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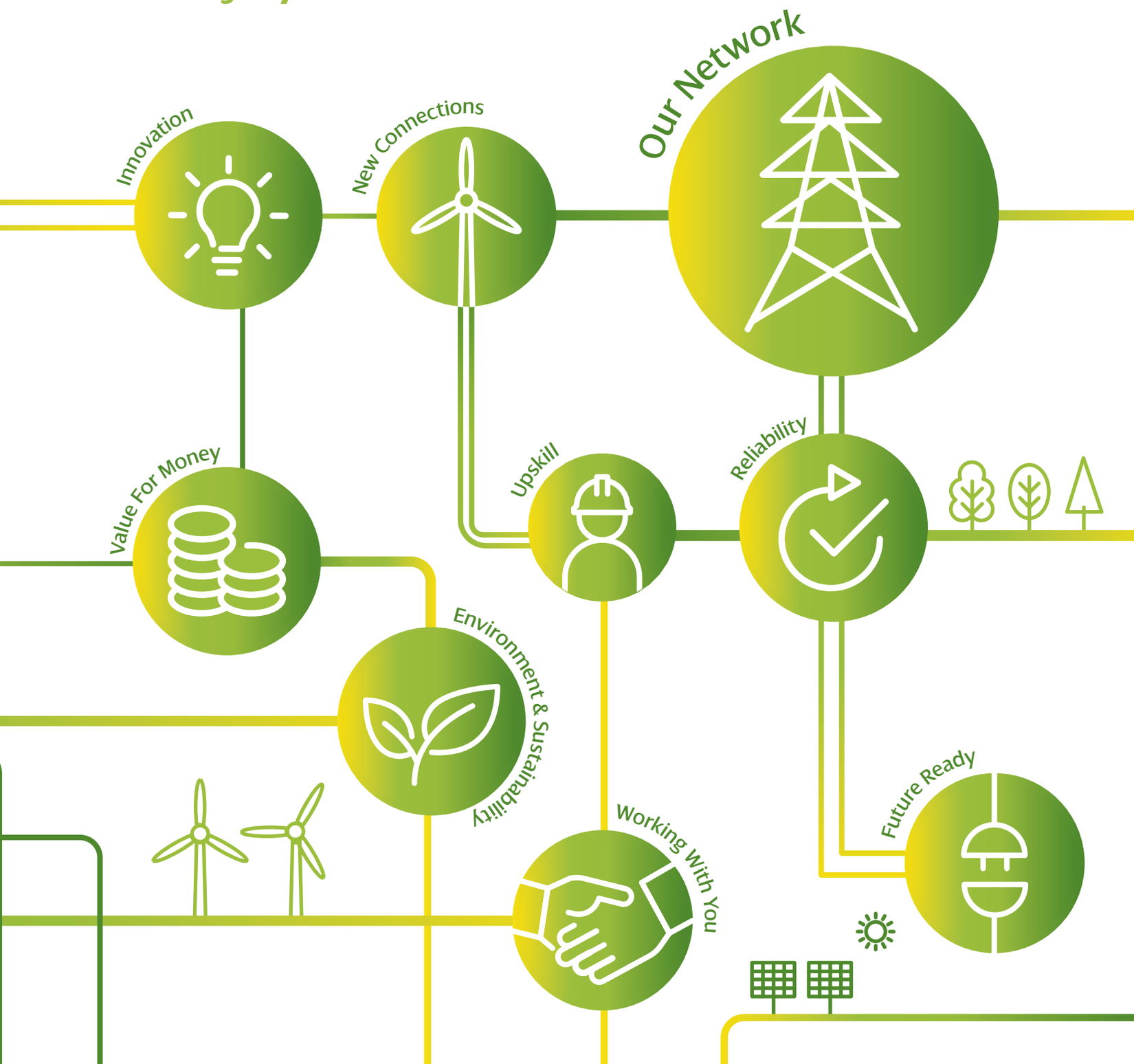
SP ENERGY NETWORKS

SP Energy Networks RIIO-T2 Business Plan

Our Draft Plan
1st July 2019



Regulatory Asset Value is forecast to be £2.5bn at the end of RIIO-T1

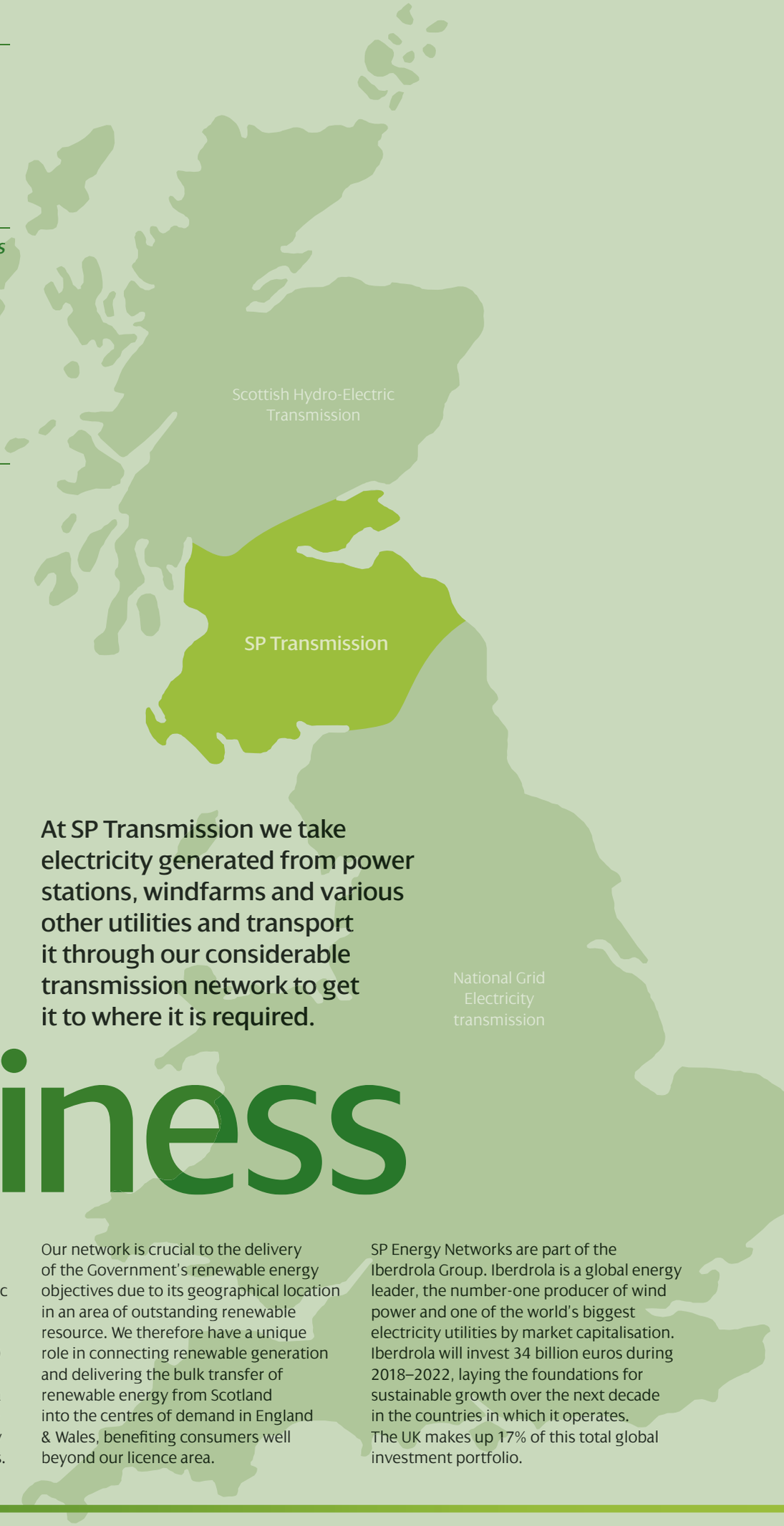
£2.5bn

Our transmission network comprises over 4,300 kilometres of circuits and 156 substations operating at 400kV, 275kV and 132kV

4,300KM

Our network area serves around 6% of all customers in Great Britain, and we have connected 28% of all GB wind generation to date

28%



At SP Transmission we take electricity generated from power stations, windfarms and various other utilities and transport it through our considerable transmission network to get it to where it is required.

Our Business

SP Energy Networks owns three regulated electricity network businesses in the UK: SP Transmission plc (SPT), SP Distribution plc (SPD) and SP Manweb plc (SPM).

SPT is the licensed Transmission Owner (TO) for the Central Belt and South of Scotland. We serve 2 million customers connected via our distribution network and our workforce of 488 internal employees are supported by around 160 major contractors and suppliers.

Our network is crucial to the delivery of the Government's renewable energy objectives due to its geographical location in an area of outstanding renewable resource. We therefore have a unique role in connecting renewable generation and delivering the bulk transfer of renewable energy from Scotland into the centres of demand in England & Wales, benefiting consumers well beyond our licence area.

SP Energy Networks are part of the Iberdrola Group. Iberdrola is a global energy leader, the number-one producer of wind power and one of the world's biggest electricity utilities by market capitalisation. Iberdrola will invest 34 billion euros during 2018–2022, laying the foundations for sustainable growth over the next decade in the countries in which it operates. The UK makes up 17% of this total global investment portfolio.

Our Purpose

We will create a better future, quicker – for our customers, our environment, and for everyone with a stake in our network. To do this, we focus on four strategic goals.

1

A sustainable, low-carbon future

We will take the lead to build a healthier, more accessible energy model – one which leaves the carbon economy behind. We will meet carbon targets, customers' low-carbon ambitions, and make a large, proactive contribution towards net zero carbon.

2

Increase efficiency through constant innovation

We will raise our performance still further through a continual cycle of innovation. With smarter solutions, we can do more with less – deploying new technology, processes and ways to share data. Innovation will help us deliver uninterrupted supply, faster connections, and meet stakeholders' ambitions.

3

Adapt our world-class, resilient network

This is a critical time for networks. Demand is changing, generation is evolving, and new threats are emerging. We will adapt our world-class network to meet these challenges, including extreme weather, cyber security and black start events – delivering ever-higher performance for customers and consumers.

4

To be at the heart of the communities we serve

We will listen and learn even more from our customers. This will allow us to continue to raise our efforts as we work to improve lives, create jobs and protect vulnerable customers. In everything we do, we aim to do more.

Better Future, Quicker

Our Plan

A message from our CEO

As we submit our draft plan our society finds itself at a pivotal moment in history with respect to energy. The way that society currently meets its energy needs is unsustainable and we are in the midst of a global climate change emergency.

To be able to mitigate the impacts of climate change and achieve a low-carbon energy system requires action now. Good progress is being made on decarbonisation of electricity but there is still much to do. Meanwhile, the mass electrification of transport and heating has barely begun. Energy networks are critical to achieving the wider net-zero emissions goal and a key component of our strategy is to lead the way with progressive plans to make it happen.

Our plan sets out four strategic goals, agreed with our stakeholders, In this context SP Transmission will:

- Take a leading role in delivering a low-carbon future that is consistent with government objectives
- Deliver increased efficiency through constant innovation for the benefit of our customers
- Maintain globally leading resilience and system operability to ensure security of supplies throughout the energy transition
- Be at the heart of the communities we serve

These objectives will guide the way we operate our business and the strategic choices we make as we shape our plans and move forward. To allow us to deliver against these 4 strategic goals, we have worked with our stakeholders to identify nine key areas that our plan and long term vision has been shaped around; further details on this can be found in our section 'Co-creating the plan with our stakeholders'.

This is consistent with the stand taken by the wider ScottishPower group: all the electricity we produce is from renewable sources. Our future will be a clean one, a sustainable one – and critically, an electric one. However, the role of SP Energy Networks is not to produce power, but to get it where it needs to be. With more renewable generation, the role played by our world-class network will become even more vital.

On top of the 4.7GW already connected to our transmission system, our plan will facilitate the connection of a further 1GW of renewable energy – the equivalent of powering 715,000 homes, and with CO_2 reductions of 1.2m tons per annum. Our transmission system is also an enabler for additional generation in the north of Scotland and within our distribution network. In total our transmission system facilitates around 11GW of Scotland's generation. This demonstrates the importance of the boundary upgrades that we are undertaking between our network and our neighbouring network operators – our plan will deliver an additional 1,500MW of boundary capacity.

Read more about our Stakeholders in Section: **Co-creating the Plan with our Stakeholders.**

Since the creation of our RIIO-T1 plan the world has changed significantly as 3.6GW of thermal generation at Cockenzie and Longannet closed. A further 1GW is likely to leave the system during the RIIO-T2 period with the anticipated closure of Hunterston. The pattern of generation we are now facing presents new challenges for our transmission system. We have witnessed large and rapid swings in the power being transferred between Scotland and England. Increasingly, we are experiencing up to a 6GW swing (i.e. more than winter peak demand in Scotland on any given day) as a result of changes in the portfolio and operation of generation within Scotland. Our transmission system must be designed and built to cope with such variability. We have invested strongly in innovation and our plans include a number of new technologies which, compared to conventional technology, provide us with more cost effective ways to ensure the network continues to operate with the greater pressures we are placing on it.

In recent years we have seen a number of other countries impacted by major interruptions to supplies and prolonged black-outs. In 2016 South Australia suffered a major black out affecting 1.7 million people due to storms impacting the network, and more recently an event in South America impacting almost 50 million customers across Argentina, Paraguay and Uruguay. The Scottish Energy Advisory Board (SEAB), which is chaired by the First Minister of Scotland, commissioned studies which estimate that the economic loss resulting from a major interruption to electricity supplies across Scotland would be over £1bn per day. We recognise the ever increasing importance of electricity to our economy and to society in general. That is why we have adopted a stance of challenging the industry on the issue of system resilience. Our plans contain proposals to minimise the likelihood of a major loss of supplies and also reduce the time to restore supplies should the need arise.

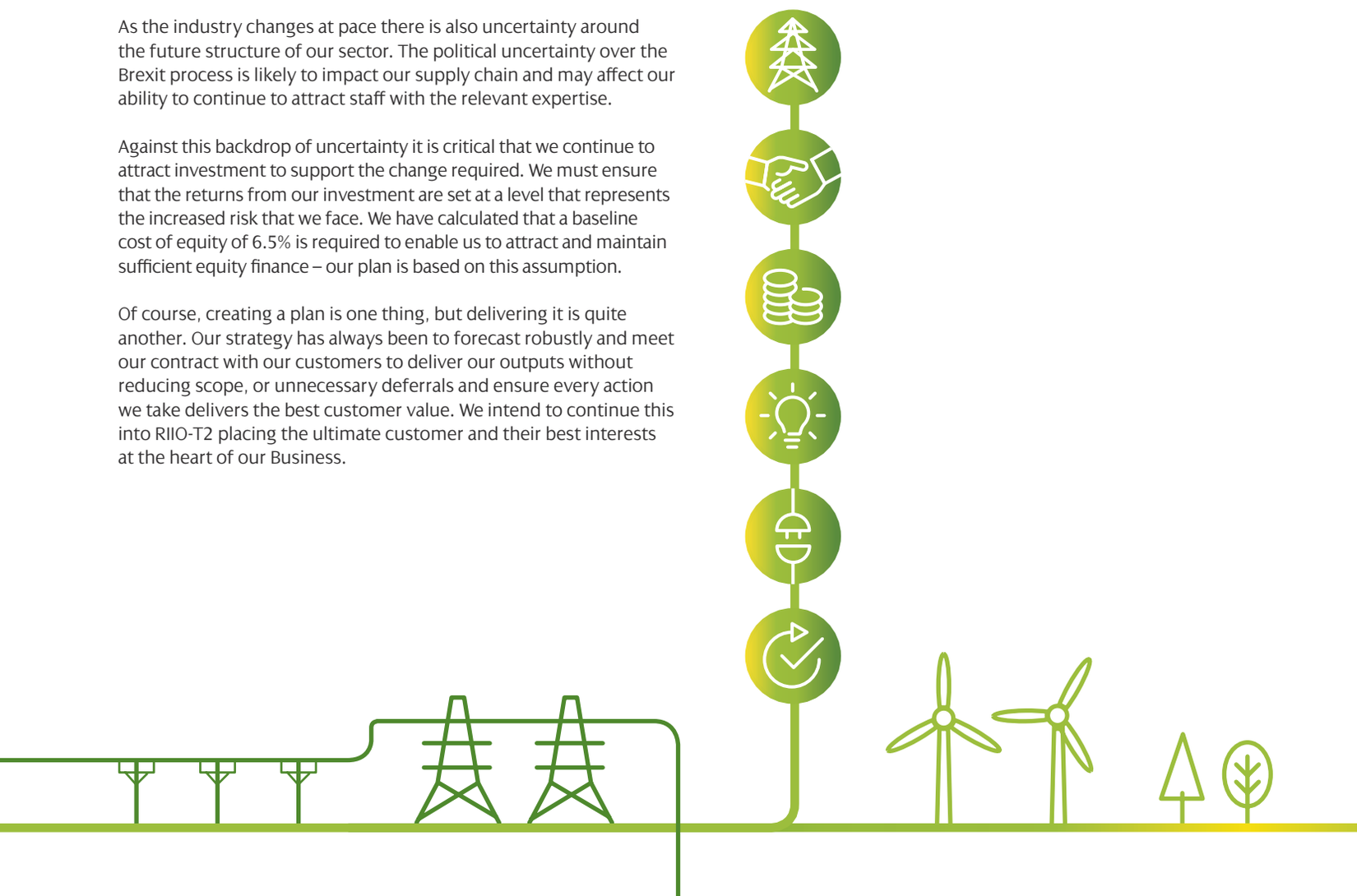
As the industry changes at pace there is also uncertainty around the future structure of our sector. The political uncertainty over the Brexit process is likely to impact our supply chain and may affect our ability to continue to attract staff with the relevant expertise.

Against this backdrop of uncertainty it is critical that we continue to attract investment to support the change required. We must ensure that the returns from our investment are set at a level that represents the increased risk that we face. We have calculated that a baseline cost of equity of 6.5% is required to enable us to attract and maintain sufficient equity finance – our plan is based on this assumption.

Of course, creating a plan is one thing, but delivering it is quite another. Our strategy has always been to forecast robustly and meet our contract with our customers to deliver our outputs without reducing scope, or unnecessary deferrals and ensure every action we take delivers the best customer value. We intend to continue this into RIIO-T2 placing the ultimate customer and their best interests at the heart of our Business.

Transmission network capacity will need to keep pace with developments on generation (e.g. large-scale offshore wind) and interconnections, and with the need to ensure that peak demand can be met reliably in all areas on still days as well as on windy days.

Committee on Climate Change:
Net Zero. The UK's Contribution to Stopping Global Warming, 2019



In RIIO-T1 we have:

Connected 1,620MW of new generation directly to our network across 16 new sites since 2013. By the end of RIIO-T1, we will have doubled the amount of wind generation on our network to the point where 94% of the generation connected today is carbon free.

Delivered an increase in Scotland-England transfer capacity from 2,900MW at the start of RIIO-T1 to 6,600MW following the completion of the world leading Western Link HVDC project delivered via a joint venture with National Grid.

Continued our substantial investment programme to renew and refurbish the older parts of our network.

We are currently forecasting a total expenditure in RIIO-T1 of £2,259m. Our headline efficiency is around 2.9% which is made up of 6.6% underlying productivity and innovation which is offset by an incremental delivery of investments (of 3.5%), made in customers' best interests despite having no allowances.

Our headline RIIO-T1 efficiencies (6.6%) are embedded in our RIIO-T2 plan. In addition, we have applied design and innovation efficiencies to reduce costs by a further 2.5%. Therefore, our RIIO-T2 plan is 8.9% more efficient than our RIIO-T1 plan. This has allowed us to keep our planned expenditure broadly in line with our average expenditure in RIIO-T1 while delivering more outputs. Overall we will maintain a very low cost to consumers – averaging £4.99 per annum.

Just as we deliver our outputs, we also put ourselves at the heart of the communities we serve. For example, we fund dedicated STEM Ambassadors to encourage thousands of young people every year to study science, technology, engineering and mathematics. It's these partnerships which help us to tackle the challenge of recruiting staff to replace our ageing workforce.

Our plan is shaped by the views and feedback from our customers communities and stakeholders. I welcome the feedback and insight that these groups can bring to our business at every level and I have endeavoured to make this a key feature of how we operate, not just for price reviews.

By 2030, the equivalent of 50% of the energy for Scotland's heat, transport and electricity is to be supplied from renewable sources.

Scottish Government Energy Strategy

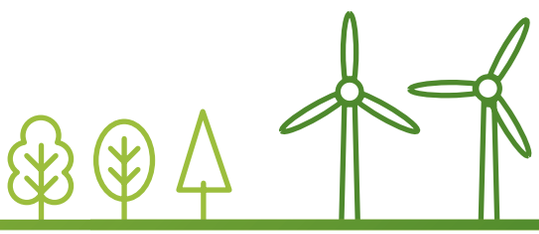
I am particularly keen to ensure that our plans reflect the aspirations of the Scottish Government. We have developed our plans to align with the Scottish Government's Energy Strategy and ensure we are playing our part in meeting the ambition for net-zero greenhouse gas emissions by 2045. Similarly, local authorities are forging ahead with ambitious plans – we are helping Glasgow to become the first net-zero city in the UK.

We have placed a comprehensive assurance framework at the heart of our business plan development process – with full support and engagement from our Board members throughout. The challenge received from both internal and external experts and from our board members has provided valuable oversight. However, this document is the result of an intense collaboration with our stakeholders, including our Transmission User Group. On behalf of the Board, I would like to personally thank everyone involved for the personal commitment and drive they have shown throughout the process.

Together we will continue to refine and develop our plan as we move from this initial draft submission to our final plan in December.

Frank Mitchell
Chief Executive Officer,
SP Energy Networks

The challenges are immense – but so too is our effort to meet them.



Contents

To help navigate our plan, we've included cross-reference boxes like this throughout. These sign-posts also show where you can find additional information: in our plan, the supporting annexes or online.

What we'll deliver – the main points

Maintaining a safe and resilient network

Maintain a network reliability of
99.99998%

Reduce our monetised asset risk by
£31,902m

Modernise 20% of our overhead line circuit
20%

Replacing or refurbishing 73 circuit-breakers
+73

Replacing or refurbishing 16 transformers and reactors
+16

Maintain a 1:1000 year flood risk at 12 of our critical sites
+12 critical sites

Reduce our injury rate for employees by
10%

Recruit 110 new trainees
+110

Delivering an environmentally sustainable network

Reduce building energy use at 47 substation sites
+47

Use new alternatives to avoid 6,500kg of additional SF_6
6.5 Tons

Removing the equivalent CO_2 reductions of 1.2Mt tons PA
1.2Mt

Facilitating 3GW of generation across Scotland, reducing CO_2 by
3.6Mt per year

Meeting the needs of consumers and network users

Facilitate the connection of 1GW of renewable generation
1GW

800MW of additional capacity for SP Distribution
800MW

1,500MVA of increased capacity to our boundaries
1,500MVA

TOUG continued to challenge how we deliver our plan
TOUG

Expenditure in summary

To deliver our outputs, we incur costs across a number of different areas to operate the transmission network.

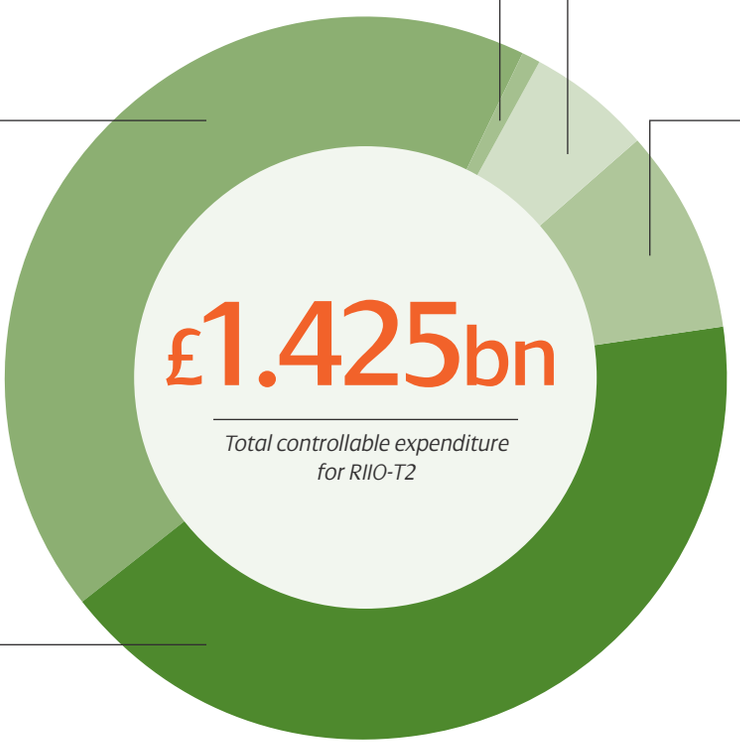
Our business plan provides full details of these costs, but we've summarised them below. For RIIO-T2, our total controllable expenditure totals £1.425bn, an average of £285m per annum, a 1% increase in our controllable expenditure compared to RIIO-T1.

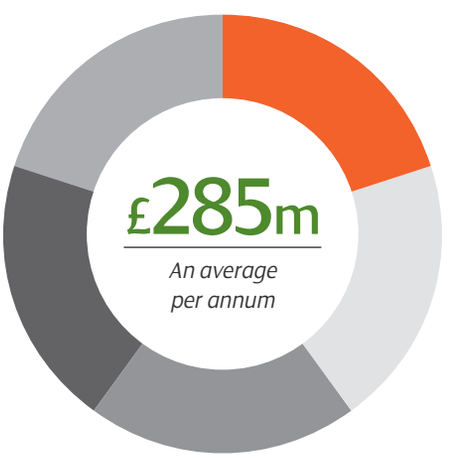
Non Operational Capex
£12.7m

Operating Costs
£81.6m

Load Related
£606.8m

Engineering and Corporate Support
£130.8m





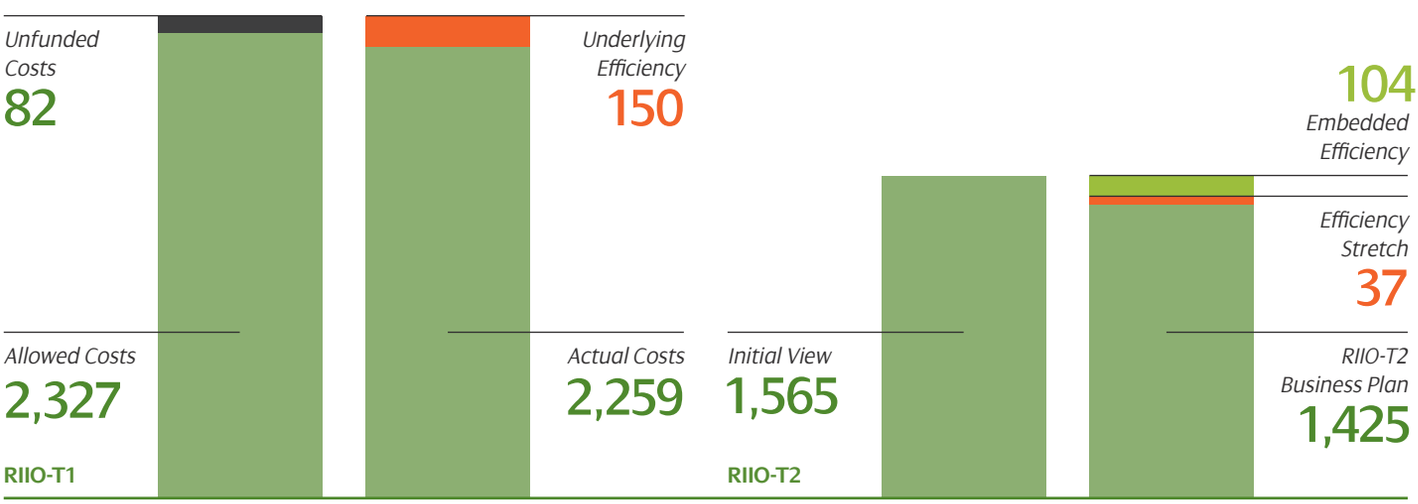
Non-load
£593.1m

RII0-T2 Expenditure Profile

		Forecast RIIO-T2 *£m (2018/19 Prices)*						Annual Average	
		2022	2023	2024	2025	2026	Total	RIIO-T2	RIIO-T1
Load Related	*Generation Connections*	40.2	48.4	22.8	3.1	0.0	114.5	22.9	69.6
	Demand Connections	28.3	32.9	30.6	20.4	9.4	121.6	24.32	10.2
	Wider Works	42.4	99.8	106.7	65.7	56.2	370.7	74.14	72.7
Non-load Related	*Lead – Circuit-breakers*	12.2	31.6	31.2	38.9	18.3	132.3	26.46	20.2
	Lead – Overhead Lines & Cables	73.4	67.9	40.7	49.3	34.0	265.2	53.04	33.5
	Lead – Transformers & Reactors	6.7	6.0	6.8	8.6	9.1	37.4	7.48	11.1
	Non-Lead	34.7	1.4	38.8	27.5	25.7	158.2	31.64	31.1
Other	*Non Operational Capex*	3.5	2.5	2.3	2.1	2.3	12.7	2.54	2.3
	Operating Costs	16.2	16.5	15.7	15.9	17.5	81.6	16.3	11.5
	Engineering and Corporate Support	26.7	26.5	26.2	25.9	25.5	130.8	26.2	23.5
Total Totex		**284.3**	**363.6**	**321.8**	**257.3**	**198.1**	**1425.0**	**285**	**285.8**
	Non Controllable Expenditure – Rates	34.2	34.9	34.7	34.5	37.0	175.3	35.1	29.4
	Non Controllable Expenditure – Pensions	2.6	2.7	2.7	2.7	2.7	13.5	2.7	2.4
Total Expenditure		**321.1**	**401.2**	**359.2**	**294.5**	**237.8**	**1613.8**	**322.8**	**317.6**

Delivering efficiency

Totex Efficiency (£m 2018/2019)



Our efficient costs were fast tracked in RIIO-T1. Throughout the period we have embedded an underlying efficiency of 6.6% which includes £82m of efficient costs that were not funded.

We believe these costs to be efficient and have confirmed this through a benchmarking exercise. An independent external review was carried out by completing a detailed bottom up exercise of our projects.

We know however that it's our responsibility to stretch our plan to extract the best value for consumers.

Through applying further innovation, value engineering and process savings we have applied a further stretch efficiency of 2.5%.

Revenues

Our evidence supports a cost of equity of 6.5% to enable us to attract and retain sufficient equity finance to provide, in our view, the necessary investment to maintain network reliability and absorb the forecast expenditure volatility as we facilitate the transition to a low-carbon economy.

In 2020/21 the SPT component of an average bill will be £4.63. In RIIO-T2 the average will be £4.99, an increase of 36p, driven by the ongoing investment that is required across RIIO-T1 and RIIO-T2.

Maintaining a safe and resilient network

Today, our business operates with industry-leading levels of health and safety for our staff, contractors and the general public. By the end of RIIO-T2, we are targeting a further reduction of 10% of an already very low total recordable injury rate for staff.

Read more about how we deliver a safe system and healthy working culture in the **Health and Safety** section.

Our network is exceptionally reliable and our goal is to continue this for the long term. Consumers will benefit from our planned investments long after the end of RIIO-T2.

Our focus for refurbishment or replacement is on those assets in the poorest condition and which pose the highest risk to reliability. Some of these assets are measured against our risk target and our detailed planning of interventions means that we maintain risk at the current level. We could have replaced more assets to get to a lower risk position but our analysis shows that it's more economical to keep them for longer. We are confident that we can manage that additional risk and ensure the costs to consumers are fair.

The other main cause of unreliability is severe weather, be it storms or ice and snow. So that we can target investment on unreliable assets and those that are vulnerable to climate effects, we need comprehensive and accurate information on the assets' condition. We inspect our 2,300km of overhead lines every year either on foot or using helicopters. We do detailed assessment of condition of every route on a 10 year cycle and we will make more use of drones for this work, giving us better information. We carry out 95,000 inspections on substation assets each year, collecting important information, adding to the smart monitoring systems sending data back to our asset management systems.

To make sure we had the most robust and up to date information to build this plan, we put an intensive assessment programme in place. During 2018 and so far in 2019, we:

- Assessed our civil assets at 143 sites
- Undertook detailed assessments of over 100 substations
- Tested conductors, climbed and inspected towers and dug down to the foundations on 19 overhead line routes

This data is processed by detailed models of our assets to quantify their health and risk. These objective measures are verified by our expert engineers, allowing us to make the right investments in the right assets at the right time.

Read more about our plans for asset stewardship in Delivering our asset replacement and upgrades programme in the **Non-load Related** section.

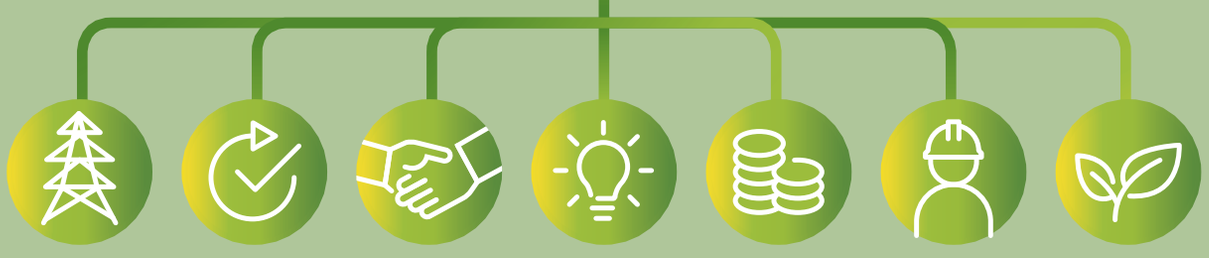
In addition, our plan is also designed to adapt to the rapidly evolving challenges of cyber and physical threats, as well as the longer-term impacts of climate change – most notably flood risk.

Read more about our plans to add further resilience to our network in **Supporting and Securing our Network** section.

A resilient network needs a workforce and supply chain to match – both are instrumental in delivering our plans and responding to issues looking forward. We have used our experience from RIIO-T1 to model the changes we anticipate to the workforce, and the specific requirements to deliver our plan.

We have a strong ethos of developing our own staff to make sure our people have the skills and experience they need. Across SPEN, we are currently recruiting 110 trainees from a diverse range of backgrounds in the form of apprentices and graduates. Our recruitment pipeline is well established. We also regularly move staff between transmission and distribution to broaden their experiences.

Read more about our workforce resilience plans in the **Delivering Our Plan** section.



Meeting the needs of consumers and network users

Our plan is inherently shaped around the views of our Stakeholders and our independent TO User Group which is chaired by The Right Honourable Charles Hendry, who previously held the position of Minister of State for the Department of Energy and Climate Change from 2010–2012.

We have listened to the feedback from stakeholders and challenges raised from the User Group and the output has been reflected in our plan to ensure that it meets the needs of consumers and network users. The evidence of this can be seen in the various sections of our plan but specifically in the 'Co-creating the plan with our stakeholders' section on Page 18.

Our plan is built on a recognised breadth of internal knowledge on stakeholder engagement strategy and delivery to help meet the needs of consumers and network users. Our ongoing business-as-usual activities have enhanced the RIIO-T2 engagement process by ensuring consistent application of strategy, channels and delivery see Annex 5: Stakeholder Engagement Activities for our stakeholder engagement process.

We know that our engagement strategy delivers for our stakeholders and customers as we were assessed by AccountAbility, the custodian of the AA1000 Stakeholder Engagement standard, who placed us in the top 16% of companies assessed globally.

We know that our existing stakeholder engagement activities are helping deliver for our customers and stakeholders as we were recognised by Ofgem as the top transmission company for the Stakeholder Engagement Incentive in 2017/18.

Overall as a network operator, we know that we are exceeding expectations for our customers and we were named as the UK's leading network operator 2019 – awarded Network of the Year at Network Awards for record high performance, exceeding expectation for our customers.

One example of the strong areas of stakeholder involvement and support has been around our future forecasts for the electrification of transport and the ongoing change to the mix of generation feeding into our network. From our engagement, we had strong support that the Scottish Governments targets for removing the need for petrol and diesel cars and vans would be achieved, so we have built our plan to facilitate the 198,000 electric vehicles that we project would be required to achieve this.

We have taken a scenario-based process to allow us to evaluate these challenges and the range of uncertainty. This approach is designed to make sure our plan provides the correct level of flexibility. The network is becoming more congested as more generators connect and changes in power flows become larger across the country. Our plan also includes upgrades to our connections with SSEN, National Grid, SP Distribution to ensure that power can be moved around the country to meet demand.

Over the course of RIIO-T2, we are planning to spend £606.8m on accommodating these evolving requirements, and expect to connect at least 1GW of new generation in RIIO-T2.

We have worked with stakeholders and our TO User Group to help shape and inform our approach and application of the scenarios when building our plan.

Read more about how we have approached consumers' and network users' needs in the **Load Related Expenditure** section of our Business Plan.

Delivering an environmentally sustainable network

In RIIO-T2, we are planning to connect 1GW of renewables; the equivalent of powering 715,000 homes and CO_2 reductions of 1.2m tons per annum.

However as well as facilitating a low-carbon energy system, we recognise that our operations also have an impact on the environment. We have embedded environment within our investment decision process, and identified multiple opportunities to minimise our impacts.

Our investments will result in over 318,000 litres of oil being removed from the system.

We have an ongoing focus on the environmental impact of our operations, as demonstrated by us making greater use of alternatives for SF_6 in our network assets, a gas that has many times the global warming potential of CO_2. We will only add equipment that uses SF_6 to our network where there is no feasible alternative. This will mean that new equipment for our 132kV system will be SF_6 free and we'll replace the worst performing assets at this voltage. We will also use only non-SF_6 alternatives for gas insulated busbars at 275kV and 400kV. If SF_6-free circuit-breakers become commercially available at these voltages, we'll adopt them as standard. This will avoid around 6,500kg of SF_6 being added to our network during RIIO-T2.

We have also developed a comprehensive environmental action plan to manage our environmental impacts over RIIO-T2 and beyond.

Read more about our plans for **Achieving Sustainable Development** section and **Annex 7** Environmental Action Plan.

Giving consumers a stronger voice

Customers and stakeholders have played a central part in shaping our plan. We systematically sought feedback throughout RIIO-T1. So far we have engaged with over 100 parties and we will continue to engage until we submit our final plan.

To achieve this, we built a feedback model with multiple layers of challenge. This included our User Group, broader stakeholder engagement through a series of targeted events, and consultation with the Ofgem Challenge Group.

These efforts have been recognised by Ofgem, who named us the top transmission company for the Stakeholder Engagement Incentive in 2017/18. On top of this, we consistently ranked in the top 16% of organisations globally for engagement since 2012.

The establishment of our User Group has provided us with a strong panel to help challenge and shape our plans, and we see an ongoing role for this forum as we deliver RIIO-T2.

Our TO User Group is chaired by The Right Honourable Charles Hendry, who was previously Minister of State for the Department of Energy and Climate Change from 2010–2012. Bringing a wealth of experience in the energy sector, Charles has recruited an independent panel of experts from a wide range of sectors to help scrutinise, challenge and co-create the Transmission Business Plans. The wide range of stakeholders represented by the members has really helped to give consumers a stronger voice.

Our RIIO-T2 Business Plan sees a step change in how we engage with domestic customers about transmission to give them a stronger voice in the planning process. For the first time we have carried out a consumer research programme at transmission level to help ensure that, as a company, we submit a plan that our end customers have helped shape, form and most importantly – accept. Their trust in us to put forward a plan that best represents their needs and desires is a critical part of this process and will demonstrate the confidence that they have in us with our final submission.

Our plans also reflect targets of the UK's devolved governments, as well as the ambitions of local authorities – both are key stakeholders. It's important to note that our engagement with these parties flows both ways, including our work to support the Scottish Government in developing its Network Vision.

Read more about our stakeholder engagement in Section: **Co-Creating the Plan with our Stakeholders.**

We conclude that we require a cost of equity of 6.5% to enable us to attract and retain sufficient equity finance.

SP Transmission propose to collect revenue of £1.8bn (Average £355m p.a) for the 5 year RIIO-T2 period in 18/19 prices (excluding incentives).

This compares to the 8 year period of RIIO-T1 of £2.5bn (Average £313m p.a).

The average annual increase in base revenue for the RIIO-T2 period is largely driven by the increase in the Regulated Asset Value (RAV) over RIIO-T1.

A track record of delivering

Although the business planning process has changed for RIIO-T2, it's worth noting that our RIIO-T1 plan was fast-tracked. This recognised that we had submitted an efficient plan that offered value for money to consumers.

However, a plan is only as good as its execution. We have delivered the outputs we committed in RIIO-T1 – and that our forecast total expenditure for RIIO-T1 is £2,259m, some 2.9% less than our allowances. This result was achieved through ongoing efficiency and innovation, sharing modest out-performance with consumers in return for the risks we have taken to achieve it.

Since the start of RIIO-T1, we have connected 1,620MW of new generation to our network across 16 new sites, doubling the amount of wind generation. By increasing the capability of the network, we have enabled the connection of 13.5GW of renewable generation all over Scotland. We have also improved the reliability of our network to be available 99.99998% of the time despite the challenges posed when improving an ageing asset base, which is vital as society's dependence on electricity continues to grow. We achieved this result through strong asset stewardship, combined with targeted reinforcement.

We are proud of our strong track record and the trust we have earned from our customers as a result. We look to build on this trust in RIIO-T2, ensuring that we submit a business plan that is free from mistakes and inaccuracies. To enable this, we have ensured that we have a comprehensive assurance framework at the heart of the business planning process.

Read more about our track record in Section: **Our Track Record.**

Read more about Assurance in Section: **Governance and Assurance.**

Finance

We conclude that we require a cost of equity of 6.5% to enable us to attract and retain sufficient equity finance to provide, in our view, the necessary investment to maintain network reliability and absorb the forecast expenditure volatility as we facilitate the transition to a low-carbon economy.

SP Transmission propose to collect revenue of £1.8bn (Average £355m p.a) for the 5 year RIIO-T2 period in 18/19 prices (excluding incentives). This compares to the 8 year period of RIIO-T1 of £2.5bn (Average £313m p.a).

Our revenues are set through regulation by Ofgem. They are set based on our proposed Investments and commitments agreed with Ofgem through the business plan process.

The average annual increase in base revenue for the RIIO-T2 period above is mainly driven by the increase in RAV related revenues. These revenues are driven by the scale of past investment. The RAV through RIIO-T1 has grown from £1.4bn to £2.5bn an increase of 72%.

We propose a financing plan for SP Transmission that is efficient and ensures financeability at a comfortable investment grade credit rating but no higher.

Read more about our finance plans in Section: **Financing Our Plan Efficiently.**

Whole system

Whole system planning is deeply ingrained in our business. We began applying this thinking in RIIO-T1, including our work to coordinate how we connect new generators quicker and more flexibly. Whole system planning also plays a central role in how we align our activities with SP Distribution and other Transmission Owners, and our work with stakeholders who are part of the wider energy system.

Our plan is designed from the outset to consider the whole system, so it aligns with all of these parties as well as the electricity system operator.

We have coordinated across SPEN to create a fully integrated distribution and transmission plan – to ensure that we can maximise the benefit for consumers through the creation of a Distribution System Operator (DSO) model. The DSO model will allow us to further enhance our coordinated approach whilst taking on new responsibilities and activities to enable the faster uptake of low-carbon technologies.

For example, in the Dunbar area the capacity of the transmission system was less than the generation looking to connect. We used Active Network Management (ANM) to connect 105megawatts (MW) of distributed generation quicker than traditional reinforcement would have allowed. Our planned roll out of the ANM scheme in Dumfries & Galloway and North Wales will facilitate up to 300MW and 200MW respectively of distributed generation in areas where reinforcement is not considered an economical option. Through our integrated distribution and transmission control room, we can provide coordinated planning across the electricity network in our area.

We have a strong record of coordinating in this way to connect new generation across the system – setting a model that is now being replicated across Great Britain.

However, it is also vital that we engage beyond the energy sector. We have coordinated our approach with local authorities for transport and heat planning, and with the Scottish Government regarding their overall Energy Strategy and Network Vision, as well as with Transport Scotland.

Read more about our Whole System Approach in Section: **Whole System Planning**.

Competition

Competition is not new to us: throughout RIIO-T1 we have fostered an increasingly competitive supply chain to drive more value. We already competitively tender almost 96% of our transmission construction activities and continue to grow our supply chain to increase this benefit further.

We are developing our Competition Plan for inclusion in the next version of our business plan. In RIIO-T2, we have already identified the sub-sea HVDC Eastern Link between Scotland and England as a potential candidate for competition, working in coordination with National Grid.

We are also reviewing other projects which may be eligible for early competition in light of Ofgem's recent request.

Read more about our Innovation Plans in Section: **Delivering Our Plan**.

Innovation

We have led the way in our investment in innovation. Our innovation has major benefits to other parties across the whole system, including reductions in the costs of operating the national system, time to connect new generation, and the network's environmental impact.

Scotland has been a pioneer in the transition to renewables and our innovations have enabled the rate of change. Project FITNESS has shown that digitalising our substations will reduce costs and future outages, allowing more renewables to generate by avoiding network congestion. Our Visor project is helping us understand the new dynamics of the system, and Phoenix will show how synchronous compensators can make up for the loss of thermal generators, giving us confidence that a carbon-free network is achievable.

The energy system transition will continue to present new challenges to the operation of the network. Our innovation focus remains to rise to the challenges, from system operability and security of supply to reducing environmental impacts and staying cyber resilient.

Our innovation is focused on providing customers with benefits. We estimate this will provide savings of £30m by the end of RIIO-T2.

We aim to deliver a balanced innovation portfolio in RIIO-T2, through core business-as-usual, incremental and transformative activities. To achieve this, we have developed a comprehensive and targeted innovation strategy. We will structure our innovation into clusters of network modernisation, system security and stability, network flexibility and digitalisation of power networks. The structured approach is part of our strategy to lead the industry in the effectiveness and transparency of our innovation activities.

Read more about our Innovation Strategy in Section: **Innovation Built-in**.

Managing uncertainty

The current energy landscape has a number of uncertainties, and we expect these to continue in RIIO-T2. For example, changes resulting from the United Kingdom leaving the European Union may increase the costs we face for equipment. We will also face increasing pressure from policies which aim to deliver a zero carbon society in Scotland by 2045.

Uncertainty means that we may see changes take place faster than we anticipate, or in areas we don't currently expect. For example, in recent years the forecasts for electric vehicle registrations are consistently being revised upwards – reflecting mass-market acceptance due in part to increased range, lower prices and higher awareness of climate change.

We fully expect our plans will have to flex, but we have included mechanisms to ensure a fair and consistent approach for both customers and investors is taken.

Read more about our Uncertainty Mechanism in Section: **Managing Uncertainty**.

During the RIIO-T1 price control period, we've consistently delivered on our commitments, and are proud of our performance.

We have propelled the shift to renewable energy, managed network risk and implemented innovative solutions in technology and process, all while sharing genuine efficiencies with consumers.

Stakeholder Satisfaction
In 2017/18 we recorded our highest ever performance for overall stakeholder satisfaction

8.3 out of 10

Outstanding network reliability
We have reduced our energy not supplied to 3.0MWh for the year 2017/18, a rating of

0.00002%

New Low Carbon Connections
By 2017/18 we have connected 1,361MW of renewable generation to our network

1,361MW

Our Track Record

Output	Metric/Target	Actual *(In year)*	Status	Year on year Trend	Comment
Stakeholder KPIs	*69 (Ofgem break even level)*	78			The score of 78 reflects the consistency in our performance on connection offers, engagement with connected customers and broad interest customers.
Stakeholder Survey	*7.4 (Ofgem break even level)*	8.3			For the second consecutive year we have recorded our highest ever performance in the annual survey, with the rating for overall satisfaction increasing to 8.3 from 7.9 in 2016/17.
Stakeholder engagement Ofgem panel score	*Ofgem – Target out of 10*	6.4			We were awarded our highest ever score and moved to 1st place overall in the incentive.
Timely connections	*100% (74 calendar days to submit final offer)*	100%			60 connection offers made in year. One offer was not issued within the licensed timescale. There was, however, no impact on the customer as their offer was received on time. Offer process reviewed and new controls implemented to ensure future compliance.
Network capacity	*1,073MVA (RIIO-T1 baseline forecast)*	860MVA			Cumulative total for the price control is now 1,793MVA. Our new forecast position for the end of RIIO-T1 is to deliver 3,482MVA.
Connections to the network	*2,503MW (RIIO-T1 baseline forecast)*	489MW			Cumulative total for the period is now 1,361MW equating to 54% of output target. Our new forecast position for the end of RIIO-T1 is to deliver 1,620MW.
Modernisation outputs	*40.5% (RIIO-T1 business plan target)*	59.0%			We continue to stay ahead of our planned outputs for RIIO-T1, keeping us on track to deliver our network renewal outputs in full.
Energy Not Supplied (ENS)	*225MWh (Based on 10 year average pre RIIO-T1)*	3.0MWh			Reduction from 13.9MWh recorded last year and represents 0.00002% of energy not supplied across the year maintaining our outstanding network reliability.
Contractor safety	*Total Recordable Injury Rate (TRIR)*	0.68			TRIR is a widely used indicator and expresses injury levels as a factor of hours worked (injuries per 100,000 hours).A continuous drive for zero harm is our aim but we have seen an increase from last year's 0.18.
Public safety	*0*	0			We can report again this year that there were zero injuries to the general public and staff resulting from our assets or operations.
Environmental discretionary reward	*50% to 69% (Targeted score in 'Proactive' range)*	69%			Achieved 'proactive' category 1% short of the 'leadership' level we have achieved in the two previous years.
Carbon Footprint – SF_6 leakage	*782kg (2018 Licence term)*	460kg			41% below 2018 target but an increase from 388kg recorded last year.
Carbon Footprint – Network Losses	*No individual target. This is included within the total BCF Target.*	183,326 tCO_2			This is a decrease on last year's emissions of 263,712 tCO_2e.
Carbon Footprint – Building losses	*6,743 tCO_2e*	455 tCO_2e			This is a decrease on last year's emissions of 487 tCO_2e.

Table above is from our Annual Report 2017/18. Link is available here:
https://www.spenergynetworks.co.uk/userfiles/file/Annual_Transmission_Report_2017_18.pdf

How we've performed in RIIO-T1

We were given fast-track status in RIIO-T1 in recognition that our plan was well-justified and efficient. That allowed us to make an early start on delivering our commitments. We have delivered on our targets and stretched ourselves to do more.

Outputs and incentives

The incentive mechanisms for RIIO-T1 are designed to drive network companies to focus on the low carbon transition, put stakeholders at the heart of our plans and deliver value for money for existing and future consumers. We have consistently delivered on these objectives as the table on the previous page (showing our performance from 2017/18) highlights.

We have delivered successfully against each of the output incentives areas throughout the RIIO-T1 period. We have made step changes in customer satisfaction and stakeholder engagement. Improvements in our customer satisfaction scores have increased year on year, now reflecting performance that was rated better than those of John Lewis and Amazon.

Our network reliability, as measured by our Energy Not Supplied (ENS) metric, consistently outperforms our annual target, achieving exceptional network reliability. This outstanding performance was achieved even with an increased number and complexity of planned outages. We need to take outages on our network to deliver our essential upgrades, new connections and asset replacement work. The unsupplied energy as a result of faults on our networks was only 3.0MWh, well below the benchmark level of 225MWh.

Totex Performance

We proposed an ambitious plan for RIIO-T1 to:

- connect large volumes of renewable generation
- reinforce the network to allow renewables from all over Scotland to find a market
- make the right investments in our existing assets to maintain the high levels of reliability our customers expect.

The level of activity we have undertaken in RIIO-T1 is significantly higher than at any time since privatisation. We've adapted to this challenge and we're on course to deliver what we said we would.

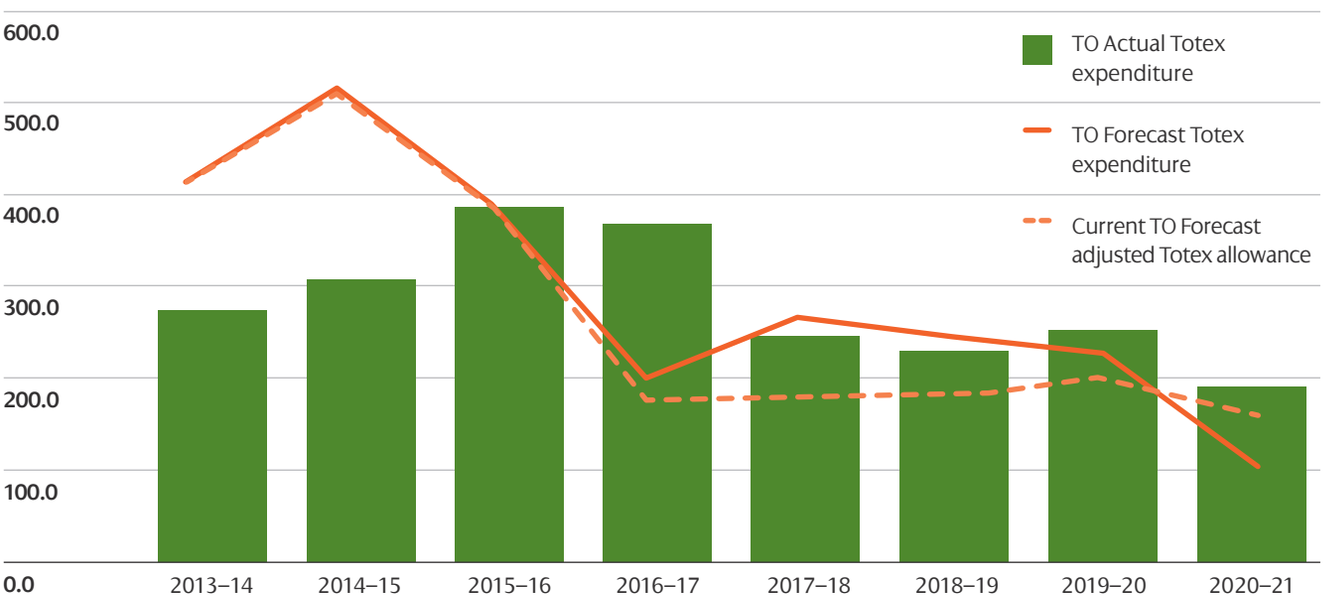
Before we've committed to an investment, we've checked that it is still the right thing to do. We've made only minor changes to our plan as a result thanks to our robust planning and accurate forecasts.

Overall, for RIIO-T1 the forecast for Totex is an outperformance of 2.9%. Innovation and efficiencies in some categories – wider works and overhead line modernisation for example – have been offset by costs above allowance in others such as switchgear modernisation and generation connections.

The figure below illustrates the actual and forecast expenditure against baseline (original) allowances. It also highlights allowance adjustment resulting from incentive mechanisms, primarily the generation connections volume driver.

The annual profile of expenditure in 2014 and 2015 was impacted by the start of the Western Link project being delayed by complex land purchase requirements and cable manufacturing issues. Also in these years, planning issues delayed the South West Scotland projects. Expenditure in the final years of RIIO-T1 includes works which will deliver output in RIIO-T2. Despite the disruption caused by the volatility of the connections background and unexpected asset failures, SPT have delivered all of the wider works projects (Western Link is still to be handed over by the contracting consortium) and is on target to deliver all of the planned modernisation outputs.

Actual and forecast expenditure



Capital Expenditure – How we've performed

We have delivered efficiencies in some areas but have faced challenges in others.

Generation connections

Our best forecast for the capacity of generation connection in RIIO-T1 was 2,503MW. Factors outside our control, including the removal of subsidies for onshore wind generation means that the actual capacity of new connections is forecast to be 1,620MW by the end of RIIO-T1. The investment category that this relates to is known as sole-use infrastructure. There is an uncertainty mechanism that adjusts our allowance if the actual capacity of generation connected is above or below the 2,503MW target. As we expect to deliver less than the target, our allowances will be reduced from the baseline values.

Shared-use infrastructure provides capacity for multiple generators or for a region of the country. We have created more capacity than forecast, partly to accommodate more generation connecting to the distribution system than expected. We have used more efficient solutions than were specified in our licence but the outcome of the RIIO-T1 mid-period review parallel work resulted in funding not being allowed for these. As a result, we will spend more than allowance in this area.

Wider works

To allow the connection of renewable generation throughout Scotland, we have also delivered an increase in the Scotland-England transfer capacity from 2,800MW to 6,600MW and added 1,440MW to the north to central Scotland boundary.

We have delivered further efficiencies in our wider works programmes. A world-first innovation in network and equipment design led to savings in our series compensation project. Consumers will benefit from the £46m reduction in costs.

We were the first company in GB to adapt our specifications for gas insulated substations to take advantage of more compact and flexible solutions. We also leverage the benefits of being part of the Iberdrola Group to procure at lower cost. These two elements came together to produce efficiencies of £25m.

Procurement efficiencies also helped to deliver savings of around £10m in our shunt compensation projects. This was only possible thanks to our highly skilled in-house engineering team. By assuming design responsibility that normally rests with the supplier, we created a better value solution.

Non-load Programme

Our programme is designed to manage the highest risk assets on the network and includes key projects in overhead lines, transformers and substations. We are on track to deliver all of our outputs in this area. We have made only minor changes to our plans. These are mainly as a result of system access restrictions but we have also reprioritised a small number of projects to address emerging condition issues. All of these substitutions have been equivalent in scope to the works that we have deferred.

Fast tracking allowed us to make the most of over-capacity in the supply chain for our overhead line works. We advanced some projects and delivered the outputs for lower costs than we had forecast in our business plan. Over time, this opportunity has reduced and more recent contracts have been in line with our original forecasts. Overall, we expect to share £70m of savings with consumers.

We have faced challenges in other areas. We expect to spend approximately £27m more than our allowances in modernising transformers and circuit-breakers. Working in brownfield substations can throw up unexpected local issues and we have experienced some difficulties with our suppliers. Our delivery programmes have also been affected by potential risks where assets owned by other network operators have failed destructively. We have had to assess our own population in light of this new information and put temporary access restrictions in place until we resolved our concerns.

Operational expenditure

Operational costs have increased over RIIO-T1 periods for a number for reasons and, overall, we forecast to spend more than allowance.

Large parts of the transmission infrastructure have been nearing the end of their design lives. Although there are programmes of work designed to conduct replacements of these assets when deemed necessary, SPT strive to ensure that assets are replaced in a timely manner according to condition and risk in order to get the best value for money for the end consumer. As a result of this however, deteriorating assets require more regular and extensive maintenance than when new to ensure that they continue to operate safely and reliably.

Totex Plans for RIIO-T2: what we've learned

Our plans for RIIO-T2 are built on the high levels of service and genuine efficiency gains delivered in RIIO-T1. All of the efficiencies we have delivered are now reflected in our baseline expenditure and we've set ourselves a stretching target to improve further.

We've proposed new uncertainty mechanisms in generation connections, taking the best practice from across the sector. The mechanisms will be designed to reflect the costs incurred with high probability. This will ensure that we recover the funding we need and protect consumers from the risk of underspends.

In areas where we've spent more than our allowances in RIIO-T1, we've improved our planning. This doesn't mean that our costs have increased but we're now better informed, for example, to make earlier design decisions.

In all activities, we continue to find better and more efficient ways to deliver what we say we will. We will focus on:

- working safely
- improving value for money
- maintaining high levels of service
- minimising our impact on the environment.

Returns and Profits

We have earned £25.8m (2009/10 prices) to date from incentives with a further £7.7m forecast resulting in total forecast incentive reward of £33.4m (2009/10 prices) in RIIO-T1.

Return on Regulatory Equity (RoRE)

Our information quality incentive (IQI) reward relates to being fast tracked during the RIIO-T1 price control review. Our additional income from Outputs, Incentives and Innovation results from performance under the Network Reliability Incentive, Stakeholder Satisfaction Output, Environmental Discretionary Reward and Performance from offers of timely connection.

There is around a 1% difference between the notional and actual gearing basis for SPT as summarised below.

RoRE – SPT operational performance
RIIO-T1

	Notional gearing	Actual gearing
Allowed Equity Return	7.0%	7.7%
Topex Out performance	0.6%	0.6%
IQI Reward	1.0%	1,2%
Outputs, Incentives and Innovation	0.4%	0.5%
Penalties and fines	0.0%	0.0%
RoRe – operational performance	**9.1%**	**10.0%**

The table has been extracted from the SPT Regulatory Financial Performance Report (RFPR) tables submitted to Ofgem on 9th November 2018.

Dividend History

Recent SPT dividends have included special dividends to ensure the company's gearing remains aligned with Ofgem's notional level of 55% in RIIO-T1 and include reimbursements to parent companies for pension deficit payments made on the company's behalf.

SPT dividend history
As at 31 March 2018

	Company	Share Capital	Divided Payout
2017/18	SPT	385	76
2016/17	SPT	385	72
2015/16	SPT	200	10
2014/15	SPT	200	229
2013/14	SPT	200	169
2012/13	SPT	200	43
2011/12	SPT	200	30
2010/11	SPT	200	35
2009/10	SPT	200	22
2008/9	SPT	200	35
2007/8	SPT	9	30

Source: SPT's Annual Regulatory Account to 31 March 2018.

Find out more information in the **Shareholder renumeration** section on Page 192.

Pay and reward

Staff participate in SPEN's performance related pay and Annual Incentive Plan. Entitlement to a bonus is dependent upon achievement of objectives set at a business and personal level.

Business objectives are set annually based on what requires to be delivered by the business and progress is tracked against a scorecard. The objectives set include targets relating to service standards, which include customer minutes lost and customers interrupted. Delivery of customer service is underpinned significantly by investment delivery in the form of outputs which are also directly incentivised.

The company reports annually to Ofgem in a statement on the linkages between Directors' Pay and Standards of Performance. This statement is made in accordance with Section 42C of the Electricity Act 1989.

Today the annual average electricity bill for a domestic customer in the UK is:

£577

The percentage of this attributed to transmission network costs is only:

6%

Our part of consumers' bills

Today the average electricity bill for a domestic customer in the UK is £577 per year. Of this only 6% is attributable to transmission network costs. This can be compared to the average bill immediately prior to the start of RIIO-T1 at £531 with 4% attributable to transmission. The increased proportion reflects the necessary investment to transition the network towards a low-carbon economy; modernising assets that are reaching end of life and operating and maintaining the network to ensure existing and future consumers continue to benefit from very high levels of reliability and performance. In RIIO-T1 we are delivering economic and cost efficient solutions for our customers against a changing energy landscape. We are doing what we promised in our business plan where this is the right thing to do or adjusting it to meet our customers' needs to ensure that investment remains justified.

RIIO-T1 has been characterised by significant investment in networks to facilitate and support de-carbonisation of generation. Over half of SPT's total expenditure is on a range of innovative reinforcement schemes that is already delivering increased energy transfer capability between Scotland and the rest of the UK whilst improving utilisation of existing assets. In RIIO-T1 this has seen the commissioning of the largest HVDC link in the UK through a joint venture with NGET (c£1.1bn); deployment of Series Compensation and/or new conductor systems (e.g. High Temperature Low Sag (HTLS) on existing overhead lines to increase capacity whilst mitigating the need to construct new ones as well as efficient delivery of more standard solutions (e.g. transformer uprating).

These have been further supported by non-build solutions e.g. load management schemes that have increased operational flexibility and permitted earlier connections for generation customers. We are currently working with the Electricity System Operator (ESO) to develop an Active Network Management System in Dumfries and Galloway combining technology and commercial arrangements with generators to maximise their access to the network under different operating conditions.

Finally, just over an eighth of expenditure is directed towards operation, inspection, maintenance and repair of the network. Whilst this is a small part of the total it is crucial to long-term performance. It ensures the smooth running of the network as it transports electrical energy from generators to consumers' homes.

Source of information: Ofgem website.

UK's leading network operator 2019 *– awarded Network of the Year at Network Awards for record high performance, exceeding expectation for our customers.*

1st place in Transmission for the Stakeholder Engagement Incentive 2017/18 *– recognising that we do the best for our customers and the communities in which we serve.*

Co-creating the plan with our stakeholders

We have listened to our customers and stakeholders to be able to build a plan around their feedback. With a tailored and locally focused approach, we prioritise their wants and needs in a consistent manner across our business. Our goal? To deliver safe, reliable services, sustainable value and a better future, quicker.

Using a suite of different approaches including consultations, webinars, focus groups, social media channels, round table meetings and conferences we have taken a number of different approaches to engage.

We recognise that time is valuable and have where possible coordinated our efforts with others. Where of value, we have collaborated with other Transmission Owners to drive best practice and reduce the time of our stakeholders to provide feedback.

We continually seek out examples of best practice on engagement demonstrated in other sectors. The recent publications of Business Plans from water companies as part of PR19 price control has provided us with useful insights into other examples of engagement.

We are confident that our strategy is robust. AccountAbility, the custodian of the AA1000 Stakeholder Engagement standard, places us in the top 16% of companies assessed globally. This highlights SP Energy Networks' commitment to our stakeholders and customers, and to delivering true value. Our strategy is the result of our journey – a combination of industry best practice, stakeholder and customer feedback, and years of our own experience in delivering meaningful stakeholder engagement.

This year, with the help of leading industry experts AccountAbility and Sia Partners, we refined and launched our new strategy which seeks to further enhance and take our engagement approach to the next level.

Our approach to engagement for RIIO-T2 was based on a robust and comprehensive engagement strategy. It also incorporates Ofgem's RIIO-T2 Enhanced Stakeholder Engagement guidance, which formalises an enhanced level of engagement and external challenge.

Throughout the RIIO-T2 planning period and through our constant efforts to create channels for the customer voice, we have continued to listen to feedback from our stakeholders and customers. This feedback has allowed us to tailor our approach as we progressed, and ensure that we always clearly explained the different areas of our business plan, and did so in a way that made sense to our varying audiences.

In this section we'll explain our stakeholder engagement activities and how these have informed our RIIO-T2 plan.

Our Stakeholder Engagement Strategy

During 2018/2019 we developed a new and improved Stakeholder Engagement Strategy. It is important that we continue to challenge ourselves and build on what we know, maintaining a robust strategy that delivers a service that stakeholders and customers want and need.

To drive high quality and consistent engagement activities across our business, we created a strategy around the 9 Key Steps, shown opposite. We explain how this methodology works in practice and was the foundation for our RIIO-T2 engagement in our stakeholder engagement strategy.

TO User Group

In preparation for RIIO-T2, we recruited an independent Chair for our User Group. The Right Honourable Charles Hendry was selected based on his extensive knowledge and experience of the energy industry from his former role as Minister of State for the Department of Energy and Climate Change from 2010–2012 and Conservative Member of Parliament for Wealden from 2001–2015. He was previously the Conservative Party's spokesman on energy issues, from 2005–2010, holding the portfolio for longer than any other spokesman. The wider User Group was selected by our Chair and comprises:

Rt Hon Charles Hendry
Independent Chair,
SPT User Group

Dan Thomas
Grid and Operations Manager, *Banks Renewables*

Andrew Robertson
Head of Operational Technology, *SSEN*

Angela Love
Love Energy Consulting

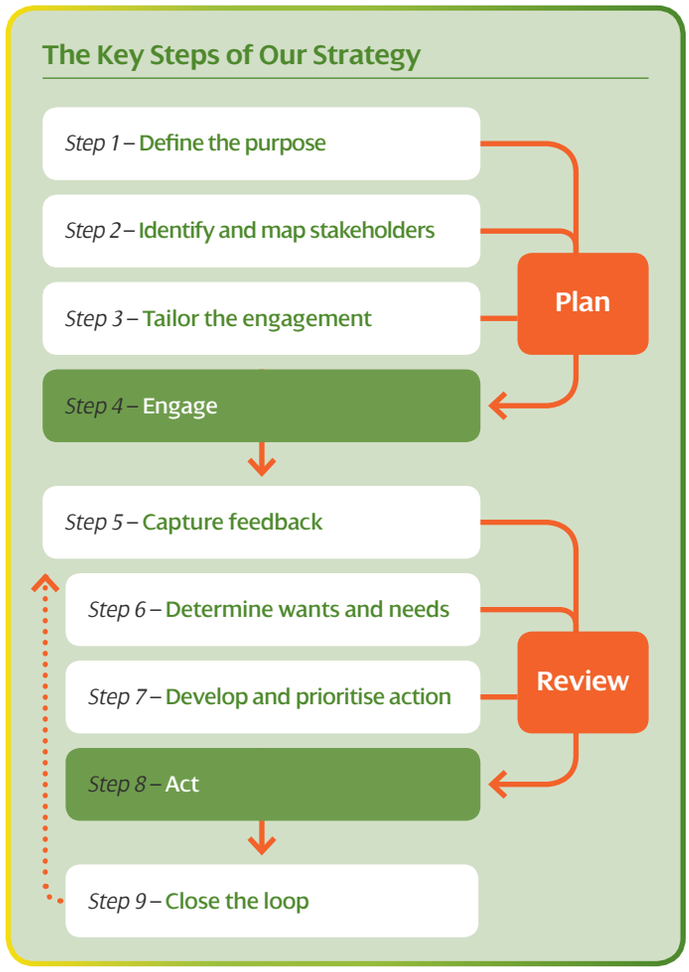
David Ritchie
Associate Director for Environment and Planning,
Environment and Ground Engineering

Julian Leslie
Head of National Control, *Electricity System Operator*

Martin Kearns
Chief Electrical Engineer-Nuclear Generation, *EDF Energy*

Prof Karen Turner
Director of the Centre for Energy Policy, *University of Strathclyde*

Rob Cormie
Director, *Edinburgh Advisers*



Purpose of the RIIO-T2 User Group

The purpose of the independent RIIO-T2 User Group was to provide formal challenge and input to our RIIO-T2 Business Plan. The group represents the wide-ranging needs and requirements of our multiple network users, customers and stakeholders. We have provided them with an 'access-all-areas' pass to our Transmission business. Every month the members of the User Group met to review various sections of our RIIO-T2 Business Plan face-to-face with the relevant individuals and teams who are responsible for producing them. The group has also toured some of our major sites including our Control Room to improve their understanding of our business.

The User Group has brought in external representatives and advisors from organisations, such as Citizens Advice Scotland, Citizens Advice England and Wales and the Scottish Government, to inform their feedback and challenges. Throughout the collaborative process, any challenges made by the User Group were recorded on a Challenge Log. This formal record was used to inform our Business Plan throughout our planning process and will be made publicly available – along with our associated actions and feedback – and submitted to Ofgem in December 2019 by the User Group along with their report.

