

Whole System Annual Report

April 2022



**Scottish & Southern
Electricity Networks**

TRANSMISSION



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About this report

This report provides an insight into the work we have done in the 2021-22 financial year around whole system and how this approach is an integral part of our investment decision making process.

To us: 'The whole energy system comprises electricity, gas, heat and transport networks and components that serve the Great Britain society'.

Components refer to devices that either take energy from, or give energy to, the transmission network and the digital technology components that facilitate supply, management, and consumption of energy. We look beyond the bill payer and consider the overall costs and benefits to the GB society, environment, and the economy.

We have done a lot to ensure that whole system is understood across the business and by our stakeholders, which is critical to enable us to operate and develop a network for net zero.

The report begins with a statement from our Head of Whole System emphasising the importance of a whole system approach in how we plan, develop, and operate the network and, how our strategy enables us to do so. For us, whole system is about creating value for our stakeholders and the communities where we operate and, in this report, we show how and where we create that value.

We demonstrate our commitment to a whole system approach through the additional resources that the business has put in place to enable whole system, as well as giving examples of the projects we are working on where a whole system approach has been central in our investment decision making process. We also highlight key challenges we have faced, and the lessons we have learnt while taking a whole system approach, and how as a business we have managed to overcome those challenges which are in our control. This includes taking leadership in working with other network licensees to overcome barriers to whole system.

At the end of this report, we are asking for your feedback, which you can send to us through the contact details provided. In particular, we would like to know about what we could do better around whole system. There may be things we have omitted that you think should be included in the report. Do tell us about those and we will be keen to consider them.

Foreword



Andrew Urquhart
Head of Whole System

Our strategic objective is to enable the transition to a low carbon future. Key to achieving this is our stakeholder-led strategy, which is underpinned by a whole system approach to network development, construction and operation to meet current and future customer's needs.

We believe that a whole system approach is essential to deliver Net Zero in the most technically resilient and economic way.

Our first priority at SSEN Transmission is to provide a safe and reliable network which supplies electricity to the communities we serve. We play a critical role in the transition to a low carbon future, developing, building, maintaining, and operating a 'Network for Net Zero'. We do this by transporting huge quantities of clean, green renewable energy over a quarter of the UK's landmass across some of the most challenging terrain. The area where we operate is home to some of the UK's greatest resources of renewable power and we therefore have a critical role in GB's transition to a low carbon future by connecting more renewable energy and transporting it to consumers across the country.

We have ambitious future investment plans, building on our £2.16 billion baseline investment case for RIIO-T2, which we expect to increase by the end of the price control period through uncertainty mechanisms.

Drivers of this include the facilitation of a huge amount of offshore wind which has been offered option agreements by the Crown Estate Scotland, under the Scotwind programme, to lease Scotland seabed for windfarm developments.

Whole system requires a coordinated approach, and in this report, we demonstrate how we have done this internally (within the business) as well as externally (with our stakeholders). We also provide our stakeholders with an insight into some of the projects we are working on and the whole system activities that we have undertaken to ensure coordinated, economic, and efficient investment decision making.

We would like to thank all our stakeholders and customers for their continued support in our efforts to deliver a 'Network for Net Zero'. We are a stakeholder-led business and as such your feedback on our approach to whole system is very important to us. Therefore, we would like to hear from you where we need to improve or what we should do differently going forward.

Strategic Themes

How we will do things to achieve or strategic objective



Taking a whole system approach to network operation and development to meet current and future customers' needs



Using data efficiently to understand, predict and get the best network performance



Integrated approach to whole life development and operation, using risk-based engineering to deliver value



Trusted partners of customers and communities, realising long-term benefit for society, economy and environment

Introduction

At SSEN Transmission we are committed to developing a network for net zero. Key to our stakeholder-led strategy is undertaking a whole system approach to network development to meet current and future customer needs.

In our RIIO-T2 business plan we have committed to deliver a customer value proposition of £350 million which includes reducing the risk of customer overpaying. Our stakeholders have also been clear that we must provide timely cost-effective whole system solutions to ensure national net zero emissions are met. We therefore see a whole system approach as critical to creating value for our stakeholders and delivering the promise we made in the Business Plan. This approach requires us to coordinate and cooperate with other network licensees where actions taken could have cross-network impacts. It also requires us to consider actions proposed by network users which seek to advance efficient and economic operation of the network.

