – and therefore consumer bills – that we do not control. The costs for these are passed straight through to consumers, such as business rates and licence fees.

Rows 1 to 8 show the totex ranges for our stakeholders' eight main priorities. To calculate the overall controllable totex for T2, we need to add the business support costs from row 10. These include costs such as human resources, finance, IT, regulatory compliance, contract management, insurance, and property management. These departments are needed to run any large organisation. We benchmark our business support spending against other organisations, wherever it is possible.

Stakeholder scrutiny of our plans

We have been carrying out a major programme of stakeholder engagement to listen to what our stakeholders want in the T2 period and to build our plan with them (see Chapter 3). Our goal is to deliver a truly stakeholder-led plan that delivers what our stakeholders want at a cost they find acceptable.

Our independent Stakeholder Group will put both our stakeholder engagement and our T2 business plan under close scrutiny. The group will report to Ofgem with its views. Ofgem has also set up an independently chaired RIIO-2 Challenge Group. This group will create a public report for Ofgem, written from the perspective of consumers, on all network companies' business plans.

The stakeholder engagement process and the review by our Stakeholder Group and Ofgem's Challenge Group will ensure that our overall package for T2 reflects our stakeholders' views and represents value for money.

Providing evidence that our plan offers value for money

There are several ways we will provide evidence to our stakeholders, our Stakeholder Group, Ofgem's Challenge Group and Ofgem that our business plan proposals are value for money.

We will carry out cost-benefit analysis (CBA) of our proposed projects for the T2 period. Certain areas of our spending are automatically covered by CBA. For example, schemes that deliver wider network capacity are assessed by the ESO's NOA process. NOA selects the most efficient option from a range of alternatives for investing in the transmission system. It uses a CBA process that takes account of system constraint costs.

For projects that are not covered by automatic CBA, we use our own CBA to select our preferred options. This allows us to take account of wider benefits to consumers. For example, we can analyse whether spending more now could save more for consumers later.

Where appropriate, we will invite independent groups to challenge and approve our processes and costs, to further prove they provide value for money.

As part of our CBA, we need to include evidence on benefits. In some cases, we can measure these by the value consumers attach to service improvements in a particular area – such as environmental improvements that have been made or fewer instances of energy not being supplied. In developing our T2 period plan, we are using consumers' willingness to pay much more than we have done in the past. This will ensure our final submission reflects, more extensively, what consumers consider to be value for money.

We will test whether the cost and service proposals we set out in our business plan are acceptable to our stakeholders and consumers.

When putting together our baseline funding for the T2 period:

- We will listen to our stakeholders and take account of their views on where and how they think we could be more efficient.
- We will build in the cost efficiencies we have already achieved so consumers can continue to benefit from them.
- We will benchmark our capital expenditure (capex) against our historical and current costs and draw on evidence from leading organisations, including international evidence where available.
- We will benchmark our business support expenditure against other organisations, wherever it can be compared.

Our regulator, Ofgem, will carry out a full, expert review of our costs baseline and will challenge us on how efficient we are. Ofgem has access to unique information, such as the costs of the two Scottish TOs, that we are not allowed to have due to competition law.

Adjusting our allowances appropriately – uncertainty mechanisms

Throughout this consultation, we have explained the uncertainties the energy sector faces during the T2 period. This is reflected in the ranges we have published for our totex. If we fix allowances at the start of T2, there is a risk we could have too much – or too little – funding to give our customers and consumers what they want.

As mentioned above, during the T1 regulatory period, the volume of generation connecting to the transmission network in England and Wales was lower than expected. Adjustments called 'uncertainty mechanisms' automatically reduced our funding. In areas where there was no mechanism to adjust our funding, we voluntarily gave money back to consumers instead.

We think our stakeholders will only want us to be funded for the activities we carry out.

We welcome feedback on our direction of travel for the T2 period. We intend to propose more uncertainty mechanisms, and to make them more sophisticated. If we do that, our allowances will more accurately adjust to reflect the work we need to carry out for our customers and consumers. We will consult on our uncertainty mechanism proposals with our stakeholders. Ofgem will also scrutinise them when it carries out the RIIO-T2 price review.

There are different types of uncertainty mechanisms. There are 'pass-through' mechanisms for costs outside our control, such as licence fees and business rates. There are 're-openers' that involve Ofgem assessing the cost of schemes when they arise. There are also 'volume driver' uncertainty mechanisms. These adjust our allowances based on the volume of work we need to carry out, which is uncertain at the beginning of the T2 period.

The volume driver uncertainty mechanisms we are currently developing for T2 can be seen in the table below. We may develop others if we see a further need to protect consumers. In developing our proposals, we are following the guidance on page 16 of Ofgem's RIIO-2 Business Plans Initial Draft Guidance Document about the information required for uncertainty mechanisms.