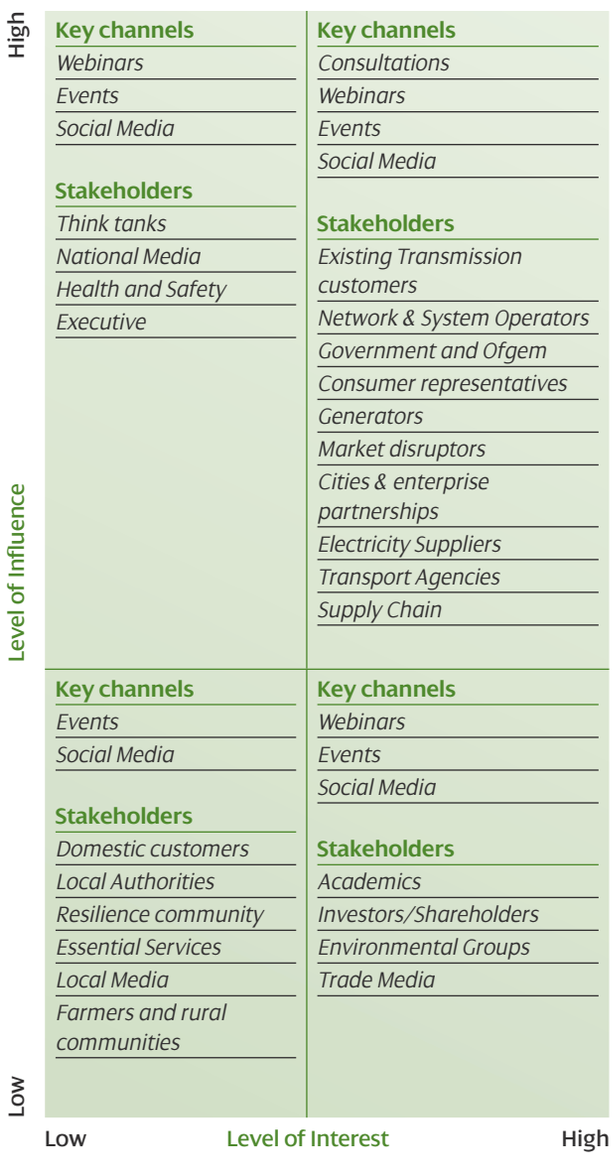
We intend to continue our User Group throughout RIIO-T2 with a focus on how we are implementing and delivering our plan.

How we have engaged

Following a robust and extensive engagement planning phase, we carried out an inclusive, tailored and cost effective engagement strategy.

We used various channels to engage with both informed and less informed stakeholders. This helped make sure their time was being used as efficiently as possible, and reduced the risk of stakeholder fatigue.

Stakeholder Mapping for RIIO-T2



Public Consultations

To provide a more detailed overview and allow stakeholders time to consider our proposals, we have held four public consultations to gather specific feedback on certain aspects of our plan.

Central and Southern Scotland Future Energy Scenarios
We asked stakeholders to help us understand the future evolution of energy supply and demand on our network through RIIO-T2 and beyond. This consultation helped shape our future energy scenarios that underpins our load related plan. We sought views to validate and further develop these for the specific challenges in our network area.

Managing Asset and Network Risk
Views were invited from stakeholders on our approach to managing asset and network risk. This document provided an overview of the processes and frameworks we currently apply to quantify and understand risk, as well as our current thinking on how we address it. This helped to shape our non-load related plans.

Innovation Strategy
Our proposed strategy, priorities and approach to innovation was shared with stakeholders. This consultation was accompanied by a webinar to allow for a Q&A session to accompany it.

Making Incentives Work for the Consumer
We sought feedback on the incentives we are proposing and gathered views on any other incentives that we should be incorporating in our plan.

Summary

Our consultations were issued to more than 2,200 stakeholders. We engaged with a number of them bilaterally to get their feedback directly as well as receiving written responses.

Webinars

Recognising that our stakeholder's time is precious, we held two discursive webinars to help explain key areas of our business plan without taking up too much of their time. This allowed not only for background information to be shared, but also a live conversation on their views.

RIIO-T2 Innovation Strategy
Feedback has told us that stakeholder's find innovation a challenging area to understand. Our webinar guided them through our current and future innovation activities. It explained how we are preparing for and making use of innovation within our RIIO-T2 Plan and enabling the energy system of the future.

Future Electricity Scenarios webinar
We provided an overview of our scenarios and planning assumptions. The session also allowed attendees to ask us and our consultants, Baringa and Element Energy, questions ahead of submitting a response to the consultation questions.

Summary

We had 116 participants in the webinars, and these have been made available online for anyone who missed the events. A number of questions were raised and addressed through the events and have led to further bilateral discussions with interested parties.

Events

We have held various events covering different elements of our RIIO-T2 plan. These have encompassed a broad range of stakeholders, and content has been tailored for each event to align with the audience and included Q&A sessions for feedback.

Managing Asset and Network Risk workshop

This focused event covered our approach to network risk management in March 2019. To aid discussions, the 'Safe and Reliable Network' consultation document was sent ahead of the first meeting. Given the specialist nature of the topic, specific people from our stakeholder community were invited based on their interest and awareness of the subject.

Energy Scenarios Workshop

We held an event hosted by Baringa Partners to inform our Future Energy Scenarios. Live polls and discussions were held on the day to capture the views. A post workshop survey was also issued to participants they required any further information and to gain learnings from the event.

Centre for Energy Policy Debate

We hosted an 'Energy Conversation' event entitled 'Keeping the lights on: what is it worth?'. Energy Conversations is an established monthly event run by the University of Strathclyde's Centre for Energy Policy. We used this existing forum to engage with new and existing stakeholders, and provide them with the opportunity to understand and question the key role SP Energy Networks play in keeping the lights on, and the RIIO-T2 price control mechanism overall.

Public Focus Group

Explain Market Research were commissioned to conduct independent, qualitative research to understand awareness of our business and how we can best communicate to consumers about how we are funded. We presented a simplified overview of the price review and funding arrangements followed by round table discussions. Attendees were all living in our licence area. This involved individuals from a range of different socio-economic groupings. In addition, one table at the workshop was specifically recruited to represent 'future consumers' aged between 18 and 24 and not responsible for their household energy bills.

Customer Connections Summit

This annual event held every December updates customers and other stakeholders who connect to our network and was partly dedicated to our plans for RIIO-T2. This event allowed for a discussion with customers on the incentives and enabling works we should be undertaking for future connections, as well as getting views on how the generation landscape will evolve.

ALL ENERGY 2019 – SP Energy Networks Seminar Session

A seminar session was held at All-Energy 2019 to take advantage of the high footfall of stakeholders with a general interest in energy. This session was to provide an overview of the role of network companies, particularly in a decentralising system. It detailed how we meet the needs of current and future transmission customers and end-users, as well as facilitate the low-carbon transition. It was designed to encourage discussion and collaboration with key energy stakeholders including the Scottish Government, SSE and Community Energy Scotland. The session involved Karen Turner and Julian Leslie from our User Group and a number of our own staff.

A PechaKucha view of SP Energy Networks' RIIO-T2

A lunchtime discussion was held at All-Energy in Glasgow, to give stakeholders the opportunity to #ChallengeOurPlan as we prepare our network for the low-carbon future.

PechaKucha is an innovative storytelling presentation format used in PowerPoint. The presenter is given limited time to present each slide, and must explain their topic against a visual background. To make it as easy as possible for stakeholders to understand the different aspects of RIIO-T2 and provide informed feedback, we challenged the transmissions business leads at SP Energy Networks to adopt this format when discussing the key aspects of their plans.

Other events

We have used other forums where we have presented to provide updates on our thinking and gather the views of the attendees. These have included the ESO Customer seminar in October 2018 and March 2019, a workshop on the emerging issues of harmonics on the network and the annual Grid and Asset Management Conference 2019. Specific events with stakeholders in South West Scotland and Dumfries and Galloway have been held as part of our ongoing work in these areas due to the huge amount of renewables connecting and our activities to support this which has informed our plans for these areas in RIIO-T2.

Summary

Across these seven events we have organised, we have had over 400 participants. They have enabled a healthy debate with a broad range of stakeholders to inform and validate our thoughts.

Social Media

Our stakeholders have told us they expect to find accurate, up-to-date information on our customer-facing website. We launched a new RIIO-T2 section of the website and have updated this daily with all content from the TO User Group to share progress with our plan, current events and publications.

We have shared the views of our User Group throughout the process and their reflections on our plans as they develop. This has included a Q&A with our Chair and videos of other group members sharing their thoughts.

We have also designed all our communications on social media with the #ChallengeOurPlan. Enabling quick access to all our published social media activity, the hashtag is the main feature on our website.

Digital channels such as Facebook, LinkedIn and the SP Energy Networks website have been valuable sources of feedback for the RIIO-T2 Project.

Summary

Over the last six months, our RIIO-T2 website has received more than 5000 unique viewings, and out consultation documents downloaded more than 500 times.

Embedding our stakeholders views

Our stakeholders and customers have been very clear in highlighting that the energy system is changing. We are changing with it.

From our engagement, we have identified nine key areas that our plan and longer-term-vision has been shaped around. We identified these areas from our engagement with stakeholders, feedback over the course of RIIO-T1, and identifying likely changes that will come in the future.

We have identified the commitments we are making over the next decade, and our longer term vision for how we will continue to adapt to address the views that have come across.

Resilient and reliable

Our network consists of assets of varying age and condition – some date from the very earliest days of the grid. As assets approach and pass their design lives, their condition can deteriorate. This puts the reliability of the network at risk. These assets need to be managed to make sure we can maintain the standards expected by our customers.

What our stakeholders told us

Our stakeholders do not want to compromise on the reliability of the network. As the dependence on electricity increases for transportation and heat, the reliability of the network will become all the more important.

To do this, we need to make sure we manage our assets as effectively as possible. Stakeholders agree that we have adequately identified the issues that affect our assets, and the types of interventions we should consider in our plan. They agree we should do the right thing to maintain this reliability in the most cost effective way – this includes how we target our investment, by using new methods to quantify and assess risk. Our stakeholders expect us to have a detailed understanding of our individual assets, but have also highlighted the need to consider the wider system.

Additionally, the Scottish Government has set an expectation that *'Scotland should have the capacity, connections, flexibility and resilience necessary to maintain secure and reliable supplies of energy to all homes and businesses as our energy transition takes place'*.

We support the Scottish Energy Advisory Board, which is chaired by the First Minister of Scotland. The board has commissioned studies which quantify the economic loss resulting from a major interruption to electricity supplies across Scotland to be over £1bn per day.

We have engaged with a number of specialist bodies, including the UK government, regarding security threats which face the network. We have received detailed guidance on the standards that we need to achieve in our role of providing critical national infrastructure.

Our commitments for RIIO-T2

We will continue to employ forward-thinking asset stewardship. Our targeted programme of replacement and refurbishment will focus on customer benefits and reduce condition-related risk to our network.

New threats are also emerging which need to be addressed. As the network becomes smarter, the increasing use of communications for the operation of the network and digitalisation of systems has created a more efficient and flexible network. But this also exposes it to new threats, such as cyber-attacks. Other countries have experienced widespread disruption to their networks because of such attacks. We will take proactive measures to make sure the network does not become susceptible to such threats, including working closely with the Centre for the Protection of National Infrastructure and the National Cyber Security Centre.

Our preparedness for resilience goes further. Our plans are designed to minimise the likelihood of such an event occurring, and also address the expectation that supplies would be restored promptly should the need arise. We have a range of projects to ensure that our network can meet the standards expected in the unlikely event of a major interruption to supplies.

Our vision beyond 2026

This price control lasts for five years, but our customers expect that our planned investments will create a reliable network for years to come. Many assets we construct during RIIO-T2 will be operating in 2060 and beyond. We always aim to strike a balance between the costs for current and future consumers, taking a long-term view to make sure we have a network that is fit for purpose.

We will apply world-class asset management techniques to ensure the reliability of our network. We will also continue to focus our attention on extracting the maximum value from our assets, making sound asset management decision to control the risk of failures.

Read the full details of our plan
>> Non-load Related Expenditure
>> Supporting and Securing our Network

Environment

We must enable the UK economy's low-carbon transformation and play our part in mitigating climate change. While we do this, we must minimise the environmental impacts of our network and future investment plans. This is accompanied by increasingly stringent regulatory and legislative changes in response to local and global environmental challenges.

What stakeholders told us

The UK Government published a 25 year plan to improve the environment which sets out the actions required to leave the environment in a better state than it was found. This has been consistent with the views from other stakeholders; they expect us to play a greater role in improving the environment and facilitating a low-carbon future. Our User Group has been very clear; we need to demonstrate how the impact of climate change mitigation is driving fundamental changes and we need to respond swiftly and decisively.

Our commitments for RIIO-T2

We will develop science-based targets to monitor our greenhouse gas emissions. We will increase resource efficiency by reducing our consumption of materials and ensuring resources are kept in use for longer. Not only will we do this ourselves, but we will expect the same from our supply chain.

To reduce the carbon footprint of our operations we will use SF_6 alternatives wherever possible, and make every effort to reduce our controllable network losses.

We will improve the energy efficiency of our substations through a portfolio of measures including heating, lighting and other building upgrades across 47 sites. We will proactively work with the Scottish Environmental Protection Agency (SEPA) to understand and mitigate the threats posed to our assets by flooding; over RIIO-T2 we will enhance the protection of 12 additional sites.

Our vision beyond 2026

Our long-term ambitions reflect our role as facilitators of the transition to a low-carbon future. We aim to be carbon neutral by 2050. As a business this is essential to meeting the global and national greenhouse gas reduction targets. We will recycle or reuse 100% of waste by 2030. We will protect and enhance the natural environment in which we operate, achieving biodiversity net gain on new infrastructure projects.

Read the full details of our plan
>> Achieving Sustainable Development
>> Environmental action plan Annex

Ready for renewables

We continue to see applications to connect more generation to the network, across both distribution and transmission, which in turn requires upgrades to the wider transmission system.

What stakeholders told us

The transition to a net-zero energy system has been a strong focus for our stakeholders. There is a clear message that as a network, we need to be ready to make this happen.

This is underpinned by the Scottish Government's ambition for the equivalent of 50% of the energy for Scotland's heat, transport and electricity to be supplied from renewable sources by 2030. We have a healthy pipeline of contracts with customers who want to connect further renewable generation. This is consistent with the feedback from customers applying to connect to the distribution network. Our customers have also highlighted other changes in the generation landscape. With the closure of Hunterston nuclear power station planned for 2023, and Torness nuclear power station in 2030, we need to be ready for further changes.

Our commitments for RIIO-T2

We will help enable a low-carbon economy. We'll help government achieve its targets, and expand our network with new capacity to meet the needs of our customers. This will include supporting greater electricity transfers through Scotland, as well as to England and Wales. Our network will be capable of operating with 100% renewable generation.

We have reviewed all the contracts we have for future connections, and have a high confidence of connecting at least 1GW of new generation to our transmission network, enough to supply over 700,000 homes.

On top of this, we will create capacity to allow an additional 800MW of embedded generation to connect to the distribution network. We have designed our plan with the flexibility to respond if this changes.

Being renewable ready requires us to go further than just connecting new generation. We have a portfolio of solutions to adapt to other challenges that will emerge from this transition due to changes in the system inertia, voltage and harmonics. As this generation is removed, it will create new issues which we will need to accommodate such as the loss of system strength and greater voltage fluctuations, all of which will have an impact on our customers.

Our vision beyond 2026

We have planned not just for the RIIO-T2 period, but also for some of the major upgrades that will be required well into the future. We are laying the building blocks for a smarter transmission network in RIIO-T2, which will serve customers beyond 2026. As the generation landscape changes in response to changing market arrangements, we are ready to act.

We will continue to support and work with the ESO, other Transmission Owners and other network operators to ensure that we are planning in a coordinated and efficient way.

Read the full details of our plan
>> Load Related Expenditure
>> Our RIIO-T2 Output Incentive Proposals

Closer to our communities and vulnerable customers

Our first-hand experience and deep-rooted connection with our communities serve as a constant reminder that the actions we take impact our customers in real ways. That's why we maintain a regular presence in the communities we serve, from hosting engagement events to taking special consideration of those in situations which make them vulnerable.

We have also played a large role at community events to highlight the role we play, and the dangers of the electricity network.

What our stakeholders told us

Across our network area, there is a broad ambition for our communities to play a pivotal role in the decarbonisation of the energy system. From installing EV charging infrastructure to establishing new heating solutions, there is a strong level of ambition. This is demonstrated by Glasgow and Edinburgh both setting targets of being net-zero cities well before 2045.

Our stakeholders see us playing a vital role in this transition: a consistent theme has been around our ability to respond as the needs emerge.

Stakeholder feedback tells us that establishing our green economy fund in RIIO-T1 was well received. This positive feedback has been incorporated into our plan, further enabling energy-related projects and helping create new partnerships.

Our commitments for RIIO-T2

We will continue to add value in our local communities by supporting vulnerable customers and protecting the environment.

We coordinate with SP Distribution in reaching out to support vulnerable customers. We don't believe in duplicating efforts, and have a well-established process for supporting vulnerable customers. We are reaching out further to other organisations to identify who these vulnerable customers are, and how we can support them and meet their needs.

We will continue to work with local authorities, schools and at other events where we can reach these communities. Our work will raise awareness of what we do, as well as safeguarding the public, and supporting science, technology, engineering and mathematics subjects.

We will continue our Green Economy Fund to support communities by investing in sustainable innovation. This will help provide them with the platform and funding to progress their ambitions.

Our vision beyond 2026

We need our communities, as much as they need us. We will continue to foster this relationship to help them deliver their decarbonisation ambitions, coordinate efforts to support customers most in need of assistance and create a future generation that share our passion for creating a better future. We rely on these communities to provide our workforce of the future, and to support us in all that we do.

Read the full details of our plan
>> Continuing to support our communities
>> Health and Safety
>> Delivering Our Plan

Green Economy Fund
We will continue to support our communities through additional funding of

£20m

Flexible and responsive to change

The Scottish Government has set an ambition that Scotland should have the capacity, connections, flexibility and resilience necessary to maintain secure and reliable supplies of energy to all homes and businesses as our energy transition takes place. In addition to this, the Scottish Government aims to phase out the need to buy petrol or diesel vehicles cars and vans by 2032.

What our stakeholders told us

Our stakeholders support the Scottish Government's ambitions, but have identified the uncertainty in the nature and the timing of the changes that will take place to make this happen.

From our engagement, we see a strong support to facilitate the electrification of transport, but a large uncertainty over how heat will be decarbonised. Customers have also highlighted that uncertainty over future market arrangements for renewable generation also means that we may see change to how our plans look at the start of RIIO-T2.

From our own analysis, we have seen reductions in demand due to energy efficiency, and the views we have received are that this is expected to continue. However, new demands will emerge due to the electrification of heat and transport. We have looked at a wide range of system trends to see the impact of changing customer behaviour.

Separately, BEIS has created a Smart and Flexibility Plan. We have taken this – as well as other industry initiatives such as the ENA Open Networks project – into account in order to build our plan.

Our commitments for RIIO-T2

The need to monitor how power is being used is more important than ever, allowing us to identify trends and make sure we can respond. We have used a scenario-based approach to shape and test our plans, which have been informed by our stakeholders.

We recognise that we need to do all that we can to allow customers to achieve their ambitions – such as connecting to the network or increasing demands. We cannot be the barrier to the uptake of electric vehicles or the electrification of other sectors. However, building assets ahead of need creates a risk that the assets may not be required.

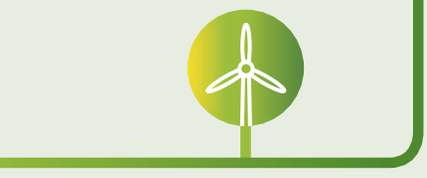
To respond to this, we are building a smarter network using the innovation knowledge we have accumulated. We are using more monitoring, control and analysis to optimise the enabling works we undertake.

We have looked at not only the solutions we use, but also how we are funded. In RIIO-T2 we propose a suite of funding arrangements that will cover the cost of further work to meet what customers want, when it is required. We have built an ambitious plan, but not sought funding for projects which are still speculative until the need is clearer.

Our vision beyond 2026

Flexibility will only become more important as the pace of change increases. The platforms we create in RIIO-T2 will enable this in the long term. We will support and coordinate our planning with the Scottish Government and other key stakeholders in this process, such as Transport Scotland, to make sure we stay one step ahead.

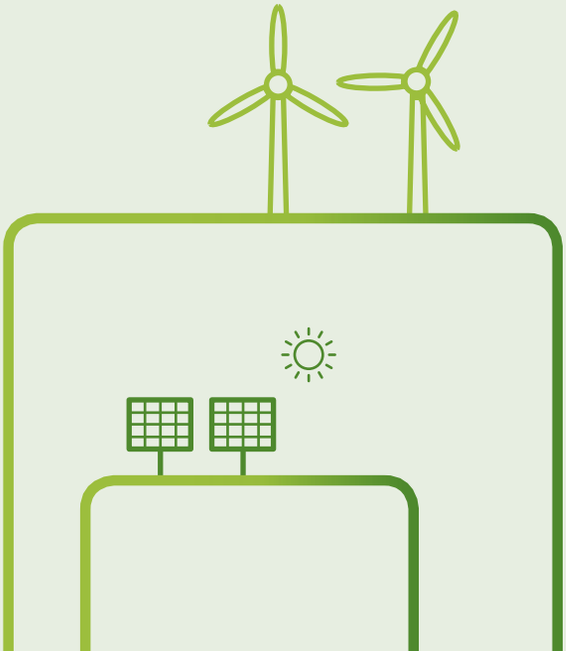
Read the full details of our plan
>> Load Related Expenditure
>> Managing Uncertainty



Electric Vehicles

By the end of RIIO-T2, we expect the number of EVs to have grown to

198,000



Up-skilled

A workforce with the right skills is essential for the safe and reliable operation of our network. Investing in our people now means making sure the network doesn't become more costly to operate in the future – over the last decade we have addressed our ageing workforce and changes to the skills we require.

We actively work with the IET, the National Skills Academy for Power and the Scottish Apprenticeship Advisory Board. Sharing knowledge through these groups helps us focus our efforts, and coordinates with other organisations to maximise our collective approach. This is demonstrated by the IET Power Academy, which has helped support around 100 graduates through university and into our business.

What our stakeholders told us

From all bodies, we've heard a clear need to look at the skills we require in the future, and how these will be different from what we have today.

Our User Group has also challenged us to look outside our own sector, to see best practice on how we can upskill and recruit from more varied backgrounds and experience.

We have engaged with the Trade Unions represented across our business: our future workforce plans are high on their agenda.

Through our annual employee engagement survey, we gather the views from staff on what matters to them. This has affirmed the strong health and safety culture we have, and staff have identified the need to continue to recruit to replace the ageing population of employees.

Our commitments for RIIO-T2

Over the next five years we anticipate 128 leavers through retirement and attrition. We have a detailed plan to focus on growing our own talent, and the majority of these leavers will be replaced with apprentices, graduates and other trainees to allow us to develop our staff with the skills they require.

We'll continue taking measures to minimise safety incidents experienced by our staff, partners, and the public. In RIIO-T2, we are building on our strong health and safety track record, with an industry leading record to reduce the number of incidents even further. We are targeting a reduction of 10% by the end of RIIO-T2.

Our vision beyond 2026

The investment we make in our people today will be returned over the long term. We will create a more diverse and balanced workforce in the long term through our work with schools, colleges and partnering other organisations to promote STEM subjects in early years. We will continue to fund dedicated STEM Ambassadors to encourage thousands of young people every year to study science, technology, engineering and mathematics.

Read the full details of our plan
>> Delivering Our Plan
>> Health and Safety

Collaborating across the whole system

We work with a range of parties across the electricity sector, including other network operators, customers, and parties that will play an increasing role in the future for electricity – such as Transport Scotland.

This collaborative approach is seen in our work with SP Distribution and National Grid ESO. We coordinated to build one of the largest active network management zones in the UK – a cost-effective way to manage new generation, and create optimal outcomes for stakeholders.

What our stakeholders told us

Whole system thinking is an increasing priority for our stakeholders. This is recognised by Ofgem in their thinking for RIIO-T2, the Scottish Government in their Network Vision, and other bodies such as the IET in the Future Power Systems Architecture work.

This is also supported by Citizens Advice. They recognise the need for us to *"…collaborate to partner with consumers in each aspect of the decision, including defining the issue, developing alternatives and identifying preferred solutions"*.

Citizens Advice: Strengthening the voice of consumers in energy networks.

Our commitments for RIIO-T2

We will work together for better outcomes. We'll collaborate with other sectors such as gas, as well as across Transmission and Distribution to provide efficiency and value. Wherever possible we'll adopt a whole system approach that covers everything from power station to plug.

But for customers to get the maximum benefit from a whole system approach, it's necessary to coordinate beyond just the electricity and gas network. A broad approach is required. A wide range of parties are affected by our plans, and we are affected by theirs: generators, customers, local authorities, other utilities and transport providers. The list is extensive. Over the course of RIIO-T2, we will continue to engage with existing and new stakeholders, to make sure our plan adapts as necessary.

Our vision beyond 2026

The energy landscape will continue to change. The creation of Distribution System Operators (DSOs), a greater role for energy storage, and new commercial approaches to manage the network will all have a longer term bearing. We are fully aligned with SP Distribution in their plans to become a DSO, and see long term value to the transmission network of this – managing the network proactively to minimise future investments.

Read the full details of our plan
>> Whole System Planning

Innovative

During the last seven years, our innovation strategy has evolved and delivered a portfolio of projects creating real value for customers. We have implemented £25m of savings as a result of our previous efforts in our plan. Our approach has evolved as we have engaged with stakeholders, gathered feedback, and observed changes to the network.

What our stakeholders told us

Through our engagement, our stakeholders have told us they support the priorities we have identified relating to the energy system transition challenges. They also agree that we need to take action and have a focussed effort on innovation.

Our analysis of the broader energy landscape and the specific challenges we face has identified additional areas where we need to focus our priorities. In addition, we have learned from approaches outside our business. This includes shaping our plans in line with the industry-wide Energy Network Association innovation strategy, which was informed by an extensive engagement process.

We have also built on the ENTSOE research and innovation framework, which canvassed a broad range of European organisations. We have coordinated all this feedback and analysed innovation activity around the world. As a result, we have developed a revised strategy and prioritised our efforts.

Our commitments for RIIO-T2

We have identified a number of clusters and themes which align with the feedback we have received and are supported by our stakeholders. This allows us to focus our efforts on what is valued the most to drive changes in our business.

The benefits will be far-reaching: accelerating decarbonisation, enhancing digitalisation, and maintaining a secure, reliable, efficient and sustainable network for future generations. To make sure these are embedded across the organisation, we have a renewed focus on our innovation culture to ensure that it is not seen as a function's responsibility. We will also improve the tracking of benefits from our efforts. This will help with continued improvement in our processes, but also help us demonstrate the value of the investments we undertake.

Our vision beyond 2026

Our efforts in innovation today will pay back in the long term. We will innovate to create value for our customers, and facilitate decarbonisation even if the benefits are seen in other parts of the energy system.

Read the full details of our plan
>> Innovation Built-in

Giving customers value for money

A balance needs to be struck. On the one hand, we need to manage the impact on consumers' bills. On the other, we need to enable some of the major changes that our energy system is going through.

All our major projects have been extensively challenged by a range of independent parties and justified through a rigorous cost benefit analysis where required. Our plans have been also assured by a range of independent parties as well as our own board. This includes reviewing our detailed processes for how we will deliver the plan. We have also worked to make sure our plan is based on high-quality, assured data.

What our stakeholders told us

The impact we have on customer's electricity bills is always a theme from our stakeholders. This is most starkly highlighted by our User Group; *"for every extra £10 on an electricity bill, you will push 40,000 customers into fuel poverty".*

On top of this, Citizens Advice identifies that *"One output of RIIO business plan should be that Consumers receive good value for money from energy networks."*

We have our own forums on supporting social obligations, and a number of partnerships with organisations who represent vulnerable customers. All express a consistent view that we have a role to play in supporting these customers.

The changes we are making also come at a cost, and we have had feedback that the service the network provides and role it plays in facilitating the decarbonisation of the sector is also vital. A number of stakeholders identify this including the Committee on Climate Change and National Infrastructure Commission. The generators we connect to the network are also dependant on the work we undertake.

Our stakeholders have fed back that the level of uncertainty over some of these changes will continue into RIIO-T2 and beyond, and we need to accommodate this.

Our commitments for RIIO-T2

We have embedded 2.5% of efficiency into our plan, building on learning from improvements made in RIIO-T1. This has allowed us to keep our planned expenditure broadly in line with our average expenditure in RIIO-T1.

We have reduced the costs of financing our plans, from the feedback we have had from stakeholders.

We have taken a pragmatic approach to building our plan – we have only included costs for those customer-driven works that have a high probability of progressing. We will use a range of mechanisms agreed with Ofgem to allow us to adjust our plans as certainty grows, to make sure we are not investing where it is not required.

We will continue to have a coordinated approach to supporting vulnerable customers across SP Energy Networks, to provide the most efficient and effective service.

Our vision beyond 2026

We will build on our innovation learning to create more savings, and continue to strive for more efficiency. When we consider any expenditure, our priority is to make sure it delivers the best value for the consumer in the long term.

We will continue to work closely with our stakeholders to make sure we are responsive to their needs, and that they see the value we provide.

Read the full details of our plan
>> Financing our Plan Efficiently
>> Managing Uncertainty
>> Governance and Assurance

Embedded efficiency

We have built on efficiencies in RIIO-T1 and embedded efficiency savings of

£136m

We have led the way in Great Britain's energy sector with our innovation activities. We have implemented new technologies and solutions on our network to address the challenges of the energy system transition.

Innovation Built-in

We understand the need for innovation

Innovation allows us to do more, for less, from making it easier to connect renewable generation, to improving the efficiency of our day-to-day operations and is crucial to achieving energy system transition.

The UK government expects energy companies to play a leading role in delivering a low-carbon economy. Ambitious targets have been set by the UK and Scottish governments to accelerate this journey. Scotland's electricity supply is already largely decarbonised.

New innovative approaches have enabled more sources of renewable generation to be connected to the network, and accelerated the closure of large thermal generators thus aiding the journey towards our low-carbon future. Our network will see a rapid uptake of electric vehicles, electrification of heat and the emergence of disruptive technologies. We're committed to making the most of this transition. We are also aware that change is happening faster than ever before. This pace is bringing new challenges which we're addressing by thinking differently and taking an innovative approach to our day-to-day business.

Innovation is key to making sure the energy system transition is seen more as an opportunity than a challenge. Our strategy for innovation is to keep in pace with the changes and continuously improve as a business to deliver benefits to GB customers, while maintaining security and reliability of supply.

Our business plan will deliver benefits in excess of £30m from roll-out of our successful innovation projects

£30m

50% payback in next price control for investment allowed in RIIO-T1

50%

A track record to rely on

As we look forward to what we plan to deliver, we proudly look back at the innovation projects we delivered in RIIO-T1 – and look forward to rolling them into business as usual in RIIO-T2.

Our four network innovation competition (NIC) and innovation roll-out mechanism (IRM) projects account for 86% of our RIIO-T1 innovation investment (the other 14% is network innovation allowance (NIA) funding allocated). The total investment of £59.46m is managed by us, making sure that the projects are delivered according to the innovation governance, and on schedule.

Around 85-90% of the NIA and NIC investment funding is directly allocated to third parties such as: vendors. SMEs, universities and other network owners. We then share the outputs through conferences, training and stakeholder engagement activities, investing the funding back into the wider economy.

SP Transmission has actively engaged in the innovation funding mechanisms and developed globally innovative projects through the NIC and IRM mechanism such as:

VISOR – £7.3m NIC in collaboration with NGET TO, SSEN, NGET ESO & GE
This project successfully delivered Great Britain's first wide-area monitoring system, providing dynamic visibility of the GB network to the ESO and TOs across GB.

FITNESS – £9.45m NIC in collaboration with ABB, GE, Synaptec, the University of Manchester
This successfully commissioned Great Britain's first multi-vendor digital substation solution. It's also an internationally-acclaimed project for informing international standard bodies and other network owners, enabling seamless roll-out of digital substations.

Phoenix – £17.64m NIC in collaboration with NEGT ESO ABB, University of Strathclyde, Denmark Technical University
We designed and are on track to deliver successfully GB's first hybrid synchronous compensator to compensate for fast declining essential grid services such as inertia, short-circuit level and reactive power compensation.

HTLS Conductor – £16.6 IRM in collaboration with 3M
The HTLS conductor is designed to operate at higher temperatures than conventional conductors and offers greater transfer capacity across the network. The HTLS technology successfully installed in RIIO-T1 coupled with the over-arching 'South West Scotland' project will contribute **1.7GW** by **2021** (and **2.1GW** by **2023**) of additional renewable generation to the GB system, representing **40%** of the onshore wind.

Our ambition for RIIO-T2 and implementing Ofgem's Reforms

We plan to be even more transformative, and use innovation to achieve a "Better Future, Quicker".

What really matters is fairly straightforward: how we trial and deliver industry-transformative innovation projects. Our business has evolved to foster an ever-growing culture of innovation, with a drive to build even more innovation capability and ability within our business.

Of course, we will also see the benefits from roll-out of our ground-breaking innovation in RIIO-T1. Our innovation success from RIIO-T1 has provided us a solid foundation and understanding of the risks, challenges to be addressed, the level of engagement required with wider stakeholders, and the kind of skillset we need to build within our business to successfully drive innovation for a sustainable future. We deliver innovation to create benefits not only for network owners and system operator but also for wider stakeholders, environment and most importantly our customers.

- Innovation through Business as usual
- Cross-sector projects
- Whole system Approach
- Focus on empowering customers

Innovation funding

We are supportive of Ofgem's decision to maintain dedicated innovation funding in RIIO-T2 aligned to energy system transition challenges to support large scale innovation projects and ensure better alignment with public sector funding.

We believe Ofgem's decision to deploy governance including industry experts, network owners, system operator and third-parties in identification and setting of the focus for this reformed funding will provide the industry with better steer for innovation. We will use this opportunity to deliver transformative projects in collaboration with other sectors to enable GB's low-carbon future quicker.

Focus areas for NIA funding

The continuity of Network Innovation Allowance (NIA) funding in RIIO-T2 will enable further research and development activities that are crucial to inform our future investment and network enhancement decisions, and trial of lower technology readiness level solutions on our network paving way to large scale deployment in future.

We are in complete agreement with Ofgem that we need to justify and show our plan to utilise NIA funding in RIIO-T2. Our innovation portfolio, to utilise NIA funding, will focus mainly on four aspects detailed opposite.

These focus areas underpin the broader innovation incentives detailed in the innovation strategy annex. Together, they demonstrate the knowledge that can be created, and the transformation that can be brought, and societal benefits that can be delivered through innovation small and large.

Our commitment for innovation is clear:

We will deliver on our innovation ambition to drive changes within our business. The benefits will be far-reaching: to accelerate decarbonisation and enhance digitalisation – but also to maintain a secure, reliable, efficient and sustainable network for future generations.

Our RIIO-T2 business plan rolls-out innovation projects successfully trialled by us and others to date. We also have identified key areas for efficiencies through innovation in all our load and non-load schemes. For us innovation is business-as-usual.

Our Innovation funding request for RIIO-T2

£17.8m

In the RIIO-T3 price control we will generate benefits up to

£40.0m

Our innovation focus

We will demonstrate the following objectives and initial benefits in all our innovation projects.

Advancing research and development and lower Technology readiness level (TRL) projects focused on addressing energy system transition challenges

We will focus on building our capability in grid modelling and enhanced capacity for large scale data analysis. This will require investment in new software as well as skills. Innovation is likely in the way we engage with others and try to access the most appropriate analysis capabilities even if not in-house. We will utilise this ability to identify any threat to the security and stability of our network in light of changing nature of generation and demand. We will be utilising our internal and external R&D capability and knowledge to pre-empt any scenario that might require significant investment in future controls and develop holistic approaches to mitigate and to manage the transition in an economic and efficient manner.

We also aim to explore the possibility of developing powerful visualisation tools which will combine 3-D modelling, artificial intelligence and advanced sensor technology to make best use of the technological advancements which will make us early adopters within the industry to use state-of-the art digitisation and information technology to create more intelligence within our network. The technological solutions may be in their infant state but through detailed case studies and gap analysis supported through innovation will enable the network digital twin of the future.

Accelerate adoption of large scale disruptive/transformative innovation aimed to deliver longer term benefits

The proportion of funding allocated across the challenges may need to be regional as the issues faced by the transmission network in Scotland may be more unique to us than others. We will work with Ofgem on these key issues over the coming months to ensure the alignment of the large scale innovation funding with our and industry wide innovation strategies.

We will utilise this opportunity to develop innovation incentives using a whole system approach, accelerate digitalisation of our critical infrastructure, ensure stability and security of our network, and trial globally innovative technology solutions.

Enabling whole system approach

Our network has boundaries but innovation and the future solutions facilitating energy system challenges do not need to. We want to enable more holistic thinking through innovation to roll-out a true whole system approach. Can increasing visibility of our distribution network help address critical issues on the transmission network? Can we build in storage capability within our gas network? Can the telecommunication sector tell us more about accelerating digitalisation within the energy industry through shared services? These and many more important questions can only be answered through whole system thinking and approach which we aim to enable through innovative incentives in RIIO-T2.

Empowering our customers and addressing consumer vulnerability

Our customers are at the heart of what we do. We consider our job goes beyond keeping the lights on. We are known for our excellent customer care and we strive to serve our most vulnerable customers by making them our priority. Can innovation play a role in it? Of course we need to eradicate energy poverty, empower our customers to not only play a role but also benefit from energy system transition. We will make this one our key priorities while defining our innovation incentives in RIIO-T2.

More details about this can be found in the **Innovation Strategy Annex**.

Innovation Strategic Focus

1

We understand and are prepared for the energy system transition challenges. Renewables, new connections to Europe, fast changing nature of demand – and the overall need to empower our customers and provide them with a reliable, resilient service. This is innovation in action.

The Scottish Government 2030 targets assume a considerably higher market penetration of renewable electricity than today. The targets would require around 17GW of installed capacity in 2030 (compared to 10.4GW in June 2018). There would also need to be greater interconnection with parts of continental Europe, extending GB's electricity market.

We understand this change and the associated challenges that our transmission network is facing with the energy system transition. We develop our innovation projects to address these challenges and ensure security of supply, despite all the uncertainties involved. In RIIO-T2, we will continue to invest efficiently in our network. At the same time, we'll keep innovating to maintain and improve the reliability, resilience and service of our network for the benefit of our customers.

In RIIO-T1 the innovation funding mechanism helped facilitate projects to help mitigate some of the challenges. However, the work is far from over – if anything we've just got started. As we move from this price control period to the next, the challenges only get more prevalent, the urgency to develop and implement new solutions increases, and we can't afford to stop the innovation momentum.

Our innovation ambition will only be enhanced by the reformed innovation stimulus to be introduced by Ofgem in RIIO-2. This will help manage the risks, enabling small-scale trials to identify any challenges for large-scale roll-out driving innovation into the DNA of the energy sector. It will also make sure we collaborate and learn from other network owners and the energy system operator (ESO). Throughout RIIO-T2 we will continue to ensure that our innovation activities are done in a collaborative and transparent manner clearly highlighting learning and benefits generated to all stakeholders. We will be even more adaptive and transformative to keep in pace not only with technological advancements, but with changes in policies and regulation as well.

We deliver innovation effectively

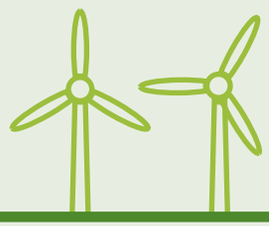
We therefore categorise our innovation into three main categories: core, incremental and transformative.

We aim to deliver a balanced innovation portfolio in RIIO-T2, taking into account Ofgem's proposal to drive more innovation through business as usual.

The projects in our innovation strategy identified under core – and broadly under incremental – demonstrate that the majority of our investment in innovation in RIIO-T1 and in RIIO-T2 is through the business-as-usual process. We have used the innovation funding mechanisms of NIA and NIC to conceptualise and deliver truly transformative projects. We will continue to maintain this breakdown in our innovation portfolio in RIIO-T2.

Our innovation portfolio and strategy is also categorised into **clusters (C) and themes (T)**, in line with the industry-wide innovation strategy developed by Energy Networks Association (ENA) and ENTSOE's research and innovation (R&I) framework. Each cluster and its underlying themes is aligned with and addresses one or more energy system transition challenge.

The clusters and themes, detailed above, are referenced throughout our business plan. All innovation incentives under each cluster are detailed in our innovation strategy annex.



Decentralisation

Developing a more flexible and dynamic grid to be ready for an uncertain future.

Making more use of distributed energy resources.

Adopting a 'whole system' approach to work across our network boundaries and with other sectors.

Decarbonisation

Increasing grid visibility and controllability to accommodate new renewable generation connections while maintaining reliability of our network.

Enabling decarbonisation of heat and transport.

Collaborating with our supplier base and academia to leverage advancements in research & development worldwide; driving efficiencies and delivering a sustainable grid.

Digitalisation

Using digitalisation, intelligence and data analytics to create meaningful information to optimise the operation of our network.

Enabling standardisation to deliver faster deployable solutions.

Deploying cyber security policies to protect our data and assets in the ever increasingly interconnected network.

Improving the sustainability of our network and business processes and empowering our customers.

Whole System Approach overcoming boundary restrictions between electricity and gas transmission owners (TOs) and distribution network operators (DNOs), transport and telecommunications sector with increased customer engagement.

Integrating new technologies and enabling digitalisation, standardisation and cyber security.

C3 Network Flexibility

T9 TO-DNO Interface
T10 Flexible Use of DERs
T11 Flexible Network Use
T12 Whole System Approach

Challenges related to increased grid dynamics and black start.

C4 Digitalisation of power networks

T13 New digital Technologies
T14 Standardisation
T15 Enhanced Data Analytics
T16 Cyber Data Security

Maintaining system security and stability, despite of reduced grid services, lower system strength, and increased grid dynamics and interactions.

C2 System Security and Stability

T5 Grid Observability
T6 Grid Controllability
T7 Network Reliability and Resilience
T8 Enhanced Ancillary Services

C1 Network Modernisation

T1 Optimal Grid Design
T2 Smart Asset Management
T3 New Materials, Processes and Technologies
T4 Health and Safety Environment and Stakeholders

Evolution of our transmission network and associated uncertainties, including new requirements for reinforcement and the replacement, operation and maintenance of aging assets.

Culture of Innovation

2

Our internal innovation culture and innovation will delivery strategy. These will make the most out of the RIIO-2 innovation funding mechanism, and maximise benefits through innovation roll-out.

We aim to improve innovation deliverability, visibility of innovation outcomes and tracking of benefits to create more value through innovation.

We will be implementing the following reforms within our business to enhance our innovation ability in RIIO-T2:

Enabling more innovation through business as usual by transparent selection of projects based on value added through innovation process

Focussing our innovation efforts on transformative innovation projects with longer term impact: Aligned with Ofgem's definition of energy system transition challenges and wider public sector innovation priorities.

Development of industry-wide approaches for increasing general visibility of impact created through application and implementation of innovative projects through increased public reporting, development of collaborative innovation strategies and tracking of innovation benefits

Continuous reviews and improvement of the innovation portfolio and projects to ensure we balance and optimise our innovation efforts evenly across challenges and levels of risk.

Gap analysis of innovation incentives and projects, to make sure projects are aligned to their original objectives and are on-track to deliver benefits.

Increased collaboration across different sectors of the energy system to share and adopt learnings that drive transition.

Increased third-party engagement through a transparent assessment process of third-party proposals and feedback procedures.

Empower our customers through increased engagement with community energy incentives, non-profit organisations and using innovation to address the needs of those in vulnerable situations.

We have demonstrated benefits generated through innovation in RIIO-1 through the roll-out of successful innovation projects in our business plan, and we will continue to improve on this success in RIIO-2. We are committed to working with the regulator, other network owners and wider stakeholders to use the lessons learnt through the innovation process in RIIO-1.

Measuring our success

3

Making innovation benefits more visible

In RIIO-T2, we propose a unified benefits tracking mechanism across the industry. This will make it easy for our wider stakeholders and customers to see the value generated by innovation.

Managing uncertainty and risk

We can manage uncertainty and risk by conducting a risk assessment at the beginning of each project. We only request funding for innovation projects with acceptable risk scores and clearly-defined mitigation measures.

We will continuously improve our project delivery process through gap analysis and reviews to ensure the project is on track to deliver perceived benefits.

Tracking and measuring innovation benefits

An industry wide cost benefit analysis (CBA) methodology will establish a unified net benefits tracking mechanism for all network licensees to present the benefits generated through innovation to wider stakeholders. The CBA process can be repeated at various stages of the project, and used to track benefits during the roll-out period.

To complement this, we also recommend a comprehensive qualitative impact assessment and performance-based methodology. This methodology can be used to review the impact of each innovation-funded project, during and after its trial.

The use of impact and benefit assessment will allow all innovation stimulus funded projects to be assessed, benchmarked and presented to wider stakeholders in a unified manner. It will also enable Ofgem to assess and publish the benefits generated through the innovation stimuli in RIIO-2.

This unified impact assessment and benefits tracking method will create transparency of the use of innovation funding by network licensees in RIIO-2.

How we developed our strategy

We have successfully led and delivered innovation projects in RIIO-T1. We employ an internal governance mechanism to manage our innovation portfolio and project delivery. In RIIO-T1 we participated in industry-wide working groups and engaged extensively with third-parties, stakeholders and challenge groups. We have a strong foundation to build and deliver an ambitious innovation strategy in RIIO-T2.

We identified that innovation is more than technology: it is also about our people, stakeholders, consumers, sustainable business processes and our regulator. Because of this, we believe our innovation strategy should cover both our 'Innovation Strategic Focus' and 'Culture of Innovation'.

In order to develop the innovation strategic focus section, we began by comprehensively reviewing innovation projects undertaken in RIIO-T1. This allowed us to identify projects with well-defined results that were also highly relevant to our business plan for RIIO-T2. As well as our own work, we carried out an extensive review of:

- Key areas of investment in our business and challenges faced by our network in RIIO-T1.
- Innovation projects initiated and led by other UK transmission owners (TOs), distribution network operators (DNOs) and the energy system operator (ESO) and gas transmission and distribution network owners delivered through the RIIO-1 network innovation allowance (NIA), network innovation competition (NIC) and innovation roll-out mechanism (IRM) stimuli.
- Innovation incentives from across Europe and the rest of the world.

The key energy system transition challenges and relevant projects identified through this review were developed into innovation options to be considered as part of our business plan development. These innovation options are identified throughout our business plan proposal and are also highlighted in the innovation strategy annex. We also launched a wider RIIO-T2 innovation strategy stakeholder consultation and gathered feedback on our innovation ambition through webinars, presentations to the TO User Group, consumer challenge group and site visits demonstrating innovation in action. Combined with our participation in various innovation stakeholder engagement activities in RIIO-1, this helped us develop a robust and ambitious innovation strategy.

Published in over 50 industry leading papers, journals and magazines

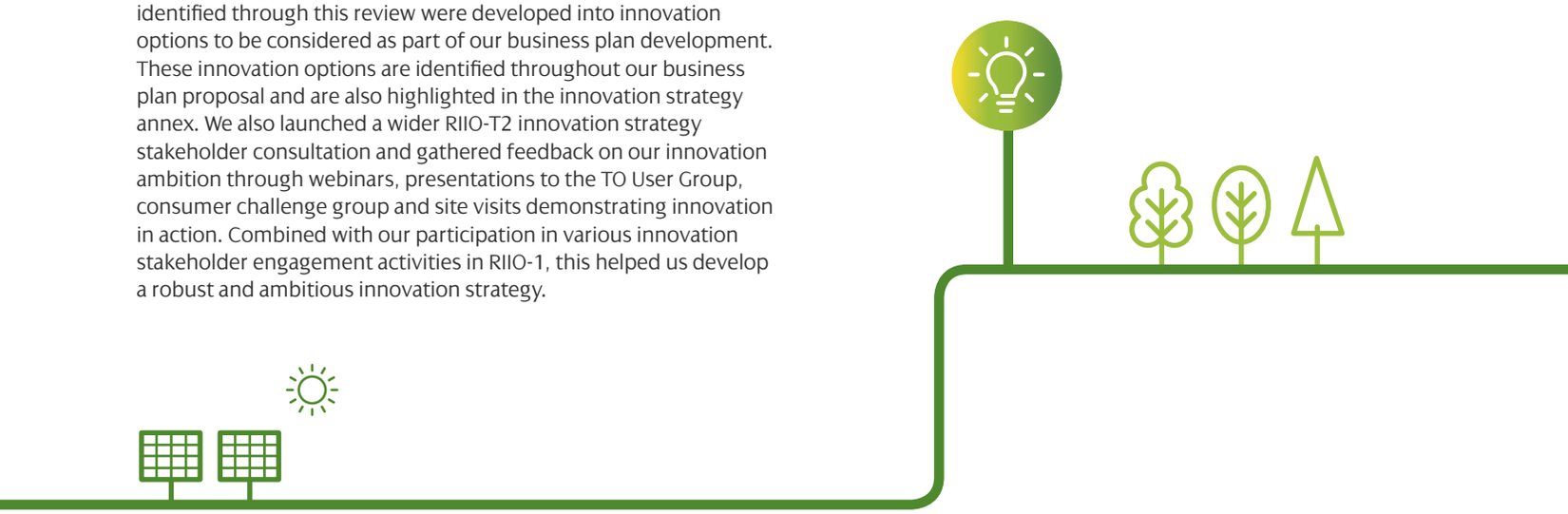
+50

Reviewed over 900 innovation projects

+900

Organised and attended over 30 stakeholder events/year

+30



Sustainable development means meeting today's needs – but without compromising the ability of future generations to meet their own needs.

A firm commitment to sustainable development sits at the heart of our corporate purpose and values. This is reflected throughout our RIIO-T2 business plan.

This section details the commitments, activities and actions we will deliver to continue to enable and drive environmental performance improvement during RIIO-T2. To achieve this, we've developed our own Environmental Action Plan (Annex 7).

Reduce our network's environmental impacts, *Pg 40* 1
We've assessed the impacts of our network and RIIO-T2 business plan and identified our main areas of focus.

Decarbonise our network, *Pg 42* 2
We're developing a science-based target for our greenhouse gas emissions.

Support the transition to an environmentally sustainable, low-carbon energy system, *Pg 44* 3
We're building a network to accommodate increasing renewable generation. In turn, this will enable the UK to meet its decarbonisation targets.

Achieving Sustainable Development

Sustainable development at our core

We are supporting the United Nation's Sustainable Development Goals, and helping to meet government targets on reducing emissions.

We are part of the Iberdrola Group, one of the world's largest utilities and a world leader in wind energy. The United Nations' Sustainable Development Goals (SDGs) are at the heart of our business strategy.

Our Sustainable Development Policy lays down the strategic pillars which align our sustainability values with the SDGs. Due to our activity as an electricity networks business, we are mainly focused on the supply of affordable, clean energy (SDG 7) and the adoption of measures to combat climate change (SDG 13). However we have a direct impact on other SDGs such as SDG 6, 9, 15 and 17.

The UN Sustainable Development Goals

Iberdrola's Sustainability Report explains how our leadership, investment and innovation are making a difference. We're firmly placed to drive electrification of the UK's economy where it matters most from the decarbonisation of transport and heating.

We know that strategy alone cannot deliver this transition. Our diverse, passionate and talented workforce is critical to delivering a sustainable future.

Sustainable Business Strategy

SPEN is working hard to create a better future quicker. We are playing a critical role in enabling the transition to a low carbon economy but not at the cost of the environment. We must reduce our business impacts on the environment while ensuring value for current and future customers.

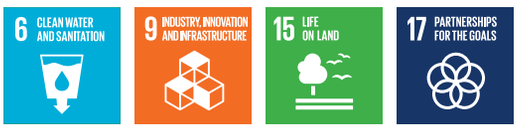
We launched our Sustainable Business Strategy in 2018. Since then, we have sharpened our position to be a leading sustainable networks business. Our Sustainable Business Plan, published in January 2019, sets out a vision to work with our stakeholders to:

- efficiently manage and develop our network in support of the low carbon transition; and
- achieve neutral or positive environmental and social impacts.

Sustainable Development Goals

Main Focus

Direct Contribution



Indirect Contribution to All Other SDGs

Details of our global commitment to the UN Sustainable Development Goals and priority focus can be found at: *www.iberdrola.com/sustainability/*

Reduce our network's environmental impacts

1

We identified our environmental impacts at business level using a Materiality Assessment. At project level we used high-level Initial Environmental and Sustainability Reviews (IESR).

IESRs informed our Investment Plan by providing an appropriate and proportional assessment of relevant projects at the earliest possible stage to identify potential environmental issues and opportunities.

The IESRs capture:

- Key environmental attributes and characteristics of the site
- Opportunities to reduce waste, resource use and carbon (aligned with the principles of PAS 2080)
- Future survey and environmental assessment requirements
- Opportunities to engage with stakeholders on specific aspects of the proposals

After conducting these exercises, we used the evidence gathered, feedback from our stakeholders and insight from our Subject Matter Experts (SMEs) to identify our main environmental impacts and areas of influence as:

- Resource use and waste reduction
- Pollution to the local environment
- Biodiversity loss
- Climate change – mitigation and adaptation

Our strategic objectives for 2050:

- reduce our waste to zero
- half our water use
- Carbon Neutral (Excluding Losses)

Environmental Improvements

Our stakeholders have told us that improving the environment around transmission sites was a key area for investment. We have proposed a regulatory funding mechanism associated with environmental improvements within our Managing Uncertainty section of our business plan.

Read more about how we're reducing our network's environmental impacts in **Annex 7**: Environmental Action Plan.

We have created an Environmental Action Plan which explains how we will take responsibility for the environmental impacts of our network in RIIO-2. Our Environmental Action Plan has been informed by stakeholder engagement, insight from our Subject Matter Experts and a comprehensive project based review of our assets in order to identify opportunities to manage environmental risks and drive performance improvements.

We will continue to develop our Environmental Action Plan over the coming months with stakeholders and submit our final version as part of our December business plan submission.

	Commitment	Example action
Minimising resource use	We support the principles of a circular economy, and commit to increasing circularity in our projects.	We actively seek to refurbish or reuse existing infrastructure where possible to reduce resource consumption and waste generation. We will avoid generating concrete waste by finding ways to reuse existing infrastructure as well as reducing waste, this also reduces consumption of fresh concrete – a material with a high carbon footprint.
Preventing pollution	We target zero environmental incidents.	We have reviewed and will continue to review all assets across our network and identified mitigation measures to prevent pollution to the local environment – land, air and water. Through condition-based assessments, we have reviewed all of our transformer bunds to identify those which will benefit most from future improvements. We then proposed measures to upgrade – prioritising those located within environmentally sensitive sites.
Biodiversity	We will protect and enhance the natural environment in which we operate.	We will collaborate with our stakeholders and other Transmission Operators to develop and pilot a common approach and robust methodology for delivering Biodiversity Net Gain, alongside Natural Capital assessment and enhancement,aiming to achieve biodiversity net gain. We'll develop an approach to multi-capital assessments – quantifying and monetising wider social and environmental impacts by considering natural, social, human, intellectual, financial and manufactured capital.

Climate Change Adaptation

Since 2011, we published our climate change adaptation plans in reporting rounds as required by the UK Climate Change Act 2008.

Increasing the resilience of our network to extreme weather events

In order to inform the development of our RIIO-T2 Investment Plan, and in advance of Round 3 reporting, we have completed an interim assessment of flood risk utilising SEPAs most recent flood data. This has allowed us to identify at-risk infrastructure, and as a result, flood mitigation works.

Decarbonising our network

2

We recognise the importance of our role in fulfilling the goals set by the historic Paris Agreement and the Scottish Government's ambitious emission reduction targets. We work to actively and decisively contribute to a low-carbon sustainable future – an effort that will also drive social and economic development through the creation of jobs and wealth.

Climate change mitigation – reducing our emissions

Target setting
Iberdrola has made a commitment to be carbon neutral by 2050. This global ambition to emissions reductions has been approved under a Science Based Target Initiative.

In response we have developed an SF_6 Strategy and Transmission Losses Strategy to manage our emissions. In addition, we will work collaboratively with our stakeholders, including other Transmission Operators, throughout RIIO-T2 to assess and manage capital carbon on our projects, driving efficiencies throughout our supply chain, and sharing best practice.

We continue to work with stakeholders to develop our RIIO-T2-specific, science-based, carbon reduction targets. We include full proposals in the next draft of our Business Plan submission.

Action on climate change

Our Sustainable Business Strategy sets our vision and targets for carbon emissions reduction.

We will develop a science-based target to reduce our scope 1 and 2 carbon footprint.

We will install flood mitigation measures at substations as part of our climate change adaptation plans.

We will track our energy consumption and carbon emissions using good quality and accurate data.

Reducing our emissions actions

Our Losses strategy and SF_6 strategy form part of our Environmental Action Plan.

Losses Strategy

We are committed to managing our emissions effectively, and explored every opportunity during the development of our Investment Plan.

Examples include: Our Investment Plan includes proposals to reduce energy consumption at substations. This is informed by historic Energy Saving Opportunity Scheme (ESOS) assessments, and a study undertaken by Napier Edinburgh University to monitor and evaluate technical losses arising from substation energy consumption.

Based on the results of this study, we propose a portfolio of intervention measures across our substations, including heating and lighting replacement, control, and building fabric improvements. Further details can be found in Annex 7.

Losses

Loss of electricity from the network can have environmental and economic implications. While we do not control the flow of energy over the GB electricity transmission system that determines network losses, there are number of steps we can take to reduce these through the use of more efficient assets and the way in which we design some aspects of the network, such as the size of the conductors we use.

We are committed to considering all reasonable measures which can be applied to reduce losses on the transmission system and adopting those measures which provide benefit for customers. We're working toward getting the most out of our existing assets and increasing the capacity of our network to accommodate this generation. At the same time, we are also aiming to improve the overall performance of our network. We will continue to analyse and report losses to demonstrate how our decisions are helping to reduce losses where that is economic and efficient and consistent with wider environmental and stakeholder objectives.

SF_6 Asset Strategy

Fugitive emissions of sulphur hexafluoride (SF_6) are the biggest single component of our carbon footprint. In 2017/18, for example, SF_6 emissions contributed approx. 87% of total carbon footprint.

SF_6 is used extensively in electricity transmission as an insulator and arc-quenching medium in high voltage equipment. As SF_6 has excellent insulating properties that cannot be commonly matched by other gases available in the market, SF_6 has become the exclusive insulation and interrupting medium for voltages above 66kV over the last 40 years.

However, SF_6 is a very potent greenhouse gas with a global warming potential (100-year horizon) of 23,900 greater than CO_2. To reduce our environmental impacts associated with SF_6, we have explored all opportunities during our investment planning to utilise SF_6-alternative insulating gases, incorporating these as options within our CBA process where technically feasible. As part of this strategy, all new circuit-breakers and GIS installations will use alternative insulating gases where there are market-ready solutions. We have assessed the associated increase in capital costs and secured stakeholder support for this strategy. Further details of our approach to managing our SF_6 on our network can be found in our SF_6 strategy within Annex 7 .

We will:

Minimise the increase in volumes of SF_6 gas on our network by reducing the volume and leakage rate in new switchgear and minimise leakage from existing assets where technically viable.
Undertake collaborative activities to encourage the technical and commercial parity of alternatives to SF_6.

Our Sustainable Business Strategy details our strategic objectives. Our strategy is reviewed and updated on an annual basis to reflect the most up to date information such as Government policy changes. *www.spenergynetworks.co.uk/userfiles/file/SPEN_Sustainable_Business_Strategy_2019.pdf*

Read more about how our Losses strategy and SF_6 strategy form part of our Environmental Action Plan in the **Annex 7** section.

Supporting the transition to an environmentally sustainable, low-carbon energy system

3

In order to deliver the UK's race to carbon zero, electricity consumption will double. We need to quadruple renewable energy generation through bold innovation alongside market and regulatory frameworks which encourage sustained investment. Iberdrola is at the forefront of the UK clean energy sector.

Iberdrola will spend £6billion between 2018–2022 in the UK with 40% on new renewable energy generation, 42% on smarter enhanced networks and 15% on innovative services and products for customers.

By the end of RIIO-T1, we will have doubled the amount of wind generation on our network to the point where 94% of the generation connected today is carbon free.

The energy generation system is changing, moving from a traditional centralised model reliant on fossil fuels, to a decentralised model focused on low-carbon renewable generation.

Demand for electricity is also changing, with the UK and Scottish government setting ambitious targets to decarbonise sectors such as transport and heat. Our network must be prepared for these changes in demand and generation.

We are leading the decarbonisation of our energy system, having connected 30% of the UK's wind generation on our networks, amounting to ~3GW of onshore wind onto our transmission network and ~2GW to our distribution network. We're investing around £775 million in our network each year.

What we are doing to support the transition

We are upgrading existing assets and building new equipment to link parts of our network to maximise the connection of renewable generation.

We will adopt new approaches, such as innovative technology to control power flow to allow renewables to connect faster.

We will coordinate with SP Distribution and other stakeholders, such as EV charging providers, to ensure the network has the capacity to meet the changing requirements of how electricity is consumed.

We will plan for long term resilience taking a long-term view for all our expenditure to ensure we have a network that is fit for purpose.

Green Economy Fund

We're also driving innovative low carbon solutions through our £20million Green Economy Fund. Given positive support for the initial fund, we propose a price control funded £20m Green Economy Fund in RIIO-T2. We believe that this would play a significant part in accelerating the low carbon transition which in turns helps to stimulate the local economy and allow communities to prosper.

Our proposal for a RIIO-T2 Green Economy Fund has received an overwhelming amount of stakeholder support which can be found within Annex 7.

Better Future, Quicker

We're speeding up the transition to cleaner electric transport and improving air quality.

We have developed our plans to align with the Scottish Government's Energy Strategy and ensure we are playing our part in meeting the ambition for net-zero greenhouse gas emissions by 2045. Similarly, local authorities are forging ahead with ambitious plans – we are helping Glasgow to become the first net-zero city in the UK.

Read more about Supporting the transition to an environmentally sustainable, low-carbon energy system in the **Annex 7** section.

Health and safety is at the forefront of everything we do. We make sure it cascades all the way through our business into every work activity that our employees and contractors deliver, and thus through all our interactions with the public. Here's our approach.

We will train a minimum 2% of our staff as mental health first aiders by 2025.

+2%

We will achieve the transition to the new International ISO 45001 SMS by 2020.

We will deliver 100% of our annual public safety and awareness programme.

100%

Health and Safety

Our health and safety culture

Visible leadership on health and safety within our networks is clear through the commitments detailed in our health and safety policy, which is signed and endorsed by the SP Energy Networks Chief Executive Officer.

Our Health and Safety Operating Plan which details our goals and objectives is developed annually, endorsed by the CEO and Executive management team and briefed to the business. This plan is reviewed regularly, so we can make sure enhancements are being delivered. In addition, every meeting in our networks begins with a health and safety contact, and regular meetings dedicated to reviewing health and safety performance and reporting are scheduled weekly and monthly.

Health and safety communications on incidents and lessons learned are published to the business and wider industry to share findings and improvements identified by our internal processes.

Health and Safety Matters

A consistent message across our organisation

Our commitment to health and safety is underpinned by our business-wide branding, "Health and Safety Matters", which is visible on all communications and employee work clothing.

We have also developed a core health and safety message through our five Health and Safety Essentials. Clear, simple and easy to remember, these are our take on important health and safety messages that are visible across the business.

HEALTH & SAFETY ESSENTIALS

Responsibility within the organisation

Day-to-day management of health and safety rests with line management, who are fully trained and therefore skilled in delivering their responsibilities.

Line management are also given professional support and guidance in health and safety by a professional team that includes qualified health and safety managers, and engineers providing compliance auditing. This team also includes Occupational Health professionals who provide Statutory Health surveillance activities and Health and Wellbeing initiatives.

Compliance with health and safety legislation

We recognise that compliance with all UK health and safety legislation is a must for our networks, so our health and safety management system is independently audited and is currently certified to British Standard OHSAS 18001.

In 2019, we began a program of transitioning to the new international health and safety standard ISO 45001. However, we view this as a minimum requirement and go far beyond basic compliance in our efforts to reduce potential harm in our activities.

All of our major construction activities comply with the Construction, (Design and Management) Regulations 2015 and even when the project is not notifiable to the HSE under CDM, we use CDM 2015 as the benchmark for good engineering and construction practice.

Performance and track record

We have a comprehensive suite of both leading and lagging health and safety performance indicators. We aim to reduce our accident and incident rates year-on-year, while reducing targets that are measured and reported to the CEO and Executive team and published to our workforce.

We measure the performance of our own staff and contractors, and treat them equally in our drive to improve health and safety performance. Our headline performance statistic of Total Recordable Injury Rate (TRIR) shows a reduction over time for both our employees and the contractors we engage.

We strive to achieve high levels of health and safety performance, but we do recognise that when accidents and incidents occur they should be thoroughly investigated and analysed, with lessons learned being implemented and shared around our business and the industry. Our leading indicators include a wide ranging internal operational audit program, near miss trend analysis and evaluation, and an occupational health screening programme.

Contractor Selection and Management

SPEN have a detailed Pre-Qualification process to only select contractors who provide demonstrable evidence of meeting key H&S performance indicators. Contractors working on behalf of SPEN are subject to regular compliance audits and monthly reports on H&S performance is required of all contractors. SPEN host regular contractor forums to share lessons learned and to reinforce expectations on H&S performance. Contractor H&S performance is evaluated at end of contract stage and the output informs procurement strategy for future contractor selection.

Managing operational risk and reducing harm

Reducing risk and potential harm is vital. Our activities are fully risk-assessed, and the comprehensive training programmes delivered at our in-house training centres guarantee the competence of our staff.

When selecting contractors, we undertake a thorough analysis of their health and safety management systems and performance. All equipment used in our activities is certified and maintained to the manufacturer's recommendations. An operational compliance team audit the activity of both us and our contractors to a defined annual programme to test the risk reduction controls implemented during our operations. Any lessons learned from these audits are shared with the wider business and, where appropriate, integrated into our training programmes.

Guarding physical and mental health

We strongly recognise the "health" in health and safety, and take measures to promote healthy living and wellbeing for our staff. We plan and fulfil all of our statutory health surveillance requirements, and have an annual programme for delivery that is measured and monitored.

Going beyond statutory requirements, we promote fitness and health as a lifestyle choice with initiatives such as the "Daily Mile" lunchtime walks programme. We also provide our staff with access to gym facilities to encourage physical fitness.

Crucially, we recognise that mental wellbeing is of equal importance to physical wellbeing. In 2018, we started training volunteer staff from across the business as mental health first aiders.

Protecting the public

We don't just value the safety and wellbeing of our staff members, but also members of the public. We therefore invest heavily in communicating the potential risk of interacting with the electrical network.

For example, we provide teachers with educational programmes such as "PowerWise" to be used in awareness-raising lessons in schools.

Our staff volunteer to participate in safety events in the communities where they live under the banner of the "crucial crew". We also work closely with the agricultural community to provide information on maintaining clearance between farming activities and the electricity network, and have significant visibility at agricultural shows.

Engaging with regulators and the industry

As a member of the Energy Networks Association, we contribute to improving industry health and safety standards.

We also engage directly with the UK Health and Safety Executive in reviewing our own activities and developing safer working methods in the industry, all with the aim to further manage and control potential risk.

Health and safety outputs *– RIIO-T2*

As an organisation, we have developed the following set of measurable health and safety outputs.

These are designed to clearly demonstrate our continued determination to lead on public and industry safety, whilst still protecting our employees and contractors from potential harm.

Reducing harm and promoting health and wellbeing	We will reduce our Total Recordable Injury Rate (TRIR) a minimum of 10% by 2025.	We will work with our service partners to reduce their Total Recordable Injury Rate (TRIR) by a minimum of 10% by 2025.	We will achieve greater than 95% delivery of our Health and Safety Operating Plan Objectives year-on-year.	We will have trained a minimum 2% of our staff as mental health first aiders by 2025.
Compliance with health and safety legislation	We will continue to subscribe to and support all industry initiatives and KPIs published by the Energy Networks Association (ENA).	We strive to achieve zero Regulatory Enforcement Notices from the UK Health and Safety Executive.	We will achieve the transition from the BS OHSAS 18001 SMS Standard to the International ISO 45001 SMS by 2020.	
Managing operational risk	We will continue to deliver 100% of our annual Electrical and Plant Authorisations programme. This includes initial and refresher training testing and ensuring the competence of our employees.		We will deliver 100% of our annual health and safety legislation and Operational compliance audit programme, communicating findings both internally and, where appropriate, with the wider industry.	
Public health and safety and education on electrical awareness	We will continue to communicate and educate the public on safety from the network through multimedia platforms.		We will deliver 100% of our annual public safety and awareness programme through the following channels: *"Power Wise" classroom safety education programme – delivering safety awareness to schoolchildren of potential harm from exposure to electricity.* *"Power Wise" website – providing specific health and safety modules for teachers to deliver to their pupils.* *"Crucial Crew" Community Safety events – engaging with the community on health and safety.* *Fixed Safety Education Centres risk factory, safety central and dangerpoint – significant footfall of visitors is measured annually and published.* *Deliver a minimum of five safety demonstrations at agricultural community shows per year – working with the agricultural community in reducing potential risk from electrical infrastructure and contact with farming activities.*	

To deliver a smart, efficient network, we need to coordinate our transmission network with the distribution system, other network operators, the generation connected to it, and the demand it serves.

As heat and transport are decarbonised, we also need to work more closely with gas network operators and with new stakeholders such as EV charge point providers.

SP Distribution, *Pg 52* 1
The Distribution Network Operator in the same region as ourselves, SP Distribution is one of the main parties we have coordinated with.

Other TOs and the ESO, *Pg 53* 2
Being connected to SSEN and NGET, coordination with the other transmission owners and the ESO is essential to ensure an efficient transmission network across Great Britain.