This is a pivotal moment for us as we work to connect historical amounts of renewable generation to our network in the coming years, while at the same time ensuring that communities have a reliable supply of electricity. The whole electricity licence condition requires us to publish a coordination register of the activities we have undertaken in the course of the year in pursuing whole system solutions. In this Whole System Annual report, we go over and above this minimum requirement by providing our stakeholders with more information on the work we are doing and how a whole system approach forms an integral part of our investment decision making.



1. Whole system enablers

For us to establish whole system thinking within our business and with our stakeholders we had to identify initiatives that would enable us to effectively engage stakeholders, collaborate with other network licensees and develop innovative ways to improve our investment decision making. Here we describe the enablers of whole system which start with our people (structure) followed by the development of processes and tools to enable them to carry out whole system activities.

| 1.1 Structure

At SSEN Transmission we take whole system seriously and we have shown leadership in the industry by establishing a dedicated team that seeks to address technical and commercial policy issues that pose barriers to whole system and implement innovative solutions that optimise whole system performance. The whole system team was established in 2019 and since then it has expanded and recruited staff in areas of whole system planning, innovation, and commercial policy. This demonstrates our commitment in developing solutions that deliver whole system.

The whole system team has established the Whole System Development Forum with the aim of coordinating SSEN Transmission and Distribution

network activities, where doing so adds value to our stakeholders and communities where we operate. The Whole System Development Forum comprise people who are directly involved in the planning, development, designing and operation of the network and this forum provides a platform that facilitates economic and efficient whole system solutions, recognising current and future system requirements. Above this forum is the Whole System Strategic Group whose purpose is to implement strategic policy and regulatory positions to promote whole system working across SSEN Transmission and Distribution networks.

| 1.2 Processes and tools

Some of the work that the Whole System team has done is to develop processes and tools required to instil whole system thinking across SSEN Transmissions Business as Usual functions. This involved creating new processes as well as making changes to the existing processes and procedures to enable whole system working, as well as to comply with the whole system licence obligation.

The Net Zero Investment Process is a process that ensures that whole system options are explored by different project teams earlier on in the project cycle. This includes collaboration and cooperation with other network licensees and network users for whole system solutions earlier in the project cycle. This has led to changes in our internal project governance process, meaning that a project cannot be progressed without

demonstrating that the recommended solution meets whole system needs. The changes we have made in the project governance process will enable us to capture whole system activities, record them in the Coordination Register and publish it on our website as required by the Transmission Licence Condition D17.

SSEN Transmission has been actively involved in the development of the whole system cost benefit analysis (WSCBA) tool through the ENA Open Networks Project Workstream 4. This tool will be used by the industry for economic, environmental and social benefit assessment of network investments across the energy vectors. We have done a lot of work on embodied carbon which we have used to feed into the development of the industry wide WSCBA.

For high value network strategic projects, we have developed a strategic options assessment guide which will enable us to identify potential issues and engage with the relevant stakeholders earlier in the project cycle. This is critical in delivering whole system solutions as it mitigates risks of progressing with options that are not viable and associated unnecessary costs that are not in the interest of our stakeholders and the communities we serve.

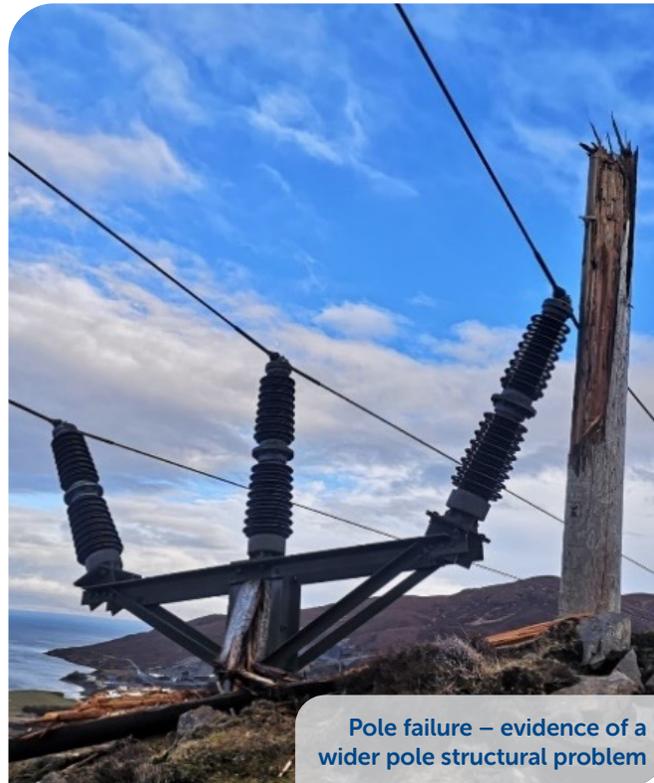
2. Whole system projects and activities

At SSEN Transmission we use Stakeholder Engagement, Work Collaboratively, and Innovate to Improve as building blocks in our network development approach. These are building blocks from our Whole System Strategy¹ which was first published in 2019. The following is a sample of the projects we are working on where whole system has played a critical role in our investment decision making process and how the building blocks have been applied.