Table 11.2 Volume driver uncertainty mechanisms we are considering for the T2 period

Uncertainty mechanism	Ensures that consumers only pay for the actual volume of…
Generation connection	New generation we connect to the electricity transmission network.
Demand connection	Additional exit capacity delivered to meet growth in demand.
Embedded generation	Additional thermal capacity and fault level capacity we deliver to address the impact of embedded generation on the transmission network.
Strategic Wider Works (SWW) pre-construction	Pre-construction work we carry out before we begin building large projects.
Incremental Wider Works (IWW)	Wider network reinforcement work we carry out to address network constraints identified as part of the ESO's NOA process.

Defining our output commitments

An important part of providing value for money is spelling out exactly what our stakeholders, customers and consumers will receive for their money. We intend to make clear output commitments across as many of our costs as we can. Outputs are measurable consumer-facing outcomes that network companies can deliver. These include licence obligations and government standards. They also include service quality improvements that consumers are willing to pay for.

The benefit of outputs to consumers is they are transparent. We can be held to account to deliver them. If we do not deliver an output, we expect to see consequences through our regulatory contract. By focusing on outputs, we can look for more cost-effective and innovative ways to achieve them. When we do that, we give customers what they want at the lowest cost and can share any savings with them.

Ofgem has proposed that network companies should have outputs related to three overarching outcomes:

- Meet the needs of consumers and network users.
- Maintain a safe and resilient network.
- Deliver an environmentally sustainable network.

In the previous chapters, we have mentioned outputs we could deliver in the T2 period within these three categories.

Ofgem has provided the opportunity for network operators to propose 'bespoke' outputs that reflect their stakeholders' views. As explained in Chapter 9, we published a discussion paper on forward-looking outputs in December 2018. We suggested some possible improvements we could deliver in the 2020s that we summarise in the table below.

Table 11.3 Possible outputs in our forward-looking outputs discussion paper

Area	Possible outputs
Carbon	SF_6 (sulphur hexafluoride), insulating gases, controllable carbon, embedded carbon, business carbon footprint and losses.
Environment	Natural environment improvements, cable fluid leaks, natural resources, educating the public about the environment and educating businesses about electric vehicles.
Community	Community investment; working with partners; and safety of the public.
Social value	UN Sustainable Development Goals, equality and diversity, social mobility, supporting education and employability.
Sustainable procurement	Supplier diversity, jobs created in the supply chain, prompt payment, paying suppliers the living wage, addressing modern slavery and drive emissions reductions in the supply chain.
Trust and legitimacy	Local community satisfaction, public trust and level of staff engagement.

We are also considering outputs we could deliver for the ESO that would lower overall energy costs for consumers. We provide more details in our paper Thoughts on a whole-system incentive for the SO:TO interface for the RIIO-T2 price control. And we welcome your comments.

Delivering ongoing cost savings

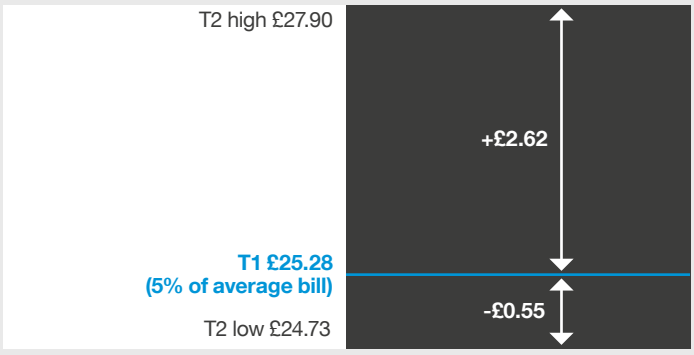
As well as setting ourselves a challenging baseline for the T2 period, we will continue to strive to deliver our services at a lower cost to our customers and consumers. For example, as we deliver our business plan, we will market test the vast majority of our spending and assess it against the latest techniques and the best prices. We will also implement the innovations we delivered towards the end of the T1 period to improve service and lower cost.

The totex incentive mechanism (TIM) makes sure that consumers start to receive the benefit of these savings quickly, rather than waiting for the next price control allowances to be set. We are working with Ofgem and our stakeholders to ensure a strong TIM stays in place for T2. This will ensure we are incentivised to keep innovating and finding cost savings for consumers. Ofgem is consulting on the TIM on pages 88 to 97 of Ofgem's RIIO-2 sector-specific methodology consultation.

Impact on consumer bills

Based on our provisional totex range, the effect on an average household electricity bill in T2 would be between a reduction of 55p and an increase of £2.62. This is compared with our forecast average for T1.