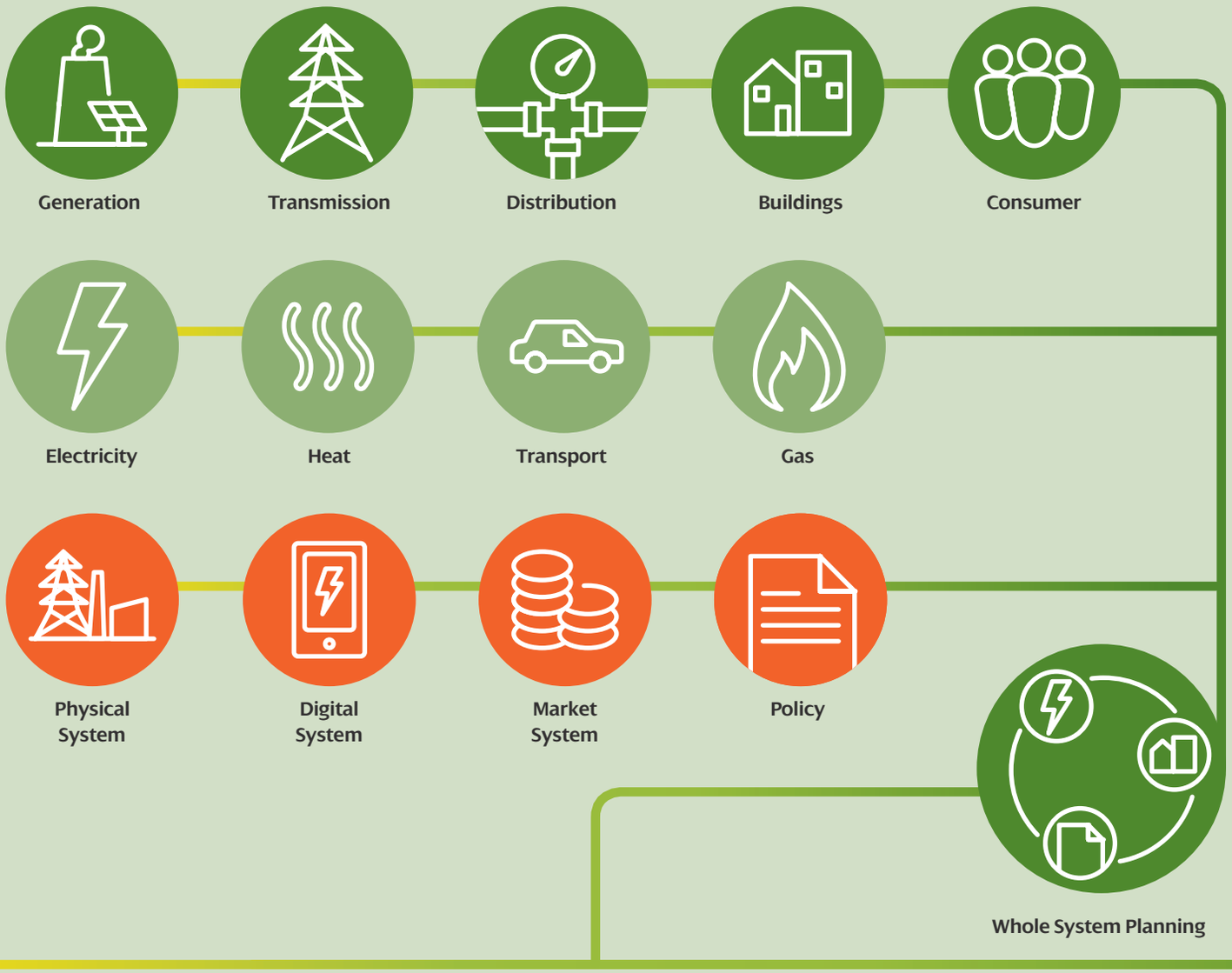
Other network operators, *Pg 54* 3
To ensure a consistent approach, we have worked with other gas and electricity network operators to plan for the future.

Generators, *Pg 55* 4
The connection of generation is one of the largest rivers of expenditure on the network and coordination is essential to ensure they are connected efficiently.

Other stakeholders, *Pg 55* 5
as we plan our network including Government and Local authorities as well as a range of other parties.

Whole System Planning

Our Whole System approach



Our approach

Whole system thinking is an increasing priority for our stakeholders. We believe that for customers to get the maximum benefit from a whole system approach, it's necessary to coordinate beyond just the electricity network, to work with other utilities, generators and customers.

We own and operate both the distribution and transmission networks in central and southern Scotland. So we have the advantage of seamless planning across the electricity network from power station to plug.

From the future energy scenarios we've created, we've modelled the potential energy flows at the interface between the distribution and transmission network. Our energy scenarios are aligned with the National Grid System Operator 2018 Future Energy Scenarios, but we've modelled the impact of these down to individual substations. We don't expect any single energy scenario to be correct in practice, but we've used the range of projections that they provide to frame and test the flexibility of our plan to make sure it can adapt to a range of realistic outcomes. These scenarios also examine the interaction between the gas and electricity systems as well as other changes in the transport and heating sector that may impact us. We have engaged with stakeholders to inform these and cover the whole system.

We've coordinated with a number of key parties to achieve our whole system approach, and have made every effort to coordinate our plan from the outset, to reduce the uncertainty in the price review period.

There will still be risk and uncertainty. Through uncertainty mechanisms, our plans can flex to accommodate this, but we will work to help achieve consensus on the whole systems policy.

Organisations we have coordinated with:

- SSEN
- National Grid ET
- National Grid ESO
- SP Distribution
- SGN
- Generation Developers
- Existing customers
- Scottish Government
- Local Authorities
- Transport Scotland

Assessing the costs of whole system planning

Through whole system coordination, different approaches by different parties may be taken to address emerging issues. Options can include whether it is distribution or transmission who undertakes work, a commercial solution or new assets being required, or the timing of when a project is progressed.

These trade-offs need to be evaluated to identify the most cost effective option. To make this evaluation, we have used a cost benefit analysis (CBA) approach to ensure a fair comparison is made. We have worked closely with Ofgem and the other network licensees to develop a method of calculation of the longer-term costs and benefits in a consistent way.

This approach has been used across all our projects where competing options are available. A CBA approach is also undertaken by the ESO to evaluate projects as part of the Network Options Assessment process. We have engaged an independent specialist to make sure that we have undertaken the analysis consistently and in accordance with the agreed methodology. The inclusion of CBAs in the investment planning processes increases our confidence that we are making the right interventions in the right assets at the right time.

CBAs are not always appropriate. For many projects we have an obligation to undertake work, like connecting a customer to the network. How we go about doing this may be possible in different ways, and where this is the case, we would use a CBA to inform our decisions.

For more details please refer to **Managing Uncertainty** section.

Coordinating with SP Distribution

1

As a first step, we've ensured that SP Distribution's plan, for the remainder of RIIO-ED1 and current thinking for ED-2 are coordinated with our transmission plans.

Substation upgrades

We have jointly identified a number of sites that are approaching or exceeding the design limit on the boundary between transmission and distribution. This is occurring for a variety of reasons including thermal, voltage and fault level constraints. The key driver behind these sites reaching this limit is due to increasing levels of embedded generation.

Working together, we have identified sites where a distribution or transmission solution would both be viable. This was based on a range of factors, including site layout, network design and existing equipment capabilities.

We have jointly assessed sites to ensure our transmission plan is deliverable and meets the needs of the distribution network and its customers. Through this coordinated planning, we've evaluated a range of solutions on both the distribution and transmission network, over the lifetime of the assets. These have been tested using a cost benefit analysis. This enables us to identify the most economical approach to minimise costs and risk to consumers in the long term – we have considered conventional and innovative means of addressing the issues.

Working with the DSO model

As SP Distribution evolve to become a Distribution System Operator, we will continue to work closely with them to look at what other opportunities arise. We expect that this emerging model will create new opportunities to coordinate commercial services for flexibility which will change the need for further reinforcement as the management of demand, generation and storage becomes further embedded in the distribution network.

A more flexible system

The increasing levels of distributed generation in Scotland is leading to greater flows of power from the distribution network onto the transmission network. As well as upgrading some of our assets to deal with this, we are also looking at smarter ways which operate across distribution and transmission.

In South West Scotland we have developed a coordinated approach spanning distribution, transmission and the electricity system operator to create 1,250MW of new capacity. We have assessed the different options to provide this capacity and are implementing an extensive active network management system, utilising real time control systems on both the network and with generators.

This system will operate across almost one third of our network area, comprising of 15 substations and coordinate generation connected to both distribution and transmission levels. This is a collaborative project between SP Distribution, SP Transmission as well as the ESO. It has required extensive planning and coordination with generation customers in the region to ensure it meets their needs. This has been supported through regular stakeholder forums to provide updates and shape the design of this initiative.

Through putting whole system planning in action such as this, we are reducing the visual and environmental impact of constructing new assets, and maximising the assets we already have in operation.

Coordinating with other TOs and the ESO

2

We work closely with the other transmission owners and the ESO. This ensures our planning of the transmission system is coordinated and complies with the standards that govern the design and operation of the network.

This coordination work is supported through the following joint forums and planning frameworks:

Joint Planning Committee (JPC)
Our activities are coordinated with the other transmission owners and the ESO through the Joint Planning Committee (JPC). This group meets quarterly to discuss investment plans, status of any joint projects, programme of works and considers the impact of changes to various industry frameworks and codes.

ESO Future Energy Scenarios
The annual production of the Future Energy Scenarios are used as the basis for evaluating major transmission upgrades, and used by us as the basis for our RIIO-T2 plan.

We actively support the ESO to produce these scenarios by sharing our insights and planning information, to make sure they reflect our network and customers. These are the same scenarios which we have based our own analysis on for RIIO-T2.

Electricity Ten-year statement
Every year we produce a review of the planned changes on the transmission network for the next ten years. This allows other interested parties such as generators and customers to understand our engineering plans for how the network will evolve in the longer term.

Network outage planning
Planning for outage on the network requires careful planning and coordination with the ESO and other TOs. Outages are required on the transmission system to carry out works in a coordinated way whilst maintaining system security. This planning is undertaken many years ahead right through to on the day decision making.

Network access policy
This policy covers the planning approach taken by the TOs and the SO. It describes the necessary consultation and stakeholder engagement that is be required to access the network and a joint network access policy is developed across all three TOs. This policy clarifies what the SO and other stakeholders can expect from the Scottish TOs regarding how our actions affect the availability of the transmission network.

Network Options Assessment (NOA)

This is one of the most notable whole system activities which have a major bearing on our RIIO-T2 plan. Using the national Future Energy Scenarios, the generation and demand backgrounds are used to calculate what level of power is required to be transferred across the network boundaries for each scenario for the next few decades.

Each transmission owner proposes projects that could address the issues that are emerging from the ESO's analysis. Where projects span two or more license areas, the TOs work together to develop these. The ESO then performs an economic study of all the proposals to identify the least worst regrets approach and provides an indication whether projects should be progressed or put on hold. The TOs then work together with the support of the ESO to fully justify the works on the system.

We have engaged with the ESO on our proposals for RIIO-T2 to ensure that they are coordinated. The ESO is carrying out a number of pathfinder projects to look at alternative means for addressing voltage, stability and constraint issues on different parts of the network. We're following this work closely to make sure our RIIO-T2 plans are aligned as much as possible at this point in time. We recognise that the pathfinder projects and other changes may have an impact on the work that we need to undertake in the RIIO-T2 period.

As we have developed our plan, we have considered commercial alternatives for some of our projects where these are viable. We have evaluated these options through a cost-benefit analysis to consider which approach is the most cost effective for consumers with the support of the ESO. Over the course of RIIO-T2, we will continue to review our plan to consider alternative approaches that may emerge through the learnings from the ESO pathfinder projects where these bring better value to consumers.

Coordinated planning
Our coordinated boundary upgrades identified through NOA will increase capacity by

1500MW

Coordinating with other network operators

3

The electricity network is extensively interconnected, and coordination is vital. As heat is decarbonised, the interactions between gas and electricity are only going to increase.

This work required extensive collaboration to agree common factors with a bearing on the Business Plans. The licensees developed a core scenario that enabled whole system impacts of the business plans to be assessed.

The focus of this work was on the key drivers that would trigger investments in the networks that will have a material impact on licensees' business plans. This work has been referenced in our Load Related Expenditure section and details the SPT-specific scenarios we have developed.

Open Networks
We have also been working with the other electricity network operators as part of the Open Networks project. This is a major energy initiative led by the Energy Networks Association that will transform the way our energy networks operate, underpinning the delivery of the smart grid. It brings together nine of the UK and Ireland's electricity grid operators, respected academics, NGOs, government departments Ofgem and other interested parties.

The Open Networks project is still ongoing, and learning from this will be embedded in our business as the project develops.

Working across sectors
We have also been working with SGN on the interactions between the gas and electricity network in central and southern Scotland. One of the major challenges for gas distribution networks has been the increase in small gas generation plants which are seeking to connect to the network. The purpose of this plant is to provide electricity at peak times in response to various market incentives. This technology has an impact on both the gas and electricity networks. We are now jointly working with SGN to consider how our planning for these sites can be more effectively coordinated.

We are also involved in a joint project with SGN in the East Neuk of Fife. This mainly focuses on the interactions between the gas and electricity networks. However, it will also have a bearing on the transmission network, and provide insight into the potential impact at a larger scale across our network area.

The key areas being considered by the Open Networks project are:

- Whole electricity system planning, including transmission and distribution data exchange and flexibility services.
- Customer information provision and connections.
- Distribution system operator transitions.
- Whole energy systems transition which also involves gas network operators.

Coordinating with generators

4

In our view, working with electricity generators presents one of the largest opportunities to deliver substantial benefits through whole system planning.

From the large amount of generation we've connected over the course of RIIO-T1, we have extensive experience in effective planning with generators, in particular renewable generators.

As well as providing points of connections we have also established a number of innovative control schemes with generators. These allow for increased operational control of the transmission network and generators connected to it. They have been developed with the ESO to provide a coordinated approach that offers the greatest value in their operation of the network.

Engagement with generators has also been one of the key influences to make sure our plan is coordinated with these customers. In RIIO-T2 we also have a number of schemes which are designed to further improve the operation of generators connected to the network. These include:

Synchronous compensation which will help to improve the system strength and operability as more renewable generation connects on to the system. Without this, the growth of renewable generation will cause problems on the network. This has been designed specifically to consider the impact on the whole system.

Harmonic filters on the transmission system which compared to previous approaches, provide a cost-effective and coordinated solution. This work will be done in coordination with generators, to minimise the cost of connections to the network.

Coordinating with other stakeholders

5

To help create a truly coordinated whole system approach, we have worked with the Scottish Government in their development of a Network Vision for Scotland for both gas and electricity.

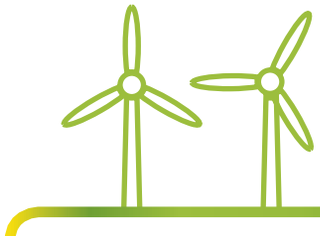
The Scottish Government identifies that to achieve their long-term energy plans, they need organisations to work in partnership, and deliver networks that support wider social and economic aims.

We have worked extensively with the Scottish Government in the development of this strategy. We are also continuing to support the Scottish Government through a network summit planned for later in 2019, along with the creation of a Scottish Energy Networks Group focussed on delivering the vision set out in this document.

In addition to this, we're coordinating with other parties involved in the wider whole system, including:

Transport Scotland – to help support their plans for the electrification of transport in Scotland.

Local authorities – the Scottish Government is placing a greater emphasis on local authorities establishing a 'local heat and energy efficiency strategy' as part of their overall development planning process. We have supported the Scottish Government in engaging with local authorities to outline the interaction of this with the electricity network. This has led to bilateral discussions with some local authorities on their ambitions, and how we can support them.



Scottish Government Network Vision: *www.gov.scot/publications/vision-scotlands-electricity-gas-networks-2030/*

Over the next decade we expect to see major changes to the way the network operates. We'll need to connect more renewable generation as the UK moves away from carbon-producing sources. The electrification of heat and transport will also increase demand, and change the way that electricity is consumed.

Enabling this evolution is the core aim of our load related expenditure. This section sets out the changes we anticipate, how we expect to accommodate them and the impact this will have on how we invest our funding.

Load Related Expenditure

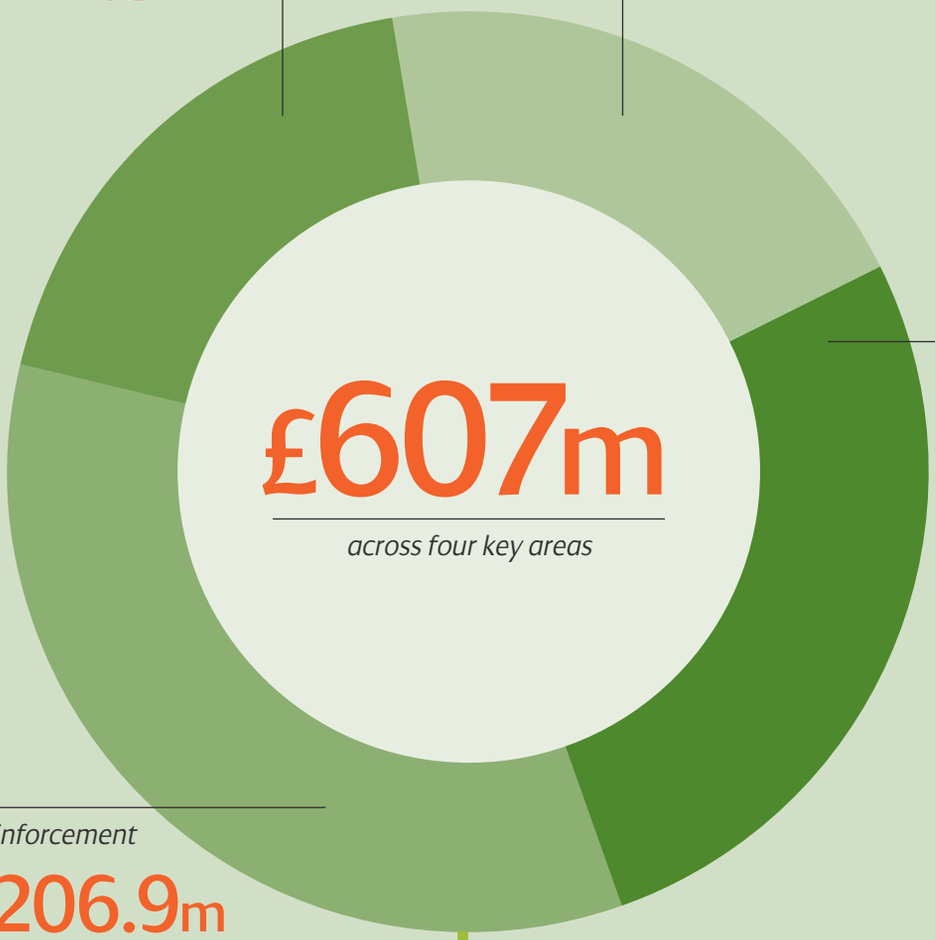
East Coast Reinforcements
We will deliver a number of upgrades to the circuits which connect with SSEN to increase the capacity by a total of 1200MW. This is delivered across two phases to provide increased capacity for more generation to connect across Scotland.

£51.4m investment

An overview of our planned expenditure across load

Generation connections
£114.5m

Demand connections
£121.6m



Boundary upgrades
£163.8m

Reinforcement
£206.9m

Planning for the future

We can't be completely certain what we'll need the transmission network to be capable of years from now. We must create a business plan with the flexibility that makes sure the needs of customers are met in a cost effective and efficient way, whatever the future brings.

Load Related Expenditure

Load related expenditure details the work we plan to undertake to accommodate changing customer requirements.

This includes:

- Connection of new generation to the network.
- Boundary upgrades at the points where we connect with SSEN to the north and NGET to the south.
- Reinforcement to ensure our network continues to operate to the expected standards.
- Connection of new demand on the network.

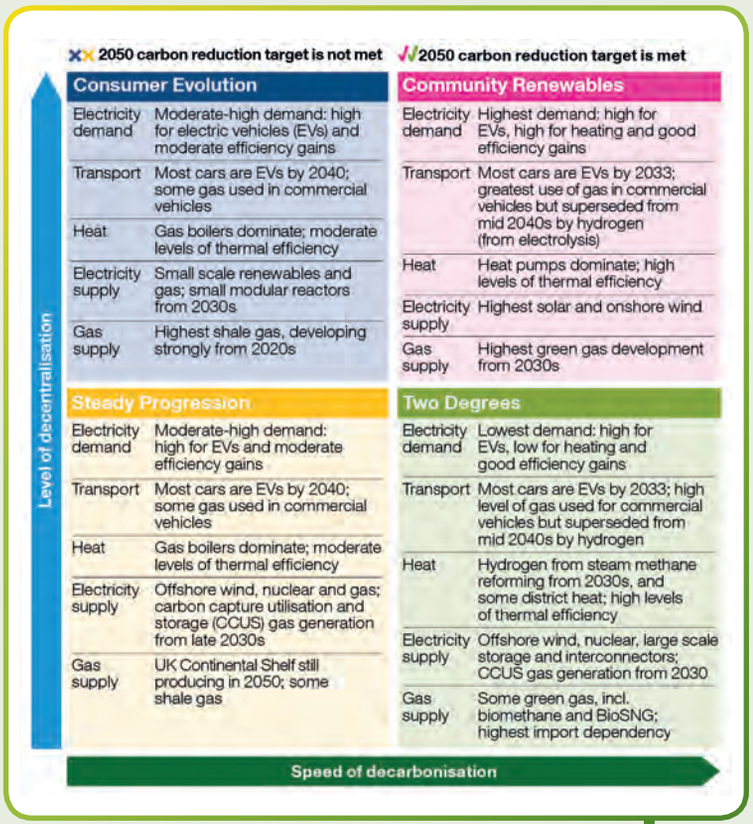
We plan for the future with different scenarios

Together with Baringa Partners and Element Energy, we've developed four scenarios for the SPT network area. These scenarios are based on the four National Grid 2018 Future Energy Scenarios but we have revised them into a more granular level for our network area to understand what this means for us.

These scenarios help us examine what we may need to make sure the transmission network can respond to, do to future changes. We've developed a plan that is flexible enough to meet the wide range of uncertainties outlined in the scenarios.

The Future Energy Scenarios are framed by two key drivers of change:

- Whether the scenarios meet the overarching 2050 carbon reduction targets (speed of decarbonisation axis).
- The level of decentralisation of the energy system.



Full detail of the energy scenarios are available in the annex: *Central and Southern Scotland Electricity Scenarios 2018*.

Scotland's renewable target

50% of the energy for Scotland's heat, transport and electricity is to be supplied from renewable sources or equivalent

50%

A greater pace of change

Whilst our scenarios cover the period out to 2040, it is the potential pace of change through the RIIO-T2 period and in the years shortly thereafter that is of most importance when planning investment for our RIIO-T2 submission.

Each scenario reflects a complex combination of factors. At a high level the Community Renewables scenario appears most closely aligned to the ambitions set out in the Scottish Government's Climate Change Plan, in terms of expansion of renewable electricity – particularly wind – and uptake of electric vehicles and heat pumps to help drive decarbonisation of the wider energy system.

The National Grid Future Energy Scenarios already contain a spatial breakdown within our licence area. However, this breakdown is generally based on simple GB-wide proxies and hence a key focus of our analysis has been to tailor the scenarios to our area. This was undertaken via a number of routes including use of supplementary data sources, refinement of the methodology to disaggregate to the key nodes on our network, and feedback from external stakeholders.

Assessing our options

Our energy scenarios are one of the indicators we have used to identify where changes to the network will be required. Once we have identified an issue, we then consider how we go about addressing this. We use our engineering experience and detailed knowledge of the network to identify a range of options and then assess these using a cost benefit analysis (CBA). A CBA is not always applicable, and we use this as an indicator on the best course of action to take. As part of our CBA, we also consider the different scenarios to look at the sensitivity between different solutions.

2045 – Scottish Government net-zero GHG ambition

2032 – The need to buy petrol and diesel cars or vans will be phased out

2030 – Equivalent of 50% of the energy for Scotland's heat, transport and electricity is to be supplied from renewable sources

2026

2021 – Our investment planning focus

You can find full details of our CBA approach in **Annex 8**: Cost Benefit Analysis.

Identifying the drivers of supply and demand

With 20% of all cars forecast to be electric, this could result in an increased peak demand of

700MW

Knowing how energy demand and supply could evolve helps us understand the reinforcements we may need to make to our network. These are reviewed in more detail in our scenarios. Here is an outline of what we expect to see.

How we think electricity demand will evolve

Over the last ten years, demand for electricity has fallen, due to changes in the industrial landscape and major progress in energy efficiency. However, the demand is set to increase as we move towards more electric transport and heating more buildings by electricity.

We think demand changes in the coming years will be driven by:

Electric vehicles – we anticipate up to 20% of vehicles in Scotland will use electricity by 2030. That's around 590,000 vehicles which could require up to 700MW of power at peak times, approximately 20% of additional demand. To minimise the impact on the network, we will need to manage this demand flexibly, for example by delaying charging electric vehicles until an off-peak time overnight.

Heating – using electrical heat pumps to heat buildings is currently quite rare, but it may become more popular in the future, particularly in new build and off-gas grid properties. We don't expect this to impact demand by much in RIIO-T2. However, it's one of the areas most difficult to predict: electrical heating is just one of the approaches the UK could take to decarbonise.

Domestic demand – we're using less electricity in our homes for things like appliances, lighting and other consumer goods, due to improving energy efficiency and 'behind the meter' generation such as rooftop solar panels. We expect further reductions as our homes become more energy efficient and people are incentivised to shift electricity use to off-peak periods.

Industrial and commercial demand – demand from shops, offices and industry has also reduced due to improved efficiency and behind the meter generation. Economic factors will mean this trend is likely to continue, with the exception of a small number of energy intensive industries.

Population changes – demand from each consumer is reducing but our population is increasing. We expect population growth in our area to be modest and won't have a big impact.
A 2% growth in population is forecast by 2026.

Overall, we expect new demand to grow relatively modestly through the RIIO-T2 period and on to 2030, although we see it accelerating rapidly after this point. However, it is the flexibility of new demand, particularly from electric vehicles, which will play the biggest part in whether peak demand increases.

How we think electricity supply with change

At the same time, we need to understand how electricity supply is likely to evolve. New distribution-connected and behind the meter generation may help to offset increases in demand seen by the transmission network. As more energy is generated locally, the transmission network will continue to play a role, enabling power to be coordinated nationally. Large increases in supply, particularly from renewables such as wind and solar, will mean increased exports across our network.

What will influence supply?
There are three main factors for our network:

Wind generation – the steady growth in wind capacity on our network is likely to continue, based on projects currently being developed. Growth in transmission-connected wind, both onshore and offshore, is expected to more than double in capacity across most scenarios, largely due to offshore wind – a prediction most of our external stakeholders agree on.

Solar PV – solar photovoltaic (PV) generation is set to increase, including small-scale building rooftop schemes and larger scale solar farms. However, we expect it will have a minimal impact in winter in Scotland, and a relatively low impact in summer.

Energy storage – storing electricity helps with the management of peak demand and network constraints. At present, storage capability is largely limited to pumped hydro. We're now seeing a greater interest in large scale batteries connecting to the distribution and transmission network, allowing power to be stored when it's plentiful and inexpensive, and used when necessary. We anticipate it having a low impact on the transmission system over the RIIO-T2 period.

We will also be impacted by some of the changes that take place in other parts of the network across Great Britain. New nuclear generation in England and Wales, an increasing number of interconnectors with other countries and other forms of generation such as gas will all have an impact on the operation of our network as they meet demand when renewables are not available.

Distribution System Operators (DSOs) and the Distribution Price Review are further discussed in our **Whole System Planning** section.

Other changes we expect to see

In addition to changes to energy demand and supply, there are other transitions which may materialise during the RIIO-T2 period:

The emergence of **Distribution System Operators (DSOs)** is likely to play a significant role, developing rapidly following the next Distribution Price Review in 2023. In the long term, this could change the supply and demand seen by the transmission network.

The Scottish Government has identified a potential role for **hydrogen** in the future energy mix, using it to decarbonise by substituting methane for heating, or as fuel for transport. However, we don't envisage it having a big impact on our forecasts in the RIIO-T2 period.

The closure of existing generation, in particular the nuclear generation at Hunterston, and longer term, Torness. The loss of this generation will create some capacity for new generation, but without mitigating reinforcement, will also significantly impact the operability of our network.

Overall, there is a wide range of uncertainty in the expected levels of demand and supply in the long-term scenarios. It's worth noting the most rapid changes happen from the late 2020s onwards – after the RIIO-T2 period.

Alignment with the industry view

We have also worked with the other network operators across gas and electricity to develop a Common RIIO-2 Scenario. This sits within the overall framework we have developed, and helps to consider the dynamics of a scenario across the different sectors. A comparison with this analysis is shown below.

Across most areas, our baseline assumptions are aligned with this work. The only area where our views are different is in relation to generation which is connected to the Distribution network in our area. The apportionment of this to our region was incorrect and our current baseline plan is above the range identified but is consistent with the historic trends we have seen and the number of contracted connections which SPD currently have.

Key Drivers	SPT 2017 starting point	SPT 2026 baseline plan	Common view 2030 range SPT *Low*	*High*	Notes
Offshore wind – Transmission connected	0GW	0.45GW	1GW	2.5GW	Timing of additional generation is still uncertain and these are funded through uncertainty mechanisms.
Onshore wind – Transmission connected	2.9GW	4.7GW	4.6GW	5.5GW	
Nuclear	2.2GW	1.2GW	0GW	0GW	Alignment with Common view Torness nuclear power station is expected to close in 2030.
Distribution Generation	1.6GW	2.4GW	0.5GW	0.8GW	Apportionment in common view is incorrect. SPT is consistent with FES18.
Other generation – Transmission connected	0.3GW	0.3GW	0.1GW	0.2GW	
Interconnectors	0.5GW	0.5GW	0.5GW	1GW	Moyle interconnector only
Storage– Transmission connected	0.44GW	0.44GW	0.5GW	0.8GW	Additional storage will be funded through uncertainty Mechanism.
Electric Vehicles	5,157	Up to 198,000	680,000	720,000	
Alternative heat	5,252 dwellings	Up to 80,000 dwellings	80,000 dwellings	164,00 dwellings	
Peak demand	3.3GW	3.4-3.5GW	4.1GW	4.2GW	Range of scenarios considered as high and low demands have different impacts on the network.

Listening to our stakeholders

Our scenarios have been developed through engagement with a wide range of stakeholders to ensure our plans reflect their views and future plans.

Gathering feedback

We refined the National Grid 2018 Future Energy Scenarios to better reflect the likely evolution of the electricity system within our own network area. The scenarios were reviewed in detail with stakeholders through a number of channels:

- Face-to-face workshop in early 2018 to help shape our approach.
- Q&A session with stakeholders by webinar.
- A large number of two-way discussions on the scenarios and our assumptions to get more detailed views on different elements.
- Direct correspondence following our consultation on the scenarios.

A wide range of stakeholders and customers were involved in this process, with particular emphasis on those most likely to be directly impacted by our plans. Stakeholders included national and local government, generation developers, existing directly connected customers such as Network Rail, Industry trade bodies including the Association of Decentralised Energy and other network operators. This wide range provided a variety of different views on current and future challenges.

Stakeholder feedback

Here's what the stakeholder feedback told us:

- Our use of scenarios is well-supported.
- The scenarios provide a range of credible potential outcomes which allow us to plan for uncertainties in the RIIO-T2 period, and give stakeholders confidence.
- There are no major issues that our scenarios do not accommodate for stakeholders.
- Stakeholders want us to use all the scenarios to highlight the range of uncertainty throughout the RIIO-T2 period.
- People feel that if just one scenario is chosen, credible options could potentially be excluded from the business plan, creating misalignments with other RIIO-2 submissions.
- To achieve the flexibility of managing demand in the ways proposed, it is likely to require changes from a number of parties to ensure this happens.

We have reflected this feedback into the process of building our plan. We have examined our network against all the scenarios rather than just one view, and tested that the plans are required for each. Where action is required in only some of the scenarios, we will treat this expenditure as an uncertainty.

Engagement with stakeholders has continued following the development of this document, and this has been taken into account in the development of our plan. We have had some specific feedback on particular assumptions we have made. We are reflecting these into our plans and will use these views as part of the ongoing development.

A detailed overview of the process we have taken and the views of stakeholders is included in **Annex 14**: Baringa SPT Future Energy Scenarios Analysis.

Using scenarios to build a flexible plan

We need to make sure our plans adapt to meet customers' needs. Our scenarios provide us with a framework to test the range of flexibility we need to be prepared for. We have used our scenarios to stress-test our plans, and make sure they can meet the generation and demand outputs for each scenario.

For our plan, we've made sure:

the expenditure is justified for each of the scenarios
the regulatory mechanisms have flexible means of adjusting the allowances to reflect this uncertainty

As we're already aware of many of the generation connections in the future, we've used these to complement the scenarios further. Reviewing these future connections has allowed us to take a more robust view of which generation we have a greater confidence in connecting to the network. This helps to provide greater certainty in our plans.

To develop our plans, we have used our highly detailed models of the electricity network to examine future issues that may arise. We've updated the models to study the different scenarios to identify where problems on the network may arise in the future, including changes to the generation make-up and demand profiles.

Full details of how we have assessed this are detailed in the relevant engineering justification papers for each project.

Standards and regulations

The design of the electricity transmission network is governed by a range of standards and regulations. When we study the future network, we need to ensure that it meets all of these requirements. These help to ensure safety, consistency in the way that the network is designed and a level playing field for all parties and is a licence requirement.

Some of the key documents include:

Security and quality of supply standard (SQSS) – setting out criteria and the methodology for planning and operating the National Electricity Transmission System
Grid Code – technical code for connection and development of the National Electricity Transmission System
Electricity safety, quality and continuity regulations (ESQCR) – legal requirements for the safe and secure operation of the electricity network.
System Operator-Transmission Owner Code (STC) – defines the relationship between the transmission system owners and the transmission system operator.

Standards Review

BEIS are have appointed a group of industry experts to review existing industry engineering standards. This process is at any early stage and we will continue to monitor it before we submit our plan in December.

The **Common RIIO-2 Scenario** can be found here: *http://www.energynetworks.org/assets/files/ENA%20Common%20RIIO2%20Scenario%20report%20-%20March%202019%20FINAL.pdf*

Expenditure on generation connections

1

Connecting new generation to the transmission network requires investment in new infrastructure. It may also lead to the need to reinforce the existing network, allowing additional power to flow. Infrastructure can include overhead lines, cables or substations as well as innovative solutions such as active network management.

The equipment and capacity is entirely dependent on the location and size of the generation seeking to connect.

However, there is a high level of uncertainty over future levels of generation connections, with numerous factors affecting site development. We have engaged with a wide range of stakeholders to inform our views on future generation and cross-checked these against the future energy scenarios.

For each of the dominant technologies, we have summarised this feedback below and referenced it against the Energy Networks Association Common RIIO-2 Scenario analysis.

Onshore wind

By the end of RIIO-T1, we expect to have approximately 3.5GW of onshore wind connected to the SPT network.

The ENA Common RIIO2 Scenario report identified between 4.6GW and 5.6GW of onshore wind by 2030 which is consistent with our view. In RIIO-T2 we have a high confidence of 1GW of additional onshore generation will connect to the transmission network. We expect further generation will also connect, but the volumes, types of projects and locations are far less certain. We believe that this is a credible out-turn for the end of RIIO-T2 based on discussions with developers, but it has some dependency on changes to the support landscape for onshore wind. For this reason, we have not included these higher amounts in our baseline plans and will use uncertainty mechanisms to fund these. Stakeholders have also highlighted the likelihood of repowering existing windfarms as they approach end of life. From speaking to existing customers and examining the relevant sites, we expect this to have a low impact in RIIO-T2.

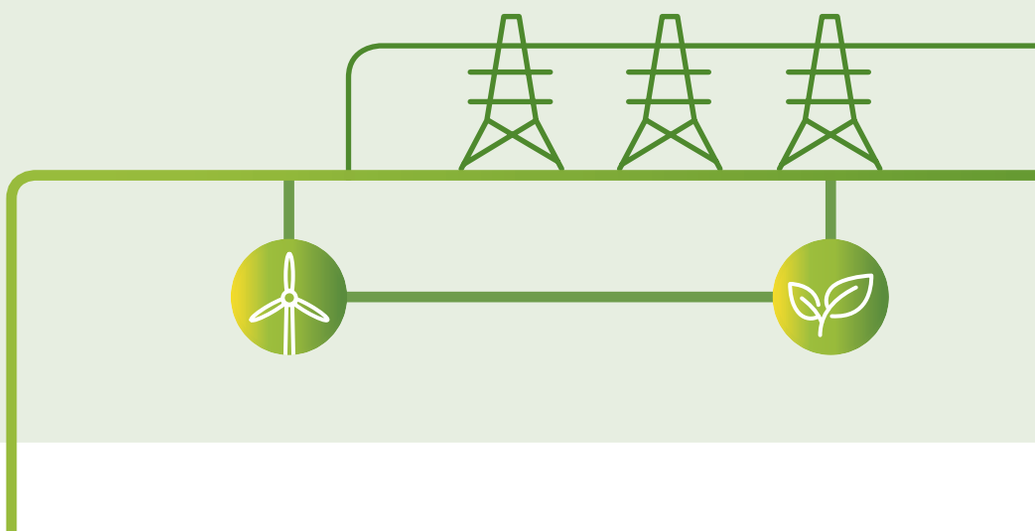
Offshore wind

We have 2.1GW contracted for connection in RIIO-T2, plus 450MW in construction which will be energised at the start of RIIO-T2. More information on these projects will become available as we move closer to the RIIO-T2 period, and we'll review these before the final submission of our plan in December 2019.

These projects present unique challenges in the amount of capacity they contribute. Due to their scale and connection requirements, we have identified the costs but have treated them as an uncertainty in our plan. To minimize the risk, we are proposing a different uncertainty mechanism to accommodate these compared to onshore wind. The ENA report has forecasted 1–2.5GW to be connected by the end of 2030, which is consistent with our planning assumptions.

In RIIO-T2, we are expecting to connect an additional renewable generation of at least

1GW



Distributed generation

By the end of RIIO-T1, we forecast to have 1.9GW of generation connected to the distribution network in our area, of which 1.3GW is wind and the remainder comprising of solar and various other sources.

Approximately 300MW of additional distributed generation is contracted to connect to the distribution system, requiring upgrades to the transmission network to allow it to connect and export. This includes wind, solar, gas generation and storage. From engagement with stakeholders, we expect this to rise further as new projects develop in RIIO-T2. This differs from the ENA Common scenario as we have identified that the apportionment of the original distributed generation was incorrect. We intend to review this through the ENA to ensure consistency.

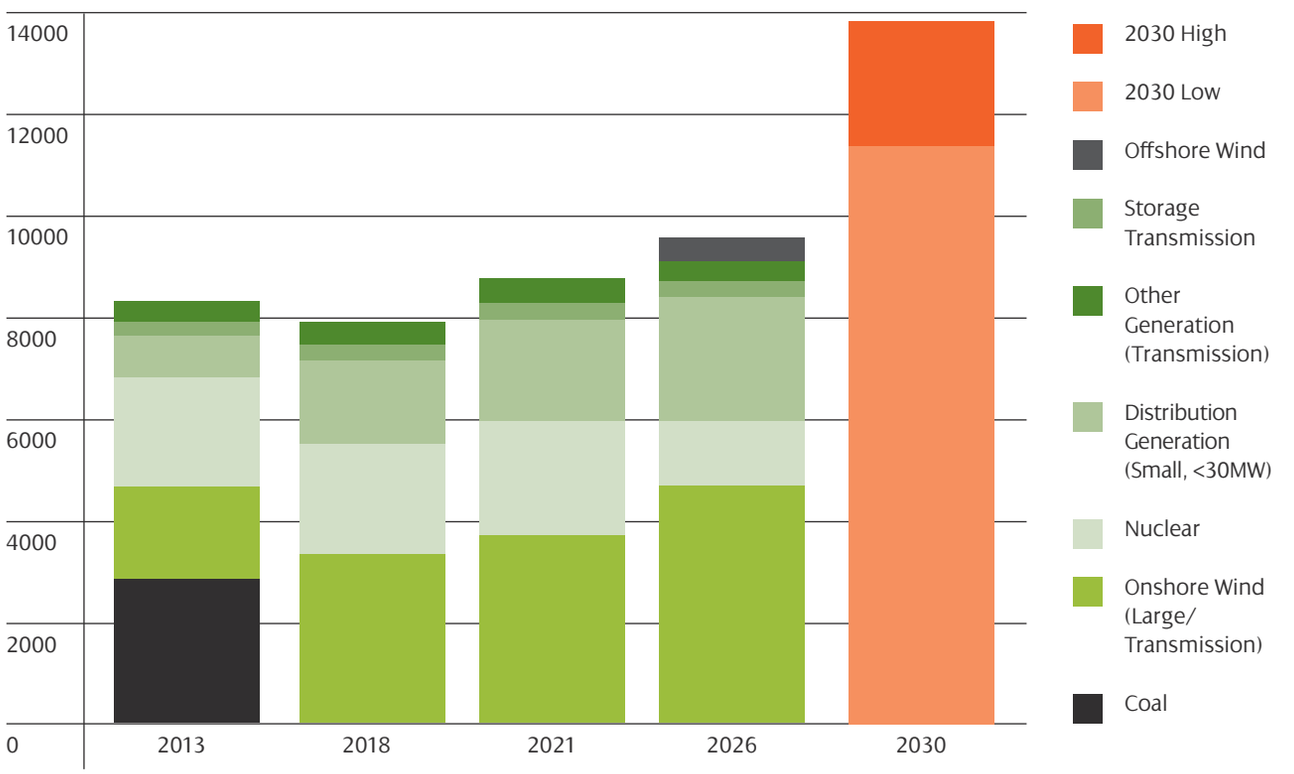
Other sources

By the end of RIIO-T1, we forecast to have 473MW of hydro generation and 2.25GW of thermal generation, mainly from the two remaining nuclear generators.

We have contracts in place relating to hydro and pumped storage and have factored these into our plans. Other forms of storage and PV have been identified as a potential technology which will grow in the RIIO-T2 period but at present there are no high probability contracted projects due to connect in RIIO-T2. From discussions with relevant stakeholders, where these do emerge, they are likely to be co-located at known generation sites and utilise the existing grid connection. This means they'll require little in the way of reinforcement and investment from us. We have had limited interest in storage-only sites connected to the transmission network. Any other technology or generation is funded by an uncertainty mechanism the same way as onshore wind. The funding mechanism has no bearing on individual customer projects. These assumptions are all consistent with the ENA Common Scenario.

Generation capacity in central and southern Scotland

MW



Funding of generation connections

Baseline expenditure

We play an important part in supporting new generation on the network. However, the generation that connects is outside our control, so it can be difficult to be certain how the infrastructure costs and volume will change over time.

Our own robust assessment process

On top of the energy scenarios we have developed, we've also created our own process to consider the engineering, commercial and financial uncertainties for new connections to help understand the probability of them connecting to the network. This was implemented in RIIO-T1 and has been recognised by our stakeholders as a fair and prudent approach. We have further improved this to consider other measures to help build our confidence on the conversion of connection applications into connection projects. We now consider developer track record, local authority planning environment, consented status and development status. All of these factors help provide an indicator of the probability of connection progressing.

A high confidence view

This robust identification process has allowed us to assess and understand future generation connections which will form part of the baseline submission. At the moment, we have close to 5GW of generation with a contracted connection application in the RIIO-T2 period. However, our experience shows us that a large portion of that figure is highly uncertain. Using our scenarios, we've tested our plans to consider what we would need to do if more than this amount materialised, to make sure that we have a means of funding it and the resources to deliver it.

Through analysis of projects, discussions with developers and industry research, a credible view has been included in our baseline plan. We have met with several developers to obtain a clearer understanding of their existing projects and future needs, and to gain additional insights into the industry.

Reforms to charging

The way that users are charged for accessing the system is currently under review. The future charging and access reforms may impact on customers connected to the network and we are involved in this review and will monitor the impact that this may have on projects as our plans are finalised over the course of this year.

Our baseline outputs in RIIO-T2

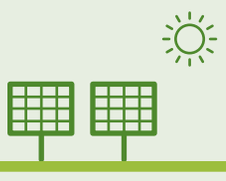
Over the course of RIIO-T2, our baseline plan is to deliver the connection of 13 new generation sites with a total capacity of 1GW, with a cost of £54m. On top of this we will create 2876 MVA of new network capacity to allow the power generated to be transmitted to other parts of the system, with a cost of £60m.

A large proportion of these costs are paid for by the generators that are connecting to the network. Generators have the option of paying for their proportion of the costs through either a capital contribution when they connect to the network or through annual charges over the life of the assets. The rules for who pays for which parts are set out in the Connection and Use of System Code.

In doing this, we will need to build:

1111km of Overhead lines
118km of cable
10 new transformers and 43 circuit breakers.

The current baseline output aligns with an outcome between Steady Progression and Community Renewables in the Future Energy Scenarios.



Generation Uncertainty mechanism

Our baseline plan of £115m of expenditure provides an allowance for those projects with the highest confidence, but we expect the actual expenditure will be different based on new connection applications and changes to existing contracted generators.

These changes will be accommodated through the uncertainty mechanism. The proportion of charges which are paid for by the connecting generator may also change as these are project specific. For the generation connections uncertainty mechanism, we will refine the RIIO-T1 approach building on the learning from the wide range of projects that connected to the network.

Ensuring a fair mechanism for all parties

We have modelled and analysed several different volume driver approaches to understand which approach would represent the most efficient option. To do this we used the Future Energy Scenarios (FES) for sensitivity analysis.

The mechanism will be set at a rate to efficiently fund us for the works required to connect a generator to the grid. This represents better value and lower risk for consumers than a large ex-ante baseline allowance, where the full amount may or may not be used.

The volume driver will work symmetrically. It does this by adjusting revenues depending on the actual output connected and the extra capacity we have created.

So, if we deliver more than the baseline output, the mechanism will provide additional revenue at an efficient rate to cover the cost for additional projects. If we deliver less than the specified output, the mechanism will recover the allowance at the same efficient rate.

Before we submit our final plan in December 2019, we will review generation connections as the connection landscape continues to change, and when new project information becomes available. Some of the notable changes we expect before we submit our plan in December include:

Outcome of Contract for Difference (CfD) allocation for offshore wind
Crown Estate Offshore Leasing
Any impact Brexit may have
Understanding of the impact network charging reviews on generators

Doing things differently

We have embedded innovative approaches in our connection projects to apply the learning and development in RIIO-T1. This includes High Temperature Low Sag (HTLS) conductor, which increased capacity in our overhead lines, allowing us to transfer more power on our network at lower cost. We now offer this regularly on new connection projects. It provides a benefit to customers by reducing costs and allows projects to connect faster.

What's more, we're making greater use of flexibility with our existing assets. An example of this is through our load management schemes, which allows the connection customer faster access to the network on a non-firm basis potentially ahead of further network reinforcement. We're expanding the use of this approach through our generation export management system project, which will allow more generation in South West Scotland to connect at a fraction of the cost of conventional approaches.

Our baseline expenditure plans for generation connections

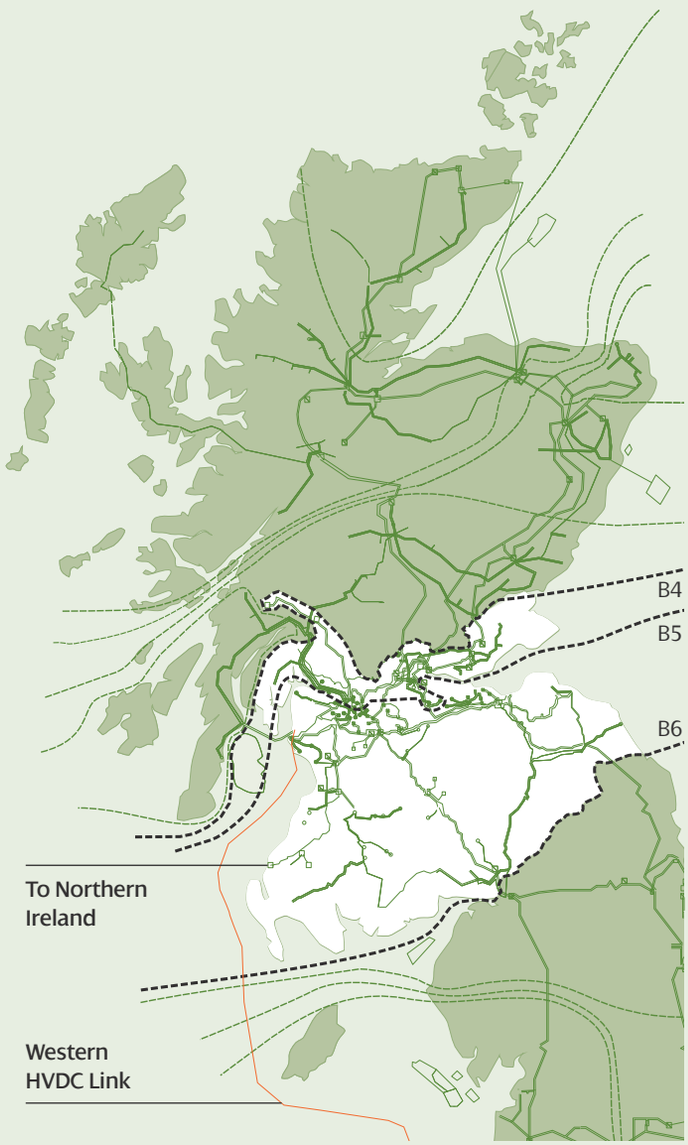
£115m

Efficient boundary upgrades

2

The landscape of generation is changing. Fossil-fuelled generation consisted of a small number of large stations, but today's renewable intermittent generation is located remotely and very widely dispersed where renewable resources are greatest.

This has led to much higher power transfers across each of the GB transmission owner areas. These upgrades are required to meet the needs of consumers and network users.



Playing a key role in Great Britain

The full GB transmission network is divided into different zones by a number of defined network boundaries. This allows us to analyse the power flow requirements of the network, making sure energy can be delivered to where it is required. We share network boundary B4 in the north with SHE Transmission, boundary B5 divides our network area in two, and share boundary B6 in the south with NGET.

Located between two transmission networks, our transmission system is not only essential for our own customers, but to customers to our north and south. We have to make sure that access to renewable electricity is available to all connected parties.

At times of high wind, large power flows from north to south are inevitable. We have seen the energy imported over B4 triple from 3000GWh per annum in 2016 to 9,000GWh in 2018. This is forecast to significantly increase as further renewable generation connects in the north of the country.

South-to-north flows are vital when the wind is not blowing. As older generation has been removed from the network, this flow is essential to meet demand in Scotland, giving customers the same high levels of reliability that every GB consumer has come to expect.

An economic and efficient approach

To help ensure that the most economic solutions are being delivered onto the system, the ESO carries out the Network Options Assessment (NOA) annually. Using the national Future Energy Scenarios, the generation and demand backgrounds are used to calculate what level of power is required to be transferred across the network boundaries for each scenario for the next few decades.

Each transmission owner proposes projects that could address the issues that are emerging from the ESO's analysis. Where projects span two or more license areas, the TOs work together to develop these. The ESO then performs an economic study of all the proposals to identify the least worst regrets approach and provides an indication whether projects should be progressed or put on hold. The TOs then work together with the support of the ESO to fully justify the works on the system.

These projects will vary from minor works that will allow for small increases to individual boundaries in the near-term, to large multi-million pound projects that will span multiple boundaries, increase capacity significantly and take many years to deliver.

Accommodating greater transfers

The current level of reinforcement carried out by the TOs mean that the existing boundaries have capabilities that are generally in line with the calculated required transfers. High levels of wind generation are set to connect within the next few years. This means the transfers are forecast to increase above the current capabilities across all three of our network boundaries by 2024, and economic assessment has shown that major reinforcements are required and justified.

To meet these required transfers we have various projects, some of which are in conjunction with SHET and NGET. These projects build on the existing assets to increase capabilities to facilitate the connection of the high level of renewable generation expected in order to meet the UK and Scottish Government targets for renewable generation.

By 2028, it is anticipated that there will be a requirement for two new 2GW HVDC links connecting Scotland and England, one of which will connect to our network. Works are currently being progressed on these links between all three TOs and the ESO to ensure that the best options are delivered for the future of the system, with development works for the projects already underway.

How we have assessed the need

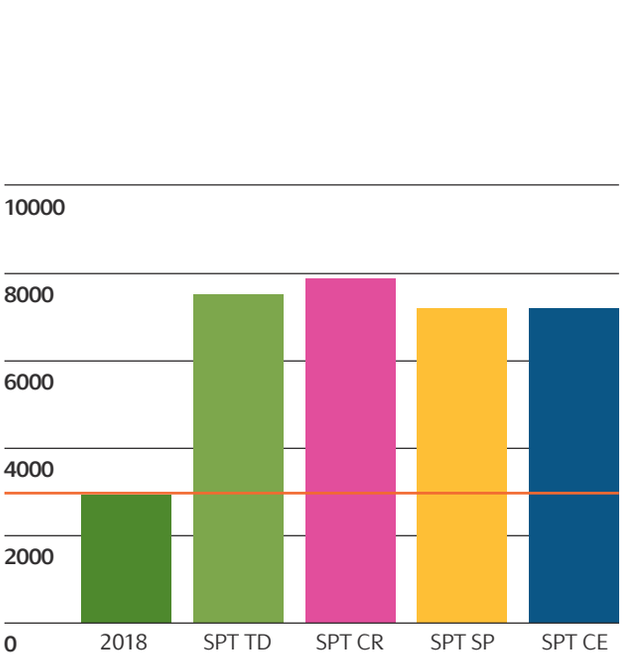
The economic assessment by the ESO is an iterative, annual process. Projects will continue to be created and assessed within NOA as they progress and become more defined in scope. This will make sure the network is developed in-line with the needs of GB consumers as they evolve overtime.

The fourth NOA report was published by the ESO in January 2019, detailing its recommendations on projects to be progressed for the next year. These were largely consistent with the previous year's results, providing a consistent message that large reinforcements are economically justified and are required on the system in the coming years.

The reinforcements recommended will lead to a large increase to the system's ability to transfer power from SHET's area to ours over B4, and from ourselves to NGET via B6. Currently, the boundary capability between SHET and SPT is restricted to around 3.2GW. The recommendations from NOA would see this capability almost double to 6.1GW. The boundary capability of B6 is also identified as needing to increase from its current value of 6.6GW to over 11GW.

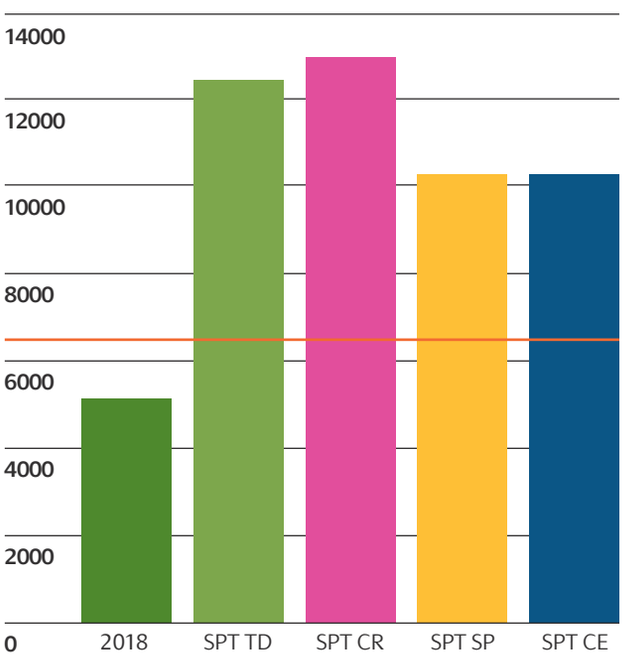
The following graphs show the boundary requirements calculated between ourselves and SHET (B4) and ourselves and NGET (B6) in the north to south direction by 2030. They show that the requirement significantly increases on both boundaries in this time, based on all four scenarios. This will require large reinforcements to facilitate these power flows through our network area.

B4 Peak Transfer Requirements 2030 *(MW)*



Fes 4 Scenarios

B6 Peak Transfer Requirements 2030 *(MW)*



Current capacity

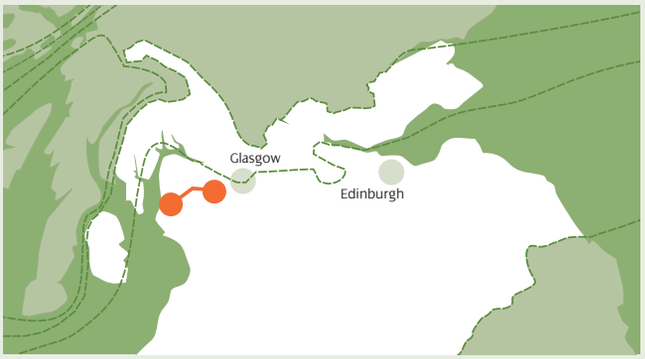
Boundary upgrade projects *— a summary*

Each of the following projects have been indicated by the ESO as needing to proceed, and are required to be delivered in the years quoted to deliver the best economic value to the GB consumer.

Hunterston East – Neilston 400kV reinforcement (HNNO)

Total value: £23.3m

This is a reconfiguration of the existing network around Hunterston and Neilston, and the installation of a new 400/275kV supergrid transformer at Neilston. These works are proposed to increase the fault level around Hunterston following the closure of the nuclear power station to enable significantly improved utilisation of the Western HVDC link connected at Hunterston East in the absence of local generation. The loss of Hunterston nuclear power station will drop the fault level in the area to below the minimum operating conditions for the WHVDC, reducing the capability by 500MW, unless these works are completed ahead of the closure. The works are currently scheduled for completion in line with the declared nuclear station closure in 2023.



East Coast Onshore 275kV Upgrade (ECU2)

Total value: £12.4m

The existing 275kV circuits that cross the B4 boundary on the East Coast will be re-profiled to run at a higher temperature. This will allow higher current to flow, increasing the transfer capability of this boundary. The majority of the works are within SHET's area. We need to re-profile two double circuits to increase the capacity between Kincardine and the SHET border and between Longannet and the SHET border, through Westfield, Mossmorran and Glenniston. Within these circuits there are two cable sections that require uprating to match the new capability of the overhead line circuits. We will work closely with to achieve the current delivery date for this project of 2023. Studies have shown that an additional 800MW of capacity can be realised over the B4 boundary as a result of this project.

East Coast Onshore 400kV Incremental Reinforcement (ECUP)

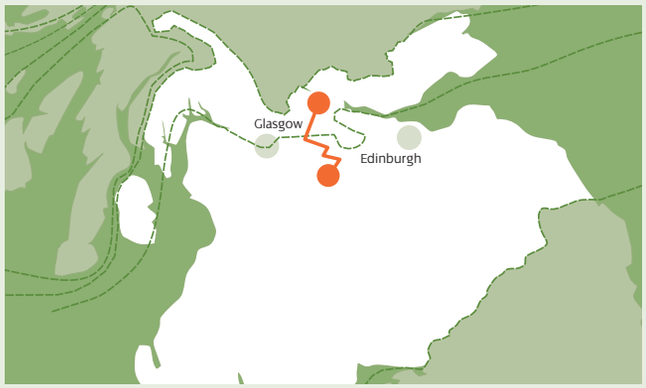
Total value: £39m

This is a joint project between ourselves and SHET, and builds on the 'East Coast Onshore 275kV Upgrade (ECU2)' by upgrading the 275kV infrastructure on the east coast for 400kV operation. As in ECU2, the majority of the works are carried out within SHET's area, with the installation of new supergrid transformers at Alyth, Fetteresso, Kintore and Rothienorman, and upgrade of the existing 275kV overhead line circuits between these locations and to the SHET/SPT border. From this border, we will need to upgrade the double circuit to Kincardine substation to 400kV, and install four supergrid transformers to accommodate the higher voltage into our existing network. This uprating increases the boundary B4 capability by 400MW, which is additional to the 800MW from ECU2. We plan to complete this work in 2026.

Denny to Wishaw 400kV reinforcement (DWNO)

Total value: £147.9m (£19.1m in RIIO-T2)

DWNO establishes a new 400kV central corridor through our network, increasing the capability of the B5 boundary by around 800MW. The project will create a double circuit operating with one side at 400kV and the other at 275kV, making use of existing infrastructure where possible. The new circuit will require the construction of 17km of overhead line between Bonnybridge and Newarthill. In addition, various existing circuits will be modified to create the corridor, with reconductoring required on two circuits to provide higher capacity. The upgrading will be aligned with the non-load programme for completion in the RIIO-T3 period. On top of overhead line works, modifications will take place at various substations to accommodate the new circuit. This project has a delivery date of 2028.



Eccles Voltage support and real time rating system (ECVC)

Total value: £72.6m

ECVC is included in our RIIO-T2 business plan to be delivered by 2026. It has currently been given a delay signal from NOA, to be delivered in line with the Eastern HVDC Link. We believe there is additional value in this project being delivered ahead of this recommendation, due to the system strength that the project delivers, which has been in decline due to the decreasing amount of synchronous generation on the system. System strength is not considered as part of the NOA.

This project gives a boundary uplift of up to 280MW on B6 ahead of the closure of Torness power station, which is currently expected to be in 2030, and maintains the current boundary capability once this has closed.

This project involves the installation of two hybrid synchronous compensators at the existing Eccles 400kV substation. Additionally, a real-time rating system will be installed on the existing network from Moffat to Harker and Gretna to Harker 400kV overhead line circuits.

a real-time rating system on the existing thermal 'bottle necks' at Moffat to Harker and Gretna to Harker 400kV overhead line circuits, and the short 400kV cable section between Thornton Bridge and Torness.

Windyhill – Lambhill – Longannet 275kV circuit turn-in to Denny North 275kV substation (WLTI)

Total value: £6.7m

These works will establish new 275kV circuits to link into the existing circuits which pass by the substation. To do this we will install two new switchbays at Denny North substation and connect these into the existing circuit.

This project is considered as 'enabling work' for several projects within the RIIO-T2 programme, including ECU2. Together with the system access restrictions, that's why it needs to be completed by October 2021, two years ahead of the NOA recommendation. This project increases the B5 boundary capability by up to 260MW and reduces the constraint costs associated the switchgear replacement project at Windyhill.

Eastern HVDC Link from Torness to Hawthorn Pit (E2DC)

Excluded from baseline plan

This is the construction of a new 2GW HVDC cable connection from a new convertor station in the Torness area in our network, to a new convertor station at Hawthorn Pit in NGET's area, which provides an uplift on boundary B6. The project forms part of the wider Eastern Reinforcement project, which is a joint project between SPT, NGET and SHET. It has the support of the ESO to determine the most economic and efficient solution for large multi-boundary reinforcements. E2DC is being indicated as the most favourable option from our area to be delivered in 2027, coupled with a longer link from Peterhead in SHET's area to Drax in NGET's in 2029.

However, there are 6 offshore variations currently being assessed, as well as an onshore AC option over B6, to determine the best option to be delivered. This project is not included in our RIIO-T2 business plan and will be submitted through a Strategic Wider Works application, but we have referenced it to provide a complete view of all upgrades that are currently identified. Analysis will continue on these options, with an initial needs case due to Ofgem in early 2020 for the Eastern HVDC Link, which should by this time have a clearer picture of the best combination of offshore works.

Refer to **Annex 4**: Strategic Investment Plans – Load.

How we plan for reinforcement

3

Reinforcing the network is required as we adapt to the changing generation and demand landscape around us. These changes bring many new challenges that the network needs to deal with to maintain a safe and resilient network and meet the needs of consumers and network users.

End of nuclear
The closure of nuclear generation on our network will reduce the total generation by

–2.2GW

System inertia
By 2026, we forecast system strength to have reduced, compared to 2012 by

70%

We understand the impact of generation

There are several ways in which new sources of electricity such as wind farms, solar panels and HVDC interconnectors differ from the large fossil fuel and nuclear power stations which are coming offline. Each of these differences has implications for how we design and operate the electricity system.

New renewable generators are generally **smaller and more distributed** than the generation they are replacing; this means that a larger number of generators need to be coordinated to deliver the same level of services that used to be provided by one or two large generators such as coal plant.

A number of these smaller generators are **distribution connected**, meaning that we need to change the way we plan and operate the distribution networks as well as reviewing the interface between distribution and transmission. This is important to make sure we can use those generators, as well as other resources connected to the distribution network, to support the wider system.

Most new renewable generation is **intermittent**. This means that we need to find ways to make sure that the system can still operate and meet demand when the wind doesn't blow or the sun doesn't shine. The output is also uncertain, meaning we need back-up that is flexible and able to respond quickly to changing conditions.

Finally, wind, solar and HVDC interconnectors do not have the same **inertia** to support the system frequency. This creates new challenges for operating the system in a stable way. As well as delivering energy, power stations have traditionally provided a range of services to keep the system balanced and the networks operating.

Our reinforcement plans have been modelled and are justified under all energy scenarios.

We build a strong network

We plan carefully to ensure that the network can:

Manage voltage: keeping voltage within statutory ranges ensures that the system is safe and that equipment connected to the network is not damaged. There's a range of options available to manage the network voltage: network equipment such as static compensators and reactors; renewable generators, such as wind farms which have the capability to support voltage, even when it isn't windy; and the use of distribution-connected generators, consumers and storage.

System strength: large fossil and nuclear generators provide 'inertia' which helps keep the system balanced in the first few moments after a major fault. Networks have always played an important role in linking sources of inertia across the country. Wind turbines, solar panels, HVDC and related technologies operate differently and we need to find new ways of either replacing the lost inertia, or keeping the system stable through new techniques.

In RIIO-T2 and beyond, we are estimating the amount of synchronous generation to reduce significantly from 47% in 2018 to 15% by 2030 as a result of increasing renewables and the closure of the nuclear sites. Analysis and experiences in other countries has shown that with less than 30% of synchronous plant, operability problems on the network start to emerge. This is consistent with our experiences following the recent temporary shutdown of Hunterston power station.

Maintain network reliability: fewer large synchronised generators and greater quantities of generation connected to the distribution network mean that the response to network faults is different. We also need to ensure that the network is designed to have the flexibility to allow for outages to undertake maintenance and other work on the network without compromising the reliability of the system.

Prepare for 'black start': we have never suffered a full-scale black-out across the whole British electricity system, and there have been relatively few major power interruptions in recent decades. However, if a black-out should happen, we must be able to provide a network capable of restarting quickly and safely. Large thermal power stations spread across the British electricity system have traditionally been at the heart of plans to 'black start' the system.

Reinforcing our network

– To reinforce the network to accommodate the energy system transition, we plan to spend

£206.9m

Reinforcement projects *— a summary*

Our baseline reinforcement plans consist of a number of projects which are justified in all of our energy scenarios to address these issues. If this landscape changes, we will also have a suite of uncertainty mechanisms to address any additional needs.

Voltage management

Total value: £29.7m

515MVAr of reactors and compensation to address voltage non-compliance following the closure of Hunterston Power station and other changes in generation and demand profiles. We have worked with the ESO to weigh up the cost of this equipment with the commercial alternatives from third parties, such as generators, to provide support. These arrangements are still under development through pathfinder projects but from the cost benefit analysis we have undertaken, these assets are the most cost effective long term approach for consumers.

Synchronous compensation

Total value: £121.5m

To mitigate the loss of system inertia as a result of the closure of synchronous generation in our network area whilst renewable generation is forecast to grow.

A minimum level of system strength is required to keep the system operable with a high amount of renewable generation, as well as assisting its ability to recover from faults, disturbances and, in the worst case scenario, a black-start.

By 2030, when Torness Power station is planned to close, our analysis indicates that 2,000MVA of synchronous capacity is needed to make sure the network remains operable. Over the course of RIIO-T2, we plan to install three new synchronous compensators to partly address this need. These units are expected to be located at Kincardine, Hunterston and Strathaven, each will have a rating of 250MVA. At the end of RIIO-T2, we will assess the need for the additional capacity before a further commitment is made.

The ESO has recently recognised the need for increased system inertia and we believe that these proposals will meet those needs in a co-ordinated, cost effective and timely manner. A separate hybrid synchronous compensator is also planned at Eccles to deliver increased boundary capacity which will complement these but is being treated separately.

We will treat these projects as Price Control Deliverables – if circumstances change and these are no longer required, there will be a clear route for the funding to be returned to consumers. The market for system inertia is only now being considered by the ESO for the RIIO-T2 period. Should this change the need for these assets, then we will adjust our plans accordingly.

Harmonic filters

Total value: £26.0m

Harmonics are a form of electrical pollution that is present on the electricity waveforms and comes from consumer appliances and network equipment. Due to the increasing amount of cable on the network to connect new generators and the number of converter-connected appliances, harmonic pollution is increasing. The installation of six harmonic filters are required at Linmill, Moffat, New Cumnock, Black Hill, Margree and Newton Stewart to prevent voltage harmonics in excess of planning and compatibility limits on our 132kV network.

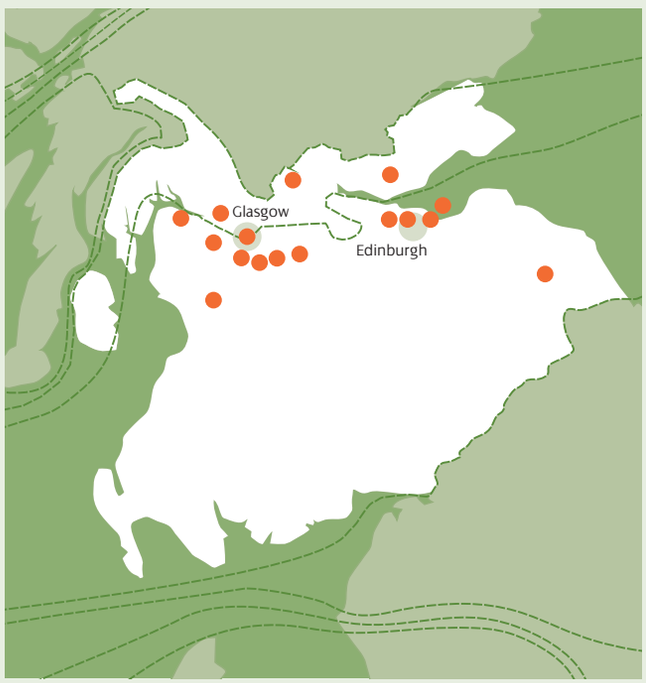
Facilitating black-start

Total value: £15.2m

From our review with the UK Government and other stakeholders, we have identified that a number of steps can be taken to improve the operation of the network in the event of a partial or complete shutdown of the electrical network.

Through minor reconfiguration of the network and installation of new monitoring we can simplify the restoration process to allow it to happen faster. It's important to say we expect major interruptions to be rare occurrences, but the consequential cost of not having the ability to restore the system quickly is very significant.

In RIIO-T2 we are planning to spend £15.2m over the course of the price review to provide the ESO with the ability to reduce the time necessary to restore the network. This will include the substation reconfiguration at 16 sites and addition of point on wave switching for 30 circuit breakers.



Generation export management system for South West Scotland

Total value: £10m

Deployment of a smart control scheme to manage 2,750MW of generation in real time and minimise the cost and time to connect new generators in South West Scotland. This project is a collaboration between ourselves, SP Distribution and the ESO to develop an innovative project which is the largest of its type in Great Britain.

This has been assessed by the ESO that this approach is more economical than building new infrastructure to facilitate the growing amounts of generation. The system will ensure our network is compliant with the relevant standards by controlling generation on the transmission and distribution network in accordance with the commercial arrangements in place.

Circuit-rating management system

Total value: £4.4m

Assets have a capacity rating which is based on a number of assumptions, including the temperature at which they operate. We plan to create a new system which will use analytics and enhanced data processing to provide real-time assessment of asset ratings.

This will help to increase the network capacity, reduce operational costs to the ESO and facilitate higher volumes of renewable generation. For this project we're implementing the learning from a number of innovation projects that have been undertaken by different network operators over the RIIO-1 period.

Anticipating demand expenditure

4

During RIIO-T1, we did not forecast any new demand projects. However, over the period we saw a number of new or modified connections from SP Distribution, Network Rail and other customers.

From this experience, we have examined more closely the potential demand connections that are expected in RIIO-T2. While doing this, we've taken a coordinated whole system approach and consider the most economic and efficient approach with SP Distribution to ensure we are meeting the needs of consumers and network users.