| 2.1 Skye Network Reinforcement

The existing Skye overhead line (OHL), which was built in distinct sections between 1956 and 1989, is approaching the end of its economic life. Asset condition assessment of the line has identified the need to intervene in order to continue to safely operate the line and provide security of supply to consumers on this part of the network. Separate to this, there is a requirement and opportunity to increase the capacity of the line, mainly driven by requests from developers to connect renewable generation in the area.

The Skye overhead line Reinforcement is fundamental to achieve a Network for Net Zero in the North of Scotland and the 2045 Scottish and 2050 UK Governments' Net Zero targets, whilst ensuring long term security of supply in the Skye and Western Isles area. Mindful of the fact that Skye is one of the most environmentally sensitive and valued wild landscapes in Scotland, we have a unique once in a generation opportunity to intervene to meet these current and future priorities for local and national consumers and stakeholders and leave Skye in a better [or no worse] condition environmentally than we found it.



Pole failure – evidence of a wider pole structural problem

What we are doing about it

As the owner of the electricity transmission system in the North of Scotland, we are obliged to provide a safe and reliable supply to our communities as well as timely connections for our customers in the most economic and efficient manner. Following extensive stakeholder engagement and collaboration, we have recommended to undertake the reinforcement of the Skye OHL circuit which will cover the full 160km length of the existing 132kV single circuit OHL from Fort Augustus substation to Ardmore on the Isle of Skye. The preferred solution for Skye is to replace the circuit between:

- **Fort Augustus to Edinbane with a high-capacity double circuit steel structure overhead line.**
- **Edinbane to Ardmore section with a single circuit wood pole line.**

¹ www.ssen-transmission.co.uk/media/3443/ssen-whole-system-strategy-20pp-22990-artwork-for-web-upload.pdf

Stakeholder engagement and collaboration

To ensure that the recommended solution is sustainable, we have engaged all the key stakeholders in the area to obtain data and information necessary to make the right investment decisions. This includes the following:

- Extensive and continuous engagement with the Electricity System Operator (ESO) and SSEN Distribution, working collaboratively in order to deliver a coordinated, efficient and economic whole system solution that will meet the electricity needs of consumers in the area and support connection of renewable generation critical to meet net zero emissions targets.
- Local authority, elected members, landowners and developers have asked that we develop an enduring solution which would avoid the need for additional infrastructure within the decade - do it once and do it right. Recent supply failures have demonstrated to those spoken with, such as landowners and elected members, that the existing assets require to be renewed and reinforced due to the connectivity limitations that constrain development on the Island and beyond. These stakeholders provided recognition or support of the requirement for a renewed asset which is both reliable and alleviates connection constraints. Statutory consultees have confirmed that a holistic, long-term solution would be the optimum solution.

Innovate to improve

At SSEN Transmission we are committed to innovation and will continue to deploy innovative products and services that deliver value to our customers and communities where we operate. One of these innovative initiatives is the use of alternatives to sulphur hexafluoride gas (SF6) switchgear. We have demonstrated commitment to reduce our own environmental impact by being the first UK transmission owner to deploy SF6 free technology². It is our intention to use this technology for the Skye Reinforcement project as well.

In 2020 we were part of a Network Innovation Allowance (NIA) funded study to investigate the potential of using domestic heating to address wind constraints on the network. The report showed that areas like Skye, which have a high proportion of off-grid gas, can benefit from switching to electric heating using heat pumps and provide demand side flexibility services to reduce network constraints costs by avoiding curtailment of wind generation³.

Considering the amount of anticipated generation volumes in the area, this is not sufficient to avoid or defer network reinforcement in the area. However, there is an opportunity to incentivise off-grid gas consumers to switch to electric heating and participate in the flexibility market that could result in savings in their energy costs.