Figure 11.2 Indicative consumer bill impact



In calculating these effects on consumer bills, we are only looking at the impact of our T2 totex ranges compared to totex in the T1 period. We have not taken account of other factors than can have an impact, such as the cost of capital for the T2 period or future inflation. This is to give our stakeholders a sense of what our totex ranges for the T2 period could mean for consumer bills.

The main factors that could increase consumer bills in the T2 period are:

- Protecting the network from external threats, so consumers have a secure transmission network.
- Investing to connect new generation to the transmission network, so we support the transition to a low-carbon energy system.
- Network reinforcement to maintain its condition and prevent consumers' bills increasing in the future.

How we will continue to engage with our stakeholders

We will continue to engage on our overall package for the T2 period and how we can make sure it provides value for money.

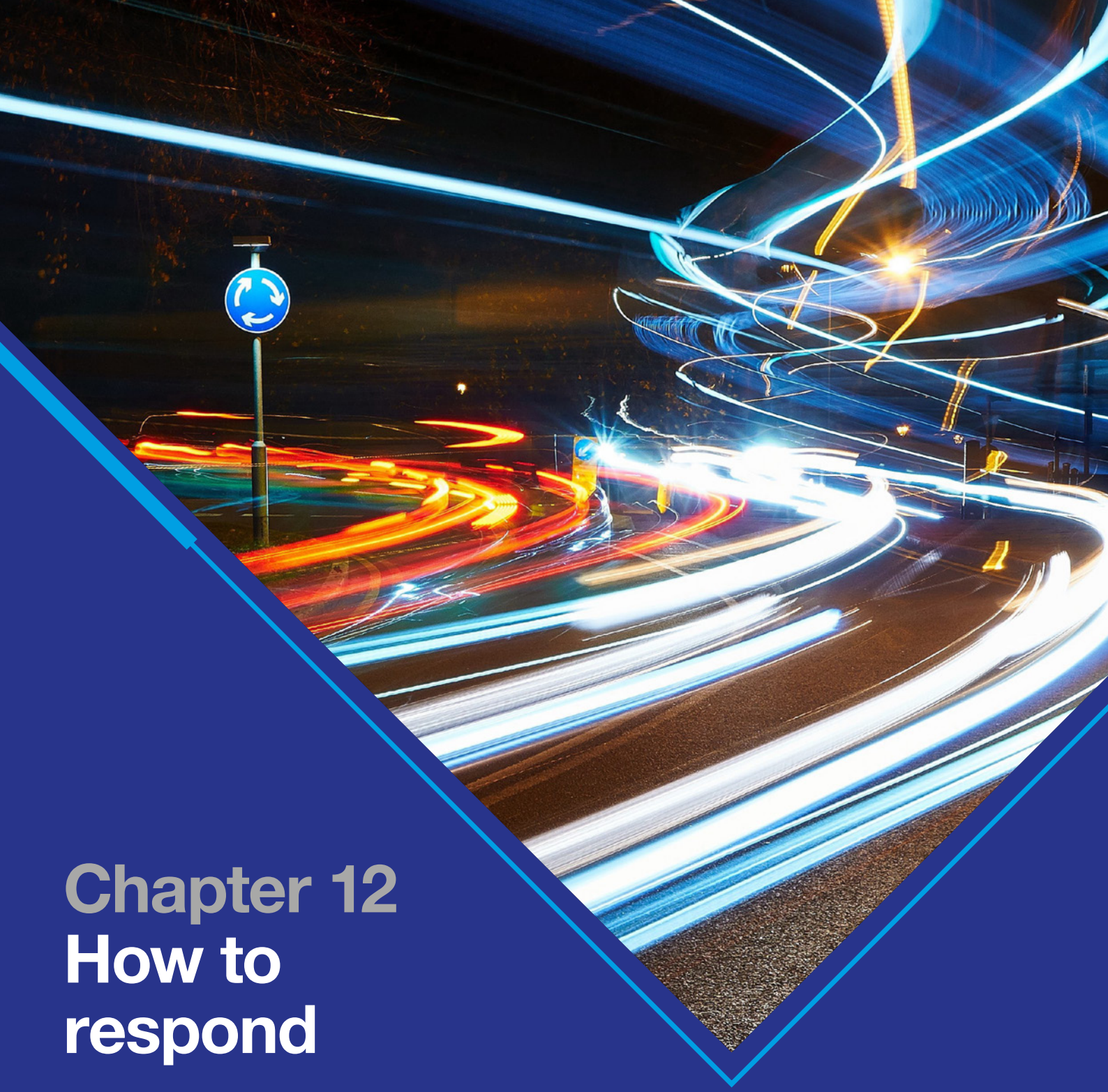
This consultation is the first opportunity for stakeholders to see how we have understood their feedback and our suggestions for addressing what matters to them. It is also the first time our stakeholders have seen our indicative totex ranges for the T2 period. We welcome your feedback on this consultation.