What we've found

SP Distribution has identified that a number of their points of connection to the transmission network are exceeding the design limit, as a result of increasing amounts of distribution connected generation, increasing fault levels, or higher loading on the network. This has been coordinated with our own scenarios to ensure consistency in the forecasting approach. Failure to address these issues could result in the serious failure of our own or a customer's equipment.

In addition to this, two new points of connection are required by SP Distribution to create capacity for additional distribution connected generation to get access to the transmission network.

Our approach to coordinating with other parties is detailed in the **Whole System Planning** section.

What we plan to do

These issues can be addressed either through SP Distribution, ourselves or jointly undertaking actions, such as the replacement of equipment. Where this problem arises on the SP Distribution network, but where expenditure is incurred by us, there is an established industry-wide process to govern the contribution that is made to the costs
by SP Distribution.

We have considered all the sites where issues are emerging jointly with SP Distribution and identified options that either company could undertake to address the issues. Using the CBA framework developed with Ofgem, options across Distribution and Transmission, for both build and non-build innovative solutions, have been assessed for each site to identify the most efficient solution. The total expenditure on this is £131m, of which £107m is incurred in the RIIO-T2 period, providing an additional 800MW of capacity for the distribution network.

The following works are planned in the RIIO-T2 period:

Increasing capacity for embedded generation to export onto the transmission network – Reinforcement of our network between Kendoon and Glenlee through the extension of an existing 132kV circuit and associated substation to increase the capacity of the network to allow embedded generation to access the wider network. This project commenced in RIIO-T1 and is under construction, this funding is to allow it to complete in RIIO-T2. The expenditure for this in RIIO-T2 is £40.9m.

Transformer replacement to address fault level at Newarthill GSP, Kilmarnock Town GSP Charlotte Street GSP, Port Dundas GSP, Westfield GSP, Strathaven GSP and East Kilbride GSP.

Creation of two new GSPs to accommodate embedded generation in Lesmahagow and Moffat

Transformer upgrades to increase capacity due to additional load at Redhouse GSP and Chapelcross GSP.

Various minor works at a further five substations to support SP Distribution upgrades

Other projects

We are in discussions with Network Rail regarding their plans as the electrification of the rail network across Central Scotland will require new points of connection or upgrades to existing sites to ensure a coordinated approach is taken. To date we have two contracted connections which are included in our baseline plan with a cost of £14.5m. Of this, the customer will contribute 32% of the total cost.

Ongoing flexibility

Other new demand connections can emerge, and we will use our demand uncertainty mechanism to ensure that funding can be adjusted to meet emerging needs. This mechanism is still being developed and discussed with the other TOs and Ofgem. We will also look to use the Whole System Coordinated Adjustment Mechanism that Ofgem have outlined as a means of updating our plans as required over the course of RIIO-T2.

Demand connections
– To total expenditure for demand connections of

£122m

SP Distribution
– Increased capacity for SP Distribution of

800MW

The assets in our network vary in age and condition. Our experience and expertise are essential for proper asset stewardship.

The strategies for all of our assets – from our high voltage overhead lines and transformers to smart control and monitoring systems – are summarised in this section, alongside the process we have used to prioritise and compile the investment plan.

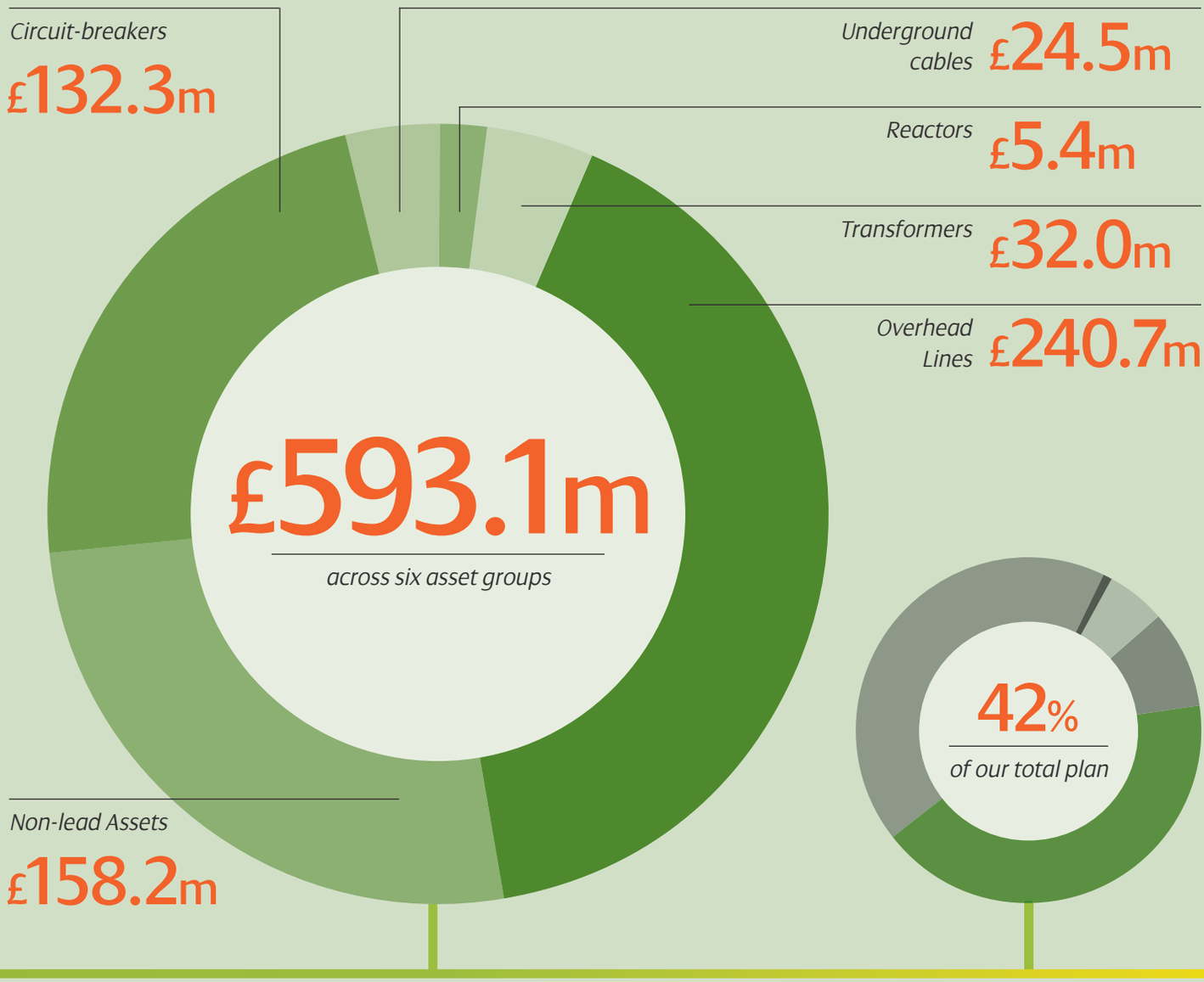
Non-load Related Expenditure

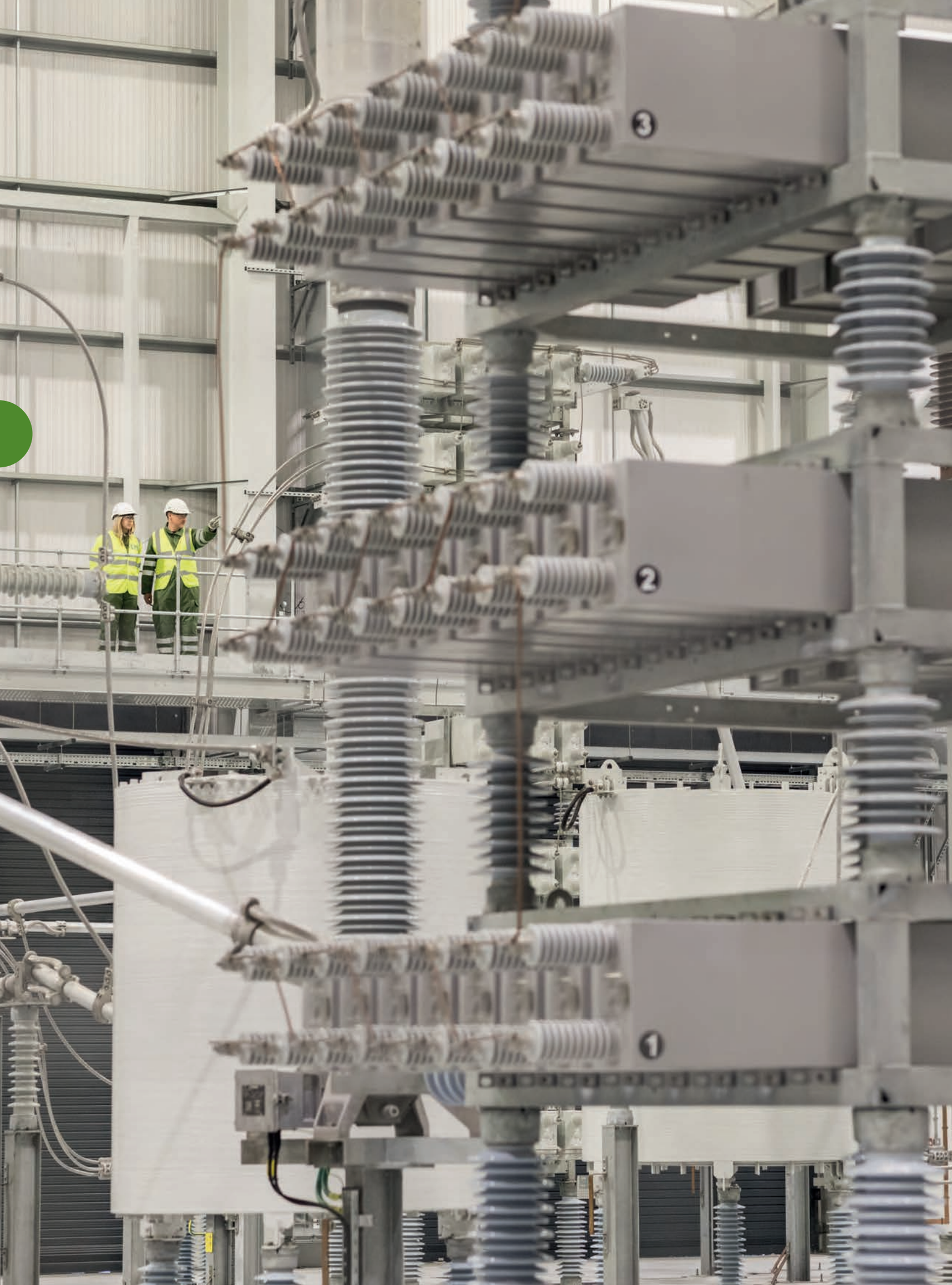
The substation at Windyhill
Windyhill is a key node in our network, but over time its circuit-breakers have become increasingly difficult to keep operational with escalating maintenance durations which require outages of the main interconnected system. Our plan mitigates this alongside reducing the SF_6 emissions from our network.

£42.92m investment

See our plan on Page 102.

An overview of our planned investment across non-load

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Understanding our assets

Here is a breakdown of our assets, how they work, and why we need to monitor them closely.

Why is it important to monitor assets?

Assets are built with an anticipated design life. As they approach and pass these, their condition can deteriorate. Keeping an eye on this is important, as their deterioration can cause an increased risk to the reliability of the network.

We need to make sure that interventions to manage any risks are effective, timely and deliver value for money to consumers. To do that, it's vital our long-term strategies are underpinned by a detailed knowledge of asset condition and deterioration mechanisms.

Why do assets deteriorate?

Assets deteriorate due to stresses they are exposed to, such as:

- mechanical, such as the vibration experienced by overhead line components
- thermal, as experienced by transformers and cables
- electrical, as experienced by circuit breakers
- environmental, caused by wind, moisture and pollution.

How is asset condition determined?

While longer exposure to stresses leads to greater deterioration, not all assets are subject to the same degree of stress. The ability of individual assets and families of assets to withstand these stresses also varies. For this reason, our assessment of an asset's health is not solely based on its age, even though time is a factor. We need to understand each asset's condition and be able to forecast how that asset will perform for the remainder of its life.

Do we consider all assets in the same way?

While the same fundamental principles apply whatever the asset type when defining a strategy, the considerations differ.

Deterioration mechanisms apply mostly to the high voltage assets, but the network is becoming increasingly reliant on electronic and software systems and obsolescence is often a factor.

These include:

- protection systems to detect and remove short-circuits when they occur
- smart network management schemes and asset condition monitors
- telecommunications systems which enable all of these applications.

Asset types

We understand the vital roles that all types of our assets play in the safe and reliable operation of the network. In the regulatory framework, though, assets are grouped in to lead and non-lead categories.

Lead assets

The electricity transmission sector's common monetised risk framework lets us quantify the risk of many individual assets, known as lead assets. It helps us identify and prioritise any assets that may need intervention, to develop a clear view of when this is likely to be required and to co-ordinate interventions with other works.

Circuit-breakers, transformers and reactors, underground cables, overhead line towers conductors and fittings complete the lead asset category.

Non-lead assets

These are equally important for the safe and efficient operation of the system. These assets are not yet covered by this framework, but their interaction with the lead assets is a critical factor in investment planning. We consider the condition and importance of the non-lead assets in the same way as lead assets, even though they aren't part of the monetised risk framework.

Disconnectors, instrument transformers, and common infrastructure such as post insulators and busbar systems. Ancillary systems and civil and buildings infrastructure are included too. Protection, telecommunications and smart control systems are also non-lead assets.

NARM: how we assess the risks of our lead assets

How do we measure the risk presented by each asset? We use a methodology called NARM: Network Asset Risk Metric. It's how we calculate asset risk from health, and the consequences of that asset failing.

We have worked collaboratively with Ofgem and the other transmission owners to develop NARM over the last five years. This methodology allows us to accurately and consistently quantify the risk of each type of lead asset.

Our lead assets

Circuit-breakers
Overhead line conductors
Overhead line fittings
Overhead line towers
Reactors
Transformers
Underground cables

Risk – how we work it out

We calculate the risk of each lead asset by combining the asset health (as a probability of failure) with a measure of the financial consequences of these failures. This gives a risk figure in monetary terms. The figures are generated by the mathematical models we use as part of our investment planning.

Asset health – how we work it out

We determine the health of assets using the operating conditions, operational experience and the information we record. The methodology incorporates a mathematical model to forecast future health and probability of failure.

Calculating consequences

When we calculate the consequences of an asset failing, we need a detailed understanding of its importance, and how it interacts with other assets to create the network.

To assess the potential impacts of each asset failing, we also consider: safety, environment and finance. We give monetary values which reflect the costs of the asset failing – these consequences are unique wto each asset.

Multiplying the probabilities and consequences of failure produces the monetised risk measure that is consistent for all types of lead asset. This measure is used by us and Ofgem to determine progress against our proposed plan.

When we refurbish or replace an asset, we see an improvement in its condition, and its monetised risk is reduced. We can think of this reduction in risk as a benefit. The total of all of these benefits is the size of output we are committed to deliver.

Total network risk

When we produce our plan, we keep a view of the total level of network risk, and how it changes over regulatory periods.

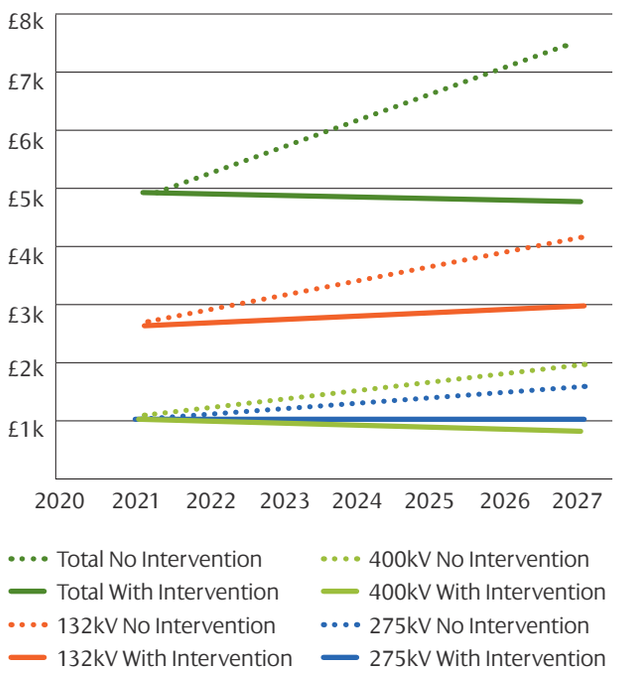
We start by calculating the total network risk for the start of the RIIO-T2 period. To do this, we add the risk values of all the existing lead assets, and make changes reflecting the work we know is still to be completed in RIIO-T1. We then use the asset models to produce a forecast of condition in April 2021.

NARM allows us to generate a forecast of network risk for March 2026, assuming we do not undertake any works (the 'without intervention' risk value).

To calculate the risk at the end of the period when we deliver our planned lead asset work, we deduct the value of the plan's interventions from the 'without intervention' value. This gives us the 'with intervention' risk value.

RIIO-T2 Lead Asset Risk Changes

Network Monetised Risk over time (£m)



Risk value by condition of asset

The risk values of all our assets increase over time. Our network is made up of assets in varying conditions, ordered here by our assessment of their condition.

New and good condition assets – most of our assets are in this category. These assets will have increased risk at the end of RIIO-T2 but won't need investing in during this period beyond routine inspection, testing and maintenance. This will mean that the overall risk value for these types of asset will be higher at the end of the period.

Assets in poorer condition – there is a smaller number of these, and we may need to intervene on some of them, but we mainly plan to do this in RIIO-T3 or beyond. Their contribution to the total network risk will generally increase. Our aim is to maximise their life while examining the risks of their failure, to get the right balance for consumers. Assets in this category are assessed individually so that we make the right intervention at the right time.

Assets that are (or are becoming) unable to perform to their required capability – this is our smallest category of assets. As discussed in greater detail in section 6I, our plan is mostly comprised of assets in this category which are those with the greatest likelihood of failure. The risk value of assets in the previous category moving in to this one will be less than the risk removed by our plan. Therefore, the total risk value of assets which are in this category at the start of RIIO-T2 will be reduced by the end.

Our network risk objective

We are committed to maintaining the exceptional levels of reliability our customers currently experience. The occasions when we experience incidents that contribute to unreliability are rare. They can be caused by lead assets' condition issues but there are two other significant factors.

Many of the most significant loss of supply events that have been experienced in the UK and overseas have been caused by non-lead asset failures. The most frequent events are caused by weather effects such as storm force winds or icing affecting overhead lines.

Because of the additional factors, reliability doesn't follow a direct relationship with the value of lead asset network risk. To make sure reliability isn't compromised by the performance of lead assets, we plan our interventions on the assets posing the greatest threat to reliability. We optimise the interventions in our plan to get the best value for current and future consumers.

As it's our number one priority, assets that would present an unacceptable risk to safety are a key part of the optimisation process.

Non-lead assets are not yet included in the NARM methodology but we identify and optimise our interventions using the same principles as for lead assets.

The value of network risk at the end of RIIO-T2 results from this detailed assessment of our asset base. This approach to setting the objective has received strong support from our stakeholders.

Assessing the risk of our non-lead assets

An important aspect of managing risk is to make sure we treat non-lead assets just the same as lead assets.

While they don't form part of the NARM methodology – so don't have a monetised risk value – they perform important functions in our network. The impacts of their failure can be as severe as the failure of a lead asset. Later in this section we explain how we make sure non-lead assets get the right interventions at the right time.

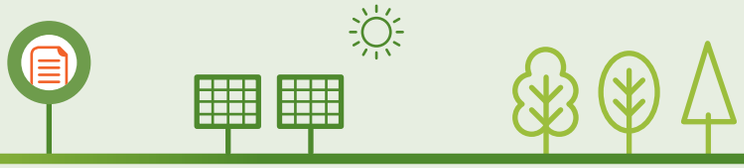
The benefit of our plan

We have determined the optimum set of interventions to manage network risk.

Without these, the total network risk of lead assets would increase by 57%. When we calculate the benefit of our plan, which in monetised risk terms is r£31.9bn, the total network risk will be 1.4% lower at the end of the period than at the start. The reduction in risk as a result of our interventions is marginally greater than the increase due to deterioration of the rest of the asset base.

Our plan strikes the right balance between costs for current and future consumers, and the level of risk on the network. We have focused our attention on extracting the maximum value from the existing assets, while making sound asset management decisions to control the risk of failures.

You'll find more information on network and asset risk in **Annex 3** – Non-load Strategic Investment Plan.



Investment planning

Reaching the most positive outcome for consumers lies at the heart of our investment planning process. To achieve this, we balance the cost to current and future consumers with the potential consequences of not intervening at the right time. Our approach is continually evolving and it has moved on during RIIO-T1. Here's an overview of how that's done.

Beyond business-as-usual monitoring

Our business-as-usual operations collect data and information on asset condition that we need. However, to make sure that we have the most up to date picture, we have undertaken a significant exercise to gather all of the data we need to define our plan. This involved detailed inspections and reviews of all our substations and in-depth reviews of all maintenance records.

We've used non-invasive techniques to understand the condition of overhead line conductors and, where possible, removed sections of conductor for forensic analysis. We have also dug down to the foundations to check their condition. This gives us confidence that we have the most accurate view of all our assets for effective investment planning.

We forecast accurately

Using mathematical models we have for each of the assets, we can:

- forecast how they deteriorate
- estimate how long it will be before their condition gives us reason to take action.

As assets are unique, individual items, these forecasts do not produce exact dates of when they will begin to fail. However, they do provide a good indication of when we will need to consider our next move.

These models are detailed and capture the major factors of deterioration. This means we are able to pinpoint which parts are causing concern and find the best way to deal with them. We don't just rely on the model; we use the knowledge and experience of our expert engineers. They check and validate what the models are telling us and what has worked best when we've faced these issues in the past.

Well-informed, long-term strategies

Taking all the information on current condition and the forecast condition over time and enriching this with our long experience of keeping our assets in good working order, we can create long-term strategies for each and every asset.

Our strategies are informed by our long-term view of the future, more information can be found in Planning for the future in our Non-load Related Expenditure section. We keep the need case for the existing assets under continual review. We take a whole system view of our activities and we examine if there is another way to provide the same function that might be more efficient overall. Once we are sure that there's still a need for the asset, we check that it has the right capacity and characteristics for the future. Any decisions to intervene make reference to these checks to ensure that we meet current and future needs in the most efficient way.

We will know how closely and how often we need to monitor and check them, which components or sub-systems are most likely to be problematic and when we'll need to consider some work to keep them in service or replace them.

These long-term strategies will give us the best opportunity to make the right investments in the right assets at the right time. By planning ahead, we can take a system-wide view and optimise the planning of our interventions to minimise disruption and costs to consumers.

You can find further information on investment planning in **Annex 3**: Strategic Investment Plans – Non Load. There you will also find information on our outlook for non-load investment in RIIO-T3.

You can find more information on the engineering process in **Annex 3**: Strategic Investment Plans – Non Load.

We identify assets that need a closer look

We have described the concept of monetised risk of assets in the Network Asset Risk Metric section. When we calculate the risk for each asset, we find that good condition assets can have relatively high risk values because the consequences of their failure are high. Equally, assets that are significantly deteriorated can have relatively low risk values due to their function in the network. So it's important to look at both parts to decide what steps to take next.

The impact of failure is related to the asset's location and function in the network. So, in many ways, it's fixed. This means that when deciding what assets should be considered for intervention in a time window – in this case, RIIO-T2 – we have to look at their condition.

We can categorise assets into three general groups:

Good condition – these may be relatively new assets, mid-life assets with no issues for the foreseeable future, or even assets nearing or beyond their design lives and in better condition than expected due to their function, duty and environment.

Intermediate condition – these are likely to be assets approaching the end of their design lives with no particular design or operational issues, mid-life assets in a harsh environment or with challenging duty, or even newer assets in which unforeseen design or operational defects have affected condition.

Poor condition, approaching end of life – often assets that are beyond their original design lives. It's common for some types of assets to need replacement components during routine maintenance, and often manufacturers end supply of these components, meaning the assets are no longer operable. Some assets may be in this category due to their environment, duty, or severe design defects. While rare, it's not unknown for relatively new assets to be in this category as a result of manufacturing or design flaws revealed in service.

The first step in the process is to identify the good condition assets. These do not need any investment, even if the impact of their failure is large. We can safely exclude these from our planning for the time being, although we will keep them under continual review.

The poor and intermediate condition assets are then examined in more detail, and we ask the following:

Do we still need the asset now and in the future? Can the same function be carried out in another way?

What is the source of concern over their condition?

Can the condition or the consequences of failure be managed if we don't intervene?

What other associated assets might need to be improved or replaced?

Are there any consequences of asset failure that we need to change?

We prioritise effectively

This review results in a draft work plan to manage the assets. We then undertake a detailed engineering exercise to map the intervention options for each asset, determine which are feasible, and generate costs. Each option undergoes a Cost Benefit Analysis to determine which produces the best outcome for consumers.

The network was built in a few short windows, mostly in the 1950s and 1960s – but now that it's in service and providing vital supplies, it will take much longer to renew end-of-life parts. Our long-term strategies will help us make the right choices and prioritise activities to avoid network disruption and keep costs of the work fair for current and future consumers.

The monetised risk framework provides a risk cost for each individual lead asset and is a good starting point on where to target our efforts. However, this only tells part of the story. The risk includes:

how likely an asset is to suffer different kinds of failure (measured as a probability and indicative of condition)

the impact or consequence of that failure (measured as cost)

Stakeholder support for our plans

We have explained this process to our stakeholders and asked for their views. We did this in three ways:

We launched a stakeholder consultation on our website in March 2019. This explained how we would use asset condition and risk to identify and prioritise interventions when creating our plan.

We held a round-table event in March 2019 to have a more detailed conversation with our key stakeholders in this area.

We asked for feedback from both the web consultation and the round-table session.

Our stakeholders were clearly supportive of our approach and it gave them confidence that we would make the right choices in our plans.

They also said that we had to be sure that we were only intervening in assets whose condition warranted investment. In response we have verified that we are doing this. We have also clearly explained where other factors were driving investment, such as our approach to managing the amount of SF_6 gas we have on the network.

They asked us to make sure that we didn't focus too much on the individual asset. They said that we should 'zoom out' and consider the role that asset will play now and in the future. We've made sure that this type of test is the first thing we do when planning interventions.

We have engaged with our independent User Group throughout this process. We have demonstrated the planning process and gone into detail on the individual elements of the plan. We have taken their feedback at each step and have checked back to make sure that the group were happy with our responses.

You can find more information on monetised risk in the **Network Asset Risk Metric** section on **Page 82**.

You can find more information on Cost Benefit Analysis in **Annex 8**.

Overhead lines
— *lead asset strategy*

1

In this section we describe the strategies for managing the three types of lead assets that comprise overhead lines. We provide details of how we plan to co-ordinate works that are the right balance of investment and risk.

A system within our network

The majority of our network is overhead line with a total length of 3,752 circuit km, roughly the distance between Glasgow and the north pole. These are predominantly steel-towers, with the oldest routes dating from the 1930s. Overhead lines are vital to transmit power from where it is generated to where our customers are. They are so important in maintaining a secure supply so it's vital that they remain reliable.

We can think of overhead lines as a system made up of three major components:

Steel towers *(sometimes known as pylons)* and their concrete foundations

Conductors are the wires that carry the power. They are attached to the towers by fittings.

Fittings, which are the insulators that attach the conductors to the towers and other components to control vibration.

Component life

Our overhead lines operate at 132kV, 275kV and 400kV, with a small number of 33kV routes – mainly to renewable generation sites – and 25kV to railway supply points.

The investment strategies for overhead lines are influenced by the different average expected lives of major components.

These averages are:

Towers: approximately 80 years *(this includes foundations)*

Conductors: 50 to 60 years

Fittings: 30 to 40 years

Component life is strongly influenced by environment. Salt and industrial pollution reduces the lives of conductors and causes tower steelwork to require more extensive treatment. Wind-induced fatigue can reduce the life of conductors and fittings, but more sheltered routes can be expected to have longer than average lives.

Conductor configurations and behaviour

The conductors are configured differently depending on the application. The majority of the 275kV and 400kV network use a two-conductor, or twin, 'bundle' to increase the power transfer capability. On some routes there is a four-conductor – or quad – bundle, and there is also a very small length of triple bundled conductor. The 132kV network is mainly configured with single conductor.

These configurations behave differently in normal operation. Quad bundles, while being very effective for power transfer, have a history of not being able to control conductor vibration and oscillation well. The components added to quad bundles to control these effects wear out more quickly than for other configurations, and are not as effective as we would like. This leads to a lot of conductor damage, which requires the circuit to be removed from service. Twin conductors also experience these effects, but it's normally less severe, except on very exposed routes. Single conductor systems are the least affected in this way.

Key developments in conductor systems

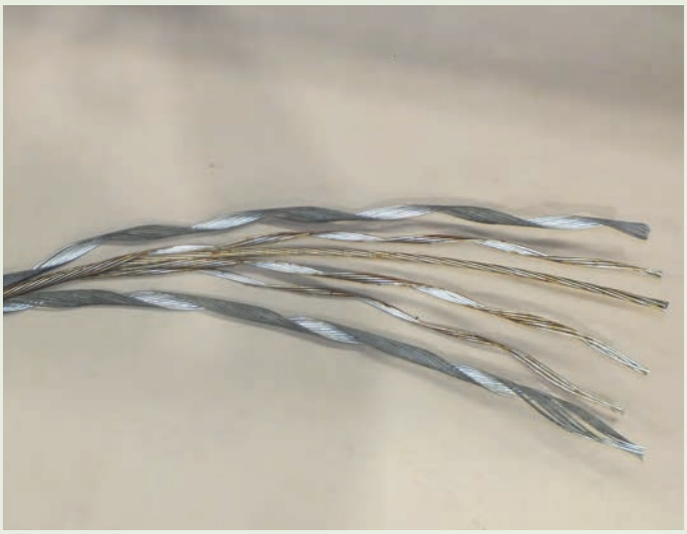
There are two main types of conductor on our system. They have very different characteristics and need different strategies to manage their condition.

Before the mid-1980s, aluminium conductor steel-reinforced (ACSR) conductor systems were used.

Before around 1969, only the steel reinforcing core was coated with protective grease to delay corrosion from moisture and pollutants ingress.

Experience from forensic analysis of decommissioned conductors supports the theory that core-only greased conductors deteriorate at a faster rate than those with all inner layers greased.

From the mid-1990s onwards, all aluminium alloy (AAAC) conductor predominates. This type is less prone to corrosion but is more susceptible to loss of strength through fatigue as it doesn't have a reinforcing core.



Our understanding of conductor corrosion

All ACSR conductors suffer from corrosion of the steel core with the fastest rates being observed in the smaller types, Horse and Lynx – with core-only grease followed by Zebra. Fully greased conductors generally corrode more slowly, with the larger Zebra conductors expected to have the longest life.

Assessing condition to maximise life

Our strategies for investment are strongly influenced by the condition of the conductor. We may need to replace parts suffering from corrosion or fatigue, or to maximise conductor life by replacing the components – known as fittings – which will cause fatigue as they deteriorate.

The individual strategies for each individual overhead line are affected by what works have gone before in their lives, with the different expected lives of the major components playing a big part in this.

Using evidence from previous interventions and an extensive programme of condition assessments, we have created a methodology to quantify the condition and expected lives of overhead line components. This takes component type into account, as well as the environmental conditions that have an influence on the expected life. This methodology has been reviewed and challenged by a world-leading expert to make sure that it is accurate and strikes the right balance between risk and cost.

There are two main conductor types we plan to replace:

175mm² 'Lynx' conductor, mainly on the 132kV system; and

400mm² 'Zebra', mainly on the 275kV and 400kV systems.

Our overhead lines also use a protective earth wire which is of type 70mm² 'Horse' on most of the 132kV network, and Lynx or Zebra on the 275kV and 400kV networks.

Our strategy applied to each overhead line system

The 132kV system

The 132kV overhead line network was mainly constructed between the 1930s and late 1960s, with a small number of extensions in the 1970s and 1980s until more recent extensive expansion due to the transition to renewable generation sources.

The earliest routes have been re-conductored, but those from the 1950s and 1960s generally use the original core-only greased ACSR conductor, mainly Lynx.

In RIIO-T1, there was a limited programme to refurbish three strategically important routes (CL, CK & V) which form part of the interconnection to SHE Transmission and National Grid respectively. The plan was limited to allow focus on the more strategically important 275kV and 400kV routes. The relatively small 132kV programme in RIIO-T1, and the expected life of the conductor, has led to more routes being considered for intervention in RIIO-T2. The shorter life of fittings means that they have already been replaced on a number of routes.

Our extensive inspection programme for towers and fittings lets us determine the condition of routes historically known to have a deteriorated condition. For conductors, where possible, we have used non-intrusive measurements to quantify condition, and we have also removed samples of the conductor for forensic analysis. This has given us a complete picture of the 132kV overhead line network condition.

132kV strategy as part of RIIO-T2

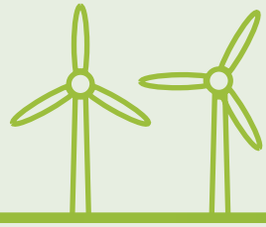
The strategy for RIIO-T2 is to replace the conductors and earth wire where we have evidence that their condition has reached the point where further loss of strength would lead to unacceptable safety and network availability risks.

Where the fittings have significant life remaining, we will retain them as this is the most economical option. We expect the towers to have enough remaining life to justify keeping them and replacing the conductor. However, we will need to do some remedial works, treating corroded steelwork where we can and replacing individual steel bars that can't be repaired.

Extensive inspection helped us discover that the foundations of towers of a design known as PL16 were not installed as they should have been in the 1950s and 1960s. While the towers have given good service despite this, we will need to take action in certain situations. We have undertaken a quantified risk assessment of each affected route and proposed remedial works at a small number of high-risk locations (at road crossings for example). This will result in an average of 17% of foundations being upgraded on the routes we are refurbishing.

Total investment in Overhead lines (OHL)

£240.7m



The 275kV system

The earliest parts of the 275kV system date from 1960, and the condition of the components led to a refurbishment programme being initiated in RIIO-T1. The RIIO-T1 programme targeted the routes with the most significant condition issues, focusing on strategic parts of the network that support the economic transfer of energy and security of supply to the whole of Scotland.

The evidence we gathered during this programme validated the condition information we had and increased our data sources. Like the 132kV network, we have added to that by a programme of inspection, testing and sampling to create an accurate view of network condition status.

275kV strategy as part of RIIO-T2

Our strategy for these routes is to replace the Lynx earth wire and Zebra conductor and earth wire where we have evidence that the condition means that intervention cannot be deferred, similar to the 132kV network approach. This is predominantly due to corrosion of the steel core and a manufacturing defect of a particular batch of conductor installed in 1966.

We will also refurbish towers using the same approach as for the 132kV network. The tower foundations don't have the same installation issue, but our experience in RIIO-T1 shows that we will need to refurbish 10% of foundations on average and intervene at critical tension towers.

The works on the 275kV network are mainly focused on minor refurbishments of routes where the conductor has significant remaining life and the condition issues relate to fittings. These routes have a fully-greased conductor type, and our condition assessments have given us confidence that there is no need to replace these until RIIO-T3 or beyond.

The 400kV system

The 400kV system was first constructed in the early 1970s for the connection of Hunterston Power Station and was extended in the 1980s when Torness Power Station was commissioned. More recently, the network has extended to increase power transfer from the north of Scotland, to England and Wales.

The 400kV system's overhead lines are a combination of new build routes from the 1970s onwards and older routes that originally operated at lower voltages and have since had their voltage increased.

400kV strategy as part of RIIO-T2

Our strategy for 400kV is to replace conductor systems which have deteriorated due to:

Corrosion – mainly core-only greased Zebra and Lynx on routes where operating voltage has increased

Fatigue – on the routes which have been exposed to harsh environments (mainly fully greased Zebra and Lynx), particularly in quad bundle configuration

There are also routes from the 1980s expansion whose fittings are showing evidence of poor condition. The strategy is to replace those that are causing damage to the AAAC conductor.

Overhead lines
— *investment plan*

We have used Cost Benefit Analysis to test the scope and timing of the options and verify that this programme has the right balance of costs and benefits for consumers.

We update all our condition data in a co-ordinated programme to make sure our investment planning process is shaped by the latest information.

We have used the asset strategies and followed the planning process to establish a prioritised programme of interventions.

The programme is summarised over the following pages. Major and minor refurbishments are described separately and identified by network voltage.

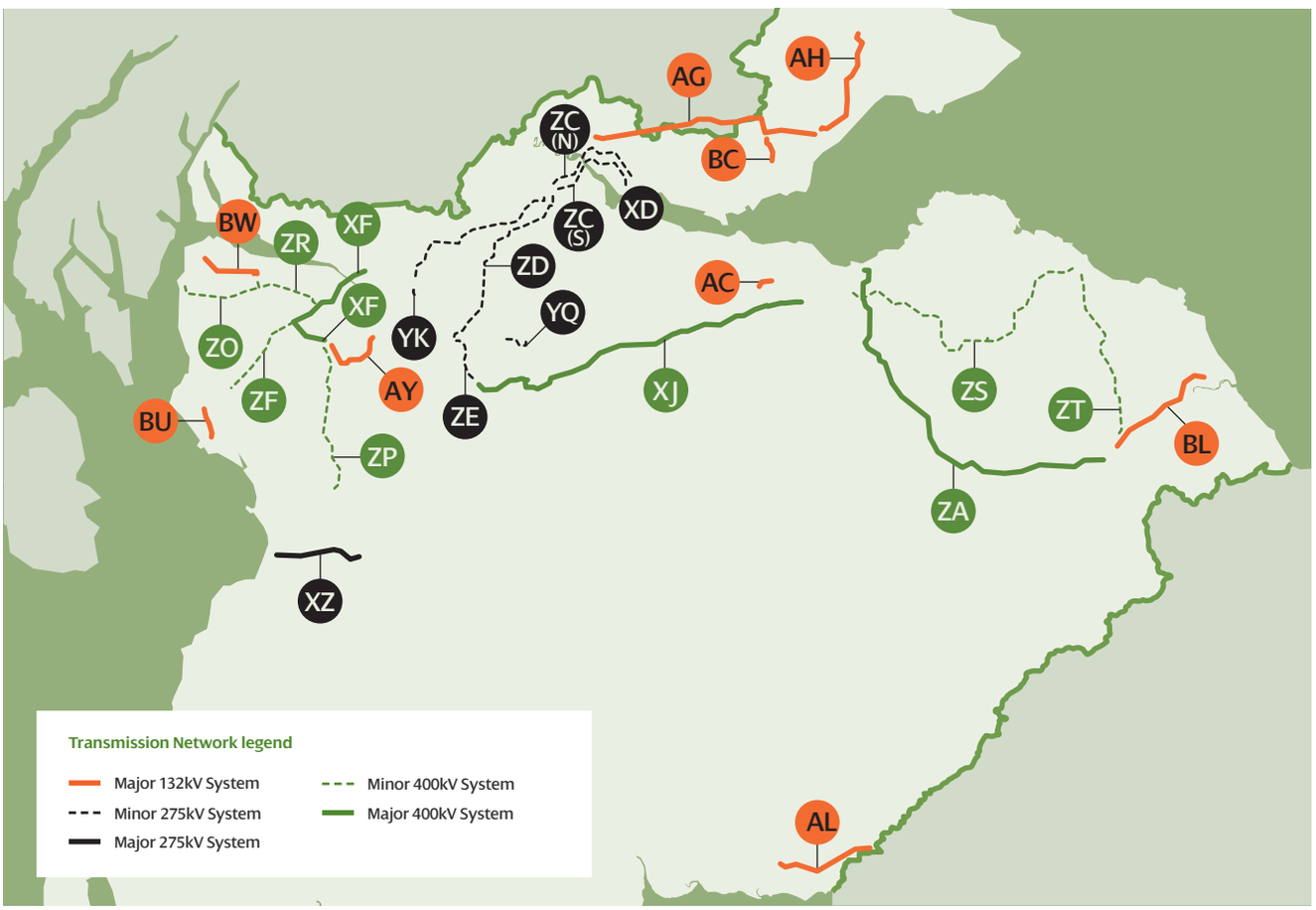
Rebuild on the 132kV system

In RIIO-T1, we initiated a project to manage the condition of overhead lines on the single circuit R (between Glenlee and Tongland) and S routes (between Tongland and Dumfries). This project is closely associated with the Kendoon to Tongland reinforcement scheme.

These routes were built in the early 1930s, and the most cost-effective approach is to build a new double circuit overhead line between Glenlee and Tongland. We are still in the process of extensive engagement and consultation with the local communities. The project is due to be completed in 2024 at a cost of £46.12m, with £40.28m of that in RIIO-T2.

The G Route scheme to replace a steel tower line dating from 1929 with a wood-pole line commenced in RIIO-T1 and will be completed with £1.2m of expenditure in RIIO-T2.

U & AT routes are due to be replaced under a load-related scheme triggered by a generator connection. If that scheme does not proceed, we will need to intervene due to deteriorating condition. U route is a single circuit steel tower line built in 1932 and AT route is a portal-style wood-pole line dating from 1959. Replacement will be required for both before the end of RIIO-T3. We propose a mechanism to allow us to progress the replacement of these routes should the load-related driver be deferred or not required in future. The total cost of the scheme is £34.11m.



Overhead lines Investments

Minor	Route	Area	Conductor /Earthwire	Circuit Length *(km)*	Planned Completion *(Year)*	Cost	Monetised Risk Benefit
275kV	ZD & ZC(S)	*Lanarkshire & Falkirk*	N/A	103	2025	£8.22m	r£1,933.01m
	ZE	*Lanarkshire*	N/A	30 Towers	2026	£1.79m	r£2062.42m
	YK	*Glasgow*	N/A	8.12	2024	£0.74m	r£75.45m
	YQ	*Lanarkshire*	N/A	6.88	2026	£0.41m	r£30.64m
	ZC(N)	*Falkirk & Fife*	N/A	37.64	2026	£4.32m	r£572.83m
	XD	*Fife*	N/A	4 Towers	2023	£5.15m	r£169.68m
400kV	ZP	*Ayrshire & Renfrewshire*	N/A	55.1	2026	£8.71m	r£2,126.46m
	ZF	*Ayrshire*	N/A	35.12	2026	£2.3m	r£2,261.17m
	ZT	*Lothian & Borders*	N/A	68.52	2025	£2.78m	r£906.94m
	ZS	*Lothian*	N/A	108.14	2025	£8.41m	r£1,276.36m
Major							
132kV	AG & AH	*Fife*	Lynx / Horse	21.32	2022	£4.88m	r£97.24m
	AL	*Dumfries & Galloway*	Lynx / Horse	28.62	2024	£8.8m	r£78.75m
	BC	*Fife*	Lynx / Horse	14.28	2023	£4.18m	r£24.57m
	BL	*Borders*	Lynx / Horse	43.14	2025	£9.93m	r£535.16m
	BW	*Inverclyde*	Lynx / Horse	15.1	2026	£4.34m	r£34.94m
	AC	*Lothian*	Zebra / Lynx	2.98	2025	£1.38m	r£14.71m
	AY	*Renfrewshire*	Zebra / Lynx	25.22	2025	£8.91m	r£211.96m
	BU	*Ayrshire*	Zebra / Keziah	17.14	2024	£5.05m	r£219.51m
275kV	XZ	*Ayrshire*	Zebra / Lynx	9.39	2022	£6.45m	r£234.22m
400kV	ZA	*Lothian & Borders*	Zebra / Zebra	131.64	2023	£44.8m	r£1,661.90m
	ZO, ZR & XF	*Inverclyde & Renfrewshire*	Zebra & Totara /Lynx	35.76	2023	£17.56m	r£2,432.03m
	XH & XJ	*Lanarkshire & Lothian*	Zebra /Lynx & Keziah	147.32	2023 *(indicative)*	£37.6m	r£2,597.28m

The timing of the XH and XJ route project is uncertain as the works are similar to those needed for a reinforcement triggered by a generator connection. We will ring-fence this project as a Price Control Deliverable and we will only trigger the associated allowance if the works are needed in the RIIO-T2 period.

Although the exact scope of work varies from route-to-route, when we describe major and minor works this typically involves a combination of:

- *Replacement insulators, spacers and fittings*
- *Replacement earthwire fittings*
- *Limited steelwork replacement*
- *Tower Strengthening*
- *Tower Painting*
- *Major and minor foundation upgrades and repairs*
- *Replacement aircraft warning lights*

Major refurbishments will additionally involve a combination of replacement phase conductors and earthwire.

Underground cables *— lead asset strategy*

2

In this section we describe our strategy for managing the two main types of underground cables. We detail our investment plans to avoid any environmental and reliability impacts of deteriorating cable systems.

Types of underground cable

377km in circuit length and dating from the late 1940s, our underground cables are of two main technology types. We also own 196 circuit kilometres of the Western Link HVDC cable which is mainly sub-sea.

Fluid-filled: Fluid-filled cables use oil in the insulating system and require oil tanks and management systems at the ends of the cable and at intermediate points along the cable length.

XLPE: The other cable type is known as XLPE (after the cross-linked polyethylene insulation system). This was introduced in the 1990s and is a much simpler construction than fluid-filled.

Fluid-filled cable is no longer widely available to buy, and new installations are of the XLPE type.

Fluid-filled cables

Fluid-filled cables are generally reliable but are prone to oil leaks, particularly where the cables are terminated and at positions where cable sections are jointed together. These need to be repaired to avoid environmental impacts and electrical failure.

Other than damage by other parties, most faults occur at joint positions. The exception to this is one particular type of cable installed in 1954, where the design has led to significant deterioration along its length and its replacement is being planned.

We have undertaken a significant programme of condition assessment of our fluid-filled cables and cross-checked the data with our maintenance records to determine the condition of each cable and the locations of any deteriorated components.

XLPE cables

The other cable type is known as XLPE (after the cross-linked polyethylene insulation system). Fluid-filled cable is no longer widely available to buy, and new installations are of the XLPE type.

XLPE cable terminations have suffered from a high rate of failure. This is partly due to flaws in the earliest designs and some quality issues in installations. The technology is evolving, and measures have been taken to improve both aspects.

How we're making improvements

Fluid-filled cables

Our strategy for fluid-filled cables is to maximise their lives as far as possible. This means we are focusing on upgrading and replacing the oil management systems and repairing and reinforcing the joints, which are the main source of reliability issues.

We will also refurbish the earthing systems to ensure the safe operation of the cables.

The exception to this is the 1954 installation noted opposite. While this route has not yet shown the same deterioration as the other of the same type, our knowledge of the mechanism gives us cause to believe that reliability issues will arise.

XLPE cables

XLPE cables are expected to give reliable service for many years to come, but the high failure rate experienced in RIIO-T1 has caused uncertainty around the terminations. We have changed our surveillance procedures on these terminations in order to seek to detect any issues prior to failure.

Total investment in underground cables

£24.5m

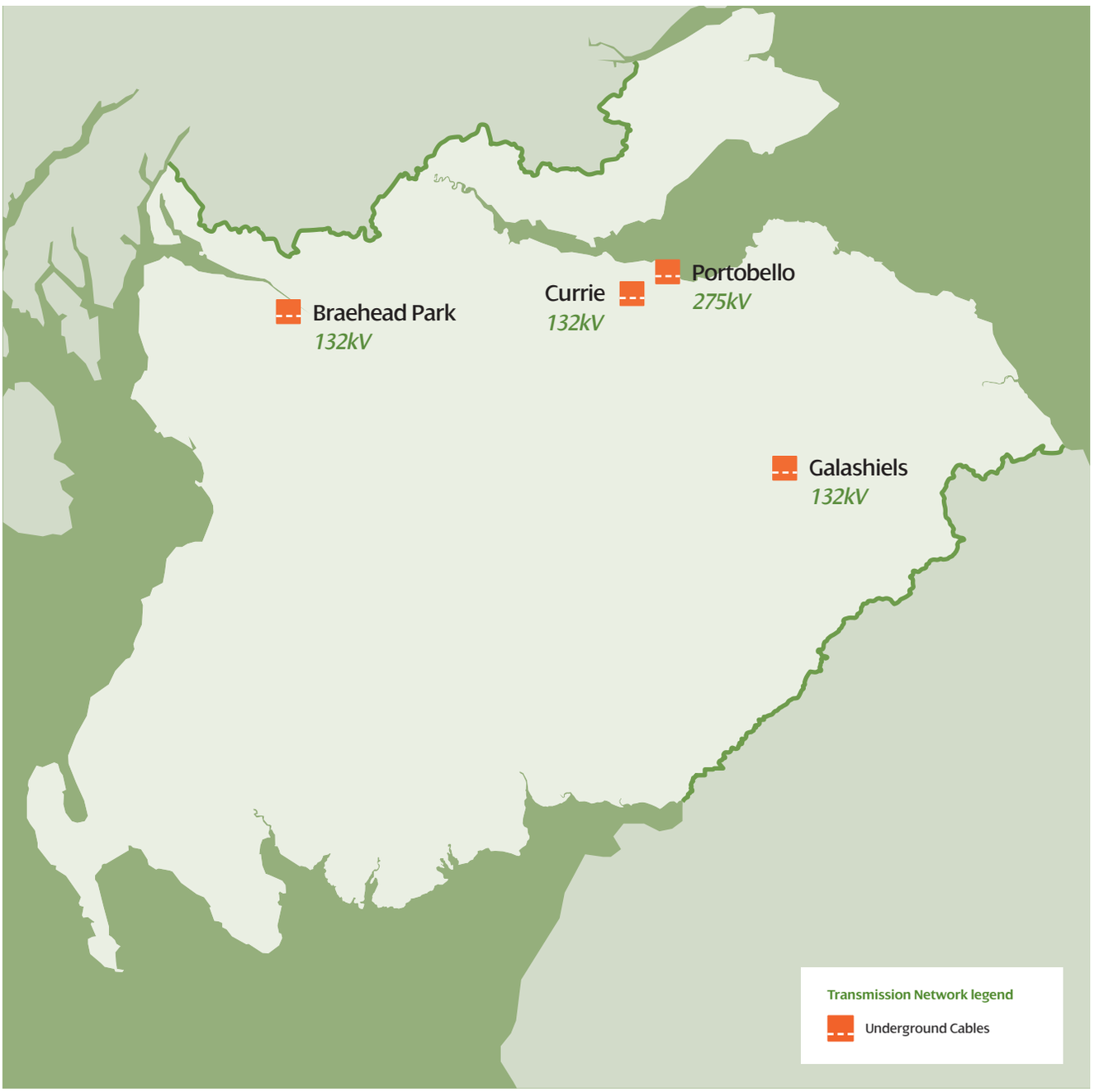
Underground cables
— *investment plan*

We have assessed our network of fluid-filled cables and determined that all but one route are likely to give reliable service for many years to come. Here's an overview of our plan.

The focus of our activity

We need to undertake refurbishment work on a small number of routes – the scope of which is consistent with our strategy for this type of cable system.

The table opposite summarises the planned works on underground cables.



Underground Cable Investments

	Route	Scope of Work	Circuit Length /No. of Joints /No. of sites	Planned Completion *(Year)*	Cost	Monetised Risk Benefit
275kV	**Portobello — Shrubhill 1 & 2** *Edinburgh*	*Refurbishment* *Hydraulic system replacement* *Joint plumb reinforcement* *Bonding and earthing refurbishment*	14 Joints	2023	£4.69m	r£444.45m
132kV	**Braehead Park — Erskine 1 & 2** *Renfrewshire*	*Refurbishment* *Hydraulic system replacement* *Joint plumb reinforcement* *Bonding and earthing refurbishment*	23 Joints	2024	£4.94m	r£75.81m
	Galashiels — Hawick *Borders*	*Refurbishment* *Hydraulic system replacement* *Joint plumb reinforcement* *Bonding and earthing refurbishment*	6 Joints	2024	£2.26m	r£0.2m
	Currie — Gorgie 1 & 2 *Edinburgh*	*Replacement of cable systems*	10.4km	2026 *(indicative)*	£9.5m	r£192.73m
	Sealing Ends	*Replacement of 132kV cable sealing ends*	60 Sealing end sets	2026	£7.8m	N/A
33kV	**Switchboards**	*Replacement of 33kV cable sections to new switchboard locations*	20 sites	2026	£3.92m	N/A

Notes on our plan

The 132kV cable system between Currie, Gorgie and Telford Road substations was installed in 1954. The cables have brass reinforcing tapes which have corroded significantly on the Gorgie to Telford Road section. This has led to fluid leaks along the length of the cable itself and it is not feasible to repair this defect. We have already commenced a project to replace this cable system. The project is likely to complete in the RIIO-T2 period as we work with stakeholders to find the best route for the new cable.

We know the Currie to Gorgie section uses the same cable design, but has not yet exhibited the same issue. We have included a project to replace this section of cable in our plan, but it will be a ring-fenced Price Control Deliverable. If the cable remains reliable and we don't need to do the work in RIIO-T2, the associated allowance will not be triggered.

We also own 33kV cables at the interface with the distribution system, and work is required to divert or replace these cables when the distribution network operator (DNO) replaces the jointly-owned 33kV switchgear. We have worked closely with the DNO and have included the costs of the works associated with their plans occurring within the RIIO-T2 period.

We have experienced an unusually high number of failures of 132kV cable sealing ends in RIIO-T1. We have included a project to replace remaining units which are the same generation as those which have failed. Again, we will ring-fence this project as a Price Control Deliverable and if the sealing ends remain reliable we won't replace them and the associated allowance will not be triggered.

Substations
— *asset strategies*

3

Our substations connect different parts of the network. They allow power to be directed around the network. We have smart systems to protect, automate, control and monitor the network and you'll find these in our substations.

There are many different types of asset in our substations. We have strategies for each and we plan and co-ordinate our activities to create the most efficient plan.

Substation types

We own and operate 156 substations, that vary greatly in size and volume of assets. As part of our strategy we grouped them into two categories:

Air-insulated substations (AIS) – substations whose high voltage components are exposed and insulated by their distance from the ground. These are the most common type on our network. Almost all of our investments in this section are in existing substations of this type.

Gas-insulated substations (GIS) – substations whose high voltage components are enclosed in steel pipework and insulated by sulphur hexafluoride (SF_6) gas but alternative insulating gases are now becoming available.

Assets within substations

In this section, we have grouped the substation assets and we'll describe the strategies and investment plans for each in turn. The assets groups are:

Circuit-breakers – Circuit-breakers are lead assets that control the circuits and stop short-circuit currents caused by faults.

Electrical assets – There are other electrical assets, such as disconnecting switches and measurement transformers that are also essential for the safe and reliable operation of the network.

Protection, smart control and monitoring systems – Protection systems continuously measure the electrical behaviour of the network and act very quickly to detect faults that might arise. We also have equipment to automatically or manually control parts of the network. To improve our understanding of how the network is operating and how the assets are performing, we have a wide range of sophisticated monitoring systems. All of these systems need a reliable telecommunications system and we have our own private network for this.

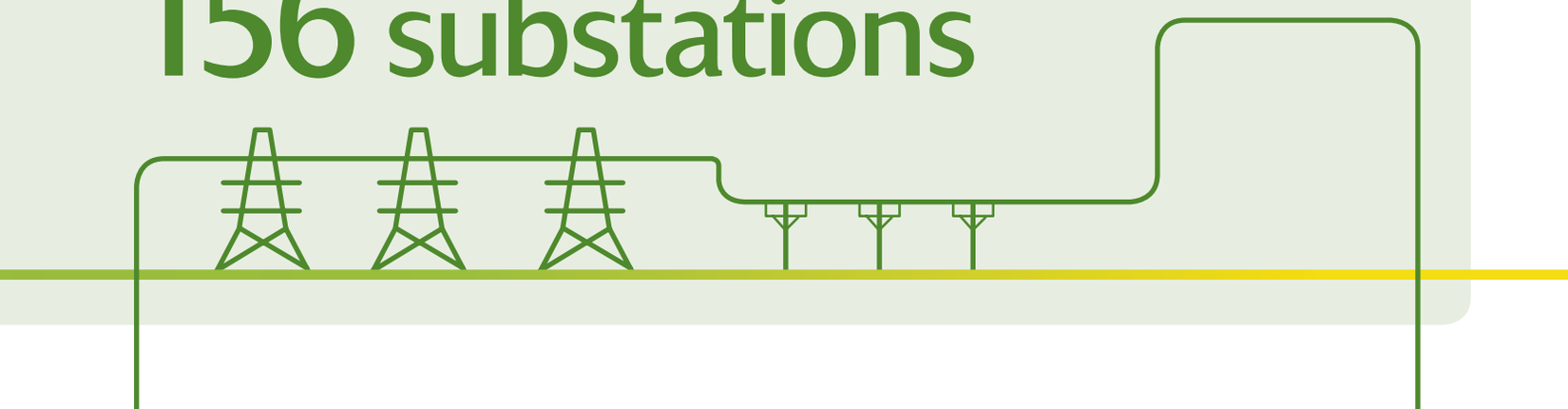
Substation civil assets

Substations contain civil assets and the generally consist of:

- Buildings with heating, cooling and lighting;
- Structures supporting electrical plant;
- Transformer bunds
- Drainage systems
- Fencing and security systems

We own and operate 156 substations, that vary greatly in size and volume of assets

156 substations



Our strategy for substation circuit-breakers

We're prioritising replacement of bulk oil and air blast circuit breakers that are in poor condition and we have limited capability to keep operational. We're also working with manufacturers to find alternatives to SF_6.

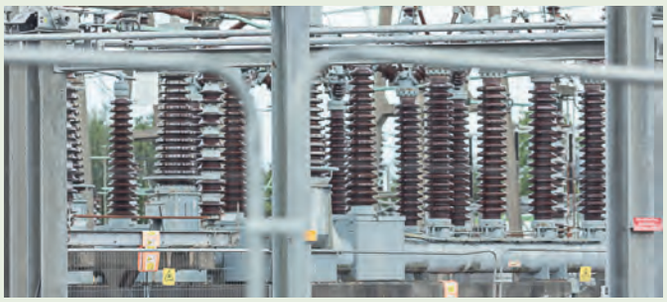
The condition of the population of circuit-breakers within our network is best understood by categorising them by technology type:

- Air blast circuit-breakers
- Bulk oil circuit-breakers
- Hydraulic/pneumatic SF_6 circuit-breakers
- Spring mechanism SF_6 circuit-breakers

Total investment in lead substation assets

£132.3m

Air blast circuit-breakers



Air blast circuit-breakers of types OBR 30/60, OIBR80, Frame-R and GA6 have all been assessed. We have found that all types have reliability and obsolescence issues, which limits their remaining useful life. The lack of manufacturer support, unavailability of critical spares and operational costs associated with ongoing maintenance indicate that these types are included in a replacement programme. We have examined the possibility of a further round of refurbishment of these circuit-breakers, but there are no viable options due to a lack of manufacturer support.

Bulk oil circuit-breakers

JW420 and OW410 bulk oil circuit-breakers were designed in the 1950s, and are now experiencing significant failure modes, so their remaining life is limited. The failures are the result of fundamental components degrading. These include, but are not limited to, stress cracking of support structures, current carrying contacts becoming misaligned, moisture ingress to the high-voltage bushings and unsupported and irreplaceable components. Any of these issues could lead to a catastrophic failure of the plant, and other network operators have experienced such failures of the 275kV JW420 type. These failures present safety and environmental risks. We have undertaken a detailed inspection of all JW420 circuit-breakers, in addition to routine inspections to ensure that we can keep them in service in the short term before being replaced.

SF_6 circuit-breakers

Since the first units were installed in the 1980s, this type has mainly been reliable. In recent years though, the earliest types' hydraulic or pneumatic mechanisms have experienced significant reliability issues. These types were supplied by a number of manufacturers and we now need to plan interventions to address this issue.

Our spring-mechanism SF_6 circuit-breakers are relatively new and have, to date, exhibited few issues that would justify any kind of intervention. The main area of concern to date has been gas tightness, and – given the relative simplicity of the operating mechanism – this is expected to be the case for the foreseeable future. Thus, there are no planned interventions beyond routine inspection, testing and reactive defect management.

Alternative gases

Referring to our strategy for SF_6, we have a different strategy for 132kV, where there are now commercially available alternative insulating gases. The cost-benefit analysis for these circuit-breakers considers the benefit of using alternative gases. We will minimise the increase of our SF_6 gas inventory where feasible. We will target replacement of circuit-breakers which need gas top-ups because they leak at a higher rate than their design limits.

The reduction of SF_6 within our network is also discussed within Our Sustainable Development Annex, within **Annex 7**: Environmental Action Plan.

Our strategy for substation circuit-breakers

Prioritising replacements

Our strategy for circuit-breakers is to replace the poorest condition, highest risk circuit breakers, which are air blast and bulk oil. These types have shown that they are approaching end of life due to performance, lack of manufacturer support and unsuitability for further refurbishment or life extension. The removal of these assets from the system will be prioritised by risk and the availability of system access.

The next priority type of circuit-breakers are the hydraulic and pneumatic mechanism SF_6 circuit-breaker population. These circuit-breakers are constructed using SF_6 as the insulation and arc interruption medium and use either a pneumatic or hydraulic energy source to open and close the mechanism. While the actual circuit-breaker interrupters are in good condition, the area of deterioration is within the hydraulic and pneumatic mechanisms. Failures are caused by corrosion and failure of dynamic seals and have led to mal-operation of the plant to either open or close. In addition, they are now increasingly unsupported by the manufacturers as the introduction of more reliable, lower cost spring mechanism designs caused the manufacture of pneumatic and hydraulic mechanisms to cease some years ago.

Where we can source the replacement components, we will deliver a programme of mid-life intervention to replace unreliable hydraulic and pneumatic mechanisms. Our interventions will prevent this failure mode causing early end of life of the circuit-breakers. These have been assessed on an individual asset basis and a cost-benefit analysis has been completed to determine where this course of action will be more beneficial for consumers than replacement. This strategy is most effective at 400kV.

Substation circuit-breakers
— investment plan

Our strategy explains the issues associated with the limited serviceability of our air-blast and bulk-oil circuit breakers. We have assessed these in detail and plan to continue the replacement programme we started in RIIO-T1.

We have prioritised the air-blast type because we have limited ability to keep them in good working order. We plan to replace the remaining units in RIIO-T2. These are located at Hunterston 400kV and 132kV substations, Longannet 275kV substation and Windyhill 275kV substation.

While there are operational issues with bulk-oil circuit-breakers, we have a greater ability to keep them operational for a short time beyond the end of RIIO-T2. This means we will need to monitor their condition more closely in the meantime. We will continue to replace this type of circuit-breaker, but over a longer time frame than we will for air-blast.

In RIIO-T2, we plan to replace the units at Westfield 275kV and Devol Moor 132kV. We expect to complete the replacement of bulk oil circuit-breakers during RIIO-T3. In all cases, we have considered the best way to do this work while addressing the condition of non-lead assets.

We have analysed the ongoing operability of our air-blast and bulk oil circuit breakers. We have the ability to keep them in service until they are replaced as defined in this strategy.

[1] https://www.smarternetworks.org/project/nia_spt_1604

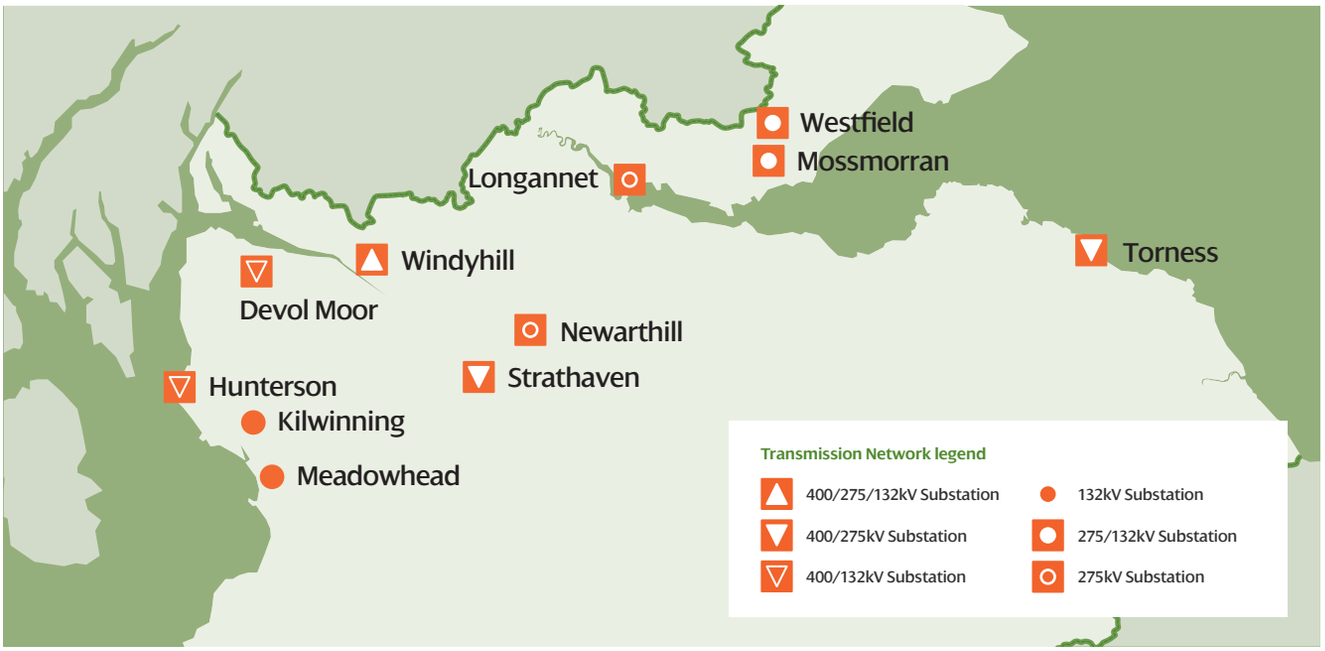
The issues with early SF_6 circuit-breakers with pneumatic or hydraulic mechanisms have reached a stage where routine repairs are no longer effective. We plan to refurbish or replace these. We have considered these on a case-by-case basis and provide details below.

As we explain in our SF_6 strategy, we plan to begin removing this potent greenhouse gas from our AIS substations and specify alternative gases for new AIS circuit-breakers and GIS substations. This has been enabled by experience gained during our RIIO-T1 innovation[1] projects. We can only do this where there are alternatives available. Our work with the equipment manufacturers indicates that it is unlikely this will be possible at voltages above 132kV before the end of RIIO-T2, with the exception of some components of higher voltage GIS substations. We provide details of this programme over the following pages, focusing on those units which are leaking more gas than the design limits.

We will use our digital substation solution at off-line build substations as we transition this key RIIO-T1 innovation project into business as usual. We also plan to use Low-Power Instrument Transformers at these sites. This will be the first time this technology has been used as business as usual.

We have considered the reuse or remediation of existing electrical and civil assets during the optioneering of interventions. The environmental benefits associated with carbon and resource consumption, and waste reduction through reuse or remediation was fundamental to the decision making process.

The investment plan summarised across the following pages is the result of an extensive optioneering and detailed engineering process. The options selected and their inclusion in our business plan are fully supported by cost benefit analysis.



Circuit-breaker Investments

	Project	Scope of Work	Number of Units	Planned Completion *(Year)*	Cost	Monetised Risk Benefit
400kV	Hunterson	*Extend Hunterston East 400kV and reconfigure circuits*	2	2026	£21.12m	r£922.21m
	Strathaven	*Refurbishment*	3	2023	£0.36m	r£31.33m
	Torness	*Refurbishment*	8	2024	£3.34m	r£284.98m
275kV	Windyhill	*New GIS Substation*	14	2026	£43.12m	r£700.29m
	Westfield	*On-line Rebuild*	7	2026	£17.87m	r£37.74m
	Longannet	*Off-Line AIS Rebuild*	11	2027	£64.39m	r£73.63m
	Strathaven	*Replacement*	3	2023	£0.37m	r£32.05m
	Newarthill	*Replacement*	1	2025	£0.23m	r£9.49m
132kV	Devol Moor	*On-line Rebuild & Refurbishment*	4	2025	£8.23m	r£36.73m
	Hunterston	*New GIS Substation*	7	2026	£14.79m	r£37.73m
	Kilwinning	*Replacement*	2	2022	£0.43m	r£13.83m
	Meadowhead	*Replacement*	3	2022	£0.53m	r£530.13m
	Torness	*Replacement*	9	2024	£1.43m	r£79.42m
	Mosmorran	*Replacement*	6	2024	£7.36m	r£29.02m
	Greenhouse Gas Reduction	*Replacement*	4	2023	£0.73m	N/A
33kV	Circuit-breaker Replacement	*Replacement*	40	2026	£7.95m	N/A

Our circuit-breaker projects
– a summary

Hunterston substations

Total value: £35.9m

Hunterston 400kV substation's Frame-R circuit-breakers have operational issues that are becoming more pronounced as they age. The manufacturer has stopped supporting them and we have a limited stock of vital components. It is unlikely that we can continue to operate them much beyond the end of RIIO-T2. In co-ordination with the closure of the power station, our plan is to reconfigure the network by extending the nearby Hunterston East substation (constructed in RIIO-T1 to enable connection of the Western HVDC Link) by two bays and relocating the 400/132kV transformers. This allows the existing substation to be decommissioned, avoiding the need to replace seven circuit-breakers, two switch-disconnectors and associated non-lead assets.

At Hunterston 132kV, there are significant electrical and operational issues with the eight GA6 circuit breakers. In addition, severe access restrictions for routine maintenance is affecting the reliability of the non-lead assets. Due to space restrictions, it is not possible to replace this switchgear in-situ. A new 7 bay Gas Insulated Substation (GIS) is due to be built nearby. As we explain in our SF_6 strategy, this will be specified with an alternative insulating gas. We will also apply our digital substation technology at this site. We have worked closely with EdF, owners of the power station to co-ordinate these works, meeting their requirements while minimising costs.

Windyhill substation

Total value: £43.12m

Windyhill 275kV is a key node in the network. Its 10 OBR30 and OBR60 circuit-breakers are increasingly difficult to keep operational with escalating maintenance durations which require outages of the main interconnected system. We have considered re-building the substation bay-by-bay (replacing the circuit-breakers but retaining and refurbishing some of the non-lead assets) and building a new GIS substation in the grounds of the existing site.

A key factor is the costs for constraining generation during long outages required to do this work. We have worked with National Grid ESO to forecast these costs, which are greater for the AIS options than for GIS. We considered these with the capital costs of each option in a cost benefit analysis, and found the most economical solution to be the off-line GIS option. We will specify that the gas insulated busbars use an alternative insulating gas to SF_6 in line with our strategy for SF_6.

Longannet substation

Total value: £64.39m

Longannet power station has closed but the substation remains an important part of the network. We examined a large number of options to re-configure the network and remove the need for the substation. All of the options had a negative impact on the network's capability in areas with a strong need to reinforce.

We have performed extensive engineering design of the various options to replace the OIBR80 circuit-breakers and the non-lead assets which are all significantly deteriorated. We have analysed rebuilding in-situ and five off-line build options.