Benefits

The benefits of the project are as follows:

- Increased security and reliability of electricity supply to homes and businesses in Skye and Western Isles.
- Environmental benefits from reduced use of high carbon intense diesel generation in Western Isles.
- Enhanced network capacity to allow connection of renewable generation required to meet UK and Scottish Governments' net-zero emissions targets by 2050 and 2045 respectively whilst securing low-cost long-term energy supply.

Project status

The project initial needs case has been submitted to Ofgem which will be followed by a final needs case submission. Upon approval, the project will undergo internal governance process to ensure efficient and timely delivery of the project.

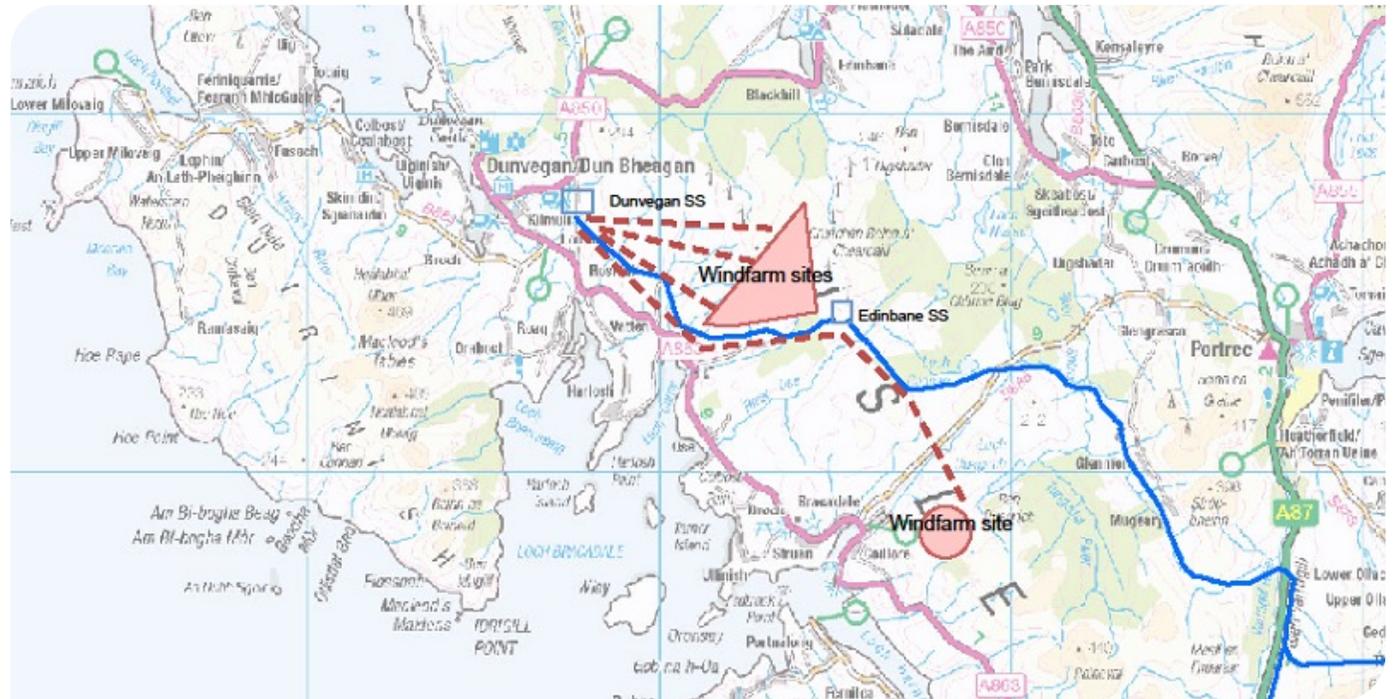
² www.sse.com/news-and-views/2019/10/ssen-transmission-another-step-closer-to-net-zero/

³ 4D Heat. Available at: <https://www.ssen.co.uk/WorkArea/DownloadAsset.aspx?id=19929>

| 2.2 Edinbane/Dunvegan Whole System Solution

Dunvegan is a grid supply point (GSP) and Edinbane is a transmission site with generation connection on the Isle of Skye. Whilst SSEN Distribution has demand and generation customers connected at Dunvegan, it does not have customers connected at Edinbane. Over the years there have been several embedded generation customers requiring us to install a new transformer at Dunvegan.