We are planning to survey consumers on how willing they are to pay for the service improvements we could make in the T2 period. We are also planning to ask consumers whether they find our overall draft plan acceptable when we are closer to submitting it to Ofgem's Challenge Group.

We welcome your views:

Question:
What are your views on our indicative ranges for our totex expenditure in the T2 period?

Submit your feedback online here:



Chapter 12
How to respond

Responding to this consultation

Electricity Transmission

nationalgrid

12. Responding to this consultation

The previous eight chapters played back what our stakeholders have told us so far. We also asked what you thought about our suggestions for addressing your feedback as we develop our draft T2 period business plan.

How you can respond to our consultation

This consultation is aimed at all users of our network, Government, regulatory bodies and energy industry professionals. We welcome responses from anyone interested in the future of electricity transmission and ask you to send them to gary.stokes@nationalgrid.com by 31 March 2019.

Next steps

We are still in the process of building our business plan with our stakeholders. We will analyse all our stakeholders' feedback on this consultation. We will also take account of the other ongoing engagement we're carrying out through workshops, consultations, bilateral meetings and webinars.

We will propose our draft business plan to Ofgem's Challenge Group in July 2019. At that time, we will publish a summary of the plan for our stakeholders to comment on. We will submit an updated version of our business plan to Ofgem's Challenge Group in October 2019. Again, we will publish a summary of this version to ensure we gather your feedback.

We must submit our final business plan to Ofgem in December 2019. Following our submission, Ofgem will scrutinise our business plan, and will hold public hearings on any contentious issues early in 2020. The regulator will publish its initial findings on our plan in summer 2020, with final findings following in late 2020. The next regulatory period begins in April 2021.

Find out more

You can find out more about the future of electricity transmission by visiting our website. Here, you can find further information about what we do, contribute to developing our plan, and follow our progress as we use stakeholder feedback to develop our business plan.

Table 12.1 Our questions for you

Question	Chapter
1. Have we understood your feedback and priorities correctly? (Yes / No / Don't know). If no, what would you like us to change?	General
2. Have we reflected your feedback correctly in our direction of travel? (Yes / No / Don't know). If no, what would you like us to change?	General
3. What else would you like to tell us? What have we missed? What should we change?	General
4. What impact do you think our society's dependence on electricity should have on our level of reliability in the future?	Safe and reliable
5. What are your views on our direction of travel in relation to making it easy to connect and use our network?	Connect to and use the system
6. What form of performance reporting and development of our annual business plan do you want to see in the T2 period?	Transparency
7. 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?	Future transition
8. What are your views on our direction of travel and investment drivers in relation to resilience?	Protected
9. What are your views on the level of ambition we should have in relation to the environment and communities in the T2 period?	Communities and the environment
10. What are your views on the level of ambition we should have in relation to innovation in the T2 period?	Innovation
11. What are your views on our indicative ranges for our totex expenditure in the T2 period?	Value for money

Appendix

Glossary

Electricity Transmission

nationalgrid

Appendix – Glossary

Term	Definition
BEIS	Department for Business, Energy and Industrial Strategy
CBA	Cost-benefit analysis
CNI	Critical National Infrastructure
CO_2	Carbon dioxide
DCO	Development Consent Order
DNO	Distribution Network Operator
ESO	Electricity System Operator
ETYS	Electricity Ten Year Statement
FES	Future energy scenarios
GW/GWh	Gigawatt or gigawatt hour (units of power/energy)
HVDC	High-voltage direct current
IFR	Injury frequency rate
Ofgem	Office of Gas and Electricity Markets
MW/MWh	Megawatt or megawatt hour (units of power/energy)
NAP	Network Access Policy
NCSC	National Cyber Security Centre
NGET	National Grid Electricity Transmission
NIS	Network and Information Systems
NOA	Network Options Assessment
OES	Operators of Essential Services
PSUP	Physical Security Upgrade Programme
SF_6	Sulphur hexafluoride
SMEs	Small and medium-sized enterprises
SQSS	Security and Quality of Supply Standards
STEM	Science, technology, engineering and maths
TIM	Total expenditure incentive mechanism
TNUoS	Transmission Network Use of System
TO	Transmission Owner
Totex	Total expenditure
T1 period	2013/14 to 2020/21
T2 period	2021/22 to 2025/26

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 8. 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>

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