The in-situ option is the least economical due to the cost of refurbishing the building, the severe electrical and space constraints of the 1960s design and the extensive network outages required throughout, what would be a seven-year programme of works.

We have identified an economically preferred option that avoids building in areas with significant flood risk. However, a number of other complex environmental and spatial constraints in the immediate surroundings means that siting and design requires careful consideration.

The wider area is also subject to a significant local authority led master-planning exercise to inform regeneration. We have started a detailed engagement process with stakeholders which will inform a detailed appraisal of all options. We hope to complete the development in 2027 but will be working with stakeholders, the local authority and the wider community to seek a full range of views on the plans.

This project is included in our plan, but it will be a ring-fenced Price Control Deliverable. If it takes longer to complete the project, the associated allowance will not be triggered.

Westfield substation

Total value: £17.87m

Westfield 275kV substation is a major supply point for Fife and a key part of the eastern connection to the SHE Transmission area. We plan to replace the seven JW420 circuit-breakers. We included retaining and refurbishing the major civil structures and refurbishing the non-lead electrical assets in our optioneering process. However, the costs of this would be higher than rebuilding the substation in-situ and have significantly longer outages which impact the capability of major system boundary B4.

We also considered an off-line build GIS but this would also be more expensive. In this case, there were no savings in outage durations due to the substation layout.

We will use digital substation technology at Westfield.

Devol Moor substation

Total value: £8.23m

Devol Moor 132kV substation's four OW410 circuit-breakers will be replaced with new alternative-gas AIS live-tank circuit breakers, in line with our SF_6 strategy.

The non-lead electrical assets are significantly deteriorated. We have examined refurbishment costs and replacement costs of disconnectors. The most economical option is to replace the disconnectors.

We have tested the concrete structures to establish their condition – using experience from a RIIO-T1 innovation project – and found it is economical to retain a number of these. This will result in approximately 500m^3 of concrete from being classified as waste when it leaves site.

132kV circuit-breaker greenhouse gas reduction

Total value: £0.73m

We have a strategy to influence the industry and encourage the supply chain to develop alternatives to the potent greenhouse gas SF_6. At present there are solutions for 132kV circuit-breakers and we plan to start replacing those units where we have been repairing leaks and topping-up gas.

In RIIO-T2, we will replace 4 circuit-breakers by 2023.

33kV circuit-breakers

Total value: £7.0m

We also own 33kV circuit-breakers at the interface with the distribution system. There are works required to replace these when the distribution network operator (DNO) replaces the jointly-owned 33kV switchgear. We have worked closely with the DNO and have included the costs of the works associated with their plans during the RIIO-T2 period.

We will replace 40 circuit-breakers at a cost of £7m. As 33kV circuit-breakers are non-lead assets, there is no monetised risk benefit attributable to these works.

Pneumatic & hydraulic SF_6 circuit-breaker

Total value: £6.69m

132kV Type A: We considered the costs of replacing the mechanism or purchasing a new circuit breaker. We have considered both SF_6 and alternative gases and propose to replace two units at Kilwinning, three at Meadowhead and nine at Torness with alternative gas circuit-breakers. We do not need to intervene on non-lead assets at these sites.

132kV Type B: We plan to replace six of this type of circuit-breaker at Mosmorran with an alternative gas equivalent. The mechanisms need to be replaced but the manufacturer can't offer this service. We have also experienced significant deterioration of the non-lead electrical assets – in part due to the substation being located at a major petrochemical works. We will co-ordinate these works to maximise efficiency and minimise outages.

275/400kV Type C: We plan a mixture of replacements and refurbishments of this type of circuit-breaker. Our analysis shows that it's more economical to replace 275kV designs so our plan will replace one unit at Newarthill and three at Strathaven 275kV. Refurbishment is the right option for the three units at Strathaven 400kV.

Torness substation: The GIS substation at Torness was commissioned in 1986 and the circuit breaker mechanisms are now experiencing deterioration. We expect to have enough spares to maintain these only until the end of the RIIO-T2 period. The only practical option is to replace the mechanisms, which we plan to do by 2024 with the close co-operation of the power station owner.

£79m of investment in air-blast circuit-breakers. Realising r£1,660m of monetised risk benefit

r£1,660m

Our strategy for substation civil assets

The good condition of civil assets is key to maintaining safe and secure sites for both staff and members of the public, and ensuring the longevity of our asset base. Here are the key considerations involved.

What civil asset condition investment covers

Investments to manage civil asset condition includes the replacement and refurbishment of transformer bunds, fences and walls, buildings, heating and lighting systems, drainage systems and structures that support the electrical assets.

To prioritise assets for intervention, qualified civil engineers have undertaken an intensive condition assessment of all transmission civil assets and developed a condition-based approach. This has progressed into a programme of civil works to ultimately extend asset life and avoid the need for replacement in the near future which would need significant investment.

The design intent for structures supporting electrical plant was to avoid the need for intervention altogether, based on the understanding that the structure would be replaced with the electrical plant when necessary. Thanks to a better understanding of both concrete and steel structures, these approaches are being adapted. The strategy now involves consideration of extending asset life to provide the best value for consumers.

Proposals for substation buildings

There are two options where other planned work has been proposed: the retention and reuse of the existing building, or the design and construction of a new building to house the associated equipment.

Installation of a new building allows for an offline build and installation of associated equipment – this ensures a modern, functionally-designed building that meets current environmental and planning standards. It also provides an environment specifically designed to house any internally-installed equipment for its lifetime.

When we re-use existing buildings, interventions will be required to bring these buildings in-line with current standards. These works will include LVAC systems, lighting, and air conditioning. In addition, any remedial works the building requires will be undertaken to address structural issues. Any works required will be assessed using CBA to provide the best value for money.

Our civil asset base contains buildings at all our substations, of which only a small percentage are being worked on as part of planned project work.

A proactive investment strategy

From the RIIO-T2 period onwards, we have developed an investment strategy to allow pro-active interventions, based on our recent condition assessments. Our substation buildings have all been assessed and given a condition-based health index (health index 1 is new and health index 5 is end of life). Proposed works for RIIO-T2 will see the removal of health index 5 building deficiencies, either when we are undertaking other work or as part of a civil works programme – whichever CBA determines to be the most economical. All remaining issues (health index 4 and 3) will be risk-assessed and addressed if they reach a health index 5 and before they present any safety risks.

The structures within a substation not only support equipment but ensure safe electrical clearance distances are maintained. These structures are essential for a reliable network.

Total investment in civil assets

£30.5m

A brief history of how civil structures have evolved

It started with concrete

Before 1980, we built civil structures with concrete which we believed would not require any maintenance. It was thought that the structures would be able to support the asset for its lifetime and would be replaced along with the plant when it was changed. Improved knowledge of how concrete ages has made intervention possible. This enables us to extend the life of the concrete structures and reduce the costs associated with changing the plant.

We have undertaken detailed assessments of concrete structure assets. Using CBA, we have determined the most cost-effective methods to employ at sites to decide whether to replace or remediate structures. Our inspection and maintenance regime runs alongside this. All concrete structures have a minor intervention strategy to extend their lifespan until replacement is more economical.

Then came steel

Steel structures were used as an alternative to concrete structures from the 1980s. These structures were designed and built with galvanised steel to ensure a typical 40-year life cycle. These were in-line with the expected plant life and so, like their concrete counterparts, were assumed to be replaced along with the plant.

The first steel structures built in the 1980s are approaching the end of their design life. We have developed a minor intervention strategy to extend their lifespan until replacement is more economical.

How we work with both

The condition-based assessment that we have undertaken has allowed us to develop a detailed understanding of the condition of concrete and steel structures.

The proposed programme for RIIO-T2 will undertake a detailed investigation of the assets assessed – and those at health index 4 and 5 – to determine which course of action is best suited to deliver the best value.

Transformer bunds

Transformer bunds are essential in ensuring environmental compliance in normal operation, and particularly in transformer failure scenarios.

Through condition-based assessments, we have reviewed all of our transformer bunds and categorised them using the standard health index methodology. Any bunds which are non-compliant with modern standards will have new fully-compliant bunds installed. Bunds that are damaged and assessed as health index 4 will have individual assessments and repairs undertaken to ensure full compliance. We have prioritised the works to target the sites with the greatest environmental sensitivity first.

Substation Security

Substation fencing is the first line of security and ensures that the public and equipment are kept safe from potential dangers and damage. As with all assets, degradation takes place with time – particularly in terms of rusting, vandalism and third-party damage.

The condition-based analysis of these sites has identified that wholesale fence modernisation is not required, but for optimum safety, we must keep on top of targeted remedial repairs and replacements.

All substations have existing security measures in place to make sure the company meets the legislative requirements detailed in the electricity, safety, quality and continuity regulations. There is a large asset base of transmission substations across the network, and whilst perimeter fencing and gates deter access into a substation, in recent times it has been identified that these cannot be solely relied upon.

We have been installing substation electronic security systems for a number of years and found that this additional layer of protection against either unauthorised or inadvertent entry protects both the public and company assets. To date, integrated security systems have been constructed in transmission substations, and we propose to continue rolling out these security systems as well as refurbishing older systems which will have reached end of life during RIIO-T2.

The sites that require security measures have been included within the scope of this project and the criteria used to apply integrated security measures is based on risk founded on the importance of the substation, and the history of third party interference.

We will also refresh and enhance fire detection systems at our substations so that they meet current standards.

Substation electrical assets *— investment plan*

There are a number of electrical assets and instruments involved in the effective operation of our transmission network.

Instrument transformer types

There are two types of instrument transformer construction in use in our network:

Sealed for life units
The sealed for life units, as the name suggests, require no maintenance and have no interventions possible. These units will be replaced with their associated circuit-breakers on a case-by-case basis where it is the most economical option, or if end-of-life failure modes develop.

Oil insulated units
The oil insulated units are inspected for oil levels and topped up as required to ensure optimal performance. These units will be monitored and any leaks identified and managed as required. The instrument transformers will be replaced on a condition-based approach, supported by condition and oil analysis.

Disconnectors and earthing switches

Disconnectors and earthing switches are essential to the operation of a transmission network, and as such there is a large population of plant within our network. These must be managed effectively for reliable network operation.

We have assessed the costs of refurbishing this type of plant and have determined that this approach is not the most economical, particularly when interventions are planned on associated equipment in the substation. The replacement of these assets will be based upon the condition assessment of the equipment to determine whether they will continue to perform reliably.

How we're making improvements

We are undertaking minor replacement works on non-lead electrical assets due to poor condition, with planned costs of £1.22m over the period.

We have one larger project to replace current transformers at Cockenzie 275kV substation. Replacement is necessary, as analysis of the oil shows significant deterioration of the insulation.

We plan to complete this by 2025 at a cost of £1.02m.

GIS monitoring systems *— investment plan*

The number of GIS substations has increased within our network over the RIIO-T1 period. This is due to reduced costs and reduced outage requirements as a result of offline builds and space constraints where AIS substations were being replaced.

Where we are now

We had limited experience of GIS prior to RIIO-T1, and the long-term performance of the modern 400kV, 275kV and 132kV installations is as yet unknown due to its relatively recent introduction. Service experience with the sites commissioned during RIIO-T1 has been mostly good. However, we have experienced some issues and need to fit monitoring equipment to detect if these arise again.

How we're making improvements

GIS substations are very reliable, but early failures can be predicted by the presence of an electrical phenomenon known as partial discharge (PD). We will roll out PD measurement and gas trending on existing GIS substations. This will allow us to understand the degradation of the GIS and develop a condition-based assessment criteria for the equipment. This will work with the ongoing maintenance regimes created in-line with the manufacturers' recommendations and the growing understanding of equipment performance.

This project will be completed in 2026 at a cost of £2.46m.

Smart control and monitoring
— investment plan

We control our network in real time using a centralised system (known as an Energy Management System, or EMS). This takes place at our control centre which communicates with equipment at every substation (Remote Terminal Units or RTUs) using our telecommunications system.

How we're enhancing our network

We currently manage our network using an EMS originally installed in 2006. It was refreshed in 2016 on an architecture delivering performance improvements and third-party support efficiencies. This platform is now obsolete and manufacturer support is time-limited, so we are progressing its replacement.

The current platform satisfied the functional requirement for the traditional suite of EMS applications and latterly for a reduced set of power analysis applications. It replaced a system installed in the mid-1980s, scanning a population of RTUs using a legacy proprietary protocol. This protocol was delivered on the EMS platform to allow backwards compatibility with the then installed RTUs and remains in use today for the majority of sites.

There has subsequently been a move to adopt industry standard protocols for communications to RTUs at new sites, with around a quarter of the RTUs using the international standard protocol. The EMS replacement will require upgrades to the remaining RTUs to implement the international standard protocol. We will also refresh other aspects of substation control, including those with unsupported operating systems in line with our strategy for cyber security.

We operate a large number of devices to monitor and record asset condition and system behaviour. This lets us pinpoint live network issues and conduct detailed post-fault analysis.

How we're making improvements

We have a number of initiatives to improve visibility, control and asset condition monitoring. We have summarised these in the table below.

Work Programme	Planned Completion *(Year)*	Cost
EMS Replacement	2026	£6.91m
RIIO-T2 System Monitoring Modernisation	2026	£3.74m
RTU/HMI Replacement	2026	£2.25m
System Health Map	2022	£0.28m
EMS-WAMS integration	2024	£0.73m

Upgrades and improvements underway

The age of parts of the system monitoring system is now approaching 25 years old. This is well in excess of the original design life of 15 years recommended by the manufacturers, many of whom are now no longer in existence. We will upgrade this equipment where we can, or replace it where needed due to unreliability or obsolescence to ensure we continue to provide adequate network coverage.

We will integrate the data from all of our system monitoring equipment into a single platform, which we call a System Health Map. This will deliver a software platform, working within operational timescales. This will aggregate and display distributed monitoring data from within our transmission system. This will be a single platform which will present the data from all of our transmission assets, comparing the values against predefined limits (such as ER G5/4 for harmonics). The outcome will be actionable information regarding system status and health. There will also be a defined architecture and methodology for integrating future applications into the platform in the future.

Total investment

£13.91m

Civil and buildings
— *investment plan*

We have completed a full condition assessment of our sites where we know, thanks to inspections, that we have civil condition issues.

We have engaged with the Scottish Environment Protection Agency (SEPA) on our prioritisation of transformer bund upgrades and replacements. We will upgrade the bunds and drainage systems at 30 sites as a result of this prioritisation and will continue this programme in future periods. We have co-ordinated these with our transformer replacement and refurbishment works.

We have a project to rationalise one of our city centre sites to manage the condition of civil and building assets from the former power station and to reduce the visual impact of the site.

We also have a project to improve the Cockenzie indoor AIS substation building at the site of the former power station.

We plan to improve the energy efficiency of our substation buildings. This will involve improving the insulation and installing more efficient heating and lighting systems. We have prioritised the sites where the biggest improvement can be made. We will co-ordinate the works with the building refurbishment programme.

How we're making improvements

Work Programme	Activity	Planned Completion *(Year)*	Cost
Refurbish substation structures	*228 concrete structures at 81 sites* *105 steel structures at 23 sites*	2026	£6.12m
Substation Building & Energy Reduction Programme	*Buildings at 47 substations*	2026	£5.18m
Oil Bund & Drainage System Refurbishment	*30 sites*	2026	£10.33m
Cockenzie building improvement		2024	£6.45m
Partick Grid Site Rationalisation		2025	£2.42m

You can find more about how we plan to improve the energy efficiency of our substation buildings in **Annex 7**: Environmental Action Plan.

Protection systems
— *asset strategy*

Protection systems detect short-circuit faults and initiate the opening of circuit-breakers to safely disconnect the faulted components. They are vital for the safe operation of the network and must perform reliably to avoid widespread network disruption. Here's how we operate them.

The evolution of protection equipment

Operated by measured electrical quantities, the original devices used in protection systems were categorised as 'electro-mechanical', and commonly known as relays. They provided a good service but could only remain accurate with intensive maintenance. They were also physically large and because each device could only perform one function, there was complex inter-wiring.

The availability of reliable electronics in the 1980s led to this type of device becoming standard. Although more flexible, their lives were shorter and when they failed, there was no monitoring in place to alert the operator.

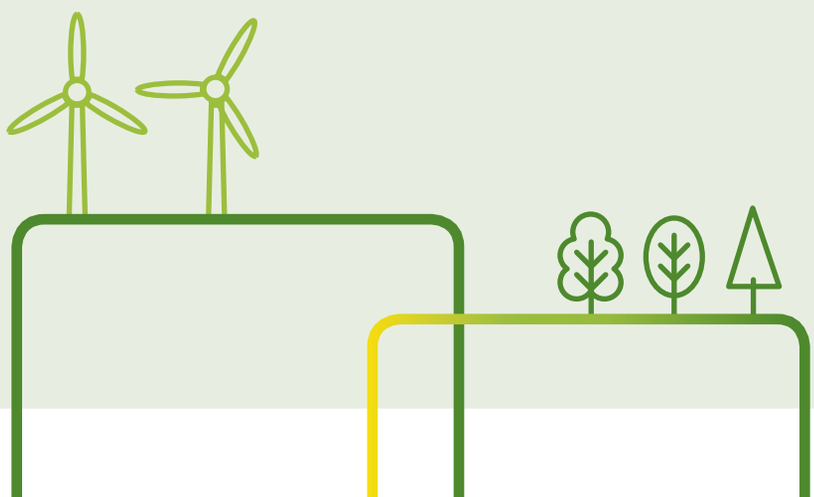
The introduction of micro-processor-based devices known as numerical protection in the early 1990s has, with data communications technology, revolutionised the design and operation of protection systems. Enhanced monitoring off-sets the shorter lives of these devices.

The protection and control methodology is to replace equipment before failure to solidify network security and availability. The electronic protection relay has a manufacturer's warranty of five years, with an expected life of 10-15 years.

Our strategy for protection equipment

Our strategy for protection equipment is informed by our asset health methodology, which details the steps to condition assess protection equipment and produces a health index for each type of relay. This health index ranges from 1 for relays with no issues and good reliability, to 5 for devices that fail to operate when required or operate erroneously, causing network disruption.

Due to the nature of protection equipment (construction, components and technological advancements), the categorisation of health is based on historical performance as there are no measurable quantities to indicate condition – unlike transformers, for example. The proposed investment strategy targets the health index 5 equipment.



Protection systems
— *investment plan*

The devices identified in the strategy will be replaced through a series of programmes. These will be planned throughout the period to take advantages of outages planned for other works where possible. The total cost of the programmes is £11.39m.

Protection Programme	Device or Scheme Volumes
First Generation Electronic Relays	324 relays
Circuit-Breaker Fail	17 schemes
Busbar Protection	1 scheme
Auto-transformer Protection	2 schemes
Signalling Equipment	14 schemes
Mesh substation auto-reclose	5 schemes

First generation electronic relays

One type of first generation electronic relays has been identified as health index 5 and is at its end of life. This is based on known component failures making them unable to operate.

Due to the number of these relays on our network, we need to develop a deliverable programme of works. Therefore the RIIO-T1 investment programme prioritised all feeder Main Protection relays of this type for replacement. We will continue replacing the remainder of the population, and complete their removal by the end of RIIO-T2.

Circuit-breaker fail

Circuit-breaker fail is a critical function that keeps the network stable and available. Incorrect operation – either through failure to operate or operating when not required – can have significant and potentially cascading effects through the network.

These schemes are constantly evaluated, and the applicable policies reviewed to ensure they are effective and compliant. Through this process of evaluation and review, we have found that some of the schemes within our network do not meet these requirements. The majority of schemes that don't align with our current policy are being replaced under the major switchgear replacement projects. The remaining schemes have been identified and targeted for replacement during the RIIO-T2 price control period.

Busbar protection

Similar to circuit-breaker fail schemes, busbar protection is a critical function. The majority of the schemes which are at the end of their lives rely on older electromechanical relays and are being replaced under the major switchgear replacement projects. Any remaining schemes that aren't replaced as part of the switchgear replacement programme are included in a programme for delivery under the RIIO-T2 period.

Auto-transformer protection

Another programme addresses the protection schemes for large auto-transformers. These transformers were originally installed with a single protection scheme but over time it's been acknowledged industry-wide that two independent forms of protection should be put in place. This will be applied to a small number of transformers with a single protection scheme. Where the existing protection is in acceptable condition, then a second protection will be added. Where the current protection is health index 4 or 5, the full scheme will be updated.

Protection signalling systems

To ensure that faults are cleared in accordance with the requirements of transmission system's operation, signalling equipment is used to enact circuit and plant disconnection at remote substations. The performance of this equipment is constantly monitored through real time systems, with performance assessed post fault through expert system analysis.

This ongoing assessment has allowed the detection of problematic equipment. There is one type which is an outlying performer and it fails regularly, requiring manual intervention to remedy. This leads to circuits being unavailable until the issue can be resolved.

These will be replaced within two work streams:

1. where there are primary plant works with associated devices these will be replaced along with any other protection upgrade;

2. through a dedicated protection programme to address units outside the scope of any other programme.

Mesh substation auto-reclose

The first generation of these schemes used proprietary ways of communicating between devices. As they have begun to fail, we've found that their replacements are not compatible. This has led to challenges in keeping the right level of network coverage. We will need to replace those schemes with failing devices and we will work with vendors to find a more sustainable solution.

Paving the way for fully digital substations

The recent development in communications technology and advancements in software tools have led to new approaches to protection design being applied, based on an international standard called IEC 61850. This allows highly reliable communications systems to replace most of the electrical wiring in a substation, saving time and money. We were pioneers in this field, installing our first systems in 2008. We have expanded our application of the technology and we will have three complete substations of this type by the end of RIIO-T1.

The evolution of this type of design has now reached the interfaces to the high voltage equipment. We've also successfully installed the UK's first live installation of this technology using equipment from multiple vendors. We developed this as a RIIO-T1 innovation project (FITNESS) and has proven to be highly successful, advancing the industry's knowledge and encouraging other vendors to develop their products. We call this approach Digital Substations, and will apply it to all new and off-line build substations in RIIO-T2.

This will make sure that:

- consumers benefit from the reduced costs
- we leverage the environmental sustainability benefits that come from smaller substation footprints and lower usage of materials such as concrete and copper cables

You can find more information about FITNESS at: www.spenergynetworks.co.uk/pages/fitness.aspx

Operational Telecomms
— *investment plan*

The operation of the transmission system is dependent on telecommunications for protection, control and monitoring. Because of this, we need to ensure that the services we use are reliable and secure. Here's how we do it.

Complete control for optimum service

We have our own private telecoms network which mainly uses our own optical fibre network. This allows us to maintain complete control of the transmission system. We have a small number of legacy systems using copper cables which are becoming increasingly unreliable. The cables carry critical traffic and if they are unreliable, it affects the reliability of the transmission network. The copper cables are also limiting new applications, such as active network management, that a low-carbon energy system requires.

The new applications are designed to more actively manage the network and take advantage of new techniques for network performance measurement and visualisation. This means that the telecommunications network is more important than ever.

How we're moving forward

Our strategy is to deliver an all-optical solution, moving services away from copper cables to improve reliability and enable the solutions needed in the future.

We will also improve resilience in two ways:

By enhancing the infrastructure needed for the main transmission system – predominantly 275kV and 400kV networks to further reduce the effects of telecoms equipment failure.

By making sure that the telecoms network is available when we need it if there are events that lead to widespread loss of supply. These will be achieved by improving parts of our network with limited diversity of communications channels, or where the essential power supplies are not resilient.

We will also replace hardware where we have no replacement parts or support from the manufacturer. The new hardware will be designed to allow enhanced cyber security applications.

How we're making improvements

Our programmes of work to improve resilience, upgrade obsolete and unsupported equipment, and enable new services for smart applications will run through the RIIO-T2 period. These works need to be carefully co-ordinated to ensure there is no risk to supplies as new systems are installed and systems transferred. The cost of these works is £35.44m.

The resilience programme achieves a more robust network by providing additional diversity of communication channels, through additional fibre routes and increasing the redundancy and resilience of the active communications equipment.

Work Programme	Planned Completion *(Year)*	Cost
All Optical Network	2026	£12.96m
Telecoms System Resilience	2026	£19.23m
Fibre Modernisation	2026	£0.75m
Telecoms Modernisation	2026	£7.16m

Strategic spares
— *investment plan*

Our plan is designed to make the right type of investment in our assets at the right time. This is intended to avoid the disruption and costs that arise when an asset fails and can't be repaired.

Unforeseen events do sometimes happen, and we need to be prepared and respond efficiently. An important aspect of this response is to keep an appropriate population of strategic spares.

Transmission assets can have a lead time of up to two years to purchase, so it's essential we have an effective plan for spares.

We periodically review our existing spares-holding. Most recently this has taken account of the rapid changes that the transition to renewables has brought. We have also considered the changing conditions of assets as we have undertaken refurbishment and replacement programmes to inform our view of what's required.

The two areas where additional strategic spares are required:

Circuit-Breakers

We have identified that one 275kV circuit-breaker is required to make sure we have sufficient coverage for any unexpected failures.

We have also identified one 400kV disconnecting circuit-breaker (DCB) in the plan. This will be suitable to replace any 400kV circuit-breaker, switch-disconnector or existing DCB. The additional flexibility of the DCB solution avoids the need for more than one type of spare.

We are confident that our existing arrangements for 132kV and 33kV circuit-breakers are adequate. We will store these units at our existing facilities.

Transformers

Our network needs transformers with a range of voltage transformations – from 400/275kV down to 132/11kV – and ratings which range from 60MVA to 1,000MVA.

In the past, we have used transformers on order to replace units that have failed, which has influenced our spares holding. We have used this method in RIIO-T1 when we had an unexpected transformer failure.

Our planned investments in transformers aim to maximise the lives of individual units where it is possible and economical. This means that we have a small order book for new transformers and we have identified that there will be gaps in our strategic spares.

Our analysis has identified that two additional transformers would be required. One of these would be 132/33kV, rated at 90MVA. The other would be 275/33kV with a 120MVA rating. Alongside our existing spares, we would be able to adequately respond to unexpected failures.

We will store these transformers at an existing facility but some civil works to accommodate them.

Total cost for strategic spares

£2.8m

Transformers and reactors *— asset strategy*

4

Transformers and reactors have similar constructions and have very similar operational requirements, so it makes sense to consider their strategies together.

This section describes how we assess the condition of these lead assets. We explain the condition factors that we need to be aware of and how we plan to invest.

Their role in our network

Transformers and reactors have very similar operational requirements but play a very different roles in the network.

Transformers connect parts of the network that operate at different voltages. They are often the interface to our distribution system customers and the connections at renewable generation sites.

Reactors are used to control network voltages or to change power flows. This makes them very useful as the energy wsystem transitions to low-carbon generation.

Replace before failure occurs

With transformers and reactors, it is particularly important to replace before failure takes place. The potential consequences due to large volumes of flammable insulating oil and the length of time it takes to replace them means that a detailed understanding of each individual transformer is needed.

Our normal practice is to assess the condition annually by sampling and analysing the oil. The presence of dissolved gases in the oil can be used to assess the activity in the main tank and the tap changers. Internal visual inspection is not performed on site because it is not very effective and attempting it could allow moisture and other contaminants to cause irreparable damage. For this reason, dissolved gas analysis (DGA) is an important tool.

We also assess the external condition, and the issues tend to be oil leaks and corrosion. There are known issues with bushings following in-service failures, and tap-changers can also suffer from reliability problems.

In addition to the normal inspection processes, we have undertaken a full, in-depth review of the entire transformer and reactor population. This has been verified by external transformer specialists, and we are confident that we have a sound understanding of each individual transformer.

Bruce Peebles transformers

The main exceptional factor is non-repairable design defect in a particular variant of Bruce Peebles transformers, which led to in-service failures before RIIO-T1.

Following forensic analysis of units of this transformer type replaced in RIIO-T1, it has been confirmed that all the units demonstrated signs of failure at the known defect location. Based on this finding and the technical understanding that remaining units are of an identical design, these transformers are subject to enhanced monitoring.

We have identified which transformers of this type are at the highest risk of failure and will replace them in RIIO-T2. We will monitor the remaining units closely and consider them for replacement based on the information we collect.

Understanding deterioration

Following the decommissioning of the other types of transformers in RIIO-T1, forensic analysis has found that, in some cases, the active part of the transformer did not deteriorate as much as the condition data suggested it would. This is due to several issues, such as design characteristics, lifetime loading and maintenance regimes.

This information has improved our understanding of asset deterioration, and has led to the introduction of a transformer refurbishment programme. Transformers are candidates for refurbishment if the condition of the core and windings is suitable for continued service but present issues with components such as the tap-changer or cooling systems.

The addition of the monetised risk methodology to our historical assessment of transformer condition brings an enhanced holistic review that identifies when a transformer requires intervention based on the weighting of the model inputs.

As well as age, the model inputs include, design characteristics, lifetime loading, oil analysis, and maintenance regimes.

This weighting allows us to identify when an intervention is required. Review of the individual weighted elements then allows the determination of the intervention required.

A cost-benefit analysis is undertaken to inform whether refurbishment or replacement would be more beneficial for consumers.

Transformer investment

£32.0m

Investment in reactors

£5.4m

Transformers and reactors
— *investment plan*

During an extensive review of our transformers' and reactors' condition, we identified need for the following works. We have engaged an independent specialist to verify our decision-making criteria remains in line with modern standards and practices. A second specialist also conducted the review of our proposed assets to validate the required works.

The transformers and reactors identified for replacement have been assessed to have limited remaining lives due to deterioration of the insulation or irrecoverable condition issues typically attributable to the core. This assessment is consistent with the output of the asset models. In this case we have not considered refurbishment due to the significant life limiting issues. In other cases, where there are condition issues with bushings, tapchangers or external condition, we have considered both replacement and refurbishment.

Our decisions have been informed by Cost Benefit Analysis in all cases.

Transformers and reactors investments

Transformers	Route	Scope of Work	Number of Units	Planned Completion *(Year)*	Cost	Monetised Risk Benefit
400kV	Torness SGT1 & SGT2	*Refurbishment*	2	2025	£1.41m	r£242.02m
275kV	Shrubhill SGT1 (Bruce Peebles)	*Replacement*	1	2024	£3.88m	r£210.07m
	Neilston SGT1	*Replacement*	1	2025	£3.7m	r£41.95m
	Giffnock SGT1 & SGT2	*Replacement*	1	2024	£11.81m	r£33.20m
	Windyhill SGT3	*Refurbishment*	1	2024	£0.69m	r£66.74m
	Grangemouth SGT1	*Refurbishment*	1	2023	£0.55m	r£71.57m
132kV	Devol Moor T2A	*Replacement*	1	2025	£3.41m	r£103.75m
	Kendoon T2	*Refurbishment*	1	2026	£0.61m	r£103.97m
	Inverkeithing T2	*Refurbishment*	1	2022	£0.64m	r£80.82m
	Saltcoats T2C	*Refurbishment*	1	2023	£0.45m	r£107.97m
	Carntyne T1B & T2B	*Refurbishment*	2	2024	£1.13m	r£145.76m
	Partick T1	*Refurbishment*	1	2026	£0.47m	r£28.97m
Reactors						
400kV	Torness Shunt Reactors	*Replacement*	2	2024	£5.93m	r£1,027.73m
275kV	Longannet Reactors	*Refurbishment*	2	2026	£3.16m	r£11.88m

Notes on our plan

The Longannet series reactor refurbishments will be co-ordinated with the circuit-breaker replacement project and ring-fenced as a Price Control Deliverable, so the associated allowance will not be triggered should it be delayed beyond RIIO-T2.

We will co-ordinate the replacement of Devol Moor T2A with the circuit-breaker replacement project to achieve the most efficient delivery. To minimise the impact on the power station, we will work very closely with the owners of Torness to co-ordinate the reactor and transformer projects with the circuit-breaker refurbishments described on page 103.

We plan to replace one transformer at Giffnock in the RIIO-T2 period and the other in the first year of RIIO-T3.

It may seem obvious, but maintaining a resilient network is about much more than simply looking after assets such as lines, cables and transformers. It's also vital we consider other factors, such as flooding, land, buildings and IT. This section explains our approach.

Supporting and Securing our Network

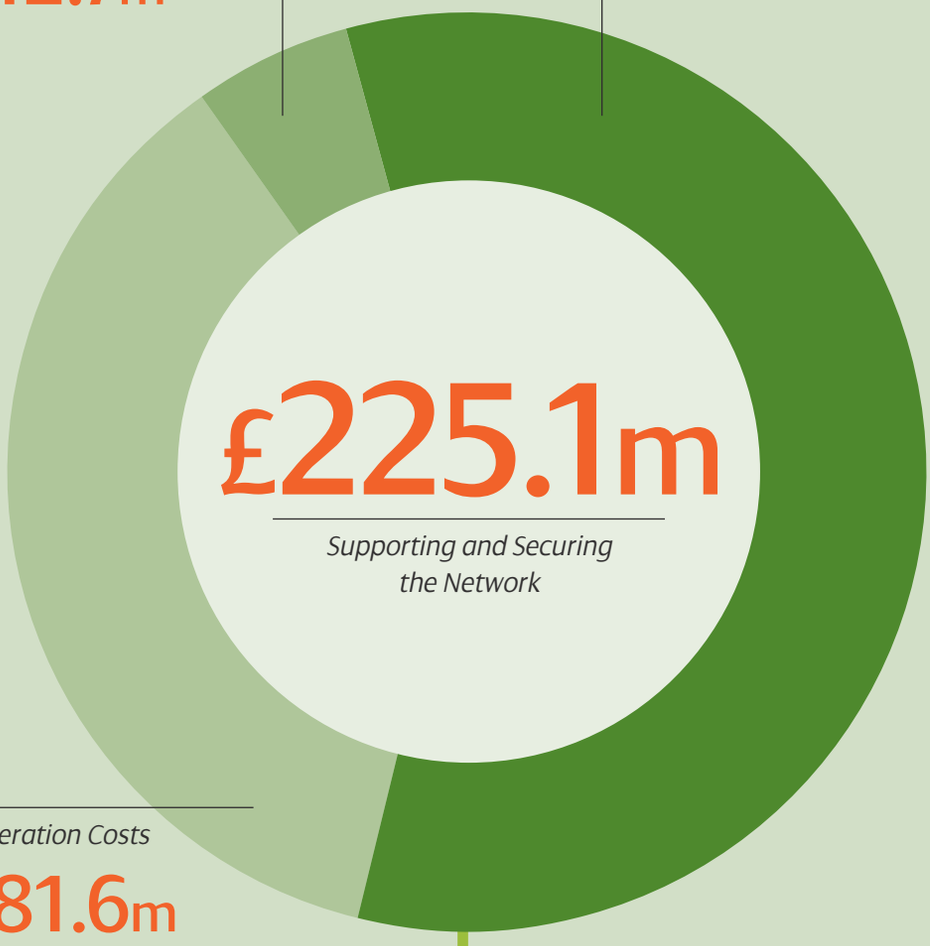
An overview of our planned expenditure

Non Operation Capex

£12.7m

Engineering and Support Costs

£130.8m



Operation Costs

£81.6m

Engineering and Corporate Support

1

To deliver our outputs and secondary deliverables efficiently, our front-line staff and contractors rely on an extensive network of support staff and services.

These are referred to as Closely Associated Indirect costs (CAI) (or, indirect costs), and Business Support (BS). We thoroughly reviewed our costs in these areas to make sure our support services are efficient and cost-effective. Then, we compared our costs to available industry costs.

What are indirect costs?

Ofgem currently describes indirect costs as activities that generally don't involve physical contact with system assets, yet play an integral supporting role in the delivery of direct activities.

Our process

In SP Transmission, indirect costs are included across three separate cost categories:

Total indirect costs – **£261m**

Costs relating to investment activity – **£133m**

Costs within controllable operating expenditure – **£128m**

It makes sense to review the level of costs at a total indirect cost basis, which is at a Gross level.

Indirect costs: the categories

Closely Associated Indirect (CAI) costs are activities directly involved in co-ordinating and supporting the operational aspects of the network operator – for example, project management and delivery, engineering aspects such as design and planning of the network, management of the network on a day-to-day basis through the control room, plus health and safety functions and clerical support.

Business Support (BS) costs include activities provided centrally that our front line staff and contractors rely on. These may be centralised within SP Energy Networks, within ScottishPower, or in some cases within the Iberdrola Group. These costs include the following cost categories: Human Resources, Non-Operational Training, Finance & Regulation, CEO, IT & Telecoms, and Property Management.

Gross Indirect costs historic to forecast

(£m 2018/19 prices)

	2008	2009	2010	2011	2012	2013	Total TPC R4
CAI	22.3	19.4	18.4	26.3	34.8	41.7	162.9
BS	14.6	13.2	12.2	14.0	16.5	20.6	91.1
Total	36.9	32.6	30.6	40.3	51.2	62.3	254.0

The fluctuation in CAI costs is attributable to the overall movement in investment activity (Capex), from the expanding portfolio of complex projects, which required an associated higher level of support services to facilitate the greater activity levels. The Regulatory Asset Value (RAV) is forecast to increase by greater than 100% from £1.4bn in 2008 to £2.5bn by the end of RIIO-T1.

	2014	2015	2016	2017	2018	2019	2020	2021	RIIO-T1 Total	RIIO-T1 Ave	RIIO-T1 Allowance
CAI	46.54	48.85	49.01	52.66	39.46	29.35	35.48	34.99	336.3	42.0	48.8
BS	15.43	15.41	19.05	20.74	15.97	21.14	19.01	19.23	146.0	18.2	13.8
Total	62.0	64.3	68.1	73.4	55.4	50.5	54.5	54.2	482.3	60.3	62.7

	2022	2023	2024	2025	2026	RIIO-T2 Total	Costs
CAI	33.93	33.49	33.08	32.73	32.61	165.8	33.2
BS	19.47	19.35	19.13	18.89	18.68	95.5	19.1
Total	53.4	52.8	52.2	51.6	51.3	261.4	52.3

We have endeavoured to identify and deliver efficiencies wherever possible, to make sure that our support costs represent value to consumers.

Buildings and vehicles

2

Our buildings and vehicles play an important part in delivering the resilient service our customers expect. Here's how we make sure that happens.

Building projects

Our building projects team works on all aspects of the end-user requirement, from building resilience and plant replacement – through to internal fit-out and full new-builds.

The team works with our technical support framework to develop detailed designs, specifications and quantifiable schedules to support our in-house procurement specialists, working together to secure the best market value for the delivery of these works.

Our standardised specifications reflect industry best-practice. We regularly review and update them to reflect innovation, and deliver the most cost-efficient and sustainable solutions. This is how we reduce the long-term financial costs associated with maintaining our sites.

Building operations

Our building operations team is made up of qualified technical staff from mechanical and electrical disciplines. They work with our framework providers to deliver planned preventative maintenance (PPM) and reactive maintenance across the portfolio.

This maintenance work allows us to annually record an accurate estimate for running and maintaining each site. If we identify failings in a site's systems or building fabric, we work with the projects team to deliver the necessary programme of work.

Our building operations framework provider records the data from each site. The data is entered onto a database which monitors energy performance of the systems on each site, highlights areas of concern, and allows our engineers to recommend remedial or replacement works before significant faults occur.

Together, this work makes sure we comply with all statutory and compliance regulations. It also allows the projects and building operations team to deliver cost-efficiently, sustainably and using innovative practices.

Our vehicles

ScottishPower is committed to decarbonising its fleet of vehicles. Our target is to be the first fully electric fleet within the Iberdrola Group and we continue to look at opportunities to deliver this as quickly as possible, but with our business needs at the forefront of our mind.

Currently, 4% of ScottishPower's fleet is electric (pure electric or petrol-hybrid). This includes 31 electric pool cars that are available to all SP Energy Networks employees.

During 2020, we aim to transition a number of small vans in the SP Energy Networks' fleet to electric. We have established a project team to focus on this transition to a more sustainable and environmentally-friendly fleet. We will be looking to enable a more rapid transition from 2021 onwards as technology for medium vans becomes available on the market. In addition to this, we have already rolled out 26 Electric Vehicle (EV) charging points across our SP Energy Networks sites to ensure that we have sufficient capacity for our commercial EV fleet, EV pool cars, and also with the view to exploring the opportunity to provide charging points for our employees in the near future.

Our telematics system is being used to provide a vast amount of intelligence, which enables us to identify trends and opportunities within our fleet and also opportunities to reduce our environmental impact – both in relation to EVs and fuel consumption. Vehicle idling, acceleration, and harsh breaking are all being monitored closely as we are very clear on the relationship between poor driver behaviour and increased fuel consumption, and this data is being used to develop initiatives and bespoke training programmes aimed at improving driver behaviour and reducing our carbon emissions.

RIIO-T2 Capital building costs

Capital cost for building projects in RIIO-T2 is £1.8m; this is associated with the extension of the mezzanine floor at our Cambuslang site which will take place over a 2 year period in RIIO-T2.

IT and non-operational telecoms

3

Our IT and telecoms strategy represents a combination of 'Business as Usual', infrastructure and application refurbishments, and investments to support future innovation. These innovations include digitisation of information and processes, management of big data volumes, data analytics, and Building Information Management (BIM).

Our IT capability

ScottishPower IT provides commercial, planning, operations and technical architecture expertise and specific project delivery resource. Our project delivery is managed and governed by ScottishPower IT, with development and integration of solutions being provided by external parties. Development work is put to competitive tender where possible to ensure the best solution is provided at the most competitive cost.

Working across the business

ScottishPower IT delivers a corporate IT service across all of ScottishPower's operations, and we have a dedicated team focused specifically on supporting SP Energy Networks. Where possible, we work to develop solutions that apply across the entire SP Energy Networks business, dividing costs amongst the different networks businesses.

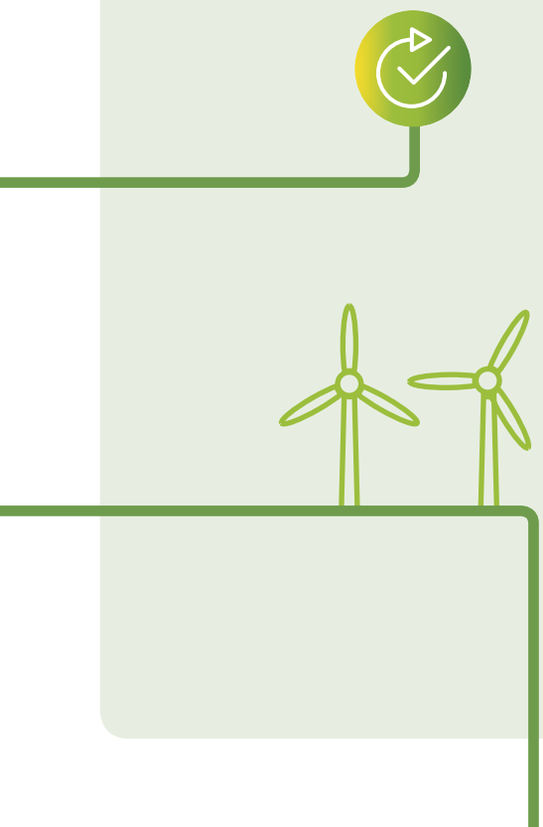
Global best practice

We work centrally to establish a common set of approaches across the group, always taking account of specific local requirements. Global practice groups operate with representatives from all parts of Iberdrola's network businesses to capture the best practices from across the group and use these to create standards, processes and solutions.

Strategic approach

Our strategy is to provide solutions to enable the growing electrification of the economy. This includes connecting more renewable energy, more storage capacity and backup energy, and more smart grids – delivering a safe, sustainable and competitive energy model.

There are two main parts to our IT and telecoms strategy: **digitisation** and **advanced analytics**.



Total Expenditure

£10.6m

Advanced analytics

Advanced analytics will allow us to know more about our operations, faster than current technology will allow. Here are the six main focus areas of our strategy:

Automatic processing of large data volumes by developing analytical solutions which provide insights into our operations at a level currently not possible.

More process automation by implementing a data exchange layer using enterprise service bus technologies.

Improve assets condition assessments by using broader and deeper data sets, helping us make better decisions on operations, maintenance, replacements and upgrades.

Enable system monitoring and dynamic rating calculations by adding more monitoring points on the network. We will develop solutions that will allow us to capture real-time information to inform optimal network operation.

Consider how transmission asset operations and management modelling will be affected by a more actively-managed low-voltage network.

Introduce machine learning and artificial intelligence to provide new insights and aid decision making.

Project: System Monitoring & Dynamic Rating
Cost: £1,000,000

Project Description:
Ability to monitor the system operation in near real-time and utilise this information to make operational decisions about the network.

Digitisation and big data platforms

Big data allows us to gain deeper insights about our operations – finding new efficiencies and creating innovative new approaches. Digitisation allows this to happen, and also allows us to transform our processes by automating manual operations.

Here are the eight main focus areas of our strategy:

Develop digital platforms to improve interactions with internal and external users. This improves the way we capture, record, analyse and report data.

Consolidate IT solutions around key asset management platforms, together with increased and enhanced data capture across a wider base of business operations. This will capture more information to support our business decisions.

Capture more data on more SPT assets including geospatial data, time series data, additional measurement points and video data. We will do this using sources such as internet of things devices and social media. Together, this work will further refine our decision-making process.

Introduce robot process automation to allow for the rapid processing of large data volumes.

Expose more information closer to the point of consumption, through the widespread adoption of mobile platforms, the development of focused applications, and technologies such as virtual and augmented reality.

Adopt secure cloud-based solutions where these represent the most efficient approach.

Improve our building data framework by implementing Building Information Model (BIM) Level 2, including full 3D modelling of our assets. This will allow us to establish a digital place where our data comes together for collaboration – known as a Common Data Environment.

Maintain a secure IT environment to respond to the ever changing cyber threat landscape. The drive to become a digital organisation is heavily reliant on stable IT solutions which need to be secured against the threat of a cyber-attack. We will submit our Business IT Security Plan in December 2019.

Project: BIM Integrated Solutions
Cost: £2,350,000

Project Description:
To ensure collaboration between all parties on a common data environment so that we will be able to plan new assets more effectively, build at lower cost and operate and maintain assets more efficiently.

Network Operations

4

Efficiency. Continuous improvement. Planning for the future. Here are just some of the ways we keep costs down and the quality of network operations up, at all times.

We have strong teams

Our teams operate, maintain and repair our substation, overhead line and cable assets. This ranges from fixing a gutter on a substation building to operating and maintaining the Western Link HVDC system. These activities therefore require people with a diverse range of skills to ensure they are carried out safely and in an appropriate manner and to ensure consumers receive best value for the money we spend.

We review to improve

To ensure our plans for these activities deliver the best possible value for the consumer, we have carried out a wholesale review of our maintenance policies. This has allowed us to identify key areas where we believe we can be more efficient. These savings are now embedded into the plan.

It has also allowed us to identify areas where we needed to bolster our activities to ensure we manage our assets more efficiently in the longer term. As a truly global business, we've taken the opportunity to challenge our new policies internally and externally. We want to make sure our plans are truly efficient and not just incremental improvements on long-held beliefs.

We keep a close eye on costs

We have also made sure we fully understand where the costs for our maintenance activities are generated. By looking at all our maintenance activities and deriving the costs from the bottom up, we've identified areas where we can be more efficient.

You can find more information on how we've done this in **Annex 3** – Non-load Strategic Investment Plan.

Substations

We own and operate 156 substations, some of which are very large with many assets, and some of which are much smaller. Here's a breakdown of how we run them.

We meet our obligations
We have a comprehensive inspection and maintenance policy to ensure we are meeting these obligations and fully understand the condition of our assets. This comprises monthly inspections of all our substation assets and tailored maintenance regimes depending on asset type and its construction. The SPT transmission network was developed over many years. So we have to be sure we can operate and maintain equipment installed in the 1960s, which no longer has any support available from the original manufacturer, as well as modern state-of-the-art equipment. We therefore need to ensure our staff are equipped with the knowledge and experience required to meet this diverse challenge.

We maintain equipment
Our maintenance regimes are set with the goal of keeping our assets in an appropriate condition and operating to our specifications. With an extensive asset base, breakdowns do happen from time to time, so we need to be able to repair our equipment to ensure maximum availability. For equipment which is still supported by the original manufacturer this is reasonably straightforward. However, for assets where manufacturers' support is no longer available, we endeavour to find replacement components to maintain assets in service without complete replacement. These need to:

- meet the appropriate electrical and mechanical specifications
- have been tested to ensure compliance with the relevant regulations or standards.

Where replacements are not available, spares are recovered from assets being removed from the system. Our Network Operations team specialists need to understand the failure mechanisms associated with different assets, to make sure we have the equipment and services available to carry out repairs in the most timely and cost-effective manner. To maintain our substations at an acceptable level we need to consider the following things:

- Our substations almost always include a building containing protection and control assets, telecoms and other critical infrastructure, so we need to maintain a large number of buildings and other civil structures.
- They almost always have outside areas, so we need to manage the vegetation in these areas, both for operational reasons and to be a good neighbour in the community.
- We need to ensure no unauthorised access can occur within substations, for the safety of the public, our staff and our assets.
- All assets which form part of the transmission system, from protection relays to circuit breakers to Series Compensation platforms, must be maintained to make sure they remain fit for purpose, and ensure efficient and secure supply.

Overhead lines

Most of our network is made up of overhead lines with a total length of 3752 circuit km. Our aim for our overhead lines is the same as for our substations: to make sure they operate safely and securely. Here's how we do it.

We monitor asset condition
Our comprehensive inspection and condition assessment policy, that ensures we fully understand the condition of our assets, consists of:

- annual inspections of all our overhead line assets
- a condition assessment regime so we understand the condition of individual components on each route

What assessment includes
Overhead line condition assessment comprises steelwork condition for towers, conductor, insulators, fixtures and fittings and may lead to a more detailed climbing inspection if required We will make greater use of unmanned aerial vehicles, or drones, where it avoids people working at height or it is more effective. We carry out additional testing on our conductors, dependent on their construction.

Aluminium Conductor and Steel Reinforced (ACSR) 40 years & older
For these kinds of assets, we carry out non-intrusive corrosion testing on the steel core on approximately 1% of our network per year. This is followed up by intrusive testing if an issue is detected. A small overall percentage tested can be considered representative for a route constructed to the same specification at the same time.

All Aluminium Alloy Conductor (AAAC)
While none of our population has yet reached 50 years of age, when the time comes we will we carry out destructive testing on 1% of these conductors to quantify their condition.

In addition to our condition assessment activities, we carry out inspections of our overhead lines. This consists of:

- thermal inspection of our conductors – we do this every two years on each route
- visual inspection by foot and helicopter for vegetation, changes in land use and conductor and fitting damage that might have occurred – each year, we inspect 50% of routes on foot and 50% by helicopter.

Results of these inspections inform our maintenance activities. We also have a tower painting programme, driven by condition assessments. We also manage vegetation and third parties working in the vicinity of our overhead line network.

We will enhance our monitoring with aerial ground clearance surveys and will survey our network every five years to provide detailed information on the asset base – This will detect age-related sagging of conductors, which may affect statutory clearances, and any issues with verticality of towers. We will integrate the survey data with our overhead line design software to provide a full digital model of our network.

Cables

We own and operate 377 circuit km of cable (more detail in the section Circuits: cables). Through comprehensive inspection and maintenance, we aim to make sure these assets operate safely and securely – and are fit for purpose. This is how we will do it.

We carry out tests
Unlike substation and overhead line assets, the majority of our cable assets cannot be visually inspected. We inspect all our visible cable terminations monthly as part of our substation inspections. The remainder of the cables' condition has to be established by testing. This includes carrying out testing on the outer metallic sheaths of all our cables and testing the cable bonding arrangement as these are typically the first indicators of the cable deteriorating. We test each cable every three years.

We provide extra maintenance for fluid-filled cables
Fluid-filled cables require additional maintenance compared with cross-linked polyethylene (XLPE) cables to avoid environmental impact and keep them operating reliably. A fluid-filled cable has a tank system that is used to maintain the fluid pressure on the cable section. The pressure in this tank system is monitored, so the monitoring equipment needs to be checked annually to make sure it's correctly calibrated. Fluid-filled cables are also prone to leaking at termination and jointing position, we need to be able to top up the fluid levels and identify and repair leaks. Our fluid-filled cables are very reliable because we test them regularly and manage fluid leaks appropriately.

We keep a close eye on 132kV XLPE cables
Our 132kV XLPE cable population has suffered from many failures of terminations, so we have begun to carry out routine partial discharge monitoring of all our XLPE terminations in addition to visual inspection and sheath testing.

We monitor nearby activity
To make sure our cables continue to be reliable we need to patrol our cable routes for any excavations or interference nearby and give guidance where appropriate to others digging in the location of our cable networks.

Western Link HVDC Scheme

The Western Link HVDC scheme is a 2250MW scheme operating at 600kV. HVDC schemes contain many components and sub-systems that are specialised and not used elsewhere in the transmission network. For this reason, we have outsourced the majority of the maintenance of the scheme to specialist contractors. This includes routine maintenance, inspection and defect repairs of the converter station equipment. The inspection of submarine cables is also outsourced due to the specialised equipment and skills required This means that we have certainty of the costs for the RIIO-T2 period.

Other Expenditure
— *Flood Mitigation*

5

The risks from flooding are of growing concern as a consequence of the unpredictability of climate change. This part of our plan sets out how we will safeguard the reliability of our network, and make sure substations remain resilient to the impacts of climate change.

Background

We have identified a major risk to the reliability of the electricity network from flooding. The three types of flooding are:

- pluvial (rainfall)
- fluvial (river)
- coastal

It's vital we protect electricity substations from the risk of flooding. If the electricity supply fails for an extended period, core infrastructure sectors would not function, including:

- water supply
- health care
- transportation
- communication
- emergency services

Where we are now

The Energy Network Association's Engineering Technical Report ETR 138, 'Resilience to Flooding of Grid and Primary Substations', details the electricity industry requirements relating to the protection of substations from flooding. These requirements are also reflected within Scottish Planning Policy.

During RIIO-T1 we carried out projects to mitigate the risks from fluvial and coastal flooding at a number of substations. However, when ETR 138 was first published, before the RIIO-T1 settlement, it did not include pluvial flooding. Mitigation against pluvial flooding is now a requirement of the current version of ETR 138.

Total cost for flood mitigation

£5.0m

What flood mitigation investment covers

The Scottish Environment Protection Agency (SEPA) continually revises the flood mapping for Scotland as more information and data becomes available. Using the latest SEPA modelling information for pluvial, fluvial and coastal flooding, we have reviewed the impact of flooding across the network.

We see a strong need to undertake further works, specifically associated with pluvial flooding. This will supplement the projects completed in RIIO-T1, and further reduce the risk to the network from flooding.

We have carried out desktop studies using SEPA's latest flood models, and identified 12 sites which are at risk from pluvial flooding. During the RIIO-T2 period we will undertake detailed assessments at these sites, and implement measures which will mitigate the flooding risk to the network.

What it will cost

Our initial review indicates that works will be required at 12 sites at a cost of £5.0m. We have proposed that an uncertainty mechanism is used in RIIO-T2. So, if updated flood risk information requires us to do additional works, there will be a re-assessment of our allowed costs. While the evidence indicates that it is unlikely, we also propose that our allowed costs are re-assessed if we need to do less work.

Average costs

RIIO-T1: Average costs on annual basis over RIIO-T1 period were £4.67m. This was associated with major construction works to mitigate flood risk mainly at Kincardine.

RIIO-T2: Average costs on annual basis over RIIO-T2 period is £1m. These works are to mitigate surface water flooding.

Other Expenditure
— *Land*

6

What land should we own? What should we sell? And what should remain with the existing owner? This section explains our approach, the risks we face and how we mitigate them.

Not all of our infrastructure and operations is on land we own – much is located on land owned by other people. This applies particularly to overhead lines and underground cables, where we have agreements with landowners and land occupiers.

We continually review how we use our non-operational estate, identifying opportunities to make sure we're making the best and most cost effective use of our portfolio. This includes pinpointing sites that we don't need any more, and achieving the best possible disposal result for our business. To do this, we employ a highly experienced team of Chartered Surveyors.

By the same token, our team of Chartered Surveyors manages our freehold and leasehold interests on our behalf. This involves making sure the correct rights are in place, and that all transactions to acquire land are at market value and meet our operational requirements. Our estates team advises and leads on any substation land requirements for SP Transmission.

Land purchase and land lease

We prefer to have freehold ownership of our substation sites. However, we sometimes enter into lease agreements. These allow us to occupy and access land for a time period agreed with the landowner. Where we need to purchase land to complete the investments in our plan, we include the costs of this in the overall funding for the project. Where we negotiate a lease, the annual payments are included as operating costs in our business plan.

Servitudes

These land rights are executed as deeds, and provide us with permanent rights for overhead lines and underground cables, recorded against a property's title and on the Land Registry. This level of security means we have the right to access the equipment for inspections, maintenance and future improvement works. To make sure we have the most secure rights, we have developed a strategy to obtain deeds of servitude for our most important assets.

Servitudes are vital to make sure we can access our assets when we require, in order to maintain high levels of reliability and to allow us to modernise and upgrade. We plan to increase our number of servitudes in the RIIO-T2 period through negotiation with landowners, our plan includes costs of **£6m** for the five-year period.

Wayleaves

Wayleaves are personal agreements with landowners and occupiers, giving us rights for overhead lines and underground cables.

Given the significance and importance of our transmission network, we always prefer to negotiate a more secure land right known as a servitude.

We generally pay the landowners and occupiers for wayleave rights with an annual payment, although in some cases we make a one-off payment.

The payments are calculated to match the owner or occupier's loss due to our equipment being on their land. The payments allowance has increased by an average of 6% every year, and our business plan includes costs for these rights. Our current forecast of annual costs for 2020 is around £700,000, which we review every year.

Wayleaves are personal agreements, so our land rights do not automatically transfer to the new owner if the land is sold. We identify any transmission circuit assets that still rests on a wayleave, or where we have identified that a wayleave may no longer be valid due to change in ownership of the land. Wherever possible, we look to secure a servitude instead. This is part of our 'Appropriate Land Rights' process.

There is an ongoing review across Great Britain which may lead to some significant increases in the wayleave payment rates. This is why we are proposing a mechanism, known as a re-opener, to revisit our allowed costs. If these revised costs increase by more than our predicted annual allowance uplift, we will seek agreement from Ofgem to increase our revenues to cover the additional cost of these payments. If the costs decrease, we propose that our revenues are decreased accordingly.

RIIO-T1 Servitudes – average annual expenditure in RIIO-T1

£1.54m – £1.57m

RIIO-T2 Servitudes – average annual expenditure in RIIO-T2

£1.2m

Rates

Like other businesses, we pay business rates. Our main rateable asset is the cables. However, many of our assets are not rateable.

These include:

- transformers
- switch gear
- fixtures and fittings
- vehicles

The RIIO price controls recognise that network businesses do not have direct control of the level of business rates they pay. That is why rates are treated as a pass-through item. Costs are relayed directly to customers, but with a two year delay.

Energy network operators collectively engage with the rating valuation agencies through the Energy Networks Association (ENA). Together, we can speak with the strongest voice, mitigate any rates cost increases, and reduce the cost of the negotiations. SP Transmission is represented on the ENA by Chartered Surveyors from our estates team, as well as by our network and regulatory planning team. Our estates team has extensive experience in this field, particularly in negotiations and the consequent challenges and appeals.

Injurious affection

Injurious affection is where our activities interfere with the legal rights held with an area of land, but we have not acquired an interest in the land.

Our team of Chartered Surveyors deals with all these claims, as well as all development loss claims, working to mitigate them as far as possible. This team review each claim when we receive it, as well as carrying out due diligence. If appropriate, we then instruct our appointed agent to carry out a formal site inspection, valuation and further due diligence prior to negotiating a settlement. This results in the production of a legal instruction pack.

Our estates team reviews each legal instruction pack, which is subject to our formal authority process. Finally, we instruct appointed solicitors to formalise, document and register the equipment rights.

This process results in a number of claimants withdrawing their claims. It also eliminates invalid and duplicate claims, as well as claims where we have existing equipment rights.

Estimates of Rates Liabilities – 2026

	RIIO-T1 *Forecast*			**RIIO-T2** *Forecast*				
	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Rates RV Rateable Value	£70,000	£70,000	£70,000	£70,000	£70,000	£70,000	£79,000	£85,000
Total UBR*	£35,420	£35,020	£34,610	£34,200	£34,890	£34,690	£34,530	£36,970

*Uniform Business Rate – is a multiplier used to calculate business rates liability. The UBR increases annually with an inflationary uplift.

The above table is a forecast of the rateable value for SP Transmission assets following a revaluation at 1 April 2022 and 2025. We have applied an assumed uplift in the Uniform Business Rate, which has also been applied to calculate the actual rates payable.

This table makes no account for any changes in the network from the 2017 revaluation information. The data assumes there are no significant capital programmes, upgrades or additions to our network, or any other kind of major investment.

Other Expenditure
— *Maintaining cyber security*

7

The threat from cyber-attacks is continually evolving. As an industry, we need to anticipate and respond

The transmission network plays a vital role in the daily lives of our customers and the wider economy. The safe and efficient operation of the system relies on a diverse range of operational technology to control, monitor and protect the assets. As the network becomes smarter, the number of these systems will increase. Protecting these critical systems from external threats is part of our core activity.

An essential part of the UK infrastructure

The Network and Information Systems regulations (NIS) have recently been introduced, and we have been designated an Operator of Essential Services.

Under these regulations we are required to assess our current cyber security maturity as measured against the Cyber Assessment Framework. We made a draft submission to Ofgem in February 2019. Following assessment of this, we submitted the final plan to address any identified areas for improvement in April 2019.

OFGEM are setting a baseline Cyber Assessment Framework in June 2019 and we will meet those requirements. We will submit a revision to our Cyber Resilience Plan in December 2019 in order to meet this standard.

Investing to protect

Ongoing investment is required to maintain a proportionate and appropriate level of cyber security across critical national infrastructure systems and the associated systems on which these depend.

The cyber threat can impact the fundamental service we provide. A cyber-attack could compromise our electrical infrastructure, including the recovery from an incident. Incidents elsewhere in the world have shown how a cyber-attack could result in disruption to supplies.

An additional factor that we consider in our cyber resilience plans is our customers' data. We have processes and systems in place to protect this data and make sure we comply with the General Data Protection Regulation (GDPR).

Our plan currently includes expenditure of

£5.78m

Working as part of the Iberdrola group of companies, we contracted with a third party consultancy company to carry out a cyber security audit. The audit was based on the structure and question set of the National Institute of Standards and Technology (NIST) guidance document from the United States – this was identified at the time of audit as the most mature guidance. We then created a proposed remedial plan which we are developing further to refine the identified scope.

Following this and the introduction of the NIS regulations, we've undertaken a further gap analysis which has identified work under this directive, some of which will be an ongoing requirement and is included in our business plan.

Our plan has three main components and we have categorised these in line with the latest guidance from Ofgem.

The Business IT Security Plan defines the business-as-usual activities for our business systems. As SP Transmission is part of a wider group of companies, the business IT security activities are co-ordinated across the group.
We have made provision for the cyber-security related refresh and update of operational systems. This ensures that we have the most up to date security provisions in place.
A Cyber Resilience Plan was submitted to Ofgem in April. We will update this according to the revised guidance being prepared by Ofgem. The revised plan will be submitted with the RIIO-T2 business plan in December 2019.

Our plan currently includes expenditure of £5.78m in the RIIO-T2 period. This will allow us to meet the requirements of business as usual refreshes and includes the cyber resilience activities needed to comply with the NIS regulations based on the current understanding of the agreed baseline standard. We have included work that we definitely know we need to do, and we are confident that the technology has matured to allow this to be reliably introduced. An example is the periodic upgrade of firewalls. We know that this is a certain requirement: the technology is mature and the scope of work is definitive.

This is an area of rapid change, and there is uncertainty surrounding how our approach might need to adapt. The uncertainty revolves around the unknown nature of threat developments, and the changes in technology that could result from this. We note that there is an uncertainty mechanism proposed by Ofgem with a re-opener in the middle of the RIIO-T2 period. This will allow our plans to adapt to regulations, but the mechanism needs to allow for changes in technology.

Our customers are at the heart of our business and this will continue throughout RIIO-T2 and beyond.

As SP Energy Networks, we have embedded an advanced strategy to help support vulnerable customers. We will leverage this experience and continue to assist those who may need our help during RIIO-T2.

We will use our position wisely to ensure we do not duplicate effort and, most importantly, do not pass on additional costs as we seek to support vulnerable customers and the communities we serve.

Continuing to support our communities

Supporting our communities in RIIO-T2

We have a responsibility to make a positive contribution to the communities we operate in. With our charitable support and community projects, we're making a real difference.

In RIIO-T2, we propose introducing a new 'Communities Fund'. The fund will be fully structured on feedback from our stakeholders and will deliver significant benefits in supporting local economies and providing support for our most vulnerable stakeholders. We will continue to proactively consult with local residents, seeking their input for these project developments.

During RIIO-T1, our community work was delivered through two main strands, which we intend to carry forward into RIIO-T2:

Community events

In RIIO-T1 we engaged with our communities regularly. We will continue organising events that strengthen the relationship we have with our communities – because we understand that a little of our time can make a significant impact. Events are currently run on a voluntary basis only. Rolling them out on a regular basis and on a larger scale would require funding.

Due to positive feedback from our communities on various events, we believe this will be an important part of our community work going forward. At the moment, we are consulting with our stakeholders for their views on what should be included in a communities fund or incentive so we can prioritise their needs. However, we also recognise that many of our vulnerable stakeholders may not be able to respond to our current consultations, so we will do our best to understand and address their needs.

We're interested in developing initiatives that provide wider social and economic benefits in the communities we serve, and extend our outreach to our most vulnerable communities. We're also hoping to build some exciting new partnerships.

Supporting and engaging with our communities

As part of our work to engage with local communities, we intend to focus on three key areas:

Inspiring the next generation of engineers and employees:

We are committed to supporting science, technology, engineering and mathematics (STEM) subjects to create a pipeline of industry talent.

We will encourage gender diversity in STEM subjects.

We will enhance existing links with secondary schools, colleges and universities to create a recruitment pipeline.

Our "Power Wise" classroom safety program will continue to educate schoolchildren on the potential dangers of exposure to electricity.

Increase safety awareness in our communities:

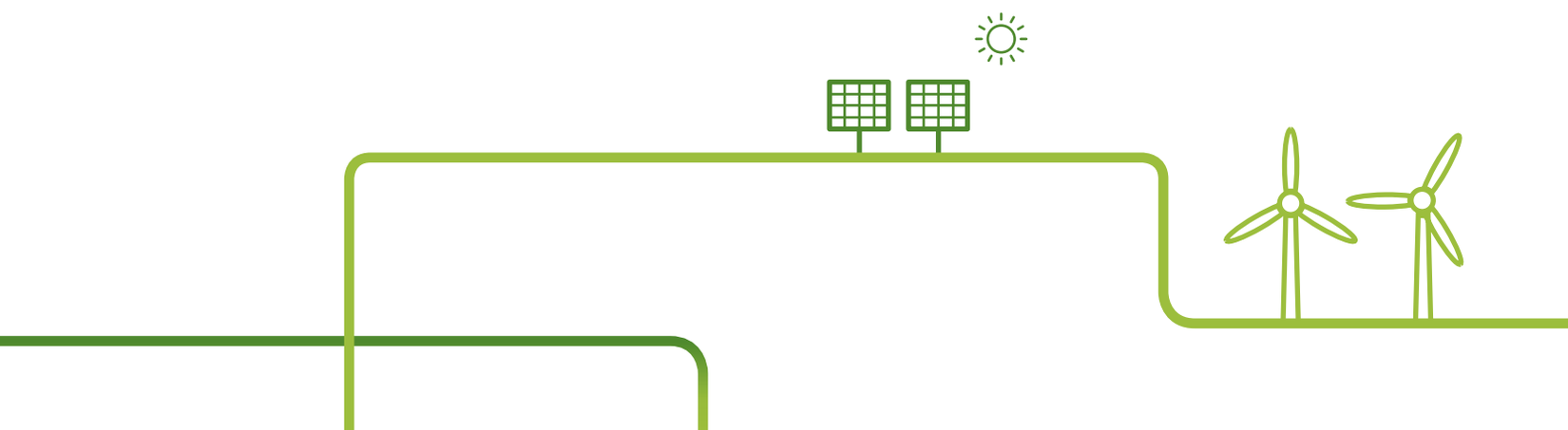
We will deliver a minimum of five safety demonstrations at agricultural community shows each year. This is part of our commitment to work with the agricultural community to reduce potential risk from electrical infrastructure coming into contact with farming activities.

We will continue our "Crucial Crew" Community Safety events – engaging with the community on health and safety.

Supporting colleague-led community engagement:

We are passionate about getting our colleagues involved in local communities through volunteering. We will continue to provide opportunities within our company to drive community-led fundraising.

Our focus is on building positive relationships and adding value to our communities at a local level. Throughout RIIO-T2, we will issue community newsletters to share ideas, news updates and get feedback on how we can add further value in our communities.



Supporting our vulnerable customers in RIIO-T2

SP Energy Networks Vulnerability Strategy

Our Vulnerability Strategy ensures we proactively engage with consumers and stakeholders to anticipate their needs and deliver an energy service that is:

- Consumer focused
- Socially responsible
- Sustainable

Our dedicated Consumer Vulnerability Strategy has been in place for a number of years. Like our overall strategy, it has been updated and developed over the last regulatory year by building on our previous experience and lessons learned.

The Strategy is supported by a set of tools and processes we have designed to ensure that our staff are empowered to make the right decisions and act when it matters.

We focused on feedback from our customers and stakeholders to ensure we were taking the best course of action. This allowed us to focus on their priorities and achieve the best possible outcomes for our vulnerable customers.

Extending support to distribution level

We recognise that our work supporting vulnerable customers is at an overall SP Energy Networks level. During the RIIO-T2 planning process, we will engage with stakeholders and customers to understand if they have any specific requirements to further support vulnerable customers and communities at a transmission level, what that support could look like and how it could be funded.

Our work supporting vulnerable customers and communities at the Distribution level is comprehensive and provides excellent value for money. As an organisation, we are keen to avoid duplication of effort that could potentially lead to increased costs and directly impact those we are trying to help.

The output from our engagement on vulnerable customers and communities will form part of our final RIIO-T2 Business Plan submission to Ofgem in December 2019.

Working with our TO User Group in RIIO-T2

Enduring Engagement

The TO User Group has been with us at every step of our report writing process. We intend to continue this engagement after we have submitted our plan.

We have a plan of enduring engagement with the TO User Group and other established channels throughout the RIIO-T2 delivery period. Tracking against what our plan says we will deliver, we will be accountable to our stakeholders.

We will utilise the TO User Group to help monitor our progress on:

- Stakeholder engagement
- Network investment and innovation
- Workforce planning
- Reducing environmental impact
- Progress toward de-carbonisation

This enduring solution will also help make us aware of changes in customer priorities, or when something new is on the horizon. We will be uniquely placed to react to these changes and will also sustain momentum on our engagement activities as the RIIO-T2 delivery period progresses.

Recognising the benefits of enhanced engagement throughout the RIIO-T2 project, we will continue to use the engagement to help inform our future decisions.

It is important that the TO User Group does not continue in isolation. We will support it through the following channels:

- Strategic Stakeholder Panels
- Annual Stakeholder Conference
- Our Distribution Customer Engagement Group
- Ofgem RIIO-T2 Challenge Group
- Our Young Energy Force Panel
- Our Online Community

Further information on our vulnerability strategy can be found in **Annex 5**: Stakeholder Engagement Activities.

Full details of our planned activities throughout RIIO-T2 is available in **Annex 5**: Stakeholder Engagement Activities.

Uncertainty is on the rise. The rate of change and the bold ambitions that need to be achieved to decarbonise the energy system are leading to more change, faster than ever before.

As we set out our RIIO-T2 plan, we expect a number of aspects to keep changing. Here, we'll show how our plans can adapt and respond to any changes. We also detail how our allowances change to ensure a fair arrangement for customers.

Managing uncertainty

Uncertainty mechanisms explained

Most aspects of our plan are relatively predictable, such as when we need to replace assets as they approach end of life, the maintenance we need to undertake, and reinforcements where the need is clearly justified.

For these areas, we can set out the efficient costs to undertake this work. These aspects are funded through out baseline plan.

However, some areas are less certain. Agreeing funding for these isn't reasonable, as they may not materialise. Instead, they are funded through a suite of arrangements called uncertainty mechanisms.

To accomodate change, the projects we undertake may change. We fund these through uncertainty mechanisms which will increase or decrease our allowances according to new requriements emerging. This protects customers as they won't need to pay more where we don't need to undertake an activity, but equally, provides additional revenue when we have additional work to undertake.

Our approach to uncertainty

A number of uncertainty mechanisms were used in RIIO-T1 to adjust our allowed revenues. This was the first time uncertainty mechanisms had been used extensively, partly due to the longer price review period, but also due to the changes that were expected.

From RIIO-T1, we have identified which mechanisms did and didn't work successfully, helping us to improve our plans for RIIO-T2. We have also undertaken far greater planning and engagement with stakeholders for RIIO-T2 to justify our plans and understand different types of uncertainties.

In RIIO-T1 all transmission owners had different mechanisms. We have looked at their experiences and shared what we learned from this to adopt a more consistent approach moving forward.

Our plans for RIIO-T2

We are working with the other transmission owners and Ofgem to identify a consistent suite of uncertainty mechanisms for RIIO-T2. These are still under development, but we have identified the main mechanisms that we think will likely be required for RIIO-T2.

We expect to have these fully detailed for the final submission of our business plan in December 2019.

Different types of mechanism

Uncertainty mechanisms are used for technical areas, such as generation connections, as well as some of the financial areas, such as dealing with changes to business rates and taxes.

There are four types of mechanism:

Volume drivers – calibrated at the start of the price control, these automatically adjust the revenue we recover to cover the costs that can reasonably and efficiently be expected when a defined volume of activity is delivered. An example of this in RIIO-T1 is for generation connections. We recovered a fixed amount of funding for each MW of generation which we connected to cover the costs associated with the connection.

Reopeners – these are forward-looking revenue adjustments. They are triggered either by a threshold being reached or at a set point in time. They allow for us to propose an adjustment to our allowances to deal with any uncertainty that couldn't have been anticipated at the start of the price review.

Pass through items – We incur the required costs which would be assessed by Ofgem after the event once data on actual expenditure is available. An example from RIIO-T1 is for business rates; changes to these cannot be predicted before the price review, but are obligatory costs that we must incur.

Indexation – for costs which can be tracked utilising recognised indices. This adjusts our allowances in line with these indices.

Uncertainty
– the drivers in detail

Generation connections

Why do we require a mechanism?

There are a number of uncertainties associated with new generation:

The volume of generation which may connect. This is due to the incentives and planning landscape which is dependent on a number of factors.

Generation technology – we have seen rapid changes in the past such as the establishment of FiTs which led to major, rapid growth in solar. Onshore wind is continuing to progress subsidy-free in Scotland, as is Offshore wind through CfD.

Location – Scotland continues to see the largest growth in onshore wind, and has a high proportion of offshore wind. Within our network we have seen high concentrations in the Dumfries & Galloway area, as well as the Borders. The distance of these sites from existing network infrastructure will drive the costs associated with facilitating them on the network.

We have seen from past experience that how these materialise will change extensively from the forecasts we have today.

At present, SPT have around 4GW of generation connections which are contracted to connect over the next ten years. We know that not all of these will progress.

Type and description of mechanism

An ex-ante forecast of generation has been made based on a detailed review of all projects to identify those with the highest probability of connecting. Many of these projects are already in construction or well progressed in terms of planning process.

A mechanism is required which will allow efficient costs that are incurred to facilitate new generators as required through the course of RIIO-T2. These are high volume projects which can emerge and progress with little prior warning to the TO.

A volume driver is proposed which would allow the TO to recover revenue in line with generation projects progressing. This driver should be reflective of the costs we TO would expect to incur – which from our experience in RIIO-T1, the volume driver did not reflect. A volume driver that funds the costs associated with the increased capacity of the substations as well as the cost of new linear assets (km of OHL) is required.

When and how will it be used

The mechanism will be required for generation which is connected to the network above the agreed baseline allowance. In the event that the baseline of generation is not achieved, revenue allowances would be clawed back at the same rate, providing a symmetrical mechanism which is of lower risk to both customers and companies.

Lessons learned from RIIO-T1

The volume driver used in RIIO-T1 differed between each TO. For SPT, the mechanism is not reflective of the costs we faced.

For sole use connections, the driver didn't reflect the length of assets required, and was only based on the generation capacity. Therefore, if a generator connected adjacent to existing infrastructure, the allowance was the same as if it were 50km from the closest infrastructure – despite the costs being significantly higher for the latter case.

For shared use infrastructure, a unit cost allowance was created for a suite of different assets. Over the course of RIIO-T1, we found that other solutions – which were not defined in the unit cost allowance – offered the most economic and efficient approach, but as they were not defined, no allowance was provided.

Major boundary upgrades – Strategic Wider Works

Why do we require a mechanism?

Major projects which increase the capacity to transfer power across Great Britain have a high capital cost, and have a number of other dependencies on them. A mechanism is required which will evaluate these projects separately to the main price review as the need case and proposed solutions evolve. At the time of submitting the RIIO-T2 business plan, some uncertainties around these projects will exist which prevent them from being included.

Type and description of mechanism

A re-opener is proposed which is similar to the Strategic Wider Works mechanism included in RIIO-T1. This allows TOs the opportunity to bring forward new projects when they have sufficient justification on need and cost certainty of the preferred solution, so Ofgem can undertake a more in-depth review.

This process should also be aligned with the NOA process that the ESO undertakes. If other projects are identified through this process which requires funding to progress in RIIO-T2, these should also be accommodated. To allow this, we propose a tiered approach. In line with RIIO-T1, the SWW process for projects in excess of £100m for SPT would be subject to a comparable process. For projects less than £100m which are identified as required to proceed under NOA but do not have an ex-ante allowance, a lighter touch single stage process would be needed. These projects would be justified through the NOA process which already involves Ofgem and BEIS.

When and how will it be used

Due to the nature and scale of these projects, most of these can be identified in advance of RIIO-T2 starting. For SPT, the Eastern HVDC link would be funded through this mechanism.

For smaller projects, these may emerge during RIIO-T2 but will be triggered by the NOA process which the ESO operates.

Lessons learned from RIIO-T1

This mechanism has been used a number of times by SHETL and National Grid. SPT developed one project under this framework, but as it was less than £100m when the final assessment was completed, it was no longer eligible. SPT had no other means of funding as a result of this, which is why a tiered approach is proposed for RIIO-T2.

Experience has also shown that the current process can be extremely bureaucratic with many stage gates. The overall process should be reviewed in light of the experiences of both TOs and Ofgem.

Demand connections

Why do we require a mechanism?

Similar to Generation Connections, new demand connections can emerge through the course of a price review which were not foreseen at the time of the plan being agreed. A number of known projects are included in the baseline plan from close working with SP Distribution and Network Rail, but others may continue to emerge which require funding.

Type and description of mechanism

An ex-ante forecast of demand projects has been made based on detailed discussions with SP Distribution and Network Rail.

A mechanism is required which will allow efficient costs that are incurred to facilitate further projects as required through the course of RIIO-T2. These can emerge and require progression in relatively short timescales.

A volume driver is proposed which would allow the TO to recover revenue in line with demand projects progressing. This driver should be reflective of the costs that a TO would expect to incur. A volume driver that funds the costs associated with the increased capacity of the substations as well as the cost of new linear assets (km of OHL) is required.

When and how will it be used

The mechanism will be required for demand connections which are connected to the network above the agreed baseline allowance. In the event that the baseline value is not achieved, revenue allowances would be clawed back at the same rate, providing a symmetrical mechanism which is of lower risk to both customers and companies.

Lessons learned from RII0-T1

No such mechanism was included for SPT in RIIO-T1 which resulted in SPT receiving no allowance, despite some of these projects materialising.

Compensating landowners under wayleave

Why do we require a mechanism?

We are required to make wayleave payments to land owners where our assets lie.

Type and description of mechanism

We propose an uncertainty mechanism to allow for a ‘re-opener’ solution, in the event the outcome of the Nationwide review between now and the commencement of RIIO-T2, results in the need to significantly increase our compensation allowance provision.

When and how will it be used

We propose a re-opener window for a logging up mechanism to cover the costs incurred in compensating landowners in relation to wayleaves.

Lessons learned from RII0-T1

This is a new mechanism for SPT in RIIO-T2.

Operability solutions

Why do we require a mechanism?

New issues are likely to emerge in RIIO-T2 such as voltage or harmonics which are non-compliant with the relevant standards. Extensive modelling has been undertaken to ensure our plans have the necessary solutions based on the FES, however these cannot cover every eventuality. Many of these issues will be instigated by the ESO due to the problems they risk creating in its operation of the transmission network.

Type and description of mechanism

An allowed unit cost for a range of solutions is proposed, including:

60MVAr Shunt reactor
132kV Harmonic Filter
Operational intertrip schemes

These would only be triggered based on an STC request by the ESO, at which point a range of commercial alternatives that the ESO could implement would also have been considered.

When and how will it be used

A number of these solutions are already included in our baseline plan. These aren't expected to be required, and are only set out as a backstop option. Without these, it is likely that the ESO would face additional operational costs in managing the network.

Lessons learned from RIIO-T1

These were not included by SPT in RIIO-T1. We were requested to install a number of operational intertrips, but no funding was made available for these.

Cyber security

Why do we require a mechanism?

The pace of change in the area makes it difficult to predict how our cyber defences will need to evolve. The threats are changing, and the technology available to us is developing rapidly.

Type and description of mechanism

We have proposed a re-opener should there be a need to invest more than it is possible to foresee.

When and how will it be used

Works and activities to provide resilience to known threats are included in the business plan. The evolution of this threat is significantly uncertain and could lead to additional costs – the scope of which is unknown. A mid-period re-opener is proposed should additional expenditure be required.

Lessons learned from RIIO-T1

This is a new mechanism for SPT in RIIO-T2.

Uncertain non-load projects

Why do we require a mechanism?

We have a number of non-load projects which have significant uncertainties associated with them, such as land purchases, or are interactive with new generation connections which may negate the need for them. We don't believe that it is appropriate to include these in our baseline with such high uncertainty at the start of the price review.

Type and description of mechanism

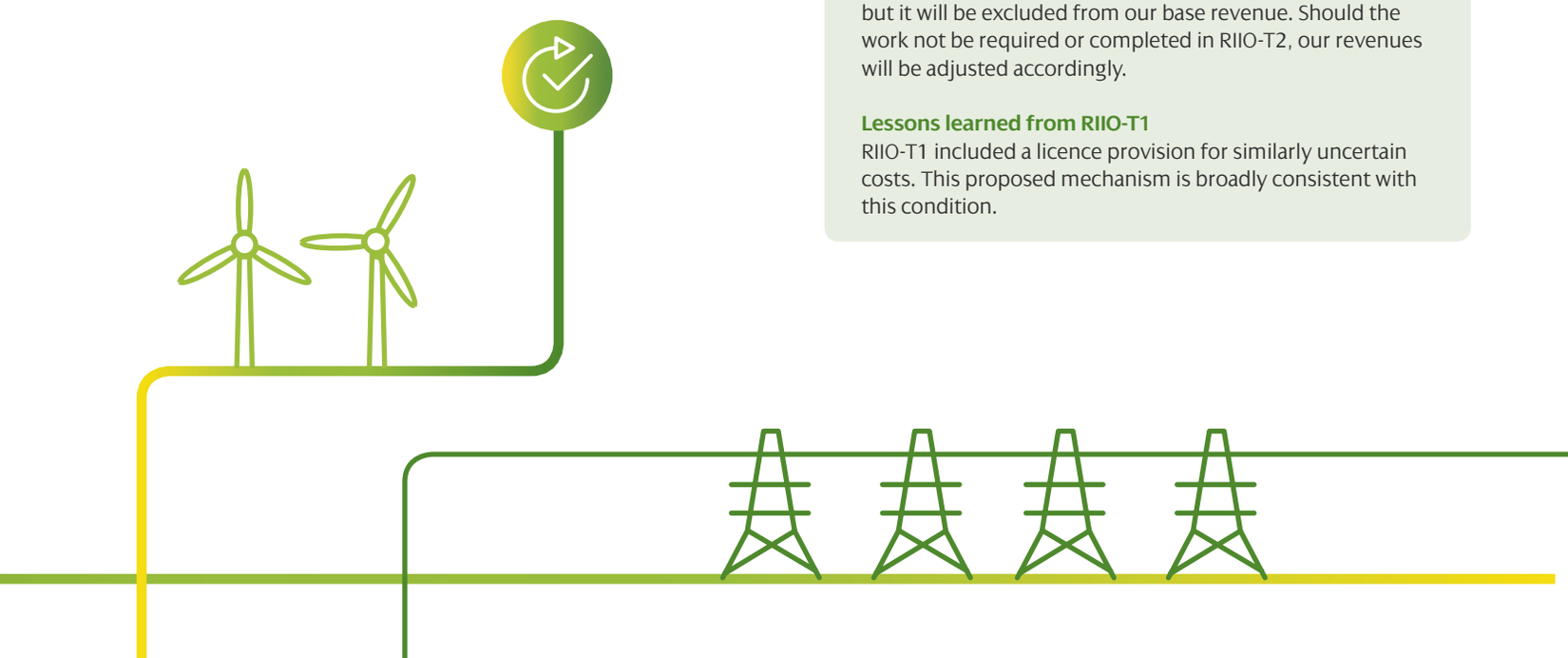
These projects will be included in our plan to allow the costs to be assessed by Ofgem, but excluded from the baseline. Should their need be confirmed, we will proceed with them and provide Ofgem with evidence as part of the annual reporting. We will propose Price Control Deliverables for each of the identified schemes.

When and how will it be used

We will agree the funding on an ex-ante basis with Ofgem, but it will be excluded from our base revenue. Should the work not be required or completed in RIIO-T2, our revenues will be adjusted accordingly.

Lessons learned from RIIO-T1

RIIO-T1 included a licence provision for similarly uncertain costs. This proposed mechanism is broadly consistent with this condition.



Legislative changes for environmental and climate change

Why do we require a mechanism?

It is currently unknown what Government Policy will be implemented over the RIIO-2 period to accommodate legislative changes as a result of the Climate Change Committee's recent recommendations and other significant legislative changes.

Type and description of mechanism

We believe there should be two re-opener window opportunities to make sure that we are equipped to respond to changes in legislation as a result of a drive to a low carbon GB. We believe this is very likely given the announcements from the Committee on Climate Change, as well as the Scottish Government's ambitious low carbon targets. Whilst we have prepared our business plans to drive a low carbon future in light of current Government targets, we recognise that there may changes to legislation associated with environmental factors that we will be obliged to accommodate.

For example, the European Commission has published its Proposal for a revised Regulation of the European Parliament and of the Council on persistent organic pollutants. We believe that the currently proposed Regulation would enforce a more prescriptive and onerous obligation on SPEN to remove PCBs (Polychlorinated biphenyl) from our networks. The ENA is now working with DEFRA and BEIS to effectively manage the cost implications of this new legislation.

When and how will it be used

Whilst we do not expect to use this mechanism, it is vital that we have a safety mechanism given the significant impacts associated with any future changes. This mechanism would only be used if the costs associated with a change met a pre-defined materiality threshold. All costs should be recoverable once they have met this threshold.

Lessons learned from RIIO-T1

This is a new mechanism for SPT in RIIO-T2.

Legislative changes following BREXIT

Why do we require a mechanism?

The timing and impact of the UK leaving the European Union continues to be unknown. As a result of this process, additional costs may be incurred due to changes in import tariffs or other legislation affecting the costs we incur. These cannot be estimated at the time of the plan being developed, but may be better understood when the final version is submitted in December 2019.

Type and description of mechanism

A re-opener window is proposed during RIIO-T2. This would allow the impact to be understood, and sufficient time for evidence to be gathered to justify any changes to allowances.

When and how will it be used

This mechanism will only be used in the event that a material change to efficient costs is experienced.

Lessons learned from RIIO-T1

This is a new uncertainty and a new mechanism for SPT in RIIO-T2.

Flood resilience

Why do we require a mechanism?

The effects of climate change are very uncertain. In response to better understanding of future changes, the Scottish Environment Protection Agency frequently reviews their flood risk mapping. As a result of this, new threats from flooding can be identified at any time. A mechanism is required which will accommodate additional costs that are identified as a result of new flood risks being identified by SEPA.

Type and description of mechanism

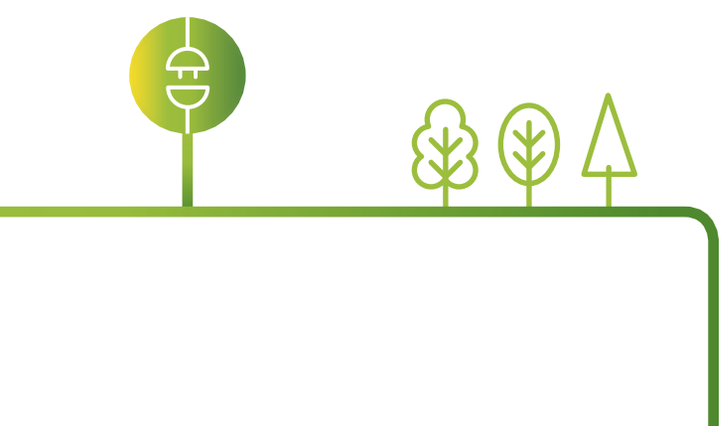
A re-opener is proposed which would allow additional costs that are required to be assessed by Ofgem. It would be the responsibility of the TO to instigate this process in a timeframe agreed with Ofgem. Any costs would also be subject to a materiality threshold.

When and how will it be used

£4.8m of allowance is included in our baseline plan for sites that have already been identified as being at risk. This mechanism would only be used where additional sites are identified by us if new information is provided by SEPA.

Lessons learned from RIIO-T1

This was not included by SPT in RIIO-T1, but our baseline funding has proven to be appropriate.



Continued use of existing financial uncertainty mechanisms

Why do we require a mechanism?
There are a number of financial uncertainty mechanisms which Ofgem have identified from RIIO-T1 and will continue in RIIO-T2.

Type and description of mechanism
Ofgem have already outlined the approach which will be applied to each of these mechanisms as shown below:

- **Ofgem licence fee –** Pass through
- **Business Rates –** Pass through
- **Inflation indexation of RAV and allowed return –** Indexation
- **Cost of Debt Indexation –** Indexation
- **Tax liability allowance –** Re-opener
- Pensions (pension scheme established deficit) – Re-opener
- **Cost of equity indexation –** indexation

When and how will it be used
Further detail is still to be developed on when re-opener mechanisms will be triggered.

Lessons learned from RIIO-T1
This is consistent with the treatment in RIIO-T1.

Non-rechargeable diversions

Why do we require a mechanism?
These relate to costs associated with diversions triggered by land-owners or developers where no current valid land rights exist due to historical land-rights no longer being valid as a result of the ownership of land being transferred. Whilst in some cases this can be resolved by securing new land rights, the valuation principle for securing those rights are based on the associated loss. This must be balanced against the economic value in retaining the asset and in some cases, the associated loss results in a requirement to re-site the infrastructure.

Type and description of mechanism
Re-opener.

Lessons learned from RIIO-T1
This was not included in RIIO-T1, and a number of projects had to be progressed with no allowance.

Whole System 'Coordinated Adjustment Mechanism'

Why do we require a mechanism?
Through the course of RIIO-T2, the optimal approach to address needs may change between companies across gas and electricity, distribution and transmission. Ofgem have identified the need for an approach to provide a means for protecting consumer interests by supporting the reallocation of project revenues and responsibilities to the network(s) best placed to deliver those projects.

Type and description of mechanism
This mechanism has been proposed by Ofgem in their May 2019 decision document and is still to be discussed with companies.

When and how will it be used
Initial indications are that this would take the form of a re-opener in light of new information emerging and would ideally be triggered by two (or more) cooperating networks. We will continue to work with Ofgem to further define this.

Lessons learned from RIIO-T1
This is a new mechanism for RIIO-T2 but is required in response to the growing need to accommodate whole system approaches which emerge over the course of the price review.

Environmental Enhancements

Why do we require a mechanism?
Environmental upgrades are required to our network on a site by site basis. We do not believe it is in the best interests of the consumer to forecast such costs given that different sites have different needs for environmental improvements and 'betterment' and new needs may emerge over the course of the price review.

Type and description of mechanism
We propose a "Menu of Options" Volume Driver to cover costs for a number of different solutions which could be reasonably foreseen. We would propose a list of associated upgrades alongside their relevant costs which would be approved by Ofgem.

When and how it will be used
As this is a volume driver, we proposed that it will be used as sites are identified and costs appropriately matched to the relevant site. This proposal will require further development prior to the submission of our final business plan.

Lessons learned from T1
This is a new mechanism for SPT in RIIO-T2.

Real price effects and ongoing efficiency

Over the price control period, the cost of delivering our services will evolve. The price changes in our input costs, relative to inflation, are referred to as Real Price Effects (RPEs). The efficiency of how we deliver our services will also evolve over the period. The increase in productivity is referred to as 'ongoing efficiency'.

RPEs explained

RPEs reflect the differences in changes between two measures:

the inflation index that is used to update our revenues each year (CPIH); and

the changes in prices for several of the inputs we use to construct and operate our transmission network, affected by external factors outside of our control.

Traditionally, Ofgem compensated network companies for RPEs through the regulatory framework, by providing fixed, upfront allowances. These 'ex-ante' allowances were based on forecasted differences between general inflation and the price inflation of relevant input price indices deemed to track network companies' costs – they were not based on actual results.

However, input price trends are unreliable and volatile, making it difficult to provide accurate forecasts. To mitigate the impact of uncertainty of input price inflation in RIIO-2, Ofgem has proposed to update RPE allowances every year using the latest available input price indices.

[9] International Labour Organization (2014), "Global Wage Report 2014/15, wages and income inequality", p. 11.
[10] ONS (April 2019), "Labour productivity, UK: October to December 2018", Figure 1.

Our view on RPEs and ongoing efficiency

We consider RPEs to be an imperfect way of reflecting the external input price pressures we face in the short-term and indexing RPE allowances may therefore be fundamentally problematic.

The range of input price indices used for setting RPE allowances do not exactly capture the inputs used by network companies and have also been found to be extremely volatile year-on-year, unlike network companies actual costs. Indeed many network companies procure fixed-priced, or inflation-linked deals, with contractors shortly after a price control settlement is agreed upon, reflecting the economic conditions at the time of the determination. Taken together, the relevant indices do not track the short-term movements in network companies' input costs. The indexation of RPEs would increase risk for both customers and companies as a fluctuating RPE index would lead to increased volatility in customer charges.

The relevant RPE indices are instead better used for observing the long-term input inflationary pressures that companies face, supporting the use of long-term average growth rates as the basis for setting ex-ante RPE allowances. There has been a long-run tendency for input price inflation to rise at a different rate than that of the CPIH. NERA's long-term average RPE forecasts for SPT in RIIO-T2 using the input price indices used to determine RPEs in RIIO-T1 and RIIO-ED1 suggests an RPEs range of between 0.7% and 1.1% per annum (see Appendix 10).

Our costs of delivery will also be affected by the productivity improvements we can realistically achieve over the price control period. This means that any assessment of RPEs needs to be considered alongside assumptions about ongoing efficiency. Empirical evidence suggests that most if not all input prices have tended to increase in line with economy-wide productivity growth in the long-run. This has particularly been the case for real wage growth in the UK (a key driver for RPEs), which has seen a near-close relationship with productivity growth at the UK economy-wide level[9]. The long-term evidence of changes in productivity indices relevant to electricity network companies suggest that long-run productivity improvements have matched NERA's long-term totex RPE forecasts.

Since the financial crisis, productivity growth across UK industries has been slower than expected, being at a near-stagnant level and failing to return to pre-crisis levels[10]. It can be argued that this would indicate an 'underperformance' against Ofgem's RIIO-T1 ongoing efficiency targets of 1% for opex and 0.7% for capex, likely offsetting any perceived gain in the RPE allowances in RIIO-T1.

Our suggestion – zero RPEs and a zero ongoing efficiency assumption

Considering the above, we believe that an RPE indexation approach may be problematic in practice. Long-run averages of RPEs have broadly been in line with productivity growth, and current RPE forecasts match the long-term evidence on ongoing productivity improvement. This close link suggests a net adjustment of zero. As such, we believe that setting a zero RPEs allowance and a zero ongoing efficiency assumption would be a pragmatic and simple approach for RIIO-T2. It would allow companies to hedge their risk exposure to changes in input costs and it would avoid volatility in revenues and customers' bills.

While the combination of a zero ongoing efficiency target and zero RPEs allowance is appropriate in the current economic climate, there may be significant input cost pressures in the event of a detrimental exit from the EU. As highlighted in the above Uncertainty Mechanisms table, we would support a BREXIT re-opener in order to address significant changes in the outlook of real input price growth.

Informed by our stakeholder engagement and building on our experience from RIIO-T1, we've developed a strong package of output incentives.

These incentives will deliver benefits for customers, stakeholders and consumers and drive the changes we need to make to support the low carbon energy system transition between 2021 and 2026.

We have built our Output Incentive Package around the categories proposed by Ofgem:

Category 1, *Pg 144*
Meeting the needs of consumers and network users 1

Category 2, *Pg 148*
Maintaining a safe and resilient network 2

Category 3, *Pg 152*
Deliver an environmentally sustainable network 3

Our RIIO-T2 Output Incentive Proposals

Why incentivise?

Our experience in RIIO-T1 shows that having the right incentives, in the right places, produces effective outcomes for customers, stakeholders and consumers. We will do this for much less than consumers have shown they are willing to pay.

From RIIO-T1 to RIIO-T2 – developing our approach

RIIO-T1 approached incentives in a deterministic, quantitative way. In RIIO-T2, we want to create a more qualitative, informed, stakeholder-focussed approach to delivering our output incentives. We propose an enduring role for the User Group to review and assess our annual output incentive performance throughout the RIIO-T2 period using a balanced scorecard approach.

We will be developing robust targets and baseline measures for our outputs over the next few months. Here's how we'll do this:

Enduring Role for the Stakeholder User Group – we believe that this Group are well placed to represent customers and stakeholders and to assesses our annual performance against the business plan they have influenced.

Develop a balanced scorecard approach – to demonstrate our output incentive performance to this enduring User Group, using a range of quantitative and qualitative measures.

Submit the annual assessment to Ofgem – to make a final decision on an incentive reward or penalty, based on an agreed set of rules and principles.

We believe our output incentive package gives value to consumers. A recent study* of consumers willingness to pay was carried out to support the RIIO-T2 process. The report confirms consumers value:

- Up to £7.70 per year for increased security of supply
- Up to £8.92 per year for environmental improvements to transmissions sites
- Up to £11.78 per year for infrastructure to connect renewable generation before definite need.

Our output incentives do this for only a few pence per year on the average annual consumer bill.

Our output incentive proposals will help us bring real benefits to:

- improve the connection process
- reduce the risk of power cuts for consumers
- reduce our environmental impacts
- deliver the low carbon energy system

*"Estimating Electricity and Gas Transmisison Customer Willingness to pay for changes in Service During RIIO2": NERA economic consulting April 2019.

We have built our RIIO-T2 incentive package around the three categories proposed by Ofgem as follows:

Category 1: *Pg 144*
Meeting the Needs of Consumers and Network Users

1

- Stakeholder Engagement
- Customer Satisfaction and Timely connections
- Energy Not Supplied
- Identifying breakthrough change to help deliver the low carbon energy system transition

Category 2: *Pg 148*
Maintaining a Safe and Resilient network

2

- Health and Safety
- Network Access Policy (NAP)
- Successful Delivery of Large Capital Projects
- Whole System ESO-TO incentive

Category 3: *Pg 152*
Delivering an Environmentally Sustainable Network

3

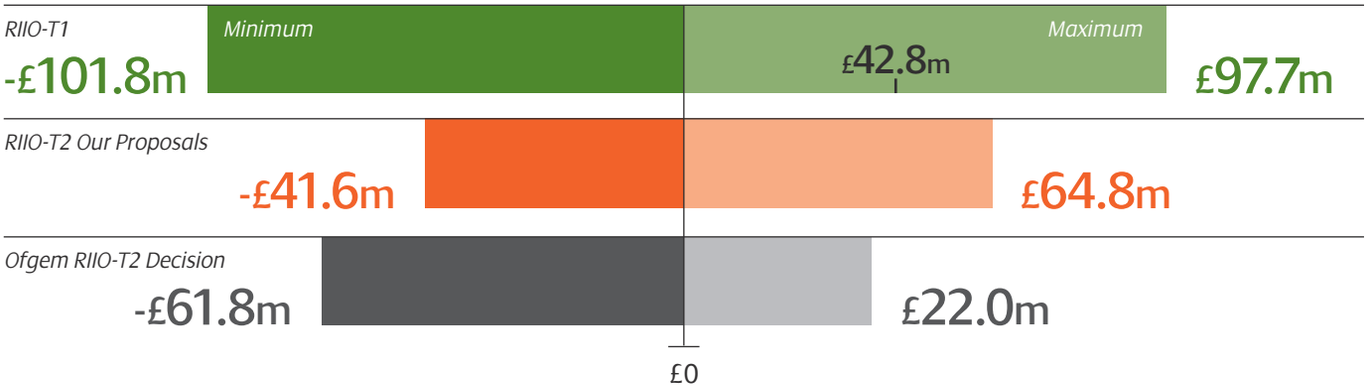
- Environmental Framework – business plans and reporting
- Improving the Visual Impact of our Network in Designated Areas
- Mitigate the Impact of SF_6 leakage
- Electricity losses from the transmission network
- Bringing More Low Carbon Benefits

Total Output Incentive Range Comparison

£ Million (2018/19 prices)

The chart below shows that we performed well relative to Ofgem's incentive targets. **We forecast to earn nearly £43m over the RIIO-T2 period.** The overall incentives package proposed by Ofgem has significantly decreased relative to RIIO-T1 as demonstrated above.

We don't believe that this is in the best interests of consumers given that RIIO-T1 incentives have resulted in significant benefits to consumers such as a 75% reduction in ENS and a 12% increase in customer satisfaction between years 1 to 5 of RIIO-T1.

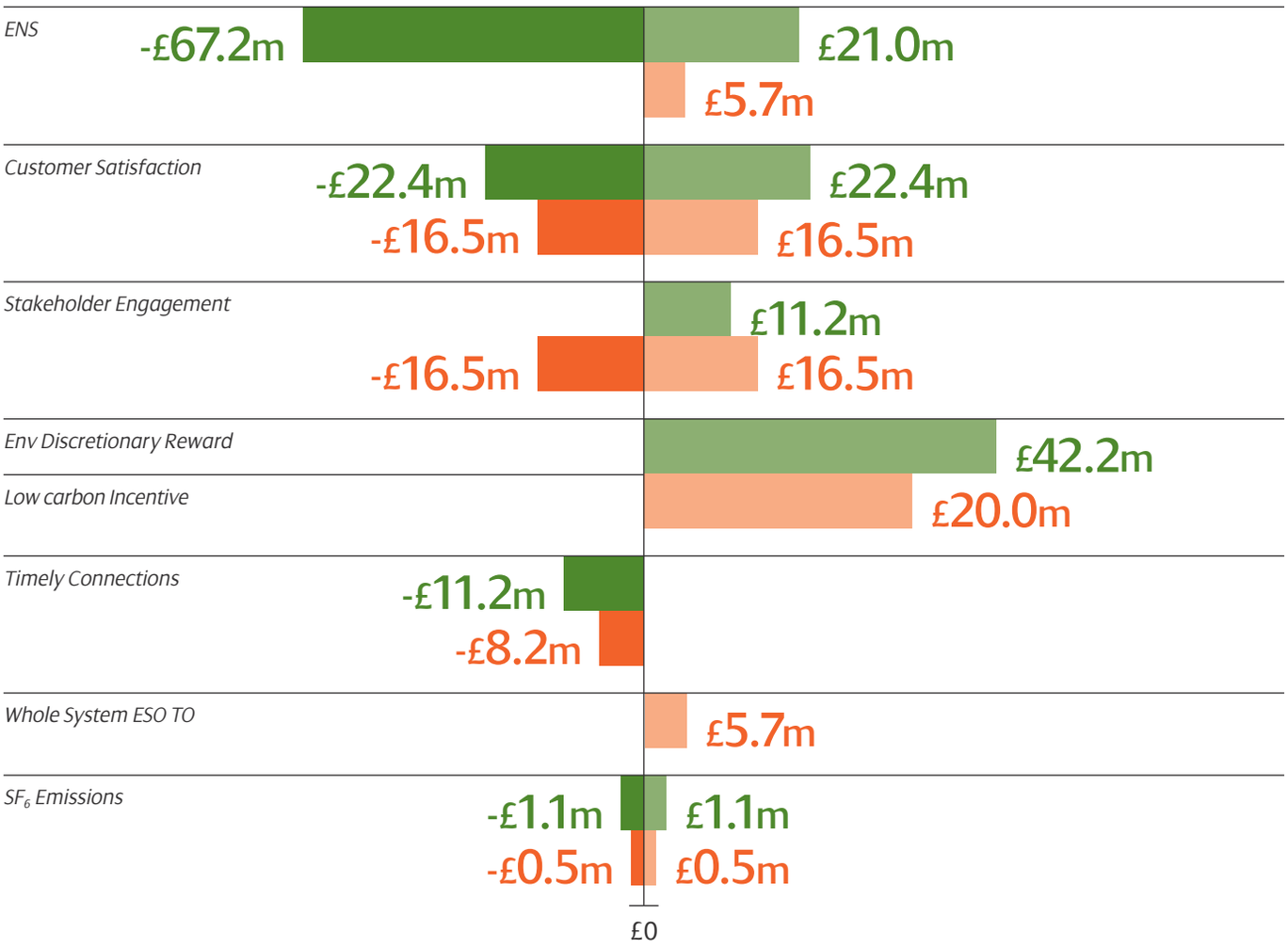


Individual Output Incentive Range Comparison for RIIO-T1 v RIIO-T2

£ Million (2018/19 prices)

The chart below presents the maximum and minimum levels of reward/penalty associated with the RIIO-T1 incentive package compared to our proposals for RIIO-T2.

We are proposing tighter targets in RIIO-T2 to reflect our exceptional performance and lessons learned. We believe this is a fair incentives package which will drive us to deliver further improvements.



Category 1: *Meeting the needs of consumers and network users*

1

Stakeholder Engagement

We will engage even more effectively with our broad interest stakeholders and improve transparency and accountability of our system reliability, major project delivery and health and safety performance. The User group will conduct annual assessment of our performance.

We define customers and stakeholders as follows:

Customers' are individuals or organisations that want to connect or are already connected to our network.

'Stakeholders' are individuals or organisations who have a vested interest in our work, including special interest groups, academics, politicians and of course, consumers.

What we've learned

Our experience has shown us we need to have different interactions for different types of stakeholders. We've reached three main conclusions:

- Differentiating between customers and stakeholders
- Adopting more targeted approaches to engagement and measurement
- Using surveys and assurance to reflect our performance and provide feedback to help improve our processes.

We've consulted with both customers and stakeholders, using their views to shape our proposals rather than simply asking them to choose between options.

What Customers Want

Getting external people and organisations to assess our stakeholder engagement has proved very valuable. It's provided a robust health check and useful feedback to help us improve.

This has driven us to our highest ever performance in the most recent stakeholder engagement discretionary reward submission, where we were the leading network company with a score of 6.4 (2017/18)[1].

From our consultations, we've reached three main conclusions:

- **The quality of a connection offer is** increasingly important for our customers
- **More up-front support and online tools** would improve the pre-application offer process
- **Engagement and flexibility throughout the connection process** is really important to customers

What our stakeholders say:

"There should be a pre-application design meeting with applicants, prior to submission."

"Cost assumption breakdowns would be more helpful than lump costs for works, also connection route assumption maps."

[1]https://www.ofgem.gov.uk/system/files/docs/2018/11/decision_letter_gdns_and_tos.pdf

Customer Satisfaction and Timely Connections

For Connecting Customers

We will increase our customers' satisfaction by improving their connection experience. We will endeavour to deliver a quality connection offer on time, right first time. We will measure satisfaction of the customer experience by targeted surveys and bilateral feedback. We will develop a higher quality connection process by offering more upfront bilateral engagement and data through an online digital experience. The User Group will conduct annual assessment of our performance.

To measure how effectively we're connecting new customers to our network, we'll ask them to complete surveys at significant milestones in the application process. One survey point would be at the completion of 'pre-application services'. This will improve the application process by making sure the customer:

- Is submitting an offer that optimises their opportunities
- Receives an offer that reflects their expectations

We intend to add to the pre-application meetings that we introduced during RIIO-T1 and develop a range of pre-application services throughout the RIIO-T2 period including:

- Heat maps
- Online applications
- Carrying out an automatic check of the information, to make sure it's complete
- More transparent data about our network

We will collaborate with industry partners such as National Grid ESO to develop these and more options including the possibility of co-designing with developers and opening up competition. This will allow customers to choose who they want to design, supply and build their 132kV connection assets to bring harmonisation with the opportunity for this approach that exits in England and Wales.

For Connected Customers

For connected customers, we will work with National Grid as the GB System Operator (NGESO) to build on our well-received bilateral engagement and provide increasingly accurate information on planned outages.We propose to increase transparency and accountability by identifying and reporting clear indicators of system performance that are useful to customers – including availability and reliability.

The performance we achieve in managing the system outages we need to take to deliver our network upgrades, connect new customers and carry out routine maintenance has direct impacts customers and stakeholders. We will identify appropriate metrics with the ESO and other TOs and report on these to the enduring stakeholder user group as part of the annual assessment of our overall performance.

We also recognise that our large capital project delivery impacts our customers and stakeholders. We propose to provide information updating progress of our major projects to the User Group to inform their overall assessment of our annual performance.

For Stakeholders

We will engage even more effectively with our broad interest stakeholders and improve transparency and accountability of our system reliability, major project delivery and health and safety performance. The User group will conduct annual assessment of our performance.

Our experience has shown us that our external assurance has provided clear recommendations to improve our strategy and approach. Our stakeholder engagement should continue to be assured by an independent audit or assurance process and the outcome of this assurance will be presented to the User Group on an annual basis to allow them to assess our performance in context and against our engagement strategy. This will ensure performance is assessed land rewarded based on robust evidence.

"Better engagement throughout the offer period should result in no surprises at the end."

Energy Not Supplied (ENS)

We will report whole system metrics on CML/CI and ENS associated with any unplanned outages and report the mitigation solutions we have implemented. The User Group will conduct an annual assessment of our performance.

What we've learned

The GB transmission network is designed to keep electricity supplies on if a fault occurs. Planned network outages, which are required to carry out essential work, including upgrading our network capacity, connecting new customers and replacing or maintaining ageing assets, increase the risk of a power cut, which affects customers and stakeholders.

The reputational impact of a transmission fault is a major incentive, providing powerful accountability for our business. We have built our ENS mitigation into our business as usual activities over the RIIO-T1 period. The societal and consumer benefits of maintaining our performance in this are enormous.

The existing ENS incentive drives us to reduce the risk of a power cut during a planned outage period. In the event of a fault, directly connected transmission customers are typically restored quickly. Consumers may be exposed to longer outages because of the way local distribution networks are designed.

However, ENS is becoming a less effective measure of reliability because the increase in embedded generation, such as rooftop solar panels. This embedded generation makes it exceptionally hard to accurately calculate ENS in real time. There is no simple solution to this.

Up to half a million of our distribution-connected consumers can be at risk every week because of our transmission planned outage programme. This is due to the particular electrical configuration of our transmission network, which – unlike the England and Wales network – includes 132kV assets. Because of this, we believe a bespoke incentive is appropriate – incorporating the Customer Minutes Lost (CML) and Customer Interruption (CI) metrics already established for distribution network companies.

Our Proposals

We want to build on the ENS output incentive to achieve a more cost effective incentive to maintain and improve on existing reliability levels. To do this, we will:

Identify and incorporate mitigation measures that reduce the risk of power cuts during planned network outages into our load and non-load business plan submissions.

Identify additional mitigation measures that may be required throughout the price control period and establish a ring fenced funding mechanism to deliver these where they are in consumer interests.

We will report relevant system reliability metrics including CML/CI[2] and ENS associated with any unplanned outages and report the mitigation solutions we have implemented. The User Group will conduct an annual assessment of our performance.

This will provide an, affordable, accountable, legitimate and effective route to reducing the risk of unplanned loss of supply to consumers.

A Willingness to Pay study[3] has been jointly conducted by the onshore transmission owners as part of the price control process. The outcome of this study indicates consumer willingness to pay up to £3.85 more per year for additional reliability. This supports our proposals for the ENS output incentive to mitigate the risk and duration of power cuts which would incur cost just a few pence per year.

To support this, we will document and define our approach to mitigating the risk of ENS and submit this to Ofgem for approval. We'll also produce a publicly available report annually, presenting our ENS, customer minutes lost and customer interruption for every transmission fault. This could include identifying other measures, building existing metrics such system availably, which could provide a better view of the volume of constrained generation or other metrics of importance to customers. We would also report on the measure we are taking to optimise system performance.

As part of our customer satisfaction incentive, we will submit this report as evidence to the proposed enduring stakeholder user group. This will help them assess our overall performance. By reporting the same metrics as the distribution network companies incentives we will start to build evidence of how effective our loss of supply mitigation measures are in respect of distribution connected customers. This will complement the existing ENS measure which is more reflective of our reliability performance for transmission connected customers.

[2]CML is customer minutes lost. CI is Customer incidents. These are primary metrics used for distribution networks supply interruption performance. We believe these are relevant to measure the impact of transmission incidents that impact distribution connected customers.
[3]Estimating Electricity and Gas Transmission Customers' Willingness to Pay for Changes in Service during RIIO2. NERA Economic consulting.

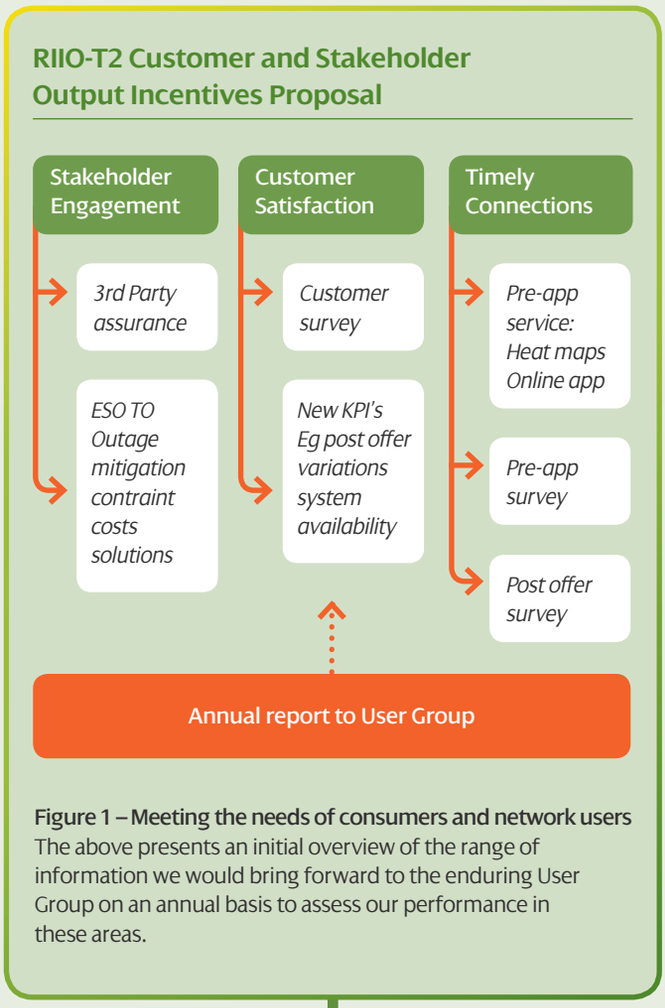


Figure 1 – Meeting the needs of consumers and network users
The above presents an initial overview of the range of information we would bring forward to the enduring User Group on an annual basis to assess our performance in these areas.

Update on Ofgem's May Decision

An enduring role for the User group in assessing performance annually is proposed.

The customer satisfaction incentive will involve two surveys. One will focus on connecting customers (financial incentive) and the second on stakeholders impacted by new transmission infrastructure (reputational incentive).

Ofgem recognise that stakeholder responses suggest they should retain the strong symmetrical incentive arrangement from RIIO-ET1, which is ±1% of the Base Revenue. However, due to their decision to set apart the connections stakeholders in the survey sample for RIIO-ET, it may be appropriate to reduce the incentive strength for RIIO-ET2.

Stakeholder engagement will be a reputational incentive requiring an engagement plan to be included in our business plan submission and annual report demonstrating how well we are delivering against our engagement plan.

ENS is retained as a financial symmetric incentive based on performance in RIIO-T1 Incorporating a methodology for including:

Embedded generation in the ENS calculation is to be developed by TOs and a proposal included in our Business plans. CMI/CL is to be considered as an alternative but brought forward as a proposal for RIIO-T3.

Impact on our proposals

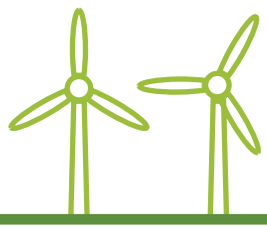
These decisions allow us to progress our proposals for improving the quality of the connection process for our connecting customers. The decision to implement a second survey for stakeholders impacted by our new investment will allow us to build on the current survey of these stakeholders that we conduct.

Making the stakeholder engagement incentive reputational only with an incentive on the business plan incentive does require us to review and update our proposed approach to this incentive.

The reduction in overall incentive strength is disappointing and underestimates the value of these incentives to customers and stakeholders. We will continue to work with Ofgem to urge them to consider the adoption of our proposals, where they differ, as we believe these are in customer, stakeholder and consumers' best interests. Companies' excellent incentives performance in RIIO-T1 has evidenced the strong signal incentives provide to companies.

Willingness To Pay Survey
Consumers prepared to pay £3.85 per annum extra, to reduce the length of a power cut should it happen.

£3.85



Category 2: *Maintaining a safe and resilient network*

2

Ofgem has included three areas in this category:

- Health and safety
- Network Access Policy
- Successful Delivery of Large Capital Projects.

We have included our proposals for a "Whole System" incentive in this section.

Maintaining a safe and resilient network is fundamental to what we have always done. But the low carbon energy system transition brings new challenges such as the increase in smaller renewable, intermittent generation that we need to face. Our output incentives in this category will help us do just that.

Health & Safety

What we've learned

Health and Safety within SP Energy Networks cascades all the way through our business and into every work activity that our employees and contractors deliver and through all of our interactions with members of the public.

Visible leadership on Health and Safety is clear through the commitments detailed in our Health and Safety policy which is signed and endorsed by the SP Energy Networks Chief Executive Officer.

We want to be more transparent and accountable to our stakeholders and share our experience, learning and initiatives with our in a more focused way.

Our proposals

We will report annually on the health & safety initiatives that we deliver. This report will be submitted to the User Group as part of the annual assessment of our overall stakeholder engagement performance. This will include updates on performance and track record, how we are managing operational risk and reducing harm. Our public safety programme and the latest on our industry and regulator engagement and We will also consider if reporting other issues such as Cyber Security is also valuable and appropriate to incorporate here.

Networks Access Policy (NAP)

What we've learned

The RIIO-T1 Network Access Policy was a reputational incentive that led to a step change in the engagement we have with the GB system operator (NGESO) ESO and enable the successful delivery of the huge number of network outages we needed to take to deliver our essential investment plans. We have delivered an thousands of system outages every year, with increasingly complex outage patterns and interactions associated with them. This has added risk to security of supply for our customers and consumers but we have delivered these with increasing levels of reliability measured by our Energy Not Supplied (ENS) metric. Crucially, this has enabled us to deliver our outputs for connecting new generation, upgrading our network and maintaining our existing assets.

Our proposals

We will optimise the delivery of our essential network outages working jointly with other network owners and the GB System operator. We will provide better reporting, better third-party engagement and better performance monitoring of our outage related activity. The User Group will conduct annual assessment of our performance.

We will do this as follows:

Better reporting – We will make the benefits of the NAP incentive more transparent to stakeholders and customers in RIIO-T2. We will report relevant metrics, useful to stakeholders and customers, replacing the need for the existing C17 National Performance report. This NAP report will include our network availability and outage planning performance, and details of the third-party engagement we conduct.

Better third-party engagement – We will work with the other TO's and NGESO to clearly define and document the roles and responsibilities for the ESO and TOs for engaging with stakeholders and customers. We will clarify the process and procedures around outage planning notification. This will include procedures for mitigating the risk of this engagement being abused for fraudulent market activity. We propose that the NGESO biannual 'OC2 Forum' be rebranded as the 'NAP Forum'.

Better performance monitoring – We recommend the proposed NAP annual report, incorporating relevant KPIs, should be submitted to our User Group to support their annual assessment of our stakeholder engagement and customer satisfaction performance.

Successful delivery of large capital projects

What we've learned

We recognise the value that we deliver as a network company, and that successful delivery of our major projects is crucial to the electricity system and consumers generally.

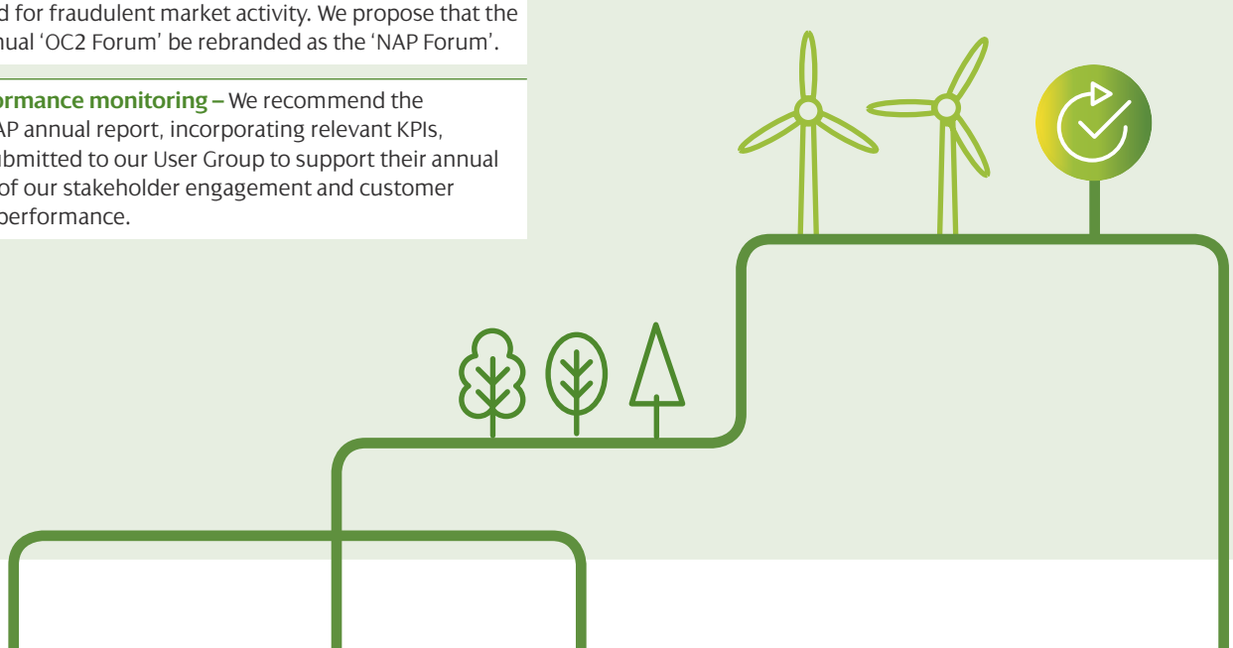
The reputational factors affecting our large capital projects, the commercial contracts with our suppliers and contractors that delivers 95% of these projects, and the efficiency mechanism all incentivise us to deliver these projects to meet forecast completion dates.

Ofgem is proposing new incentives in this area for RIIO-T2. We are concerned could lead to negative impacts for consumers.

Applying an indeterminate financial penalty for delivery of large projects is effectively applying an unlimited liability value to the project. In any commercial contract, liabilities would be assessed and built into the risk proposal for the contract by all parties.

Our proposals

We will deliver our major capital investment projects on time and with quality. We will increase our transparency and performance through better reporting and incentivise this through our stakeholder engagement reward or penalty. The User Group will conduct an annual assessment of our performance.



New whole system ESO-TO incentive

What we've learned

Constraints costs are an inevitable part of an economic transmission system. Constraints are incurred by the GB System operator (NGESO) to pay for services provided by generators to enable them to balance the electricity system and keep the lights on. To eliminate constraint costs would require building larger capacity transmission networks that would cost consumers much more than the cost of constraints. These costs impose a heavy financial burden on consumers as increasing volumes of intermittent generation are connecting to the electricity network. When transmission operators require the network to carry out essential work, constraints can increase.

We work hard to mitigate these costs, but we believe consumers could benefit financially if transmission operators are funded to provide infrastructure solutions that will reduce the risk for high constraints.

Although these solutions can incur higher infrastructure costs, the corresponding decrease in constraint costs could be of a much higher level. This would mean a significant reduction in overall lower whole system costs for consumers.

Our proposals

We will mitigate the risk of high constraint costs associated with our essential network outages by improving the outage planning process. We will report annually to the User Group to conduct annual assessment of our performance. We are considering an approach to incentivise our supply chain to reduce whole system costs in their proposals. We are proposing an ESO-TO whole system incentive that builds on existing licence and regulatory arrangements. This will provide funding for infrastructure services TOs could provide to mitigate the risk of high constraint costs associated with network outages. This constitutes a deliverable ESO/TO Constraint mechanism.

We will utilise an existing funding mechanism of £1.14m per annum. The User Group will also conduct an annual assessment of our performance.

The proposal would work across three stages:

Stage 1 – We have identified certain essential large scale construction projects as being at a high risk of incurring significant constraint costs. As part of our RIIO-T2 Price Control submission, we will incorporate solutions for non-load and load investment that lessens this risk. There may be additional investment costs as a result, so we have asked the ESO to conduct a cost-benefit analysis of the options to find out if the constraint mitigation solution will be beneficial for consumers.

Stage 2 – We will improve existing operational planning procedures that already require outage plans to be assessed two or three years ahead of time. Historically, these have not included economic assessment of options of outage patterns that the ESO identifies as presenting a high risk of constraint costs. Going forward we propose to bring forward alternative options to design or deliver these outages. These options should reduce the risk of a project that presents a high risk of constraints. Where the recommendation for an option involves higher costs for the TO, funding will be provided through the existing STCP 11-4 process.

Stage 3 – We propose that key performance indicators be introduced to highlight performance in the year ahead and real time timescales of our outage planning and delivery. We will agree these with other TOs and the NGESO and, put forward under an updated Network Access Policy. These metrics could include the number of projects that are identified as suitable for funding through this mechanism; a forecast range of constraint cost reduction and the forecast cost of the funding needed to implement the solution.

These metrics will be presented as part of an annual report, which is submitted to our User Group to inform their assessment of our performance.

Limiting our annual revenue for delivering increased reliability to a maximum of

£1.14m

Update on Ofgem's May Decision

No Safety incentive is to be introduced but Ofgem support our proposal for voluntary reporting to the enduring User group.

The NAP remains a reputational incentive with a requirement to work across TOs to produce a consolidated NAP and potential metrics to monitor benefits of the NAP.

The proposal for a discretionary Whole system funding mechanism is dropped, although a business plan incentive, innovation stimulus package and a reopener window will be incorporated to support a Whole system approach.

Successful delivery of large capital projects will be supported by the introduction of an automatic mechanism for re-profiling allowances

Two proposals for addressing customer detriment are kept open on late delivery and a new proposal for output impacts during the operational phase of major projects.

Impact on our proposals

The decisions for the Safety and NAP incentives align well with our proposals.

The removal of a whole system discretionary mechanism as well as the retention of proposals for penalties for late delivery and during the outage phase adds risk and reduces opportunities for supporting the low carbon transition.

We will continue to work with Ofgem to urge them to consider the adoption of our proposals, where they differ, as we believe these are in customer, stakeholder and consumers' best interests.

Category 3: *Deliver an environmentally sustainable network*

3

This incentive category includes the outputs and wider price control measures intended to support network owners to reduce the adverse impact of their networks and business activities on the environment, and to support the transition to a low carbon energy future.

Environmental Framework – business plans and reporting

We have established an environmental action plan that will deliver the following outputs:

- Decarbonising the energy networks – with a focus on business carbon footprint and embedded carbon in networks.
- Reducing networks' environmental impacts.
- Supporting the transition to an environmentally sustainable low-carbon energy system.

We will publish an annual environmental report in line with future Ofgem guidelines which could include:

- Business carbon footprint (BCF) and embedded carbon.
- Other environmental impacts including pollution to the local environment, resource efficiency and waste, biodiversity loss, and visual amenity issues relating to infrastructure.
- Contribution to the low carbon energy transition.

Additional incentives are included in this category:

- Mitigating visual amenity in designated areas
- SF_6 and other insulation and interruption gases (IIGs) leakage
- Electricity losses from the transmission network
- Additional contribution to low carbon transition.

More detail about these are included within **Annex 7**: Environmental Action Plan.

Improving the Visual Impact of our Network in Designated Areas

What we have learned

We used the RIIO-T1 process as an opportunity to examine and,where appropriate, address the visual impact of our existing infrastructure in designated landscape areas. We launched our 'Changing the VIEW' initiative by asking stakeholders to help us develop a robust policy document and by assessing all qualifying infrastructure in the SP Transmission Licence area.

Our assessment identified the qualifying locations where transmission infrastructure has the greatest level of impact – this included National Parks and National Scenic Areas. We found that only 3% (approximately 124km) of the total infrastructure within the SP Transmission licence area would qualify for the project. Of that 3%, less than half was deemed to have any opportunity for successful mitigation.

We held a series of stakeholder meetings and workshops early in the process to help us identify and understand the key individuals and sensitivities to be considered within those landscapes that qualified. This helped us identify the specific visual impacts of existing transmission infrastructure, and potential mitigation proposals which could deliver mutual benefits in the areas being considered.

We considered a wide range of potential mitigation options from the outset of the 'Changing the VIEW' initiative. Options considered ranged from small-scale landscape interventions through to large-scale engineering projects with subsequent considerations of undergrounding, subsea/loch cable routes and re-routeing of overhead lines out with the designated landscapes.

It was proposed that schemes for 12 sites be taken forward. Four of those are being progressed, and three projects are subject to significant delay due to local issues such as eagles nesting creating a proximity zone. This further highlights the potential difficulty in delivering outputs in such highly sensitive locations. Even in projects supported by stakeholders, ecological constraints have limited our ability to fully develop them in line with the broad range of specialist interests – an inherent difficulty in considering visual amenity in isolation.

Our proposals

During RIIO-T1, we identified with stakeholders all potential options for introducing visual mitigation of our existing transmission network within the specified designated areas of national parks and national scenic areas. Should this funding mechanism be maintained, we would like to see it extended to allow us to bring forward visual mitigation schemes in other nationally or internationally important designations.

Mitigate the Impact of SF_6 Leakage

What we have learned

During RIIO-ET1, a symmetrical financial (reward and penalty) incentive was implemented to drive transmission operators to fully consider lifetime costs when making decisions about SF_6 assets and to improve the management of, and reduce leakage rates from, SF_6 assets operating on the system. We have been able to deliver a lower leakage rate than the target has through effective management and mitigation approaches.

Our proposals

We will continue to mitigate the leakage of SF_6 gas from our assets and work with industry to identify alternative insulation and interruption technology to find a better alternative to SF_6 gas.

Electricity losses from the transmission network

What we have learned

Transmission losses arise when electricity is transported across a network. Factors affecting losses includes the materials and design of assets on the network, the distance electricity travels, and the voltage at which the electricity is transport. Losses are expected to increase in future as an increasing number of decentralised renewable generation is connected to the transmission network.

Our proposals

We propose to integrate reporting of the initiatives we are taking to mitigate the losses on our network within the Environmental Action Plan and annual reporting framework.

Our Losses Strategy detailing our approach to minimising controllable losses is located within Annex 7.

Bringing More Low Carbon Benefits

We will bring forward a range of initiatives around connecting new flexible generation and optimising network utilisation to increase the MWh of low carbon generation. The energy system transition is accelerating especially fast in Scotland, with the anticipated loss of all conventional and nuclear generation by 2030. We need to:

- Build on our achievements in RIIO-T1.
- Become even more innovative and vigilant.
- Anticipate what will be required to maintain system strength, capability and resilience.

To do this, we are proposing a range of initiatives, which we will outline in the next section.

1. Maximise network capability for the connection of new low carbon generation (MWh incentive)

What we've learned

We believe this incentive should continue the £4m per annum value of RIIO-T1 to drive breakthrough change in the progress towards a low carbon energy system. We will develop our existing ideas and work with industry and stakeholders to identify and develop new proposals over the next few months and throughout the RIIO-T2 period.

The transmission network provides a route to market for generation connected at both distribution and transmission voltages. Where an area is rich in renewable generation sources, such a wind or water, the maximum capability of the transmission system can be reached very quickly. This limits how much we can replace traditional carbon-intensive generation.

The transmission, network capability is typically designed to cope with the highest volume of energy that it might be required to transmit.

Increasingly with intermittent generation flexible connections are a more economical way of accommodating the average flow of energy. We are designing and building operational control schemes to achieve this and we want to demonstrate the extent we are able to do this.

Our proposals

We propose a reputational incentive to reporting on the additional MWh (the measure of the volume of electrical energy flowing) capacity we can connect, ahead of network capacity upgrades, to increase the volume of low carbon generation.

We propose to set a target for the early MWh capacity we expect to provide over the price control period, based on our localised energy scenarios, which can be converted into a carbon emissions equivalent value. This will highlight to customers and stakeholders the value of the solutions we are implementing to support low carbon generation. The previously referred Willingness To Pay study gives consumer support for investing in infrastructure that connects new renewable generation up to £11.78 per year. We will be able to do this for a much lower cost.

Willingness To Pay

Consumers prepared to pay £11.78 per year to support investment in infrastructure to connect renewable generation before definite need.

£11.78

2. Maximise network capability for existing low carbon generation

What we've learned

The rapidly-evolving energy system transition and increase in intermittent non-synchronous and distributed generation is driving significant change.

Traditionally, static ratings have been used, but dynamic or real-time ratings are increasingly becoming available through innovative and increasingly sophisticated measurement and forecasting tools. Fault level is an example of a limitation of system capability.

Our proposals

We are proposing an additional reputational incentive to report on the number of instances where we are able to provide increased network capacity ratings. We'll also consider reporting on the increase in low carbon MWh this enables if the service we offer is deployed by the electricity system operator (ESO).

3. Low Carbon Contribution from Operational Land Use

We are developing a proposal to provide access for alternative uses to our operational land where it is vacant such as through the installation of solar PV.

A competitive process could allow third party suppliers to come forward with proposals for installing and operating this technology on these sites.

The benefit that consumers would gain is the increase in low carbon generation. Funding would be required to cover some of this but we are exploring this further before a final plan is provided in December. We would report the volume of displaced carbon equivalent in tonnes achieved by the volume of new low carbon generation we have connected on our available land.

We are considering a £100,000 ex-ante mechanism and commitment to report annually on costs and generation connected. A volume driver or re-opener mechanism could be established should there be an opportunity for additional connections above the initial funding levels.

Update on Ofgem's May Decision

Ofgem have decided the Visual Amenity scheme will continue to cover only existing infrastructure within National Parks, Areas of Outstanding Natural Beauty and National Scenic Area.

Ofgem confirm an intention to retain the SF_6 incentive with the following modifications: The scope of the incentive will be expanded to include other insulation and interruption gases (IIG). The incentive mechanisms will be adjusted to provide tighter and more accurate baseline targets.

Ofgem have decided that we will leave open the option for TOs to develop bespoke ODIs with stakeholders for delivering an additional contribution to the low carbon transition.

Impact on our proposals

It is disappointing that Ofgem have decided not to extend the designated areas in the scope of the visual mitigation incentive. We will review the decision and identify if there is any potential to develop non-technical mitigation projects within the existing designated areas.

Ofgem's decision does however, support our proposals to bring forward initiatives output delivery incentives (ODI's) that will contribute to the low carbon transition. We will engage with customers and stakeholder to develop these further and determine if these should be included in our final submission.

Refer to **Annex 7**: Environmental Action Plan.

It sounds obvious, but it's vital that we can actually deliver our plan for RIIO-T2.

We've used our experience and strong record of delivery to assess our plan against the constraints that can affect it, and set out how we'll manage these.

Delivering Our Plan

Building on our experience from RIIO-T1

Connecting new generators, replacing assets and deploying innovative new equipment to increase the capability, and reliabilityof the system all present different challenges which we have learned from.

Ongoing business improvement has identified a number of areas where small changes we make will introduce an improvement in the way we plan, develop and deliver our projects. These key areas will improve the way we deliver RIIO-T2.

Reducing unknowns

We have recognised that identifying project-specific issues earlier and in more detail through more up front studies and surveys can significantly improve the way in which we deliver our projects. This may introduce some additional cost to the development stage of a project but these costs are heavily outweighed by the benefits in considering these issues and constraints in the overall concept design and plan; mitigating their impact or avoiding their affect altogether. Previously these may only have been known at construction stage. This will reduce project delays, minimise costs due to changes in plan and ensure a safer and more environmentally sympathetic project delivery.

Improved planning

More complete understanding of our existing assets and proposed work sites allows us to better inform each stage of the design process. It allows us to reduce changes in scope and to freeze the final design of projects earlier. This earlier clarity of our works throughout planning and consenting enables use of a wider suite of communication media with Statutory Bodies, our Customers and the wider stakeholder community. Alternative forms of media may include 3D digital modelling, stage by stage graphical storyboards and visualization of our Environment Impact Assessments. These optimise the planning process and reduce significant changes in planning and consenting applications; delaying commencement of on-site works. We understand that any use of new media technology must not serve to exclude any of our existing stakeholders.

Embed innovation and manage risk

Innovative approaches

We have deployed a range of innovative approaches in RIIO-T1 through using new technology on the network, different techniques when we construct assets, or the way we work with our suppliers to reduce cost and risk. We have worked with our supply chain to ensure that they can support us in the deployment of new technology such as digital substations and that their staff are acquiring the skills required alongside us.

Managing risk

All projects have risks. It is the understanding and management of these risks that determines the success of a project. Risk can take on may forms such as:

- Unplanned network events such as faults
- Exceptional weather events which affect the duration or sequence of our works
- Environmental conditions being different from anticipated
- Contractor performance
- Archaeological, ecological or environmental constraints
- Landowner and access difficulties
- Unexpected soil or ground conditions
- Planning and consenting issues
- And a wide range of other risks

Applying our approach to managing risk

Small changes will improve the way we plan, develop and deliver our projects and manage risk. When risks are not managed these can delay projects or increase costs, so they are a key focus for us. Delays not only impact on the benefit of the investment being realised but will also have a knock-on impact on other projects.

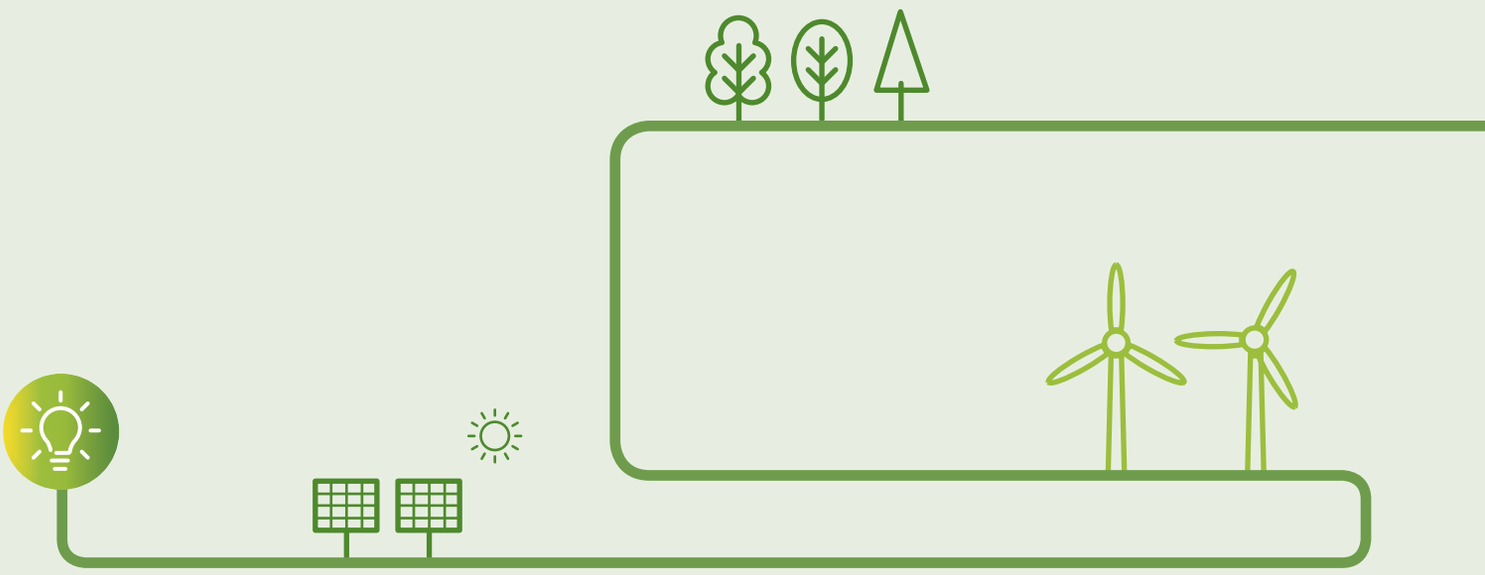
Sound project management techniques such as use of risk registers at project and portfolio levels allows us to identify and categorise risk, agree mitigation and/or management measures. Ongoing risk reduction meetings allows these risks to be monitored throughout the project lifecycle.

We deploy rigorous financial governance for the release of risk funding.

Each project has a project delivery strategy agreed to make sure the correct contracting model and levels of disaggregation are balanced against any project risks. Where we believe any risks can be more efficiently managed by our supply chain we look to transfer the risk transparently through our contract terms and conditions.

We have robust project and contract review processes which allow us to identify lessons learned and feed these back into our subsequent projects. We have identified that by earlier engagement and wider data gathering through targeted inspection, system/site studies and site investigations, we can identify and manage project issues more efficiently. This additional upfront effort allows us to reduce the number of risks on a project and also mitigate the probability and consequences of residual risks.

All of these factors have influenced the way we have developed our plan to make sure that it can be delivered efficiently and on time.



Accessing the network

1

Much of our RIIO-T2 plan requires us to gain access to the live equipment on the transmission network to replace equipment, maintain it or connect new assets. To do this, we need to safely de-energise and disconnect plant and equipment from the network. When we do this, we may reduce the capability and reliability of the network and we need to plan our works in great detail to minimise any effect on the network or risk of interruptions to our customers.

In the short term, we can't alter the physical configuration of the existing network within our license area, or the current operability of the GB grid. To counteract this, we use our vast experience and expert knowledge of the system's capabilities and interactions.

This, together with the ongoing communications with the Electricity System Operator and other Transmission Operators, enables us to plan our works in a way which will:

- be acceptable to the Electricity System Operator; and
- minimise the impact of our operations on the network, our stakeholders and customers.

Our network is built to be a good balance between efficient design; incorporating optimum redundancy and duplication of assets and appropriate security of supply. This balance means that when we de-energise any part of the system, there's an additional risk to consumers and generators.

Our network also supports the power flow of energy across Great Britain; balancing supply and demand, so any depletion in capacity during construction or maintenance works can introduce significant constraints in the grid's overall power flows. These restrictions can introduce significant challenges to the operability of the overall network, and adds costs to our customers as a result of 'constraining off' generation capacity or introducing the need to use alternative, less efficient generation.

During the development of our plans we have assessed the deliverability of nearly

300 Initiatives

Planning high impact projects

We began by identifying all projects within our plan which would impact the overall use and operability of the **400kV** and **275kV** Main Interconnected Transmission System (MITS). Works on the MITS introduce the biggest challenge for overall system operability, and can trigger significant costs associated with constraining generation due to reduced system capacity.

Projects identified within this category include those which:

- **Severely impact the required boundary capacities** required to minimise system constraints or system operability. These projects include those identified through the System Operators Network Options Analysis (NOA) process.
- **Non-flexible projects** and those which have specific delivery dates. These projects are as a result of commitments to customers to increase system capacity and facilitate the connection of new generation.
- **Impact the MITS.** These are predominantly non-load projects which are renewing equipment at key sites and their availability is vital to the operation of the network.

Our initial high-level plan looked at ways to schedule all MITS projects, based on a full understanding of the project interactions and effect on the network. By scheduling work in the most optimised way, we can minimise risk to customers, limit boundary and localised constraints, and minimise effects on the operability of the network. Where possible, we've looked to minimise project interdependency to introduce some flexibility, which may be required at delivery stage.

Planning nested projects

Next, we identified projects which could be delivered using outages already required on the MITS system and which could be delivered at the same time to reduce overall impact as opposed to delivering them separately.

Planning flexible projects

The final group of projects are those which did not generally impact consumers or generation beyond the local network. These were predominantly on the **132kV** network or, if at higher voltages, required simple connection of new assets to the existing network. These projects have the flexibility to be programmed and delivered around other planned works. This process gave us a starting point in the formation of our plan.

Project timescales

2

Our projects for the RIIO-T2 period are still at an early stage of development. That said, it is vital we assess how long each project is likely to take.

Many project lead times in our plan are relatively fixed. For example, statutory periods associated with necessary planning activities and construction licenses. Another example is the long time it takes to manufacture many of our main system components; some which may have manufacturing times in excess of 12 months from award to on-site delivery.

Although there are often options to accelerate works during construction, many of the overall programme activities associated with the development and delivery of projects can't be changed.

Getting agreement on durations

To successfully complete our planned projects, we need agreement on development and delivery timescales. These timescales are indicative, but designed to be as accurate as possible.

To help in this process, we developed programme templates for all our major project types, using data gathered during the delivery of similar projects in RIIO-T1. These programmes identified key stage sequences and durations, and allowed us to test the viability of the initial plan shaped by available system access. The main stages of a project are shown opposite.

For the diligence of the plan, we have challenged standard project timescales for all of these activities. This is to make sure that we take consideration of:

- Earliest possible connection of generation
- Earliest benefit from network improvements
- Most efficient construction methodology
- Risks associated with any acceleration of timescales

Where these programmes didn't meet our identified system access windows, we carried out a further iteration of the system access plan to ensure a 'best fit'.

Where conflicts still existed, we considered more detailed analysis of the individual project to look at accelerating the programme or deferral depending on the risks.

Where specific projects have a significant and extended duration on the network as a whole potentially constraining other works, we looked to reduce the construction period. This is achieved by increasing resources, while still balancing the risk of the accelerated programmes.

Stage 1: Definition

- Understand the problem
- Gather data and information to set an overall scope definition
- Develop a range of solutions
- Analyse the best option
- Agree the overall programme

Stage 2: Development

- Gather more site information through studies or surveys to determine ground and site conditions, environmental and ecological constraints, and planning restrictions
- Identify stakeholder requirements
- Refine initial scope and gain a full understanding of risks
- Start planning and consenting work
- Concept design freeze
- Secure relevant Planning and consenting approvals
- Refine programme

Stage 3: Delivery

- Detailed design
- Develop tender specification and documentation
- Tender and award contracts
- Site establishment and access
- Construction
- Quality management through inspection and monitoring
- Contractual management
- Stage-by-stage Commissioning and decommissioning of equipment
- Staged Demolition and disposal of old assets

Stage 4: Close Down

- Contract and project reviews to establish lessons learned
- Commercial reconciliation
- Commissioning and final file documentation
- Regulatory reporting

Internal resources

3

To deliver our plans efficiently, we need to make sure our internal workload and resource requirements remain relatively steady throughout RIIO-T2. Where possible, we've tried to sequence our works to avoid periods of peaks and troughs in internal resource requirements.

During RIIO-T1 we have grown and matured an internal team of highly skilled multi-disciplined staff, capable of developing and delivering projects on time and to the highest quality. Over time, this workforce will need to evolve to meet the changes of workload, technology and portfolio requirements. We'll also need to make sure we have long-term plans for the inevitable movement of staff, both within the industry and retiring from it at the end of their careers.

Linking resources to programmes

To accurately forecast our future resource needs, we've developed a tool which introduces a direct link between resource requirements and portfolio project programmes. This tool provides resource forecasts at a project level, as well as for the overall plan. It covers every resource discipline, month-by-month.

Drawing on detailed time-recording, we've gathered historic data for all RIIO-T1 projects we've completed. This data includes all hours allocated by each resource discipline against pre-determined activities or project stages. The result: we can categorise project types and link resource requirements to specific activities and stages of delivery.

The tool allows us to flex resource requirements associated with each project's scale (CAPEX) and duration (programme) variables. We have applied this tool to our remaining RIIO-T1 programme, introduced our RIIO-T2 proposal list, and made a forecast assumption of the potential works associated with RIIO-T3.

As well as named projects, there are always ongoing levels of uncertainty for customer connection works. Based on our experiences in RIIO-T1, we've taken a pragmatic view on the work involved in progressing connections and their resource requirements through to completion.

In addition we have assessed the staff required to operate our network and to fully deliver our RIIO-T2 maintenance plan critical for ongoing system reliability.

Finally we have analysed the wider business support needed to pursue our SPT business strategy and, through discussion and departmental analysis, looking at both existing skills and new roles needed for the future, determined the necessary support resources.

This structured approach has allowed us to forecast an overall workforce requirement for RIIO-T2.

Over time, our workforce will need to evolve to meet the changes of workload, technology and portfolio requirements.

To deliver RIIO-T1 we've increased our workforce by

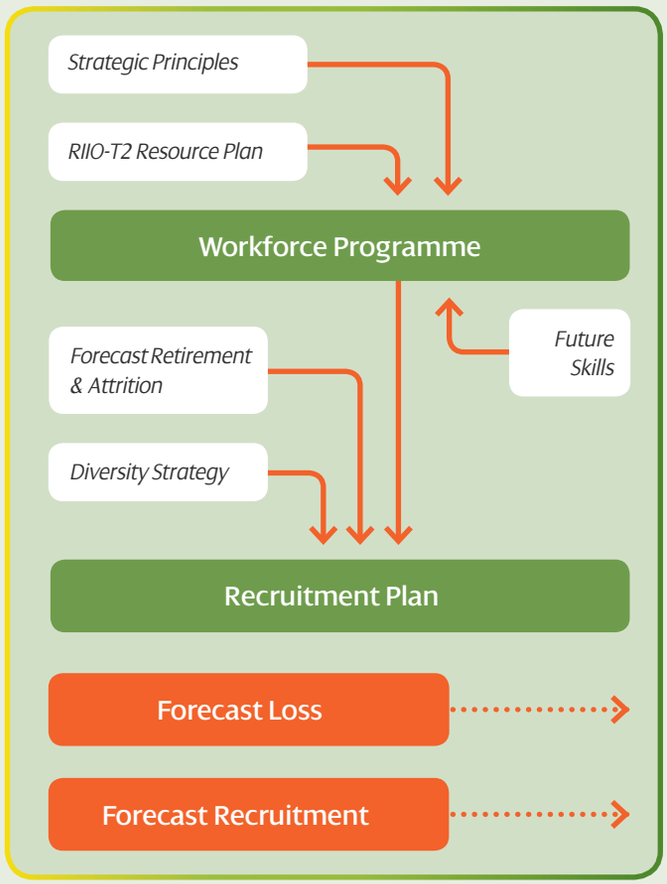
25%

Forecasting resource gaps

To allow us to analyse our workforce resilience and develop a sustainable workforce strategy, we've used the outputs from the resource forecasting tool and managerial forecasts. We've then rationalised them to remove outlying results and modelled attrition rates. This allows a gap analysis between requirements and forecasted headcount.

This has confirmed a significant future need to bring in fresh resources and has given us clear visibility of where and when we need to invest in staff development and recruitment. We also carried out an assessment of any changes to roles or disciplines resulting in the introduction of alternative or innovative delivery methods or solutions.

How we will bridge this gap and further details on our plans to ensure a sustainable workforce are detailed in the next section.



A sustainable workforce

4

A workforce with the right skills is essential for the safe and reliable operation of our network. Investing in our people now ensures we have the necessary staff with the correct skills to delivery our plans in the future. That's why we continue to undertake detailed reviews of our resourcing plans, and are investing to make SPEN an even better place to work.

Skill Shortages

Energy and Utilities Skills Groups and Trade Unions have acknowledged the skills shortage facing our industry. This is against a background of maintaining existing skills, a new low carbon future and the requirement for new technologies.

Our diverse internal skill-set means that our workforce is particularly affected by these shortages.

Our review processes have highlighted that many of our talented and experienced staff are due to retire during the next price control period.

This analysis along with the growth of our industry and the new challenges associated with the low carbon future, makes it's clear that we need to recruit and train new staff. We need highly skilled, suitably authorised employees, with the specialist skills to deliver our investments. For example, new digital technology and the challenges of merging Telecoms, SCADA, Protection and Control solutions.

Alongside our business plan, we have published our Sustainable Workforce Strategy, read Annex 2: Sustainable Workforce Strategy, which details the technical skills we need to run our transmission business effectively.

Our current workforce

We employ a wide range of highly-trained staff to operate and maintain our network, and deliver our investment programme. Our staff are grouped into seven main categories:

Management – Providing leadership and vision in the delivery of our plan

Specialist Operational – Operating our plant and providing essential safety from the system for Staff and contractors

Project Management – Ensuring our projects are fully delivered to a high quality, on time and within budget

Professional Engineer – Analysing our asset and system needs, determining solutions and providing designs for construction

Construction Management – Ensuring our onsite works are planned and coordinated in a safe and considerate manner

Industrial – Carrying out inspection, critical defect repairs and maintenance of our assets.

Support – Provide critical support for:

Regulatory, performance and commercial reporting
Production of development, design and construction drawings
Establishing and maintain work programmes
Management of Health, Safety, Quality and Environment
Contract management

Our comprehensive resourcing review has shown: that over the RIIO-T2 period we anticipate 128 of our current workforce of 488 will leave as a result of retirement and attrition. We see a significant trend in the reduction in retirement age for staff with long service attached to a defined final pensionable salary pension which reduces forecast age of retirement to below company average of 58. Beyond RIIO-T2 we foresee a gradual reduction in the number of employees retiring at 58 or below due to historic changes in the Company's Pensions Schemes, however we may also see a slight increase in the attrition rates due to increased employee mobility resulting from the ease of transporting accrued benefits.

We do not anticipate the overall level of leavers to change significantly beyond the RIIO-T2 period.

Attracting and retaining skilled personnel is becoming increasingly challenging. The challenges and cost of recruiting in these areas reinforces our belief that our strategy of growing our own talent is the more cost effective and resilient strategy.

This will be supported by our overall employee experience, which encompasses market aligned terms and conditions, a supportive approach to work life balance, and an environment which facilitates personal and professional development.

This organic growth is supplemented by selective external recruitment for highly specialised roles, or forecasted peaks, in attrition to maintain appropriate levels of experienced staff to allow for, and support the, development and training of trainees in our Business.

We are continuing to invest heavily in the recruitment and training of highly skilled people to deliver our investment plans and maintain a reliable Transmission Network.

As part of this programme, we will recruit:

80 Graduate trainees
30 Engineering and craft apprentices
28 Skilled individuals direct from the market

Between 2019 and the end of the RIIO-T2 period. Recruitment will be advanced two years ahead of need to allow for 'time to effectiveness' of new intakes.

Partnership Arrangements

We recognise the benefits of working in partnership with other Industry Bodies to share best practise and ensure a pipeline of talent for the Industry.

We continue to be a member of EU Skills with representation on the Transmission and Distribution Group and the National Skills Academy for Power (NSAP).

The Scottish Apprenticeship Advisory Board provides employer leadership and contribution to the development of apprenticeships in Scotland, our CEO Frank Mitchell currently Vice-chairs this board.

We continue to partner with local Universities to attract talent into the industry.

Training and development of our Staff

To ensure that our staff remain equipped to work to the highest standards expected we continue to invest in-house training and development, delivering 5,165 internal training hours; a 50% increase since 2016.

We have recently invested over £400,000 in our two training centres in Cumbernauld in Central Scotland and Hoylake in England extending the training catered for and improving existing facilities. They provide essential internal and external training and operational authorisations for our staff and contractors ensuring consistent standards of core skills and safety from our system. These facilities are a key part of our delivery strategy for the future.

Skills needed to support the energy system transition

We must respond to unprecedented environmental issues by working to deliver sustainable growth and support urgent decarbonisation of our economies and prevent worsening climate change.

The skills required by our staff are changing as a result of new technologies to meet:

- The Challenges of ever increasing and changeable boundary load transfer requirements
- Efficient facilitation the connection of low carbon generation
- The digitalization of networks and associated data
- The growing need to interpret and use detailed network data associated with digitalization.

These new skills will be required for both our existing staff and within new disciplines over RIIO-T2 and beyond.

Understanding our staff

Our annual employees survey 'The Loop'; responded to by over 75% of our staff, allows our workforce to indicate what matters most to them within their employment and how we a performing against their expectations.

Living Wage

We are committed to equality in all of our working practices. As a result, we fully endorse and support the accreditation framework set out by the Living Wage Foundation, and can confirm that for all ScottishPower employees, we comply with the principles of the real Living Wage.

Inclusive Employer

We're focused on attracting and inspiring the best talent – regardless of gender, age, sexual orientation, disability, ethnicity or any other factor. We remain committed to becoming a more inclusive employer, and have placed a significant focus on the following areas during RIIO-T1:

Unconscious bias training – All recruiting managers and all new line managers have unconscious bias training built into their development programmes. All of our recruitment adverts are designed to remove gender specific terminology and appeal to the broadest spectrum of potential applicants.

Supporting young people with learning disabilities – our award-winning Breaking Barriers programme, run in partnership with Enable Scotland and Strathclyde University, gives ambitious young people with learning disabilities the chance to study for a business qualification. It also provides work experience to improve their prospects of securing meaningful employment.

Addressing mental health – we've introduced mental health first aid training across the business with 13 employees now capable of identifying signs of and supporting those presenting with mental health issues.

Supporting women in sport – we've extended our rugby partnerships in Scotland and Wales to support more women in sport.

A commitment to inclusion – We work alongside EU skills, actively support the Inclusion Commitment and proactively share best practice across the Sector. We continue to develop initiatives to improve education on diversity and inclusion both externally and internally through leadership training and mentoring. We continue to remove barriers to employment through inclusive policies such as flexible working.

Supply chain dependency

5

Complex projects rely on an extensive supply chain. This section explains the strategies we use to make sure we deliver on our commitments.

Almost 96% of our regulated transmission contracts are competitively tendered to a wide range of suppliers, including:

- Specialists used to gather defining information through site studies and surveys.
- Designers using global experts on the design of transmission networks, where highly specialist knowledge is required.
- Equipment manufacturers providing assets, both locally and from around the world, including transformers, cables, switchgear, protection and control systems, and all other major plant items.

We also rely on a range of specialist contractors to undertake the construction work on site:

- Civil contractors to prepare the sites and the necessary infrastructure for us to access our assets. They also install the supporting foundations, construct the necessary buildings that hold and house our plant, protection and control systems.
- Specialist electrical contractors who are responsible for installing and commissioning electrical plant and equipment.
- Cable suppliers and installers.
- Overhead line contractors who build, paint and refurbish our pylons and replace the wires that are supported by them.
- Specialist demolition contractors who fully understand the works associated with the safe and environmentally responsible disposal of electrical assets.

Our supply chain provides the support and agility to respond to changes in workload over the course of a price review.

Our alternative supply chain model

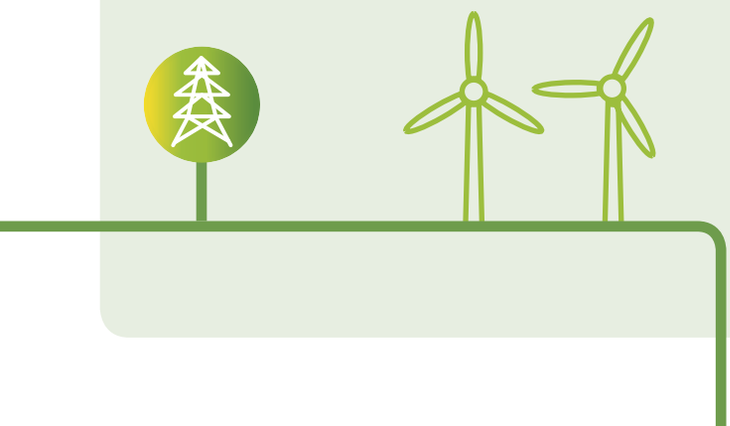
Throughout RIIO-T1, one of our major successes has been our ability to deliver our project plan efficiently, to a high quality, while maintaining excellent standards associated with health and safety and environmental compliance.

To achieve this, we are delivering a significant proportion of RIIO-T1 projects under an alternative model to the historic UK industry approach.

Typically, a network operator would deliver a major scheme by contracting with a single experienced large engineering, procurement and construction (EPC) contractor. They in turn would engage sub-contractors for aspects such as the civil works, main electrical, protection and demolition works. A margin on any subcontractor's cost would be added to cover management costs, profit and other items. The terms and conditions required for EPC contracts require acceptance of many of the risks associated with site conditions, detailed engineering, contractor performance and co-ordination between subcontractors. EPC contractors will include the costs of this risk, whether it materialises or not. The network operator may directly procure the significant main plant but in general, the EPC contractor would procure much of the equipment, again with associated margin.

Our model has moved us away from placing engineering, procurement and construction type contracts as standard and towards carrying out significantly more engineering and detailed design in-house and assuming roles previously adopted by a Principal Contractor. In essence, we act as our own EPC contractor. The benefits of this are:

- It avoids restricting our supply chain to only those capable of all components of works associated with a project.
- It allows greater ability to Identify internalize and manage risk.
- It allows greater flexibility in how scheduled work is designed and planned, giving greater control of development, deployment of innovation, and embedding of sustainable methodology from the onset.



We will continue to adapt and accelerate decarbonisation, enhance digitalisation, and invest in our supply chain. Our focus is always clear: a reliable, efficient and sustainable network.

This change has also allowed us to break out the works into component parts (disaggregation), and tender these in smaller supply and construct contracts. This has widened our supply chain from only 5 main contractors pre-T1, to more than 150 contractors who have worked with us during RIIO-T1. This has significantly increased tender competition.

Awarding contracts to more small and medium enterprises (SMEs) has also reduced many costs of subcontracted activities and promoted use of local labour. We have also leveraged the benefits of the wider Iberdrola global group to procure main items of plant and equipment at significantly lower cost.

In summary, our move away from a single EPC contracting strategy has created efficient and cost-effective delivery of large infrastructure projects. It has also opened up the markets to a wide range of new suppliers which would not have otherwise had the opportunity. Critically, we have maintained high levels of performance regarding health, safety, environment and quality.

A flexible model

We recognise that we need to be flexible. Sometimes we assess that disaggregation would not deliver efficiency benefits, or that the balance of technical expertise or knowledge necessary to introduce the best innovative solutions lies outside our organisation. In these cases, we would consider tendering under an alternative approach.

Service-type activities, smaller projects and some O & M programmes are considered for longer-term framework contracts, which will be competitively market tested. This supports strong long-term working relationships with our supply chain, while reducing tendering workload and costs.

On this basis, we will continue using our existing delivery model throughout RIIO-T2, alongside ongoing assessment of the potential benefits of options such as traditional EPC models and bespoke alternative, on a project-by-project basis; supported by individual Project Delivery strategies (PDS). This will enable us to continue to determine the most appropriate balance, and achieve the most cost-effective delivery model.

We have also made consideration within our programme of works to avoid short-term peaks and troughs of contractor requirements, specifically in individual disciplines. This reduces any risk of supplier over and under-capacity. We also believe that it's critical to promote a healthy supply chain relationship by endeavouring to maintain a relatively steady order book for suppliers throughout the full regulatory period.

Developing our supply chain

Our disaggregation of contracts has resulted in a wider supply chain base, and the introduction of a numerous smaller suppliers working with us. Despite some initial turnover of contractors entering and withdrawing from the market, we have now reached a level of maturity within our supply chain. This supports collaborative working and an increase in repeat contract awards to a recognised supplier base.

The quantity of works proposed for RIIO-T2 are representative of those within RIIO-T1. However, to make sure our enduring supply chain is capable, available and equipped for delivery of RIIO-T2, we are carrying out an in depth analysis of them meanwhile keeping them informed of RIIO-T2 developments through:

Supplier events – we have created forums for existing and new suppliers to engage with teams from across SPT, including procurement, to understand how we can involve them in our plans.

Newsletters – reaching a wider audience, these have provided suppliers with visibility of upcoming tenders, what we have achieved together, and our longer term plans.

Bilateral meetings – to allow for more detailed discussions on opportunities, take feedback, and consider how we can work together in more innovative and sustainable ways.

We've been keen to share the associated challenges and opportunities that we and our supply chain will face within the RIIO-T2 environment. We have discussed opportunities to work closer together to support alternative tendering and award approaches, provide opportunities to extend order books, support investment in local resources and reduce use of agency staff where possible.

Overall, we believe our approach is consistent with the need to build innovation, efficiency and sustainability into the way we deliver our RIIO-T2 plan.

Embracing markets and competition

6

In this section, we're going to look at competition. We have a responsibility to operate an economic, efficient and coordinated transmission network. We extensively use market driven competition to do this for the benefit of consumers, and we will continue to do so during RIIO-T2.

In recent years, we've taken a series of steps in developing our processes to further extend our use of competition.

Almost 96% of our regulated transmission construction activities are competitively tendered

96%

Native competition

Ensuring purchasing independence

As part of the wider Iberdrola Group, the ScottishPower Group's procurement resources are organised to drive purchasing independence and cost efficiencies – which benefit us at SPEN.

The Energy Networks Procurement team is part of ScottishPower Group's corporate procurement function, however is embedded within the Energy Networks business – their sole remit is delivering and managing purchasing and contracting for SPEN.

The Head of Energy Networks Procurement team reports directly to ScottishPower's Procurement and Insurance Director (and indirectly to Iberdrola's Global Head of Procurement). In order to actively promote procurement independence, the Head of Energy Networks Procurement has no reporting line into the CEO of SPEN or SPEN's Senior Management team.

The Head of Energy Networks Procurement, and his team, adhere to the Iberdrola Group's Purchasing Policy and UK Utilities Contract Regulations. The objectives of the team are set by SP's Procurement and Insurance Director and the Head of Energy Networks Procurement. These objectives are set with a specific focus on continuing to increase competition and savings in the tendering processes for SPEN.

The Energy Networks Procurement team is also responsible for delivering the SPT Annual Procurement Plan. This Procurement Plan looks one year in advance at forthcoming projects and contracts due to be procured. The Plan details the forthcoming tendering processes required – including the type, value and timescales for each of the tenders. Based on this Plan, team resourcing is adjusted to make sure the size of the procurement team is suitable for the volume of tendering work due over the coming year. This flexible approach to resourcing, ensures there is adequate staff resource during the identified forthcoming procurement peaks.

Operating an economic, efficient and coordinated network

We support competition in transmission, and are already delivering on this – with almost 96% of our regulated transmission construction activities tendered in the open market. The remaining 4%, covering both operational and maintenance activities, is deliberately delivered in-house due to the reactive and specialist nature of the work.

We also use our in-house team to undertake the more specialised maintenance activities for substations, routine overhead line repair works and some targeted minor refurbishment activities. However, high volume works such as tree felling, civils, overhead line refurbishment and cable maintenance are all openly tendered for.

Maximising our mobile workforce

Our expansive network covers parts of Scotland, England and Wales – that's why we strongly believe that delivering the more specialised maintenance activities using our in-house resources is the most cost-effective option for consumers.

In SPT, we have an 'internal' mobile workforce operating across Scotland, who can undertake this more specialised maintenance work. In addition to the cost benefits of managing a mobile, flexible workforce – this also allows us to effectively target our internal resources at, and be reactive to, urgent maintenance and repairs – optimising the security and reliability of our network.

As previously detailed we will continue to drive efficiencies through use of a flexible delivery strategy based around a disaggregated contracts model which has significantly increased tender competition.

Before the start of RIIO-T1, we only used 5 contractors. We are currently contracting with over 50 suppliers and have used in excess of 150 different suppliers throughout RIIO-T1. This includes a significant number of SMEs who, in the past, would only have operated as subcontractors for larger suppliers. We intend to build on this positive trend of awarding more contracts to SMEs throughout RIIO-T2.

This model has also significantly increased competition in tenders, with between 4 and 8 suppliers tendering for each package of works. This lets us continually pursue and identify ongoing cost efficiencies in the market, ensuring we manage our network costs effectively.

Our wider and flexible model has also resulted in the improvement of our own internal capabilities for commercial, contract and risk management. Such capabilities have enhanced our future design work, improved our internal decision making and resulted in better overall investments. In turn, this approach has undoubtedly developed and encouraged our staff to grow, utilising their wider range of knowledge and skills to the benefit of stakeholders and customers alike.

Full details of our disaggregated model, efficient delivery practices and pioneering supply chain engagement are in the previous section – **Supply Chain Dependency**.

Promoting additional purchasing flexibility

We have a responsibility to operate as an economic, efficient and coordinated transmission network. To achieve this, it's important that we have the utmost flexibility in contracting. In addition to the disaggregated model, SPT has access to a suite of additional purchasing tools and procedures.

We have framework agreements in place which, while limited in number due to the success of our disaggregated procurement model, offer additional benefits – particularly when purchasing in bulk or products with replicable design features. These frameworks are reviewed by the Energy Networks Procurement team on a weekly basis, through the use of framework status reports, taking into account existing and future work and accurately reflecting business need. These frameworks tend to last 3-5 years and are fixed in price for the duration of the framework period. At the end of the framework, each framework is reviewed and competitively tendered again in the market.

Our existing framework agreements are:

Equipment – we have significantly increased the purchase and free issue of main items of plant and overhead line conductors. This allows us to leverage full benefit of our Global Purchasing Model and standardized specifications.

Maintenance – these frameworks offer the business greater flexibility in relation to external maintenance activities, particularly for reactive work with tight delivery time frames.

In addition, we also have other purchasing tools to complement these framework agreements. These include:

Emergency Purchasing – a procedure used infrequently for work of an immediate nature which could not have been foreseen and limits the impacts of time associated with full tendering activities to a minimum.

SP Procurement Shared Services – utilised for lower value contracts up to £350k. This team was introduced to provide a quicker, more agile solution for SP, proportionate to the value/complexity of the contract.

As part of the wider Iberdrola Group, we also look to benefit from Iberdrola's strong presence in global markets. For significant, high-value purchases such as transformers, the Energy Networks Procurement team work alongside Iberdrola's Global Procurement team to access the global market and find items at a more competitive rate. Accessing this team opens up the global supply base to drive efficiencies for the benefit of SPT and GB consumers.

Continually expanding our supplier base

Our work to drive competition and savings helps us closely monitor developments in the supply chain, and continue to build on our existing supplier base. We achieve this by measuring the trends of suppliers tendering for particular contracts, identifying gaps in our supplier lists, and engaging directly with the supply chain to address such gaps for future tendering exercises.

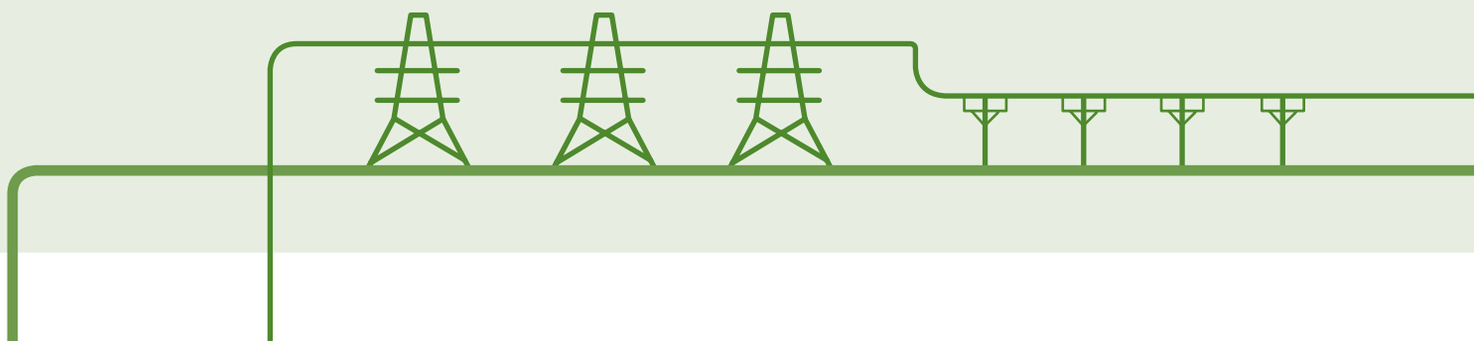
Meeting Ofgem's proposed principles of best practice

How our practices reflect Ofgem's principles

The recent request in the Sector Specific Methodology decision for a Competition Plan, which aligns with Ofgem's native competition best practice principles, will be submitted as part of the finalised Business Plan submission, given the time required to prepare such a Plan. In the meantime we have provided a high-level summary of how our practices reflect Ofgem's principles.

Accredited with our ISO 9001 Procurement Policy and Procedures status since 2013, we are confident that SP's existing procurement practices reflect Ofgem's Best Practice Principles, as set out in the table below.

Ofgem's proposed principles of best practice	SPT delivering best practice
Utilisation of competitive processes for all procurement and projects, except where the potential benefits of doing so are outweighed by the costs.	The Iberdrola Group's Purchasing Policy sets out a Global framework which recognises the importance of minimising the overall cost of the purchase of equipment & materials and contracts for works & services, guaranteeing the strategic alignment of awards, conformity of processes with the Group's internal regulations and strict compliance with applicable legislation as well as full respect of the ethical commitment by its Suppliers. This is enhanced by SP's Procurement Procedures which states the options to contract under these guiding principles.
The competitive process must be robust, transparent and provide equal treatment of potential bidders and protect information appropriately.	Tenders are managed under a common corporate model: procurement planning on the basis of annual Procurement Plans (in this instance the SPT Procurement Plan); within required budgets approved by SP Corporate Control and Administration; formalising the contractual relationship between SPT and a supplier. SPT's Procurement Plan is determined by the requirements of SPT, however the procurement process is independently managed by the Energy Networks Procurement Team to ensure transparency, fair and equal treatment of information between SPT and all suppliers. All communications during a tender process are facilitated by the Energy Networks Procurement team in order to ensure all tenderers are furnished with the same level of information and opportunity to submit questions. The SP Procurement Procedures sets out the steps each tender process must follow. The process is managed through an electronic based procurement system, the "Supplier Relationship Management" system, which has access limited to the relevant Energy Networks Procurement team members. The proposed award approvals are considered and ratified by a hierarchical Procurement chain of personnel that ensure the procedures have been adhered to and are in line with Group policy.
The complexity of the competitive process should be proportionate to the value and time-sensitivity of the project or system need in question.	The introduction of the SP Procurement Shared Services team in 2016/7 has provided SP with this ability to be agile. For purchases up to £350k, which are non-complex/strategic, the SP Procurement Shared Services team manage tenders with a primary focus on time before cost. The team follow the SP Procurement Procedures of fair and equal treatment of suppliers and by streamlining timescales. Using a simplified 2-step approval process, the team is able to reduce the time taken to award and provide a simpler route to market.



Ofgem's proposed principles of best practice	SPT delivering best practice
Any information must be provided equally to all parties, and any conflicts of interest have to be appropriately managed.	The "Supplier Relationship Management" system is accessible to all suppliers, subject to a simple registration process. Information on tenders can be found on this system as well as on SP's website. The role of the Energy Networks Procurement team is to support the relevant SPT Project Managers throughout the procurement process. It is the responsibility of the Energy Networks Procurement Team to ensure a consistency of approach in the information that is made available to all relevant parties, ensuring that answers to any technical questions raised are circulated to all parties. Pricing information during the tender process is withheld from SPT colleagues until a bidder has been determined as compliant by the Energy Networks Procurement Team. Conflicts of interest are managed during the tendering process with suppliers asked to raise any potential conflicts of interest in their bid. Where conflicts are identified, procurement and/or compliance colleagues will investigate the conflicts raised, before determining whether that party is permitted to tender for the particular contract. Internal procedures are also in place to deal with potential conflicts of interest within the Energy Networks Procurement Team itself, for example where a family relation works for a supplier. In such instances, the staff member cannot work on particular contracts of relevance to the supplier in question. Such arrangements are subject to the approval of SP's compliance team.
Licensees should be agnostic to technology and bidder type.	All specifications are checked by the Energy Networks Procurement team in order to ensure outputs are described, based on performance only. In order to proceed to tender for a purchase with a sole supplier, SPT project managers must provide to the Energy Networks Procurement team, a Single Source Proposal which explains the reason for not undertaking a competitive process. This approach must be signed off by an SPT Director to validate the explanation.
Competitions should be structured to generate outcomes in the interests of current and future consumers.	The Iberdrola Group adopts a "technically compliant, lowest cost" award model. Given this, the business users determine what constitutes the minimum technical compliance bearing in mind the needs of the current and future consumers. Once technical compliance is established with each tender submission, negotiations focus purely on compliance to commercial terms and conditions before the best and final offer to determine lowest cost.

Monitoring and governance procedures

In addition to the robust procurement procedures, detailed above, we also use thorough monitoring and reporting requirements to maintain the effectiveness of our procurement processes. These will be outlined in detailed in the recent request for a Competition Plan, which will be submitted with our finalised Business Plan.

Late Competition

We anticipate that the only project to fall within Ofgem's Competition Criteria of new, separable and high value (more than £100m) during the RIIO-T2 Price Control period will be the Eastern Subsea HVDC Link.

The details so far

The Eastern Subsea HVDC Link is a cross boundary project affecting all TOs. As a Strategic Wider Works (SWW) project, it falls outside the scope of this Business Plan. The details below are provided for illustration only.

Late Competition Models

In terms of the delivery of late competition models, we continue to hold the view that the 'early' CATO model is the only proposal put forward by Ofgem which delivers actual competition, allowing consumers to benefit from innovative solutions and efficiencies in the design, construction and delivery of transmission assets. Our long standing views on the Competition Proxy Model (CPM) and the Special Purpose Vehicle (SPV) remain unchanged. We consider both proposals unlawful and will in no way deliver actual competition to transmission, nor benefit consumers.

Project Name	Project Description	Size	Earliest in Service Date	Additional Comments
Eastern Subsea HVDC Link from Torness to Hawthorn Pit	Construction of a new offshore 2 GW HVDC subsea link from Torness area to Hawthorn Pit to provide additional transmission capacity. The onshore works involve the construction of AC/DC converter stations at Torness and Hawthorn Pit.	Approx. 2,000 MW	2027	Analysis is currently being undertaken by the three TOs supported by the ESO to ensure that this link delivers the best value for the consumer. Other options are being considered in combination with this, including a separate HVDC link out of Peterhead in the north, other landing points in the south, and an alternative onshore AC option. Findings from this work will be included within a SWW initial needs case, to be submitted to Ofgem in 2020.

Early Competition

Given the detailed requirements for early competition, as set out in Ofgem's Sector Specific Methodology decision, and the limited time to compile the requested information, further details on early competition will be included in SPT's finalised Business Plan submission.

In summary

We are proud of the extensive purchasing model we have developed and have confidence that it will continue to succeed. Our various procurement tools and extensive use of the Disaggregated Contracting Model provides us with considerable flexibility to engage with a wide range of suppliers and procure work from the market at competitive prices.

With almost 96% of our regulated transmission contracts already tendered in the open market, and a disaggregated procurement model which has allowed us to significantly expand our contractors, particularly SMEs, we intend to continue to utilise our existing procurement model, throughout the RIIO-T2 period. This model has, and will continue to, support SPT in operating an economic, efficient and coordinated transmission network, cost effectively. As recently requested by Ofgem, a full Competition Plan will be submitted with our final Business Plan, setting out SPT's procurement and competitive practices in greater detail.

This section considers the overall financing arrangements within our draft plan, an overview of our revenue and then an insight into how we have approached our financing plan. Much of our evidence is highly technical. The following pages provides an accessible summary of this detail. We will provide a full analysis within a dedicated Annex to our final business plan.

This section also addresses questions on appropriate cash flow levels, and appropriate shareholder remuneration.

We also explain our plan assumptions on capitalisation and regulatory depreciation, and how we adopted Ofgem's financial policies on the treatment of taxation and pension costs.

Our plan at a glance

We have set out the business plan assumptions which influence our revenues and regulatory asset value (RAV). All our assumptions are consistent with RIIO principles and are fully in line with Ofgem's Sector-Specific Methodology Decision (SSMD) document with the exception of cost of equity and dividends assumptions.

SP Transmission propose to collect revenue of £1.8bn (Average £363m p.a) for the 5 year RIIO-T2 period in 18/19 prices (excluding incentives). This compares to the 8 year period of RIIO-T1 of £2.5bn (Average £313m p.a).

The average annual increase in base revenue for the RIIO-T2 period is largely driven by the increase in the RAV over RIIO-T1.

We conclude that we require a cost of equity of 6.5% to enable us to attract and retain sufficient equity finance. In our Cost of Equity section we provide justification for the 6.5% cost of equity used in our business plan.

We assume 60% notional gearing in both our financial scenarios, which reflects Ofgem's guidelines.

Financing our Plan Efficiently

In this section, we'll outline each of the following areas in more detail to show how we reached our financing conclusions.

Cost of Debt, *Pg 176*
In our plan we have adopted Ofgem's policy of indexation, choosing to use a longer trailing average of the iBoxx indices (the 11-15 year 'Trombone'). We explain where we disagree with Ofgem, and recommend alternative calibrations to the index mechanism.

Cost of Equity, *Pg 177*
We examine Ofgem's methodology, and offer a fair alternative proposal based on economic and financial principles.

Notional gearing, *Pg 182*
We introduce cash flow risk. We also test that our proposal delivers acceptable upside and downside potential from the price control package, using Return on Regulatory Equity (RoRE) analysis.

Financeability, *Pg 185*
We carry out 'static' (or, in other words, non-probabilistic) testing. This ensures an expectation of a comfortable investment grade credit rating – but no higher.

Efficiency and financeability, *Pg 190*
We further test our plan by conducting a comprehensive probabilistic risk analysis, using a framework developed in conjunction with our economic advisers NERA. This is designed to test our plan against external shocks.

The financial inputs

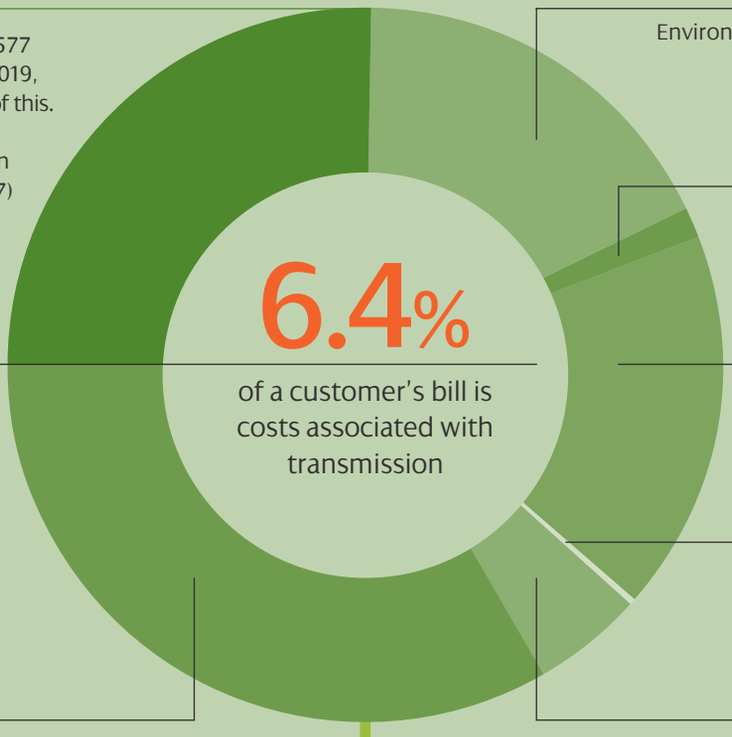
Parameters	Assumptions Ofgem	SPT
Cost of Equity	4.80%	6.50%
Cost of Debt	iBoxx 11-15 year Trombone	
Notional gearing	60%	60%
Financeability adjustment	None	
Capitalisation rate	85%	85%
Dividend yield	3.0%	4.0%
Credit rating	Baa1 to A3	
Other policies	Per Ofgem	

Based on our current assumptions, we will not need to implement any further financeability adjustments. However, this could change if our input assumptions have to be altered during the business plan process.

Customer bills

The average UK customer's electricity bill is £577 – based on the latest Ofgem analysis in May 2019, network charges account for £147 or 25.5% of this.

We have calculated that the Network costs can be split into transmission charges at 6.4%(£37) and distribution charges at 19.1% (£110).



25.5%
Network costs

17.5%
Environmental/Social obligation

1.3%
Other direct costs

17.2%
Operating costs

0.4%
Supplier pre-tax margin

33.5%
Wholesale costs

4.8%
VAT

Our revenues

We have two strands of base revenue that finance of our plan. Here, we provide some context on revenues before detailing our financial plans in full.

Our average revenues explained

We have two strands of revenue. On the one hand, we have revenue directly associated with past capital investment. This is referred to as regulated asset value (RAV) revenue, and includes depreciation and return.

On the other, we have revenue related to the day-to-day running of the network (not RAV-associated). This revenue pays for a wide range of items, including network upkeep and maintenance, taxes (such as corporation tax), and business rates.

Our average annual increase in base revenue for the RIIO-T2 period mainly reflects the increase in our RAV-related revenues. These revenues are shaped by the scale of past investment; during RIIO-T1 we made a substantial investment across our franchise area.

We forecast that RAV-related revenues relating to the opening RAV of £2.5bn will be greater than 85% of revenue associated with the RAV.

Set by Ofgem, recovered through National Grid

Our revenues are set by Ofgem. They are based on proposed investments and commitments we agree with Ofgem through the business plan process.

Our revenues are a combination of elements which are:

Fixed – based on us delivering agreed outputs in the future

Variable – due to uncertainty about the future, such as the amount of connected generation

Incentives and adjustments from previous years – and price controls.

We recover our revenues through charges to the system operator, National Grid. National Grid, in turn, levies charges to generators, networks and end consumers. The charges are collected by the energy retailers through electricity bills.

The table shows our proposed base revenues at this stage of the price control for the five-year RIIO-T2 period, giving an annual average of £355m. Over the eight-year period for RIIO-T1 our total revenue was £2.5bn – an annual average £313m.

Our forecast revenues for RIIO-T2 and in comparison with RIIO-T1 *(7.0% RPI basis)*

£m (2018/19 Prices)

	RIIO-T2 based on a CoE 6.5% CPIH basis						Averages		
	21/22	22/23	23/24	24/25	25/26	**Total**	RIIO-T2	RIIO-T1	Variance
Depreciation	166.6	177.8	182.0	179.7	158.8	**864.9**	173	140	+33
Return	95.3	102.0	105.3	107.3	107.8	**517.8**	104	89	+15
Revenue associated with RAV	**262.0**	**279.8**	**287.3**	**287.0**	**266.6**	**1382.7**	**276**	**229**	**+48**
Fast Pot	42.6	54.6	48.3	38.6	29.8	**214.0**	43	29	+14
Non-Controllable Open (Rates)	34.2	34.9	34.7	34.5	37.0	**175.3**	35	32	+3
Equity Issuance Costs	0.0	0.0	0.0	0.0	0.0	**0.0**	0	1	*-1*
Additional Income	0.0	0.0	0.0	0.0	0.0	**0.0**	0	11	*-11*
Tax allowance	18.5	21.1	20.0	17.5	11.7	**88.9**	18	13	+5
Other	*-7.7*	*-8.3*	*-9.6*	*-10.4*	*-10.2*	***-46.2***	*-9*	*-2*	*-7*
Revenue not associated with RAV	**87.7**	**102.4**	**93.3**	**80.2**	**68.2**	**431.9**	**87**	**84**	*+3*
Allowed Baseline Revenues	**349.7**	**382.2**	**380.6**	**367.2**	**334.8**	**1814.5**	**363**	**313**	**+51**

*the figures above are calculated using the working assumptions (Inflation etc.), with the exception of CoE, published by Ofgem in the Sector Specific Methodology Decision document – May 2019.

Establishing Cost of Debt

Network companies need revenue to service their long-term debt, and this needs to reflect the actual costs of financing this efficiently incurred debt.

We use Ofgem's working assumption for the cost of debt index. This is calculated from the 11-15 year Trombone[1] trailing average of the yields on iBoxx A and BBB rated sterling non-financial bond indices with a maturity of more than ten years, less the expectation of CPIH inflation by using the Office of Budget Responsibility's (OBR) long-term CPI forecast.

We support the recalibration of the RIIO-1 index. NERA's modelling of Transmission operators' debt performance over RIIO-2 under their existing mechanisms show that the transmission sector would be expected to underperform the debt allowance[2]. This emphasises the need to re-calibrate the allowance mechanism in order to address expected underperformance.

In our business plan we have based our financial modelling on an average cost of debt of 1.93% (CPIH) – this is the average value of the iBoxx 11-15 year Trombone over the RIIO-2 period, as can been seen in table below.

Nevertheless, the cost of debt index is expected to continue to fall up until the start of RIIO-T2 and remain below 2% throughout the price control period.

Implied cost of debt estimate over RIIO-T2
Forward rates on 20-year UK gilt, %

iBoxx Trombone A/BBB	21/22	22/23	23/24	24/25	25/26	**Avg**
Nominal	4.07	4.00	3.95	3.92	3.89	**3.97**
CPIH	2.03	1.96	1.91	1.88	1.86	**1.93**

Our view

A move to a longer trailing average for the cost of debt index would provide network companies with an allowance that is more reflective of the actual cost of financing their efficiently incurred long-term debt i.e. providing companies with sufficient revenue to service their debt costs.

We believe in a simple average approach to calibrating the cost of debt mechanism, as setting this based on a weighted average would be akin to a pass-through for the largest network in the sector[3] and would fail to treat the other companies' actual debt costs.

We consider our approach to be correct for deriving a CPIH real allowance utilising the inflation measure used to index our RAV i.e. outturn CPIH. This methodology would largely mitigate risk for investors in recovering nominal debt costs[4]. Although it does risk introducing volatility in the allowed real debt component of revenues, this could be mitigated by utilising a suitable trailing average of outturn inflation.

Using an expectation of CPIH (OBR's CPI forecast) to deflate the nominal iBoxx indices is preferable compared to the RPI breakeven inflation approach plus an expected RPI-CPIH wedge adjustment, as it is a more appropriate measure of long-term inflation and would remove the reliance of RPI in a CPIH-based price control. This deflationary approach, however, needs to be further developed given that it may accentuate risk due to the co-variation in nominal debt costs and inflation[5] and through the use of CPI forecasts as a proxy for expected CPIH[6]. Issues could be mitigated by trueing up the CPI forecast for actual CPIH inflation when known.

Lastly, no adjustments should be made to account for the so called 'halo effect'[7] given the lacking evidence-base to support it[8]. An explicit allowance for debt transaction, liquidity and cost-of-carry should therefore be provided to companies to compensate for the unavoidable costs associated with raising debt financing. Such an allowance has been supported by regulatory precedent. Further evidence will be provided in the December business plan submission following subsequent analysis.

To finance the investments that allow us to meet our goals, we need a workable level of allowed returns. We've examined Ofgem's proposals, set out where we disagree and offer a fair, evidence-based alternative proposal.

1. The length of the trailing average will start at 11 years for the first year of RIIO-2 and advance by a year each year, trombone-like, until the end of RIIO-2 where the period length will reach 15 years.
2. NERA (March 2018), "Cost of Debt at RIIO-2", a report for the ENA
3. Which in the case of the Transmission sector would be NGET.
4. The inflation element of the cost of debt is recovered from the capital gain on the RAV and the remaining real element is recovered as a return on the RAV.
5. With an allowance set based on the outturn nominal iBoxx yields and a fixed inflation expectation, a fall in inflation would result in a decrease in the real cost of debt allowance, leading to an under-recovery of debt costs.
6. The divergence between CPI and CPIH would have unintended financial ramifications.
7. The assumption is that network companies have raised debt at rates less than the iBoxx benchmark.
8. NERA (March 2018), "Cost of Debt at RIIO-2", a report for the ENA

Establishing Cost of Equity

Cost of Equity (CoE) represents the return shareholders require for providing their capital to a company, proportionate to the risk faced by the company.

CoE is the minimum return we need to attract and retain equity financing in our business, so that we're able to fund our investments.

We have commissioned a third-party report (NERA) to provide us with an independent assessment of the cost of equity. The report is included within the supporting annexes (appendix 9). It has helped to inform our position on what we believe is a fair and appropriate range for the parameter for RIIO-T2.

Evidence supports a CoE within the range of around 6.5% real (CPIH), post-tax. Recently, water companies have submitted their Business Plans to the UK water regulator, Ofwat. Despite the fact that water companies are less risky than energy networks Ofwat has recognised a return of 5.00% CPIH, a return that is 20bps higher than Ofgem's working assumption.

In contrast to the cost of debt, the cost of equity cannot be directly observed. Regulators routinely set a forward-looking allowance for the cost of equity using asset pricing models. We have relied on the application of the Capital Asset Pricing Model (CAPM), which is Ofgem's preferred framework for RIIO-2.

Under the CAPM framework, the return required by equity investors consists of the return on a risk-free investment and a risk premium that reflects the risk involved in a particular equity investment. This is estimated as the product of the risk premium on the equity market as a whole (i.e. equity risk premium) and the equity beta, a measure of the riskiness of a particular equity investment relative to the equity market. By construction, the equity risk premium (ERP) is calculated as the residual between the total market return (TMR) and the risk free rate of return (RFR). The TMR is the expected return on the market portfolio[9]. Formally, the CAPM equation for the cost of equity can be defined as:

$$\text{Cost of Equity} = \textit{risk-free rate} + \textit{beta} \times (\textit{total market return} - \textit{risk-free rate})$$

Risk-free rate and cost of equity indexation

The risk-free rate (RFR) is generally estimated with reference to yields on government issued bonds (or 'gilts') with strong credit ratings, as they are considered a suitable proxy for the RFR given their negligible default risk. In the past, Ofgem generally relied on a combination of long-run and short-run market evidence on yields from long-dated gilts when setting a fixed, forward-looking RFR. However, as we have adopted Ofgem's cost of equity indexation mechanism, which adjusts the cost of equity annually based on changes in the RFR, we instead rely exclusively on spot market evidence on long-dated UK gilt yields.

Ofgem's approach is to derive a CPIH- real RFR by applying an expected RPI-CPIH wedge to the average yields on the 20-year RPI-linked gilts (ILGs).

For the purposes of our business plan submission, we have adopted Ofgem's average real RFR RIIO-2 working assumption of -0.75%[10] on a CPIH basis. We acknowledge that this estimate will be updated for latest market evidence as we get closer to the start of RIIO-T2.

Our view

For a CPIH based price control a more objective and suitable measure of the real RFR would be to deflate nominal 20-year gilts by expected CPIH inflation. This approach would lead to a more objective, stable and less complex cost of equity index and is preferable to Ofgem's approach, which continues to use breakeven inflation and retains the use of RPI in a CPIH-based price control[11]. The deflationary approach is also consistent with that suggested for the cost of debt mechanism.

As an indication, the table below sets out expected movement in the RFR over the RIIO-T2 period, based on forward rates of the 20-year nominal UK gilt and deflated by the OBR's long-run CPIH expectation of 2.00%. As can be seen, forward rate evidence indicates that the market expects a moderate increase in yields during RIIO-T2.

Implied risk-free rate estimate over RIIO-T2
Forward rates on 20-year UK gilt, %

	21/22	22/23	23/24	24/25	25/26	**Avg**
Nominal	1.70	1.76	1.82	1.86	1.89	**1.81**
CPIH	-0.33	-0.27	-0.22	-0.18	-0.14	-0.23

Forward rates are based on 20-year nominal spot rates as of 29 March 2019 to remain consistent with date used by Ofgem for their working assumption. The RFR is set equal to the October forward rate for the preceding financial year e.g. 2022/23 RFR is based on October 2021 forward rate.

In the case where the move to cost of equity indexation does not occur we would recommend a real RFR estimate of 1.25% (RPI). In line with UK regulators, as well as the CMA, this estimate is set based on a combination of long-run and short-run market evidence on yields from long-dated gilts, with greater weight placed on long-run evidence and adjustments to short-term evidence to incorporate expected changes in rates.

9. The market portfolio is a portfolio consisting of all stocks where the proportion invested in each stock corresponds to its relative market value. Measured by a broad market index such as the FTSE All-share.
10. Based on the spot rate and the forward curve of the 20yr ILG, as of 29th March 2019
11. The breakeven inflation implicit in the RPI-linked gilt market is a poor measure of inflation, particularly at the long-end given the excess demand from pension funds for real gilts. The RPI-CPIH wedge also adds further complexity to the derivation and variations between forecasts and outturn RPI-CPIH wedge, as well as differences between CPI and CPIH, could present NPV neutrality concerns.

Estimating total market return ranges

The total marker return (TMR) is the expected return available to investors for investing in the equity market as a whole. We consider that the TMR is the most appropriate basis on which to derive the allowed cost of equity, as it's the most stable component of the cost of equity. This approach, commonly referred to as the TMR approach, involves estimating the TMR and RFR directly, and calculating the equity risk premium (ERP) as the difference between the two.

The stability of the TMR over time has been supported by empirical evidence and financial literature affirming an inverse relationship between the RFR and the ERP, which have been volatile over time. A constant estimate of the ERP – assumed in previous determinations – mixed with a fluctuating RFR would therefore produce a volatile TMR value, and hence a more volatile cost of equity allowance.

The use of a TMR approach is consistent with UK regulatory precedent, including the CMA[12], and has been adopted by Ofgem for RIIO-2.

Ofgem's approach is to base their real TMR estimate on long-run historical averages and using forward-looking approaches as a cross-check. This approach has led Ofgem to setting a 6.25-6.75% (real, CPIH) TMR range, placing significant weight on the long-run realised average returns range of 6-7% (real, CPIH) or 5-6% (real, RPI) cited in the 2018 UKRN report.

The UKRN report estimate is considered to be downwardly biased due to the reliance on a flawed historical inflation measure and not making a full adjustment for the difference between geometric and arithmetic returns. Ofgem present forward-looking DGM estimates from CEPA, as well as investment managers' forecasts, which all support a reduction in the TMR. However, CEPA's DGM estimates of the TMR are understated as a result of undue reliance on UK GDP growth as a basis of dividend forecasts, and the investor expectations of returns is an unreliable source of evidence and should be attributed little weight as confirmed by academic research and precedent.

Our view

Despite the use of a similar methodology for estimating the TMR, we estimate a real TMR range of 6.2-6.8% (RPI), or 7.3-7.9% in CPIH terms[13]. The difference between our and Ofgem's estimates relates to how we have interpreted the evidence to inform the expected real TMR.

Our determination is based on an update of the evidence base considered by the CMA in its NIE 2014 determination. The CMA primarily relied on long-run historical realised equity market returns, as well as taking into account forward-looking approaches as a cross-check. Like Ofgem, we rely on long-run historical realised returns as the primary source of evidence. We consider that they provide an unbiased and objective estimate of investors' future expectations of equity market returns due to the parameters stability over time.

Our long-run historical estimate is informed by evidence considered by the CMA in its NIE 2014 decision and updating it to account for recent data. The CMA drew on the Dimson, Marsh and Staunton (DMS) database as the basis for its long-run historical estimate. The DMS database provides long-term time series data on returns on stocks, bonds, bills as well as inflation over the period since 1900. It is the standard reference point for UK regulators, including the CMA, as well as financial practitioners.

There is debate around which is the most appropriate averaging method when estimating historical average realised returns. The academic literature and analytical studies are broadly supportive of placing greater weight on arithmetic rather than geometric averages for estimating historical realised returns to use when computing the expected TMR[14].

When arriving at its historical TMR estimate in its 2014 NIE decision, the CMA utilised a number of different unbiased measures of expected returns, which include simple and overlapping arithmetic averages, as well as 'Blume' and 'JKM' estimators[15], differentiated by holding periods.

The table below shows an update to the CMA calculations using the 2018 DMS publication data over the period 1900-2017.

Long-run DMS TMR estimates
Different averaging methods and holding periods

(real, RPI) %	Simple	Overlapping	Blume	JKM
1Y Holding	7.1	7.1	7.1	7.1
2Y Holding	6.6	7.0	7.1	7.1
5Y Holding	6.7	6.8	7.0	7.0
10Y Holding	6.8	6.7	7.0	6.7
20Y Holding	7.1	6.8	6.8	6.2

NERA's analysis of the DMS Credit Suisse Global Investment Returns Yearbook 2018. The 2018 DMS publication includes real returns for the UK market since 1988 which have been calculated using CPI as opposed to RPI inflation. To ensure consistent treatment of inflation, the real UK historical returns have been re-calculated to be based on a RPI deflated basis.

12. From CMA (March 2014), NIE Limited price determination, p. 13-16, para. 13.82: "Our preferred approach is to deduct our estimate of the RFR from our estimate of the equity market return [TMR] to derive the ERP. […] the market return has tended to be less volatile than the ERP […], and there is some evidence of the ERP being negatively correlated with Treasury bill rates over the short term. " 13. Converted by applying Ofgem's expected RPI-CPIH wedge through the use of the Fisher equation: (1+6.5%) x (1+1.049%)-1.
14. See: Dimson, E., Marsh, P. and Staunton, M. (2015), 'Credit Suisse Investment Returns Sourcebook 2015', p. 34; Cooper, I. (1996), 'Arithmetic versus geometric mean estimators: Setting discount rates for capital budgeting', European Financial Management, 2:2, p. 157; and Jacquier, E., Kane, A. and Marcus, A. J. (2003), 'Geometric or Arithmetic Mean: A Reconsideration', Financial Analyst Journal, November/December.
15. Both estimators provide weighted averages of arithmetic and geometric means to provide unbiased estimates of the forward-looking TMR, depending on the assumption of the typical holding period – greater weight is placed on the arithmetic mean the shorter the investment horizon is relative to the historical period.

Based on empirical evidence of typical investor holding period, the TMR should be estimated on the basis of 1 to 5 year holding periods. No weight is placed on the simple average as the number of observations is relatively limited for holding periods up to 5 years. Taking these considerations into account supports a historical RPI-real returns range of 6.8-7.1%. A CPI historical returns equivalent can be determined by applying a historical RPI-CPI wedge estimate of 47-72bps to the derived historical RPI-real TMR range[16]. This supports a real CPI forward looking return of 7.3-7.9%, or 6.2-6.8% if expressed in RPI-terms.

Taken together, the above evidence supports a real forward-looking TMR value of 6.2-6.8% (RPI).

As an alternative to the long-run historical approach, the TMR can be calculated based on forward-looking evidence, as derived using the dividend growth model (DGM). The DGM derives a discount rate which sets the present value of projected future dividends equal to the current share price. If applied to the entire market index, the discount rate implied by the DGM reflects the expected return on the whole market (the TMR). As utilised by regulators and practitioners, we use evidence from the DGM as a cross-check to the real TMR estimates derived from long-run historical data.

We have considered estimates from the Bank of England's (BoE's) DGM, which derives the TMR for the FTSE All Share index, using equity analyst estimates of short-term dividend growth, and a long-run dividend growth assumption based on long-run GDP growth estimates for the different regions from which FTSE All Share companies derive their earnings. Table 8.4 shows the results from the BoE's DGM, using spot (March 2017 in line with latest data from the BoE) as well as 1 and 5 year historical averaging periods, in order to smooth for volatility.

Bank of England DGM TMR
Estimates

(real, RPI) %	Spot (March 17)	1yr Average (March 17)	5yr Average (March 17)
Average RFR	7.2	7.3	7.8
Long-run RFR	7.6	7.6	8.1

Source: NERA analysis of Bank of England (2017), An improved model for understanding equity prices, Quarterly Bulletin 2017Q2, p.94 and Bank of England yield curve data using March 2017 as cut-off date (later data from BoE on the TMR not available).

Depending on the averaging period, the forward-looking estimates of the real TMR, based on the BoE's DGM, lie in a range of 7.2-8.1% (real, RPI) or 8.32-9.23% in CPIH, which is higher than the long-run historical average estimates. However, we consider that this evidence should be treated with caution, given the relative sensitivity of the results to the long-term dividend growth assumption. Considering there are no independent analyst forecasts for these, DGM estimates should only be used only as a cross-check on the TMR estimated from long-run historical returns data.

In recognising the benefit of predictability and stability in a regulatory framework, we deem it appropriate to attribute more weight to evidence from historical realised returns than that of individual forward-looking projections. We therefore conclude on a real TMR range of 6.2-6.8% (RPI) or 7.3-7.9% in CPIH terms.

Estimating equity and asset beta

According to the CAPM, the return required by equity investors is a direct function of a company's exposure to systematic risk (i.e. non-diversifiable risk)[17]. The larger the level of systematic risk, the higher the return is required by equity investors. This is captured in the CAPM by the equity beta, which reflects the relative risk of a company or investment to the market as a whole.

Whilst the equity beta captures both the financial and overall business risk for a company or sector, it can be adjusted for the effects of leverage (i.e. financial risk) to estimate the asset beta. The asset beta is independent of the choice of capital structure and is therefore a more relevant measure of the fundamental business risk of a company/sector[18]. Obtaining the asset beta also requires an estimate of the debt beta, which represents the risk for debt investors.

The estimation of the equity beta should ideally be forward-looking, but the estimation relies on the interpretation of historical market data. The equity beta is derived by estimating the correlation between the returns on a stock and a benchmark stock market index. This is generally done by using the ordinary least squares (OLS) econometric method[19].

The equity beta estimation needs to take into consideration the frequency of the data and the time period over which betas are assessed. Both should be considered together to ensure sufficient observations in the regression, which lead to precise estimates, i.e. estimates with relatively low standard errors. Using high frequency data (e.g. daily and weekly) and longer estimation periods can achieve this. However, longer time period may be less relevant for assessing the forward-looking beta as they can lead to the inclusion of older data points in the estimation which may not be representative of a company's current, or future, exposure to risk.

However, for businesses that are not listed (such as SPT) it is not possible to calculate a direct estimate of its equity beta. The absence of stock market data is overcome by calculating the equity betas of listed companies with comparable operations and/or risk profiles. These are then adjusted by their respective capital structures ('de-levered') in order to obtain asset betas. The asset betas are then re-levered at the proposed notional gearing level to estimate the company's appropriate equity beta.

Ofgem's proposed approach for estimating the beta has not been properly justified and is technically flawed – particularly in reference to the reliance on long term beta estimates and the new leveraging and de-leveraging adjustment to the equity beta values. We do not consider that there is sufficient rationale to adopt such a significantly different approach, and that the common regulatory practice of estimating betas – one that has also been adopted by other regulators in recent determinations – is a more appropriate and justified approach.

16. The lower bound for the historical wedge draws on the ONS backcast CPI-series from 1950-88, whereas the upper bound is based on data since 1989, when CPI is available as official ONS statistic.
17. The degree of systematic risk associated with any particular investment depends on the relationship between movements in returns on that investment and returns on the market portfolio.
18. The asset beta is calculated as: $\beta\_A=\beta\_E^{*}(1-gearing)+\beta\_D^{*}gearing$
19. The traditional OLS approach invoves regressing actual stock returns against market returns of a given benchmark market index (e.g. FTSE All-share index).

Our view

NERA has carried out empirical beta analysis using market stock and index return data on a selection of listed UK regulated utility comparator companies. This enables them to derive the appropriate asset beta for SPT in RIIO-T2, relying on relatively recent estimation windows (2- and 5-year periods) combined with high frequency data.

As set out in the table below, asset beta estimates for National Grid plc, SSE, UU, Severn Trent and Pennon have increased considerably since the height of the financial crisis in Europe (2011-2012) and the RIIO-T1 determination in 2013. The average asset beta of UK networks stands at 0.34-0.39, or 0.32-0.35 if SSE is excluded[20]. This rise indicates a reversal of the decline in asset betas which came about as a result of the 'flight to quality' following the global financial crisis[21] i.e. the market's view of equity risk has increased. Little, if any, weight should therefore be placed on the asset betas from the period 2011 to 2014.

Empirical 2-year asset beta estimates
For UK energy and water network companies

Cut-off:	17 December 2012			**8 February 2019**		
	1Y	2Y	5Y	**1Y**	**2Y**	**5Y**
National Grid	0.21	0.22	0.28	**0.33**	**0.39**	**0.38**
SSE	0.32	0.36	0.41	**0.39**	**0.41**	**0.55**
United Utilities	0.17	0.20	0.26	**0.24**	**0.27**	**0.33**
Severn Trent	0.22	0.24	0.26	**0.25**	**0.29**	**0.34**
Pennon	0.26	0.29	0.27	**0.28**	**0.34**	**0.38**
Average	**0.24**	**0.26**	**0.30**	0.30	0.34	0.39
Average (excl. SSE)	**0.22**	**0.24**	**0.27**	**0.27**	**0.32**	**0.35**

Source: NERA analysis, Bloomberg, daily data, reference index: FTSE All Share

We also assume a debt beta assumption of zero. Analogous to the equity beta, the debt beta captures the degree of correlation between the returns to debt-holders and the broader economy. Most practitioners have assumed a zero debt beta – the UKRN report provides empirical evidence that the debt beta for UK energy networks is likely to be close to zero when using daily data. It is of note that, as confirmed by the CMA, overall the assumed debt beta has a negligible impact on the equity beta and cost of capital, assuming de-leveraging and leveraging is undertaken correctly.[22, 23]

We consider that NG is the most direct comparator for SPT, as the only listed energy network[24], and that therefore selecting an asset beta for SPT in line with that estimated for NG is appropriate. NG plc's two-year asset beta sits toward the top-end of the range compared to the other comparators at 0.38-0.39. However, NG plc's composite beta reflects the combined systematic riskiness of NG plc's UK and US operations. Despite comprising a similar share of NG plc's overall regulated asset base, their US operations are subject to regulatory regimes which impose lower risks on investors[25]. Simply taking the NG group beta estimates thus risks understating the true systematic risk faced by UK energy networks.

By decomposing NG's beta into a UK and a US component, NERA derive an asset beta range for NG's UK component between 0.46 to 0.57, depending on estimation window, as shown in the table below. This result is consistent with that produced by Indepen for their National Grid beta decomposition example.[26]

NG plc asset beta decomposition
Estimation

	NG Overall	US	UK
Share of regulated assets most direct comparators		*41%*	*59%*
2Y Beta	0.39	0.13	**0.57**
5Y Beta	0.38	0.21	**0.49**
all comparators			
2Y Beta	0.39	0.16	**0.55**
5Y Beta	0.38	0.26	**0.46**

Source: NERA analysis, Bloomberg

Given the differences between the risks faced by UK water and energy networks, we do not consider it appropriate to place equal weight on beta estimates from all UK listed utilities when selecting an asset beta for SPT. More weight should be placed on those estimated from other energy network companies over those of water companies. In addition to differences in the regulatory frameworks, investors in energy networks face higher risks than those for water companies. This is due to greater system operability risks and greater exposure to asset stranding risk, due to the government's decarbonisation plans. TOs also face greater risks than most other energy networks from the relative complexity of the investment programme, extended competition models, and uncertainty regarding TOs future role due to distributed generation.

NERA's water beta estimates and comparative risk analysis, as well as regulatory precedent, support the above assertion that energy networks face greater risk than water networks.

20. SSE is predominantly a non-network business, and its beta shows volatility over recent periods because of the effect of Brexit. The pure networks' businesses are less affected.
21. During this period, investors became more risk-averse and reallocated their portfolios towards less risky assets such as regulated utilities.
22. The assumed debt beta affects the notional cost of equity only to the extent that leverage for the comparators differs from the notional assumption. If empirical leverage is the same as notional and consistent debt betas are used for un-levering and re-levering, there is no impact on the re-levered cost of equity.
23. For example, at the BW 2015 appeal, the CMA assumed a debt beta of zero, noting that debt beta has very little impact on the overall cost of capital as BW's notional gearing level was similar to the comparators.
24. SSE is pre-dominantly a non-network business with significant share of generation and supply activities.
25. US regulatory regimes impose lower risks on investors due to a number of factors, including: some assets are regulated under cost-plus rather than incentive regulation; objective methods for setting cost allowances; less stringent financial output incentives; and, greater investor security offered by court based proceedings which have enshrined property rights and prudence standards" which imposes a high evidentiary bar for the disallowance of costs.
26. Indepen (2018), Ofgem Beta Study – RIIO-2 Main Report

In line with recommendations from Oxera and Citizens Advice, as well as UK and European regulatory precedent, we take into consideration empirically estimated betas from international comparators[27]. These can provide an appropriate benchmark for a UK regulated network, provided a relative risk analysis is conducted. NERA, as well as Oxera[28], have found that the equity betas of comparator European energy networks closely track the equity beta of National Grid. This is consistent with investors' viewing these businesses as having similar systematic risk profiles.

NERA's evidence of estimated betas for Spanish and Italian network comparators supports an asset beta of around 0.4 on average over the most recent 2-year period. Coupled with a relative risk assessment between the regimes, which suggests that Italian and Spanish networks face broadly similar risks to SPT, the 0.4 asset beta provides a relevant benchmark for SPT.

Taking into account the evidence above, we propose an asset beta range of at 0.37-0.45 for SPT in RIIO-T2. The lower bound is based on the evidence from the empirically estimated betas for NG and European comparators, considering that SPT's beta should be at least as high as NG plc's, as well with beta estimates from the UK listed water companies. More weight is placed on the evidence from NG and European energy companies over those of water companies given the differences between the risks faced by UK water and energy networks.

The upper bound is taken as the mid-point between NG plc's asset beta and the decomposition of the UK NG plc's beta. Although we do consider that NG plc's beta is likely to understate UK energy network risk given its US operations, we do not place notable weight on the decomposed UK NG beta given the absence of wider evidence to support this assumption and the scope for statistical error in decomposing group betas into their constituent elements.

The equity beta must be 're-levered' to be consistent with the notional gearing assumed for the price control. In line with Ofgem's point estimate, we have assumed a 60% notional gearing for SPT over RIIO-T2. Re-levering for the notional gearing assumption results in a notional equity beta range of 0.93-1.13.

We believe that the SPT asset beta for RIIO-T2 should be at least 0.37 given that the wider empirical evidence shows that beta risk has increased since the RIIO-T1 determination. Our asset beta range is in line with those set in the RIIO-T1 and RIIO-ED1 determinations.

Conclusion

Taking a balanced consideration of the economic evidence outlined in the previous sections, evidence supports a cost of equity of at least 6.5% in post-tax, CPIH terms which in fact falls below our Cost of Equity estimations based on the available CAPM evidence (see below). We believe this provides an appropriate return for shareholders considering the risks facing the Transmission sector over the RIIO-T2 price control, thereby ensuring that the investment required to provide for a safe and reliable electricity supply to our customers from our networks can be met.

Our proposal is made on the basis that our uncertainty mechanism proposals are accepted. If network companies are expected to take on further risk over RIIO-T2 (e.g. 'no deal' Brexit and further political risk), then the level of returns that equity holders require would need to be reassessed.

CAPM implied Cost of Equity for RIIO-T2
CAPM components, %

	SPT RPI		SPT CPIH	
Range:	*(low)*	*(high)*	*(low)*	*(high)*
Gearing	60	60	60	60
Risk-free Rate	*-1.78*	*-1.78*	*-0.75*	*-0.75*
Total Market Return	6.20	6.80	7.31	7.92
Equity Risk Premium	7.98	8.58	8.06	8.67
Asset Beta	0.37	0.45	0.37	0.45
Debt Beta	0	0	0	0
Equity Beta	0.93	1.13	0.93	1.13
Cost of Equity	**5.42**	**7.87**	**6.71**	**9.00**

Despite their inherent lower risks, Ofwat has recently recognised a return of 5.00% CPIH for water companies.

27. For example, the CAA in its 2014 price review for Heathrow and Gatwick estimated an asset beta by reviewing evidence from airports from countries such as Germany (Fraport) and France (ADP): CAA (2014), Estimating the cost of capital: technical appendix for the economic regulation of Heathrow and Gatwick from April 2014: Notices granting the licenses, pp.39-43.
Another example is a Portuguese waste regulator (ERSAR), which used UK water companies (Pennon, United Utilities and Severn Trent) as a benchmark to assess systematic risk for a Portuguese waste company: ERSAR (31 July 2018), Proposal of an Asset Remuneration Rate for the determination of Allowed Revenues in the scope of Tariff Regulation for Urban Waste management services for the regulatory period 2019-2021, pp.49-51
28. Oxera (February 2018), "The cost of equity for RIIO-T2 - Prepared for Energy Networks Association".

Notional gearing and return on regulatory equity (RoRE)

Over the following pages we assess notional gearing in the context of the financial benefits and penalties available to the network companies in RIIO-T2 from outperforming or underperforming the price control assumptions.

Notional gearing represents the assumed percentage of net debt to RAV for the notional company. This in turn impacts the percentages of RAV that attract debt and equity allowances.

Setting notional gearing is complex, bringing together many issues and interactions. The diagram below illustrates the key inputs involved and their relationship.

SP Transmission
RIIO-T1 and RIIO-T2 comparison

	RIIO-T2	RIIO-T1
Notional Gearing	60%	55%

1. Cash flow volatility

Cash flow volatility is affected by:

- Scale of investment
- Capitalisation rate
- Profile of expenditure
- Totex incentive rate (Sharing Factor)
- Other incentive mechanisms and rates
- Uncertainty mechanisms

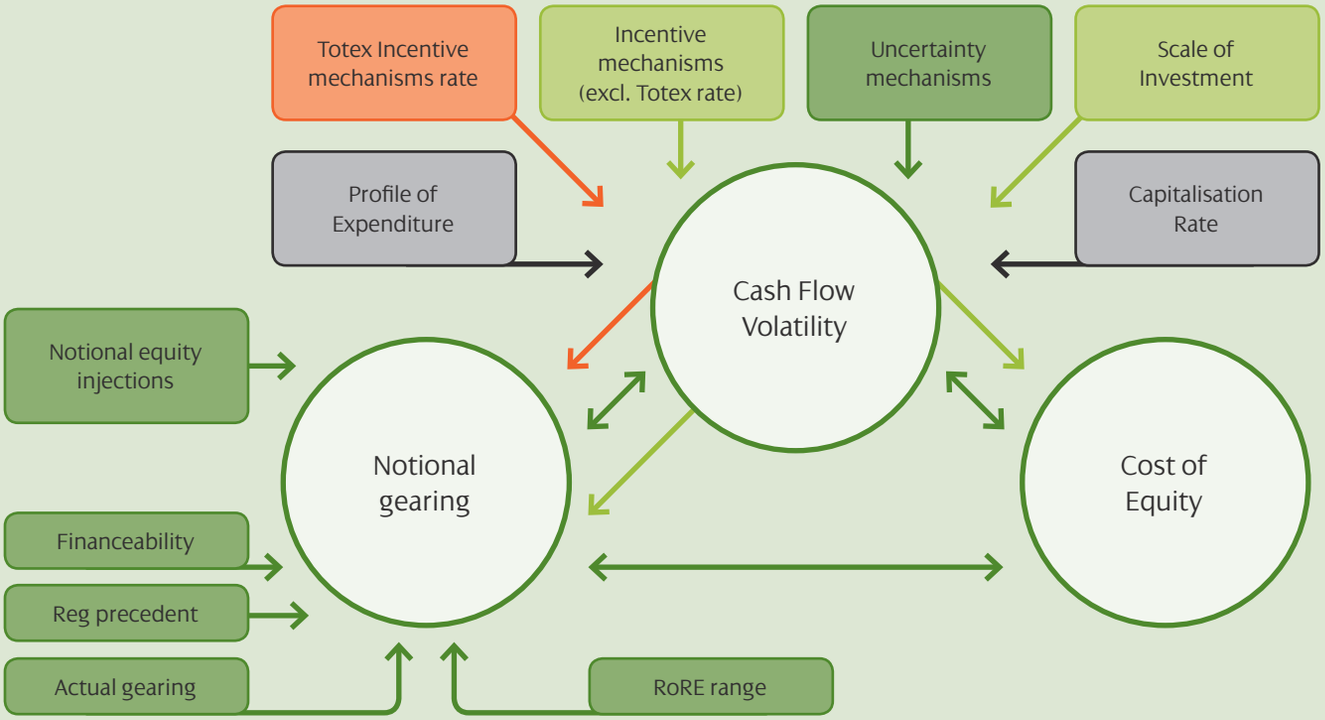
Scale and profile of expenditure is largely determined externally by the requirement to meet present and anticipated outputs – in order to deliver a secure and efficient network.

The RIIO-T2 uncertainty mechanisms and incentive characteristics are yet to be finalised. However, in general, we have not departed from the overall framework set out by Ofgem and have not sought to adjust cash flow risk.

We have however proposed a decrease from the current RIIO-T1 capitalisation rate of 90% to a rate of 85% for RIIO-T2. This capitalisation rate more closely aligns with the mix of capital and operational expenditure that will be delivered in the RIIO-T2 period – it also aligns with the working assumptions provided as part of the Ofgem RIIO-T2 sector specific methodology decision (SSMD).

Capitalisation rate can provide a short-term lever to adjust financeability. In the longer term, a notional capitalisation rate which differs from the actual capitalisation policy can lead to an accounting mis-match. As a result, we prefer not to use the capitalisation rate as a financeability lever.

Setting notional gearing



2. Cost of equity

The extent to which the cost of equity can be flexed is externally limited by the minimum expected return required by the market to secure investment.

Evidence supports a current market cost of equity of 6.5% as detailed in our Cost of Equity section. This cost of equity is dependent on the systemic (non-diversifiable) risk as reflected (under CAPM) in the asset beta. This differs from the current assumption of 4.8% that Ofgem has proposed within the SSMD.

3. Notional gearing

In this section we introduce a central base scenario for gearing of 60%, as set out in Ofgem's sector specific methodology decision along with two alternatives of ±5% (i.e. 55% and 65% gearing).

It therefore remains to ensure that given the above externally determined factors, the idiosyncratic risk for a notional average network business at a given level of gearing will, when exposed to the full range of RIIO-T2 incentives and external risk, lead neither to excessive returns for shareholders nor to financial distress.

The current proposal of 60% gearing for all RIIO-2 sectors would represent an increase for Electricity Transmission. However, it would represent a decrease for Gas Distribution and Transmission, as notional gearing of 55% was accepted by both Scottish transmission operators at RIIO-T1. While 65% was the level accepted by gas distribution and transmission companies, the current proposals would represent an increase of 5% for SP Transmission. This, as well as Ofgem's working assumption of a lower cost of equity assumption of 4.8%, would reduce cash flows and adversely impact credit metrics when compared with RIIO-T1.

Ofgem has suggested adopting sector-specific notional gearing if it would enable the maintenance of appropriate credit metrics under a wide range of market conditions. We explore this further in our financeability and risk assessments. Given that scale of investment during RIIO-T2 will not materially differ to that at RIIO-T1, greater emphasis should be placed on this proposal.

Taking these factors into account, 60% gearing with a ±5% variation is the base scenario we have used to carry out our detailed overall financeability testing.

Having identified a starting range for our gearing assessment, we then introduce a range of plausible outperformance or under-performance outcomes arising from the most material of the package of RIIO-T2 incentives.

This allows us to stress-test our proposed level of notional gearing by examining the overall range of returns to which SP Transmission will be exposed. In line with the SSMD on regulatory adjustment mechanisms (RAM's), we aim to calibrate the RoRE within the 300bps range as a maximum, with returns around the level of the Cost of Debt index at the minimum.

We later further validate our conclusion on notional gearing by simulating the external risks to cash flows and the resulting impact on business financeability (by Monte Carlo, using Moody's credit rating methodology). This further credit rating testing is described fully in the Financeability assessment section on page 187.

4. Return on Regulatory Equity (RoRE)

At this stage we conduct RoRE analysis. This estimates the financial benefits and penalties available to the notional network company in RIIO-T2 from outperforming or under-performing the price control assumptions.

In accordance with Ofgem's Sector Specific Methodology Decision for RIIO-T2 and the RIIO principle, the overall financial package should ensure a fair return to shareholders (as measured by the return on the notional proportion of the RAV that is financed by equity), with a minimum return around the cost of debt.

The RoRE calculation is forward-looking. We use RIIO-T2 average RAV values and average allowed revenue determined by our internal Business Plan Financial Model (BPFM) in our calculation.

We recognise the draft nature of the incentive assumptions due to the ongoing price control refinements. We expect that these inputs will be revised in the subsequent business plan submissions.

The assumptions underlying our RoRE analysis are summarised below:

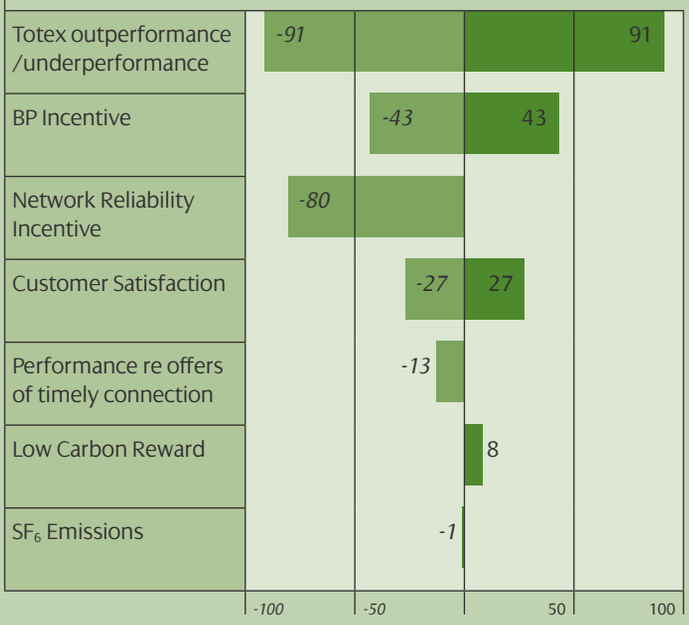
RoRE analysis
Assumptions made for RIIO-T2

Input	SP Transmission	*Source*
Base Revenue *(Annual Average)*	£363	*Calculated by BPFM (18/19 Prices)*
Equity RAV *(Annual Average)*	£1,294	*Calculated by BPFM (18/19 Prices)*
Gearing	60.00%	*Per Ofgem SSMD (May 19)*
Sharing Factor	35.00%	*Per Ofgem SSMD (May 19)*
Totex *(Annual Average)*	£285	*BP Totex (18/19 Prices)*
BP Incentive	2% of Totex	*Per Ofgem SSMD (May 19)*
Totex Incentive	±5% of Totex	*Per Ofgem SSMD (May 19)*
Network Reliability Incentive	-3% of Base Revenue	*Per Ofgem SSMD (May 19)*
Customer Satisfaction	±5% of Base Revenue	*Per Ofgem SSMD (May 19)*
SF_6 Emissions	±£0.1m p.a	*Per Ofgem SSMD (May 19)*
Low Carbon Reward	+£5m p.a	*Per Ofgem SSMD (May 19)*
Performance re offers of timely connection	-0.5% of Base Revenue	*Per Ofgem SSMD (May 19)*

In line with the Sector Specific Methodology Decision document, the BP incentive value is removed from the calculation of the RoRE. If included this would have increased/decreased RoRE by circa 43bps.

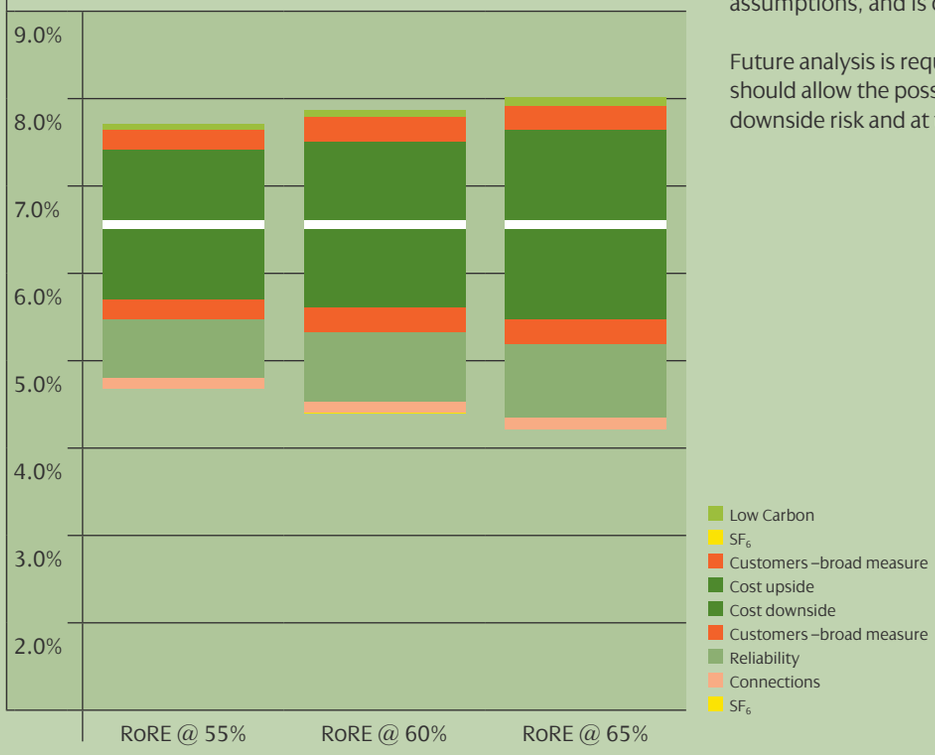
We show the relative impact of the most material RIIO-T2 risks as basis points of RoRE in the Tornado chart below:

Revenue Risk Factors
As basis point of RoRE



Combined, these individual risks determine the overall range of feasible RoRE performance in RIIO-T2. We present this as a 'layer cake' below, showing a range of gearing.

RIIO-T2 RoRE
Change with Gearing



Our view

Our key conclusion: current outperformance will peak at 169bps, whereas underperformance could reach a reduction of 255bps.

The range of feasible RoRE at 60% gearing extends from a maximum of 7.8%, down to a minimum of 4.3%. This compares with a Cost of Debt which starts at 2.03% in RIIO-T2. These values exclude the Business Plan incentive as per Ofgem's working assumptions.

Overall, our analysis indicates that Ofgem's draft working assumption for Cost of Equity and Gearing (4.8% and 60%) are consistent with the level of risk currently embedded within our draft RIIO-T2 Business Plan.

However, our analysis also indicates that the draft price control RoRE range is far below the 300bps set via the RAM's methodology which would allow a return of 9.5% before adjustment. This represents a substantial decrease in the total RoRE achievable when compared with the RIIO-T1 period, with a top-end RoRE of around 11%.

We've carried out analysis to find out if the draft gearing assumptions are set at an optimal level, alongside the effect of varying the gearing up or down in 5% increments. The impact of these changes in gearing is shown in the table below..

Our conclusions:

RoRE range comparison

Grearing	Outperformance RoRE	Downside Cover
55%	7.6%	4.6%
60%	7.8%	4.3%
65%	7.9%	4.1%

60% represents the optimal level of gearing based on our draft assumptions, and is consistent with a financeable Business Plan.

Future analysis is required after the incentive package is agreed which should allow the possibility of reasonable returns without excessive downside risk and at the lowest overall cost to customers.

Financeability – key assumptions and headline proposals

We conclude that we require a CoE of 6.5% to enable us to attract and retain sufficient equity finance to provide, in our view, the necessary investment to maintain network reliability and absorb the forecast expenditure volatility as we facilitate the transition to a low-carbon economy.

In our financial modelling, we assume that the cost of debt is 1.93% which is the value of the iBoxx 11 to 15 year trombone, as per the SSMD. However, the allowed cost of debt is set in real terms and our debt is primarily nominal (i.e. the coupon includes an inflation component). Our financeability analysis indicates that this mis-match contributes to declining financial ratios.

To support the process of assessing financeability, we have engaged economic consultants including NERA, First Economics, and OXERA.

Within this section we present our financial plan based on the companies assumptions, shown in the financial inputs table below, and we have included a comparison to Ofgem's working assumptions from the SSMD for both the notional and actual company.

Our plan results in an investment grade credit rating on Moody's rating scale which is consistent with the range that underpins Ofgem's cost of debt index. The company's assumption provides a credit rating consistent with the A3 rating at RIIO-T1. We then considered further external risks which, if they were to materialise, yield a base rating one notch lower and represent material downside risk.

It's also worth noting that additional financial levers may need to be considered at final proposals, including gearing or the capitalisation rate. These additional levers may be necessary due to the draft nature of these assumptions, and with a weakening of ratios for the notional and actual company.

Financial Parameters

Inputs	Assumptions	
	Ofgem	SPT
Cost of equity	4.80%	6.50%
Cost of debt	1.93%	1.93%
Gearing	60.00%	60.00%
Vanilla WACC	3.08%	3.76%
Asset lives	Held at 45	Held at 45
Capitalisation rate	85%	85%
Additional income (BP incentive)	N/A	N/A
Equity injection threshold	5.0%	5.0%
Dividend % of notional equity	3.0%	4.0%

Target credit rating

We have assessed the credit ratings for SP Transmission on both a notional and actual basis against our target overall rating of A3 to Baa1 before risk.

This makes sure that our financeability criteria are fully consistent with credit quality underpinning the allowed cost of debt index, which equally weights A and BBB (S&P) rated non-financial sterling bonds. This is also consistent with our licence obligation to maintain an investment grade credit rating.

As explained in our Financeability assessment section, we have taken into account the full range of credit rating factors, not just credit metrics. This means that the scores for individual sub factors may be outside A3 or Baa1, and could fall outside the wider investment grade range of A1 to Baa3 (A to BBB range in S&P ratings).

Ofgem's economic model assesses an individual standalone company, and Ofgem has a statutory duty to ensure that Network Operators are financeable – meaning they are allowed sufficient cash flow to pay interest and dividends to the providers of finance. Financeable also means that a company needs to be able to raise the required financing in the financial markets in order to deliver its Licence commitments and expected expenditure resulting from the RIIO-2 price control settlement.

SP Transmission is competing in the financial markets with other electricity and gas network companies. To compete on equal terms, it is important that our implied credit ratings as part of the final proposals are no worse than the implied credit ratings afforded to other networks in the previous RIIO price control settlements, which were set using a similar cost of debt index.

Based on Moody's rating methodology[29] for regulated electric and gas networks, the RIIO-T1 price control resulted in an implied rating of comfortable A3 – this is explained in the RIIO Regulatory precedent section. Therefore, the RIIO-2 final proposals for electricity transmission need to achieve an implied credit rating of at least a comfortable A3.

One of the main impacts within the move to the RIIO-T2 methodology was Ofgem's decision to transition the measure of inflation from the Retail Price Index (RPI) to the Consumer Price Index (CPI/CPIH). This move has been deemed appropriate due to RPI no longer viewed as the official measure of inflation in the UK.

In theory, any change in the inflation index used for price setting purposes should be revenue-neutral, As long as the same inflation index is used to calculate the real cost of capital and to index the RAV over time, the choice of inflation index has no impact on the present value of revenues charged to customers.

However, the inflation index determines the balance between the amounts recovered within period versus those deferred into the future. As a result, it affects the profile of bills over time – referred to as intergenerational fairness.

This impact will be of significant interest to a wide variety of stakeholders, and it is of vital importance that they understand the full impact of the move to CPIH and are fully briefed on its NPV neutral nature.

29. Rating Methodology – Regulated Electricity and Gas Networks – March 2017

Ensuring efficient financing costs – Price Control Financial Model ('static') analysis

In this section we present our financing plan based on the draft assumptions and primary analysis; we refer to this as our 'static' analysis. This is in contrast to our 'probabilistic' risk assessment, presented later in this section, which applies the Monte Carlo model to analyse the likely impact of external risks to our financeability ratios. In this section we also generate and test our regulatory credit ratios.

'Static' refers to the fact that we introduce a number of financing components and assumptions, then test the outcomes to ensure that an efficient, financeable plan can be demonstrated using Ofgem's Business Plan Financial Model (BPFM). As this model is still not final, we have devised our own Price control Financial Model (PCFM) which is a modified RIIO-T1 model. We will submit the BPFM to Ofgem on the 31 July 2019 in line with their guidelines.

We have explained our allowed return financing components in this section. You can find further explanation of our other assumptions and policies in our Financeability assessment section.

Our overriding objective has been to deliver an efficiently financeable plan that will offer an adequate return to investors at the lowest possible cost to customers. This results in the following credit rating based on Moody's 2017 rating methodology for regulated electric and gas networks.

Credit rating

	Notonal
Moody's notional Credity Rating	A3

The key ratios forming these results are detailed under our Key credit ratios section in the comparison of credit ratios to RIIO-T1.

For the 'static' analysis that informed the credit rating above we have assumed Business Plan Incentive additional income of zero. There is currently uncertainty regarding this as Ofgem have still to publish guidance on how this will be structured.

It's possible that Ofgem's view of the efficiency of our Totex proposals may result in a penalty with a resultant risk to our financeability. This would be in addition to the penalty applying under the Totex incentive mechanism if we have to spend in excess of the allowance in order to deliver our outputs and, importantly, make sure we meet our licence obligations around continuity of supply.

Capitalisation rate
The capitalisation rate of 85% in our business plan is consistent with historic levels. It is also in line with expected statutory capex over the RIIO-T2 period. You can find more our total expenditure and capitalisation section on page 192.

Asset lives and depreciation
We can deliver an efficient financing plan and maintain an investment grade credit rating, without employing additional financial levers.

However, it's worth reiterating our current assumptions are draft. We may have to revisit these levers, especially around the final year of RIIO-T2 due to the existence of a depreciation cliff edge.

You can read more about asset lives and depreciation in our Evolution of the Regulatory Asset Value (RAV) section.

RIIO Regulatory precedent

As mentioned in our analysis of the target credit rating, the RIIO price control proposals for regulated electricity and gas network companies result in an implied rating of Baa1/A3 based on Moody's rating methodology.

In the next section, we set out how we have followed Moody's rating methodology for SP Transmission, and have mainly assumed that the qualitative factors applied in recent RIIO price control proposals are the same.

Implied credit ratings for RIIO price control proposals

Company	Cost of equity	Gearing	Credit rating score	Implied credit rating
SPT	7.0%	55%	6.85	A3
SHETL	7.0%	55%	7.32	A3
NGET	7.0%	60%	7.41	A3
NGGT	6.8%	63%	6.61	A3

The tables show that Electricity and Gas Transmission companies have an implied credit rating of comfortable A3. This supports our conclusion that the RIIO-T2 final proposals for SP Transmission need to achieve an implied credit rating of at least comfortable A3.

In our assessment of the implied credit ratings As, we have mainly assumed that the qualitative factors are the same as those that we applied in RIIO-ET1. These qualitative factors have a weighting of 60%, and contribute broadly the same score for all companies to the overall credit rating score.

The remaining factors that influence the final rating score are the four key credit metrics used in Moody's methodology. Each has a weighting of 40%, and could have a significant impact on the overall score.

Financeability assessment

In the main we have followed Moody's rating methodology for regulated electric and gas networks.

This approach considers credit metrics and qualitative factors, for example business risk and regulatory environment. Moody's stated objective is for users of this methodology to be able to estimate a company's rating within two alpha-numeric notches.

Moody's analysis focuses on four key rating factors. These are:

- Regulatory environment and asset ownership model
- Efficiency and execution risk
- Stability of business model and financial structure
- Key credit metrics

A fifth factor focuses on structural considerations of debt. This is assessed on features that contribute to likelihood of default such as complexity and creditor influence. Together, these qualitative features act as an overlay against any score that may be derived from the first four factors. We do not expect this factor would have a material impact on the overall credit score derived from our analysis.

Each factor is made up of a number of sub-factors, to each of which Moody's assigns a weighting.

First, we set out our assessment of sub-factors as shown in the table below. Our assessment of the key credit metrics is set out later in this section, following on from our financial modelling.

In arriving at our Moody's notional credit rating score we have maintained the non-credit metric ratio factors at the same level as our RIIO-ET1 assumptions. This is in line with the updated methodology published in 2017. Recent events may influence a reduction in the future assessment of these qualitative factors.

The tables below summarise our assessment:

Rating factors for SP Transmission

Factor 1: *Regulatory Environment & Asset Ownership Model (40%)*	Aaa	Aa	A	Baa	Ba	B
a) Stability and Predictability of Regulatory Regime	X					
b) Asset Ownership Model		X				
c) Cost and Investment Recovery			X			
d) Revenue Risk		X				
Factor 2: *Scale & Complexity (10%)*						
a) Scale and Complexity of Capital Programme				X		
Factor 3: *Financial Policy (10%)*						
a) Financial Policy & Behaviours				X		

N.B. The values for the key credit metrics that comprise factor 4 are calculated as part of the financeability assessment later in this section.

Factor 1: Regulatory environment and asset ownership model

Regulatory environment and asset ownership model is assigned a weighting of 40%. To measure this factor, Moody's examines:

- Stability and predictability of regulatory regime
- Asset ownership model
- Cost and investment recovery (ability and timeliness)
- Revenue risk

In line with recently published credit ratings of Ofgem regulated networks, we have assessed these sub-factors as follows:

Rating factors for SP Transmission

Sub-factor	Rating	Sub-weighting
Stability and Predictability of Regulatory Regime	Aaa	15%
Asset Ownership Model	Aa	5%
Cost and Investment Recovery (Ability and Timeliness)	A	15%
Revenue Risk	Aa	5%

Historically Moody's has assessed the RIIO approach as broadly supportive of our Aaa assessment of the stability and predictability of the regulatory framework. We have maintained this for our analysis. However, this rating may change depending on the outcome of the RIIO2 process.

In Moody's view, network operators map to the Aa category for the 'Asset Ownership Model' sub-factor, reflecting the licensing regime.

NOs will continue to be subject to efficiency targets for the RIIO-2 price control and so map to the A category for the 'Cost and Investment Recovery' sub-factor.

We assume that 'Revenue Risk' will continue to be scored at Aa for RIIO-2 reflecting the limited exposure to volumes and the ability to carry forward under- and over-recovery of charges.

We will continue to monitor the rating for these sub factors as the price control process develops.

Factor 2: Scale and complexity

The second factor is risk relating to scale and complexity, to which Moody's assigns a weighting of 10%. This is measured by Moody's in relation to the capital program by examining features such as size, scope, complexity, and management ability.

Again, in line with recently published credit ratings of Ofgem regulated networks, we have assessed these sub-factors as follows:

Rating factors for SP Transmission

Sub-factor	Rating	Sub-weighting
Scale and Complexity of Capital Programme	Baa	10%

As average annual additions to RAV as a percentage of the RAV value lie within the range of 5% to 12% of the RAV, we have assumed we score Baa for the 'Scale and Complexity of Capital Programme' sub-factor.

Factor 3: Financial policy

To this third factor, Moody's assigns a weighting of 10%.

To measure this factor, Moody's examines the track record in relation to leverage and financial decisions, as well as required returns of owners.

We have assessed these sub-factors as follows:

Rating factors for SP Transmission

Sub-factor	Rating	Sub-weighting
Financial Policy Behaviours	Baa	10%

Moody's typically maps network operators to the Baa rating, based on conservative financial policy prevalent in the industry. Using Ofgem's working assumptions of setting of notional gearing at 60% – which is 5% higher than in RIIO-T1 – we believe this is consistent with a Moody's score of Baa.

Using this Financial Model, we now develop our credit ratios.

Factor 4: Key credit ratios

Credit metric ratios account for 40% of rating agencies' rating assessment, and so have a significant impact on the overall rating. It is worth noting that Moody's rating methodology takes the average of the worst three consecutive years in assessing an overall rating for a particular ratio.

We ran three metric tests, two notional one actual, when developing our plan and here is what we found.

Notional company with SP Transmission's draft assumptions
Key Credit Metrics

	Weighting	RIIO-T2		RIIO-T1	
Adjusted Interest Cover	10.0%	1.57x	Baa	1.79x	Baa
Net Debt / RAV	12.5%	61.1%	Baa	57.1%	A
FFO / Net Debt	12.5%	11.9%	Baa	14.3%	Baa
RCF / Net Debt	5.0%	9.2%	Baa	10.4%	Baa
Rating Including Rating from Grid Factors 1-4		6.94	A3	7.25	A3

RIIO-T2 Period	21/22	22/23	23/24	24/25	25/26	Avg
Adjusted Interest Cover Ratio	1.78x	1.58x	1.57x	1.57x	1.59x	1.57x
Net Debt to Closing RAV	60%	61%	61%	61%	60%	61%
FFO / Net Debt	13%	13%	12%	12%	11%	12%
RCF / Net Debt	11%	10%	10%	10%	9%	9%

The Notional company with SPT's draft assumptions results in a overall rating of A3 for the notional company. This overall grade is in line with the notional company at RIIO-T1. However the individual ratings are again weaker than those in RIIO-T1 but with enough headroom to maintain a similar overall rating.

The only area that registers an improvement is the rating for 'scale and complexity of capital program'. This is due to the fact that although the investment program for both periods is similar, the RAV is larger in RIIO-T2 as a result of the investment undertaken in RIIO-T1. This improves this sub factor from Ba in RIIO-T1 to Baa in RIIO-T2 uplifting the rating for the RIIO-T2 period.

The main difference between the results below and those of the notional company are due to the assumption around the transition of gearing between the RIIO-T1 and RIIO-T2 periods.

Actual company with Ofgem's draft assumptions
Key Credit Metrics

	Weighting	RIIO-T2		RIIO-T1	
Adjusted Interest Cover	10.0%	1.43x	Ba	1.79x	Baa
Net Debt / RAV	12.5%	56.6%	A	57.1%	A
FFO / Net Debt	12.5%	12.0%	Baa	14.3%	Baa
RCF / Net Debt	5.0%	8.1%	Baa	10.4%	Baa
Rating Including Rating from Grid Factors 1-4		7.25	A3	7.25	A3

RIIO-T2 Period	21/22	22/23	23/24	24/25	25/26	Avg
Adjusted Interest Cover Ratio	2.14x	2.05x	1.64x	1.42x	1.23x	1.43x
Net Debt to Closing RAV	52%	53%	55%	57%	58%	57%
FFO / Net Debt	16%	15%	14%	12%	10%	12%
RCF / Net Debt	11%	11%	9%	8%	6%	8%

Once the parameters have been updated to reflect the actual capital structure of SP Transmission the rating improves further.

The gradual increase in gearing from the RIIO-T1 position of 55% to the working assumption of 60% allows for lower interest payments over the RIIO-T2 period, which improves the suite of ratios and leads to an improved overall rating of A3 when compared to the notional company at Ofgem's draft assumptions.

Notional company with Ofgem's draft assumptions
Key Credit Metrics

	Weighting	RIIO-T2		RIIO-T1	
Adjusted Interest Cover	10.0%	1.28x	Ba	1.79x	Baa
Net Debt / RAV	12.5%	61.9%	Baa	57.1%	A
FFO / Net Debt	12.5%	10.6%	Ba	14.3%	Baa
RCF / Net Debt	5.0%	8.6%	Baa	10.4%	Baa
Rating Including Rating from Grid Factors 1-4		8.30	Baa1	7.25	A3

RIIO-T2 Period	21/22	22/23	23/24	24/25	25/26	Avg
Adjusted Interest Cover Ratio	1.51x	1.29x	1.27x	1.27x	1.28x	1.28x
Net Debt to Closing RAV	60%	62%	62%	62%	61%	62%
FFO / Net Debt	12%	11%	11%	11%	10%	11%
RCF / Net Debt	10%	9%	9%	9%	8%	9%

The FFO/net debt and RCF/net debt both weaken but remain slightly above the investment grade rating floor of 11% and 7% respectively on average. The impact of the strength of these metrics in relation to external shocks will be examined as part of our risk assessment analysis in Efficiency and financeability.

A further consideration is required in regards to the long term financeability of SPT based on the draft assumptions provided by Ofgem. The move to CPIH for example may provide a boost to short term metrics but will weaken any long term outlook based on the reduction in the growth of the RAV in future periods. Ofgem have stated the long term outlook should be addressed at a future price control.

Notional gearing

Similar to our approach to RoRE analysis, we modelled the static analysis on a notional basis, using a gearing level of ±5%. Our conclusion: the movements in financeability are quite significant at 55% and 65%.

Gearing for SP Transmission

	@ 60 %	@ 55%	@ 65%
Moody's notional credit rating	A3	A3	Baa1

Further deterioration in the AICR and increased gearing leads to a weaker overall rating at 65% gearing – the opposite is true for gearing of 55%. We believe that a notional gearing of 65% is not appropriate. Compared to a lower lever of gearing, our probabilistic analysis shows that the weak credit rating would lead to greater risk to the implied investment credit rating.

However, the working assumption of 60% or 55% gearing would provide a stable investment grade credit rating, and align with regulatory precedent. Further detail will be provided in an annex to accompany the final business plan.

Efficiency and financeability

We have worked with NERA to develop a Financeability risk model. The model is based on SPT's Price Control Financial Model, and helps support our assertion that our proposed financing package is not just efficient, but robust.

We have extended the base model to incorporate the calculation of credit metrics and overall score, using the Moody's Methodology (previously described). We attach a paper describing NERA's modelling methodology in an annex.

We have used the model to demonstrate that the suggested financeability scenario delivers an efficient, robust financeability plan – one that will offer an adequate return to investors at the lowest possible cost to customers. To do this, our model uses the Monte Carlo method to simulate the individual and aggregate credit metrics over the full range of plausible outcomes. The model does this for every individual risk we have identified.

The model considers the risk to cash flows from external risks only – where possible, we have identified the plausible distribution of outcomes for an average network business. In conjunction with our RoRE analysis, this should make sure the business is sufficiently securely funded, so that the normal operation of RIIO-2 incentives is unlikely to lead to financial distress when coupled with adverse shocks from external risks.

For us, a robust plan is one that makes sure the expected overall credit rating for a notional average transmission business will be solidly within the A to Baa (Moody's) range of credit rating. ('Overall' means we include non-financial ratio components.)

Under any realistic combination of adverse external outcomes, there should only be a small probability that this rating might drop to a level inconsistent with the allowed Cost of Debt. More specifically, we target an overall credit rating of A3 or Baa1.

Ofgem have a statutory duty to ensure that TOs are financeable, meaning that they are allowed sufficient cashflow to pay interest and dividends to providers of finance.

Initial assumptions

Before conducting our financeability testing, we have considered each of the components of the allowed return. This provides us with the opening parameters for our risk and financeability testing that we established earlier.

Risk assessment
Notional

Inputs	Ofgem
Cost of equity	6.50%
Cost of debt	1.93%
Gearing	60.00%
Dividend yield	4.0%
Asset lives	Held at 45
Capitalisation rate	85%

We have followed Ofgem's guidance for RIIO-2 regarding SSMD when we calculated the notional inputs above. With the exception of dividend yield where we have used 4.0% on the notional equity proportion of the RAV. This is consistent with our view of an appropriate dividend yield as set out in our shareholder remuneration section.

Each unique combination of these inputs constitutes a single scenario. For each scenario, a network business will be exposed to a range of financial risks. Some of these risks will be external to the business, and some will arise from regulatory mechanisms specific to the price control. For example, incentives, output mechanisms and residual risk may be only partly mitigated by uncertainty mechanisms.

Our financeability assessment

We test the robustness of our financial plan only against external risks not directly within our control. The external risks we consider are:

Risk	Modelling approach
Totex Uncertainty	*±10% of base assumption for 10-90th percentile applying a triangular distribution.*
Non-controllable Opex Uncertainty	*±10% of base assumption for 10-90th percentile assuming a triangular distribution.*
CPIH Uncertainty	*Simulated based on OBR forecast uncertainty ranges.*
Taxation	*Actual and allowed tax modelled bottom-up.*
Cost of Debt Indexation	*Based on modelled uncertainty in the real RFR given historical variation and relationship between RFR and debt spread. We use Ofgem's trombone approach.*
Cost of Equity Indexation	*Based on modelled uncertainty in the real RFR given historical variation and Ofgem base Cost of Equity parameters.*
Sharing Factor (Customer Share)	*50%*
Dividend Yield	*4%*
Equity Issuance Threshold	*5%*
Base Cost of Equity	*6.5%*
Incentive Uncertainty	*±1% (max/min) of RoRE based on triangular distribution (calibrated such that RoRE max/min is ±300bps together with Totex uncertainty assuming a triangular distribution).*
Totex Capitalisation Rate	*85%*
Proportion of inflation-linked debt	*25%*

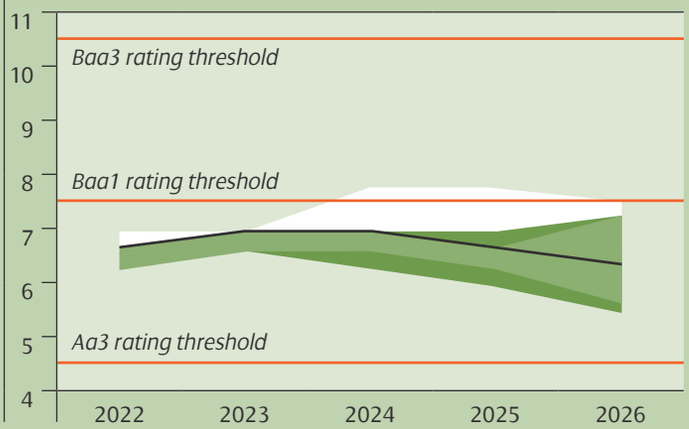
We simulate a set of outcomes using Monte Carlo. For each iteration of the Monte Carlo Model we calculate the credit metrics and use these to derive an overall credit rating using Moody's' methodology (as described in the Financeability assessment section).

Moody's methodology applies significantly greater weights to components of the overall calculation. These are closer to the low rating end than to components at A or above, so the distribution of rating outcomes is strongly asymmetric.

SP Transmission – notional basis

The distribution of credit rating outcomes generated by simulation is shown as a fan chart below.

SPT credit rating including External Risk



The central path (the median) is shown as a dark line. Using Moody's methodology, the path commences at an A3 rating and retains this level for the period despite decreasing in the years of peak investment. At the median position we are therefore forecasting we will maintain an investment grade-credit rating consistent with the allowed cost of debt.

Conclusion

In summary, we have demonstrated by this Risk Assessment that our plan, and in particular a notional gearing of 60% should ensure a business sufficiently securely funded that the normal operation of RIIO-T2 incentives is unlikely to lead to financial distress when coupled with adverse shocks from external risks.

Ofgem Deterministic analysis

We have also undertaken the prescribed deterministic analysis of financeability for the notional company to demonstrate the movement in our credit ratings. The 6 scenarios used are listed in the table below:

Ofgem's prescribed scenario outputs at our Risk assessment inputs

		21/22	22/23	23/24	24/25	25/26	**Avg**
Static Values		A3	A3	A3	A3	A2	**A3**
Interest Rate	+1%	A3	A3	A3	A3	A3	**A3**
	-1%	A3	A3	A3	A3	A2	**A3**
CPIH	+1%	A3	A3	A3	A2	A2	**A3**
	-1%	A3	A3	A3	A3	A3	**A3**
Totex	+10%	A3	Baa1	A3	A3	A3	**A3**
	-10%	A3	A3	A3	A2	A2	**A2**
RoRE *(through incentives)*	+2%	A3	A3	A3	A3	A2	**A3**
	-2%	A3	A3	Baa1	Baa1	Baa1	**A3**
Proportion of inflation-linked debt	+5%	A3	A3	A3	A3	A2	**A3**
	-5%	A3	A3	A3	A3	A2	**A3**

Evolution of the Regulatory Asset Value (RAV)

Below we set out our business plan assumptions which inform the evolution of the RAV. In all cases our assumptions are consistent with RIIO principles, and fully adhere to Ofgem's strategy decisions.

The forecast RAV table below reflects the impact of the forecast total expenditure, regulatory capitalisation assumption, and regulatory asset lives amortisation assumption which are explained below.

Growth in the RAV through RIIO-T1 is evident, increasing from £1.4bn to £2.5bn – an increase of 72% compared to the forecast increase over RIIO-T2 of 20% to £3bn.

RIIO-T1 forecast RAV and forecast RIIO-T2 RAV
£m (2018/19 Prices)

	RIIO-T1		RIIO-T2				
	Yr1	Yr8	Yr1	Yr2	Yr3	Yr4	Yr5
Closing RAV	1,436	2,472	2,582	2,819	2,911	2,950	2,960
RAV Growth		**72%**					**20%**

Total expenditure and capitalisation

Our total expenditure (totex) included the categories prescribed by Ofgem. These are mainly direct expenditure, non-system capex and indirect costs. Totex does not include business rates or pension deficit funding. Within our business plan a fixed 85% of totex is allocated to the RAV for SP Transmission which is consistent with Ofgem's guidance and reflects our forecast annual statutory capitalisation.

We calculated totex with reference to the expenditure projections over the RIIO-T2 period and applying an asset life threshold to distinguish between 'slow' and 'fast money'. This compares with 90% in the RIIO-1 period which saw unprecedented levels of capital investment in our network.

Asset lives and depreciation

Consistent with Ofgem guidance, our base assumption is to model regulatory depreciation using average economic asset lives of 45 years for new assets with straight line depreciation.

Assets existing at 31 March 2013 continue to be depreciated over 20 years, consistent with Ofgem's decision as set out in the March 2011 RIIO-T1 Strategy. During the RIIO-1 period, asset lives increase linearly from 20 years in 2012/13 to 45 in 2020/21.

Our plan does not seek to adjust asset lives as a source of financeability adjustments. This preserves the intended equitable inter-generational amortisation of the RAV.

Shareholder remuneration

We aim to enhance shareholder remuneration by leading the sustainable creation of value for society, citizens, customers, shareholders, and the communities in which we do business.

We aim to equitably compensate all groups that contribute to the success of our work. To this end, we consider our contribution to social return, employment and wealth for society when we're making investment decisions.

Our dividend policy is based on the principle all parties must share in success. This means customers benefiting from lower bills and better services, while investors earn a reasonable return.

We have assumed a dividend yield of 4.0% on the notional equity proportion of the RAV. This is lower than our assumption at TPCR4 and RIIO T1, which was 5%.

Comparative dividend yield

Company	Dividend yield
National Grid	5.8%
SSE	8.8%
Pennon	5.5%
Severn Trent	4.7%
United Utilities	5.0%
Average	6.0%

Observed dividend yields for UK networks companies are higher than our assumption. Adjusting for the current high yield of SSE, the average excluding SSE is 5.25%.

We believe our dividend assumption of 4% is sustainable, and compatible with the maintenance of our financial strength. We propose that it's also prudent when compared to companies with a similar business profile.

In determining SPT's dividend policy we have taken into consideration Ofgem's proposal of 3.0% for a notional company. However, we consider this to be materially below the level investors expect from the sector.

Through our parent companies we maintain the flexibility to adjust the level of dividend we pay, and the amount of new equity required to support our long-term investment strategy.

RIIO-T1 is notable for the unprecedented level of investment in the transmission infrastructure – we were able to achieve this thanks to an equity injection of £185m by our parent company to support this period of investment.

Financial Policies

Pensions

Our business plans fully reflect Ofgem's pensions methodology as set out in various documents and consultations since 2009.

Our pension costs are calculated on the basis of the decisions set out in section 7 of the RIIO-2 Sector Specific Methodology Decision, Finance Annex (24 May 2019).

Established deficit

For the ScottishPower Pension Scheme (SPPS) a roll-forward valuation to 31 March 2016 has been produced from the previous formal triennial valuation dated 31 March 2015 reflecting the requirements set out in the Decision on Ofgem's policy for funding Pension Scheme Established Deficits (7 April 2017).

We have used the method set out in the Pension Deficit Allocation Methodology (PDAM) to determine the split of liabilities and assets between pre (Established) and post (Incremental) cut-off date of 31 March 2012.

The funding allowance of the regulatory portion of the established deficit reflects a 0.2% discount rate spread evenly over 8.6 years from 1 April 2016. The pension principles are subject to ongoing review by Ofgem to make sure they continue to meet the interests of current and future consumers.

Established Deficit Annual allowance	**SPPS**
Regulatory fraction	4.8%
SPT annual allowance 8.6 years from 1 April 2016 at discount rate of 0.2% (18/19 prices)	£3.3m p.a.

Incremental deficit

The incremental deficit is included in totex, and benchmarked as part of total totex. Consistent with the calculation of the established deficit, this has been calculated based on a roll forward of the 31 March 2015 triennial valuation to 31 March 2016.

Incremental Deficit Annual Payment	**SPT**
Incremental deficit payments for 18/19	£0.5m p.a.

Pension scheme administration costs and Pension Protection Fund (PPF) levy costs

These costs are reflected in our plan, but are relatively small in value. Details will be provided in an annex to our December 2019 Submission.

The CRS Report can be found online here: https://bit.ly/2KGoXjF

The Iberdrola Report can be found online here: https://bit.ly/2Ngktmd

Ongoing future service costs – Defined benefit and contribution schemes

Our defined benefit pension schemes closed to new members in 2006. The possible contribution rates for future service accrual for 2019/20 (based on the estimated 31 March 2018 triennial valuation) are shown below:

Ongoing defined benefit scheme
Excluding expenses (%)

	SPPS	Manweb scheme
Pension and death benefits	57%	55.5%
Employee	5%	5.5%
Employer	52%	50%

Defined benefit projected employer contributions
Excluding expenses (%)

	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26
SPPS	48%	52%	52%	52%	55%	55%	55%	61%
Manweb	45%	50%	50%	50%	52%	52%	52%	57%

Defined contribution employer contributions
Excluding expenses (%)

	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26
Average	9.9%	10%	10%	10%	10%	10%	10%	10%

Tax transparency and beyond

The Ofgem policy decisions effecting taxation are in the main modelled automatically in the Price Control Financial Model. Our business plans fully reflect all policies that are well established and understood. A financial annex to the December 2019 business plan submission will further detail our taxation payments.

We feel very strongly that it's important for us to not simply respect the letter of the UK's tax laws, but to be completely transparent in how we are taxed.

The two main tenets of our tax policy are:

Respect legislation – we stay strictly within the boundaries of law

No artificial structures – we take a conservative and prudent approach planning).

Our ultimate parent company is Iberdrola S.A has published a full report on tax transparency and the company's commitment to society.

CSR Europe the leading European business network for Corporate Sustainability and Responsibility released a Blueprint on Responsible and Transparent Tax behaviour and recently featured Iberdrola endorsing its approach .

As the energy transition evolves at pace, maintaining our strong track record of trust and transparency with our stakeholders and consumers is vital. To do this, we have produced a business plan that is robust, accurate, and tested for ambition. This allowed us to challenge ourselves, and truly stretch efficiency targets.

To achieve this, we placed a comprehensive assurance and governance framework at the heart of our business plan development process – with full support and engagement by our board throughout.

The thinking behind the framework

In this section, we explain how our robust assurance and governance framework provides confidence in our business plan by:

Building on an established framework, which regularly receives positive feedback from Ofgem

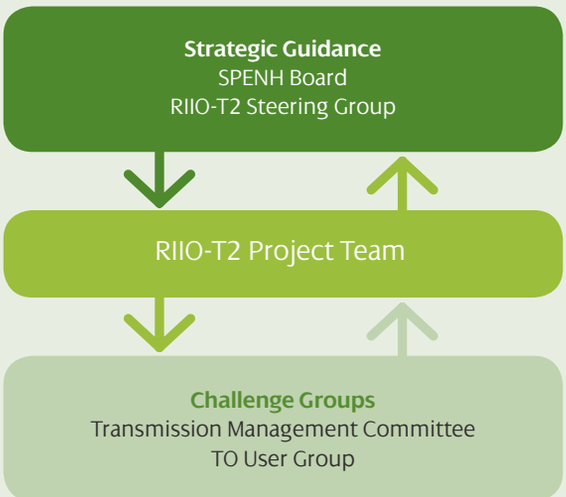
Responding to extensive challenge from a team of internal and external experts, with continued engagement from our board

Underpinning everything with robust and accurate evidence

Governance and Assurance

Governance

An overview of our governance framework:



Ms Wendy Barnes
Independent Non-Executive Member, SPENH Board

"It is critical as Sufficiently Independent Directors and as a Board that we are guided by our stakeholders to ensure that we deliver a truly meaningful plan. It is heartening to see our stakeholders directly influencing the shape of the business plan. This level of transparency and unprecedented access to information provides me with confidence that our plan will meet their requirements."

Strategic Guidance

Board of SPEN Holdings Ltd
The board of SPEN Holdings Ltd (SPENH) has overall responsibility for the long-term strategy and direction of our RIIO-T2 business plan. The board seeks to ensure the company continues to operate responsibly and ethically, while delivering success for consumers, stakeholders and shareholders.

The SPENH Board is comprised of 7 directors, 2 of which are independent.

Sr Armando Martínez	Chairman	*Non-Executive*
Sr Antonio Espinosa de los Monteros	Member	*Non-Executive*
Sr José Izaguirre Nazar	Member	*Non-Executive*
Mr Frank Mitchell	CEO	*Executive*
Mr Scott Mathieson	Member	*Executive*
Ms Wendy Barnes	Member	*Independent, Non-Executive*
Ms Alison McGregor	Member	*Independent, Non-Executive*

To that end, the SPENH Board have been fully engaged in the preparation of our RIIO-T2 business plan. Dedicated workshops have been held with the SPENH board to focus on RIIO-T2, in addition to an extraordinary board meeting to approve the first draft of our business plan. These workshops have been effective in providing the SPENH board members the opportunity to challenge our RIIO-T2 project workstream leads to ensure that we are delivering an ambitious and efficient plan, and provided them with reassurance that our plan is underpinned by a comprehensive assurance framework. This strong level of engagement with the SPENH board is set to continue until our December submission.

RIIO-T2 Steering Group
Chaired by Frank Mitchell, the CEO of SP Energy Networks, the project steering group, set up specifically for RIIO-T2, comprised a representation of the executive team from across our business including Iberdrola and Corporate and met on a bi-monthly basis.

The purpose of the steering group was to provide direction and governance at a senior executive level to the work being undertaken by the project team. This helped to shape our business plan outputs and create a plan consistent with our purpose.

As part of our commitment to full governance, all of our steering groups are run to a set agenda, with minutes of meetings captured and action logs in place.

Our RIIO-T2 project team

For RIIO-T2, our dedicated and highly experienced team is led by Programme Director, Jim Sutherland. Jim has undertaken a variety of engineering and regulatory roles at SPEN including leading the development of the Western Link offshore transmission project through initial design, funding and contract placement.

Jim oversees a team of work stream leads, each who have considerable experience in their areas of expertise, aligned to the price review process. Each work stream lead also has their own team of highly skilled individuals.

This layered approach allows us to cover each area in detail and ultimately create a robust business plan.

Internal Governance

Our project plan

Once the team was established, our first step was to create our project plan. The project plan was managed centrally within the Programme Management Office (PMO). It was then divided into work stream areas and published on Microsoft Project Enterprise for full visibility and reporting purposes.

The project plan is a live document and updated to ensure alignment with the timescales set out by Ofgem in their consultation and decision documentation.

Each deliverable within the programme was managed within the PMO and supported by the work stream leads through planned monthly meetings, and additional meetings when required.

Programme Management Office

We implemented a standardised reporting process that allowed us to effectively:

- manage progress
- highlight risks via our risk register
- allow for sufficient recovery plans where necessary
- make sure the required deliverables were on target and meeting our expected business standards.

Our monthly internal meetings with the PMO and work stream leads enabled continual tracking of progress against the project plan – which allowed for consistent reporting. We established key timelines and shared these with all internal key stakeholders so that milestones and reporting were achieved on time.

We also held monthly meetings with the RIIO-T2 programme director and work stream leads to monitor progress and risk registers. These regular sessions allowed us to ensure transparency and work collaboratively to resolve project-wide issues. Our RIIO-T2 risk register also fed into SPEN's overall Enterprise risk reporting framework.

Challenging the project team

In addition to the expertise of the project team and guidance at a strategic level, it's important that we receive the appropriate level of challenge to develop our business plans. This helps us make sure we are aligned with our corporate values and committing to deliver what our stakeholders want.

During the preparation of our RIIO-T2 business plan, our internal assurance activities were supported by challenge through two key groups – Transmission Management Committee and TO User Group:

Transmission Management Committee

The Transmission Management Committee is comprised of our key internal stakeholders, senior leaders and experts who are involved in running the Transmission Business, supporting the business and have key roles in preparing the business for RIIO-T2.

The Committee is an established "Business As Usual" internal forum and, for the purpose of RIIO-T2, is used for collaboratively supporting and challenging the development of the business plan. The key objective is to make sure that all decisions have been fully considered and are robust.

A number of changes have been made to our business plan as a result of this challenge, a couple of examples being:

Deliverability; the timing of our projects and the investment profile (money spent per year) has now been updated

Supply Chain; as a result of the challenge received, we are in the process of developing a Supply Chain Strategy

The committee meets on a monthly basis and, as part of our commitment to full governance, has Terms of Reference in place, with meeting minutes and actions captured.

TO User Group

The independent TO User Group (TO UG), comprised fully of external members, provide formal challenge and input to our Business Plan. The group represents the wide-ranging needs and requirements of our multiple network users, customers and stakeholders.

The group meets on a monthly basis, chaired by the Right Honourable Charles Hendry. Each month, the group focusses on a schedule of business plan chapters and review, working alongside the relevant workstream lead, the approach and methodologies that underpin the area.

For RIIO-T2, we have provided a level of transparency never seen in our plans before. We gave our TO UG an 'access all areas' pass to business plan details and senior management – including visits to our control room and operational sites.

This open and honest approach has resulted in positive engagement and challenges which can be directly linked to many of our key decisions within the business plan. See our section Co-creating the plan with our stakeholders for more details.

Assurance

We need to ensure that this business plan is free from mistakes and inaccuracies and for this reason we worked hard to build on our already robust internal assurance framework.

This existing framework has been developed over the years to ensure strict adherence to Ofgem's Data Assurance Guidance (DAG). We are proud of the way that we have applied Ofgem's DAG methodology in our organisation and regularly receive positive feedback from Ofgem.

DAG requires a framework of assurance to be embedded within the business and stipulates the following steps in relation to every submission made to Ofgem, of which our RIIO-T2 Business Plan is one:

- Undertake a risk assessment for each submission, following a defined risk assessment methodology, and prepare a method statement explaining how the submission is prepared.
- Undertake second person checks and senior manager reviews of every submission prior to being sent to Ofgem.
- Determine and complete any additional assurance activities for those submissions assessed as high or critical risk, prior to submission, from a pre-defined list.
- Report to Ofgem annually on the results of the risk assessment and assurance activities, providing confidence in the accuracy of content.

In order to enhance this framework further we developed a holistic approach to assessing risk with our Assurance team, adding a strategic view of business impact by using our Enterprise Risk Reporting methodology.

Combining this with Ofgem's existing DAG methodology lets us consider risks from a range of perspectives and obtain an overall risk score[1].

It was important for us that this assessment was carried out independently so we could be confident that the right level of assurance was defined for each risk identified and the right provider engaged to deliver the assurance. Therefore, we worked with independent external experts, Complete Strategy to support us in this. Complete Strategy has extensive experience in regulated industries and proven success in the production of high standard submissions with large companies in the utility sector.

To carry out the appropriate risk assessment, our business plan was broken down into several key components, referred to as "building blocks".

Each of these building blocks was then risk assessed using both methodologies. The assurance activities were deployed based on risk score, the higher the score the greater the amount of assurance required. Where there was a disparity between the DAG and Enterprise Risk Reporting methodology score, the level of assurance applied was based on the highest score, providing the greatest amount of coverage across the plan. Scores can be Low, Medium, High or Critical.

First line of defence

We use a 'Three Lines of Defence' model for deploying our assurance activities.

This represents the minimum DAG process undertaken: Risk assessments and method statements are in place followed by second person and senior manager review.

This is applied to all sections of the business plan regardless of risk score, across both our data tables and narrative, with method statements in place for both.

This consists of:

- **Risk assessment –** *Applied to full content*
- **Method statement –** *Applied to full content*
- **Second person –** *Applied to full content*
- **Senior manager –** *Applied to full content*

Ms Alison McGregor
Independent Non-Executive Member, SPENH Board

"I am confident that we have achieved a robust and deliverable plan, which is underpinned by a comprehensive assurance and governance framework. The ongoing engagement we have had with the project team via the Board has provided reassurance that this framework has been adhered to and the plan has been subject to extensive challenge and review from a number of independent specialists."

[1] The DAG methodology considers risks of providing inaccurate or incomplete data submissions and how this impacts on customers; competition; financial; and comparative efficiency.

The Enterprise risk reporting methodology considers risks to SPEN associated with the investment options and how this impacts on profitability; health and safety; operational performance including impact on customers; environment; and stakeholder reputation.

Second line of defence

For those aspects of the plan attaining a risk score of High or Critical we applied additional assurance activities;

Challenge from internal experts and / or external experts –
Applied based on risk

Challenge from our internal Assurance Team –
Applied based on risk

Challenge and sign-off by our directorate, CEO and Sufficiently Independent Directors via our Board –
Applied to full content

Internal / External Experts
We made use of internal experts in various teams throughout our organisation, including colleagues in our Engineering Design and Standards teams and our Control Room. These teams, who are independent from the RIIO-T2 project team, provided challenge on a number of aspects ranging from validation of the needs case and detailed engineering designs to ensuring that our proposals were "deliverable" from a systems access, resource and supply chain perspective.

All of our investment proposals were then challenged via our Technical System Review Group. The System Review Group, which is independent from the RIIO-T2 project team, is a long established internal forum, comprising engineering experts. The group meet on a monthly basis to review the content of investment proposals, from a technical and engineering perspective, in order to approve the concept and technical design. All of our investment proposals are submitted to this forum for scrutiny and refinement as required.

We wanted to make sure that the external parties we used to challenge the plan were recognised as experts in their field, thus providing quality assurance. The detailed level of scrutiny provided by our external experts gives us confidence that we have fully considered all options and that our submission is based on factual evidence. All recommendations made as a result of these assurance activities were fully explored by the project team and updated in our submission as appropriate. The recommendations, and challenges, are being tracked centrally to detail which have been implemented and, provide justification for those that were not taken on-board.

The table overleaf provides details of the external parties who have carried out assurance activities, the purpose of the engagement and a summary of the key outputs:

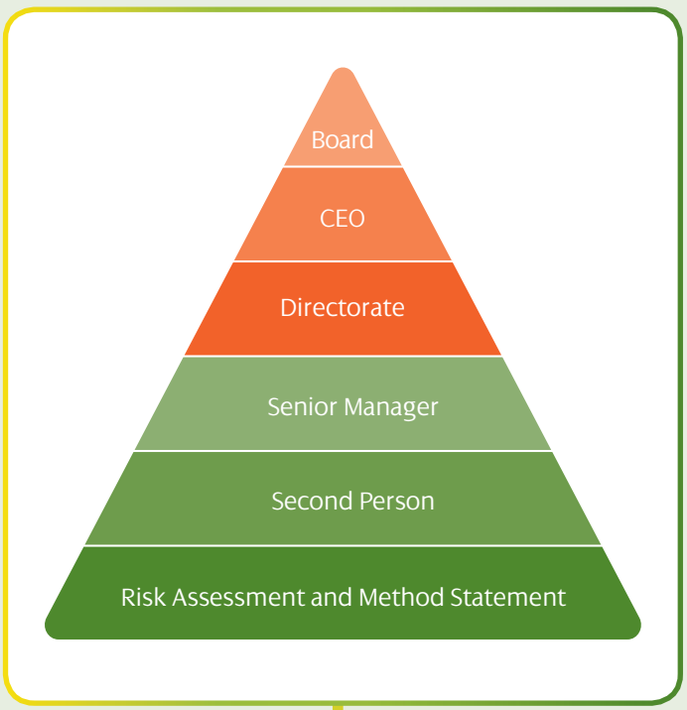
Using our SharePoint site, we have an assurance library in place for collating our assurance activities. By creating and updating this library, we now have quick access to crucial information for the above detailed assurance and audit purposes. We will continue to add to this library as relevant information becomes available.

Internal Assurance Team
We also work with our Internal Assurance team to provide independent assurance on our data tables, completed on a sample basis. The team have been involved from the outset, carrying out a data audit on the first draft of our data tables in Q2 2018, which looked at e.g. Load and Non-Load expenditure tables and several other cost tables. At this stage, improvement opportunities over the control of the data tables were identified. Further iterations of the population of the tables have since been completed and a further data audit carried out in Q1 of 2019 on the same tables showing the required controls were in place to ensure an accurate submission. The adequacy of the second and senior manager challenges and method statement content were also looked at to ensure these were to the required standard.

Review and Sign-off
We have applied the additional assurance option related to sign-off, from the DAG to ensure a rigorous review process for our submission. We engaged the relevant directors, CEO and Board to review, challenge, and sign-off all sections of the plan using formal certificates to be clear on accountability.

This process will be subject to review by our Licence and Assurance team, to ensure we have adhered to our internal DAG process prior to making our submission.

It should be noted that the minimum DAG process has been applied to the population of our NARMs data tables, as well as the additional assurance option related to sign-off and a sample check for consistency. Prior to our final submission in December, and once a definitive set of tables has been received, we will review whether any more extensive assurance for these tables is required.



You can find further details on how we review our investment proposals in our **Investment Process Annex.**

External Party	Purpose of our engagement	Output
Arcadis	A benchmarking exercise to ensure we are comparatively efficient against similar companies across the UK and Europe and our unit costs are appropriate.	The main conclusion was that the costs for the core activities in the plan are efficient against their benchmarks but we will refine a small number of areas in relation to the costs of load related investment projects.
Balfour Beatty and Prysmian	Review, and challenge, the needs case and scope for Cable investment work.	Refinement of our candidates for cable investment work.
Complete Strategy	Understand the regulatory and political context in which the plan is written, to make sure, ultimately, that we are "answering the exam question".	Areas of narrative identified which did not provide full information requested in Business Plan Guidance Document; narrative updated as a result.
Doble	Review robustness of our engineering methodology for producing the input required by the Condition Based Risk Management (CBRM) Tool for Transformers.	Doble report was mainly supportive of the methodology SPT apply, however identified some possible modifications with the scoring methodology applied; we are currently in the process of reviewing and addressing these recommendations prior to final submission.
Elias Ghannoum	Review robustness of our engineering methodology for producing the input required by the Condition Based Risk Management (CBRM) Tool for overhead lines.	Elias report was very supportive of the methodology applied. A small number of recommendations were made which have been addressed. Examples of changes that have been made as a result of the recommendations are: Historical defects (conductor damages, reliability issues as cotter pins/Andre spacers, porcelain insulators) collected and incorporated into the plan as part of the evidence to support intervention. Innovation plan updated to include new approach for site specific ratings of the current environmental areas (wind and corrosion).
Graham Boydell	Review methodology used for CBA and confirm our analysis is consistent and in accordance with the agreed methodology for a sample of projects.	The sample check was completed by Graham Boydell. Minor numerical errors identified and resolved. The CBA assurance work will continue until final submission.
Polaris	Review Transformer candidates for replacement and refurbishment, output from CBRM, and confirm suitability.	A review of the original proposed Transformer replacements was undertaken by Polaris to ensure that the onsite condition matched the CBRM proposal. While this validated the majority, several units (as an example, Longannet Reactors) were changed from replacement to refurbishment based on a detailed analysis.
Ramboll	To challenge the engineering decisions on RIIO-T2 major schemes so that our process stands up to scrutiny.	Challenge was provided on how the project details are presented to the reader to ensure clarity; as a result of this challenge, the presentation details were amended. As a result of the challenge given on justification for non-lead assets, detailed site surveys are now available which will be referenced in the Engineering justification papers submitted to Ofgem. Ramboll also identified alternative engineering approaches which could be considered; as an example, suggestion of mixed technology switchgear for double busbar sites (later ruled out after technical review) and for Hunterston shunt reactor, establish alternative operating arrangements to address the need.

We also worked with independent organisations to verify and support our approaches:

AccountAbility and Sia Partners	We worked with AccountAbility and Sia Partners to refine and launch our new Stakeholder Engagement strategy.
Baringa Partners and Element Energy	Together with Baringa Partners and Element Energy, we've developed four scenarios for the SPT network area, using the four National Grid 2018 Future Energy Scenarios as the starting point and running until 2040. These scenarios were used to inform our load-related investment proposals.
NERA	We commissioned NERA to carry out a piece of work to estimate the cost of equity for the RIIO-T2 price control period. This piece of third party advice is being used to support our strategic direction on cost of capital. We have also commissioned NERA to create a report on Real Price Effects using real indices to evidence why the existing indices do not adequately reflect the reality of RPEs we face as a TO. Review and challenge uncertainty mechanisms for Load.
PWC	To consider whether our proposals for cyber resilience are in line with NIS requirements, and to test whether we have developed costs using a reasonable methodology.

Third line of defence

ScottishPower has a well-established Internal Audit team which is independent from SPEN. The annual audit plan for SPEN focusses on the main risks of the business including regulation and is approved by the SP Energy Networks Holding Limited Audit and Compliance Committee.

Internal Audit has carried out audits related to (a) governance of the internal RIIO-T2 project programme and (b) RIIO-T2 business plan assurance.

Example of critical risk:

Overhead Lines – cases, optioneering, methodology

Overhead lines are a significant part of our investment plan, around £150m in spend.

Our plan is based on condition data interpretation which is complex and requires a high degree of engineering knowledge, it is critical that our strategy is robust.

DAG – high

The amount of totex covered brings DAG impact score to high.

The required approach has changed since RIIO-T1, and the need to draw information from multiple sources, with lack of established method statements means the DAG probability score is also high.

Enterprise Risk Evaluation Methodology – critical

The amount of totex covered by this element is enough to make it critical risk.

Adjustments to our allowance by Ofgem would also impact our operational performance, if we are unable to deliver the most efficient set of work, although this is not expected to reach the point where safety is compromised.

Assurance

DAG process completed; second person and senior manager review.

External assurance applied via Elias Ghannoum, a 'world-renowned' expert with over 48 years experience in Overhead Transmission Lines (Engineering, Design, Specifications, Construction, and Failure analyses).

SP Internal Audit.

Example Assurance feedback

Fatigue at spacer locations should be considered for failure ahead of conductor tension.

Recommended that focus should not be only on CBRM and should review network at higher level to profile works.

Actions taken

Increased minor works programme aiming at spacer replacement reducing the replacement of conductor.

Long-term RIIO-T2 / RIIO-T3 plan has been produced.

Assurance of our plan as a whole

We wanted to make sure the plan is assured as a whole as well as by individual component. As part of this ambition, we reviewed our full business plan with public organisations Citizens Advice Scotland and Community Energy Scotland to challenge whether we were meeting the needs of those they represented. This assurance activity also extended to Scottish Government to review and challenge whether our proposals will enable them to follow through on their policy commitments.

Another key motivator for assurance of the plan as a whole was to ensure that we were providing the information our regulator has requested. Working with Complete Strategy, we developed a list of the requirements and expectations set out by Ofgem through their various consultations and business guidance document. These expectations were then used to verify the content of our business plan and ensure we were addressing the key topics in our submission.

We are proud of the assurance framework we have implemented and are confident that it not only meets, but exceeds, the expectations of our consumers and stakeholders – giving them trust in our plan. These assurance activities will continue until final business plan submission and beyond.

Sr Armando Martínez
Non-Executive Chairman, SPENH Board

"As chairman of the board, it is essential to me that we have provided a robust challenge to ensure that the plan is line with strategic direction, whilst delivering for our stakeholders and shareholders. I have been very impressed with the responses provided by the RIIO-T2 Project Team to the challenges and questions raised by the board."

SP ENERGY NETWORKS