However, the number of distribution lines required to connect these wind farms to the grid would encroach on the corridor planned for the Skye reinforcement project. The map highlights the issue in that there are 4 distribution lines that need to be built from the wind farms close to Edinbane to Dunvegan along the same corridor planned for the Skye Reinforcement project shown in blue. This cannot be done without cross-network impacts and hence the need for a whole system solution.



What we are doing about it

In order to provide a sustainable, efficient, and economic whole system solution, we have worked with SSEN Distribution to create a new GSP at Edinbane instead of significant additional works at Dunvegan. This will enable the wind farms to connect at Edinbane, which will avoid their grid connections encroaching on the

corridor for the Skye Reinforcement project. This solution also provides shorter line route lengths not only for the 4 windfarms but also other customers seeking to connect in the area in the future.



Stakeholder engagement and collaboration

We have developed the whole system solution through coordination and cooperation with different stakeholders including SSEN Distribution, ESO and customers. There will be more engagement with stakeholders as the project progresses to ensure that the proposed solution does not negatively impact on the communities in the area. Information and data collected from these stakeholder engagements is important to make the right decisions around line routing, designs, environmental impact assessments etc.

Benefits

The benefits of the project are as follows:

- Shorter distribution lines resulting in cost savings for SSEN Distribution and users, currently forecast to be about £2 million, for reinforcing the distribution network to connect customers to the grid⁴.
- Avoided additional costs for consumers that could have resulted from additional works to mitigate cross-network impacts, such as maintaining safety clearances between the planned Skye transmission line and the power lines connecting the wind farms to the grid.
- New capacity at Edinbane which will allow connection of renewable generation required to meet UK and Scottish Governments' net-zero emissions targets by 2050 and 2045 respectively whilst securing low-cost long-term energy supply.

Project status

Customers will be issued new offers following the change of the connection point and scope of works. Upon acceptance, the project will go through the internal governance process to ensure efficient and timely delivery of the project.

⁴ This figure is based on the current assumptions and may change as the project progresses into delivery.

| 2.3 Errochty – Charleston 132kV network

The Errochty – Charleston 132kV line has 346 towers spanning over a 131 km stretch. Most of these towers were built between 1931 and 1940 and their condition is deteriorating and will require replacement in the near future. In addition to this, there has been an increase in the number of customer applications to connect large and small-scale renewable generation to our network. In the Errochty – Charleston area, most of these applications are small scale distributed energy resources which include battery storage systems. Traditionally, these connection applications would be assessed based on deterministic planning methodologies as set out in the planning standards.

However, this would incur significant network reinforcements costs to customers and consumers. Under the Regional Development Programme, SSEN Transmission is working with the ESO, SSEN Distribution and SP Energy Networks to explore efficient and economic whole system solutions that will enable the connection of these renewable energy resources to the grid without requiring immediate significant network investments ahead of asset replacement.

What we are doing about it

The most efficient and economical solution is a non-network intervention between now and until such time when the line will be replaced with higher capacity conductors. We are engaging stakeholders in exploring these interim non-network solutions further, which include managing the generation in the balancing market, load management schemes or use of flexibility services⁵.



Tower corrosion – a wider problem on the Errochty-Charleston line

⁵ Flexibility services include changing generation output by the distribution network operator to manage network constraints. SSEN Distribution has a number of sites where they are seeking to procure flexibility services to help with managing network constraints.



Stakeholder engagement and collaboration

The whole system solution is being developed through coordination and cooperation with different stakeholders including SSEN Distribution, ESO, SP Energy Networks and customers. These activities include collaboratively exploring whole system options with stakeholders which can deliver value. We will have more engagement with landowners and the local authorities to ensure that the line replacement project does not negatively impact the communities. Information and data collected from these stakeholder engagements is necessary to make the right decisions around line routing, designs, and environmental impact assessments.

Innovate to improve

Since most of the drivers triggering the need to reinforce the network in this area are battery storage (which have different operational characteristics when compared to traditional generation like wind and gas), we have employed a probabilistic assessment methodology to inform investment decisions for local networks. Using this methodology has enabled us to better understand and manage the risk of connecting these customers ahead of network reinforcements at a local network level. We will continue to develop this planning methodology and extend its applicability to other areas of the network where there is value for our customers and stakeholders.

Benefits

The benefits of the project are as follows:

- The solution allows for immediate connection of renewable generation required to meet UK and Scottish Governments' net-zero emissions targets by 2050 and 2045 respectively whilst securing low-cost long-term energy supply.
- Cost savings for consumers and customers from delivering timely transmission network reinforcement.

Project status

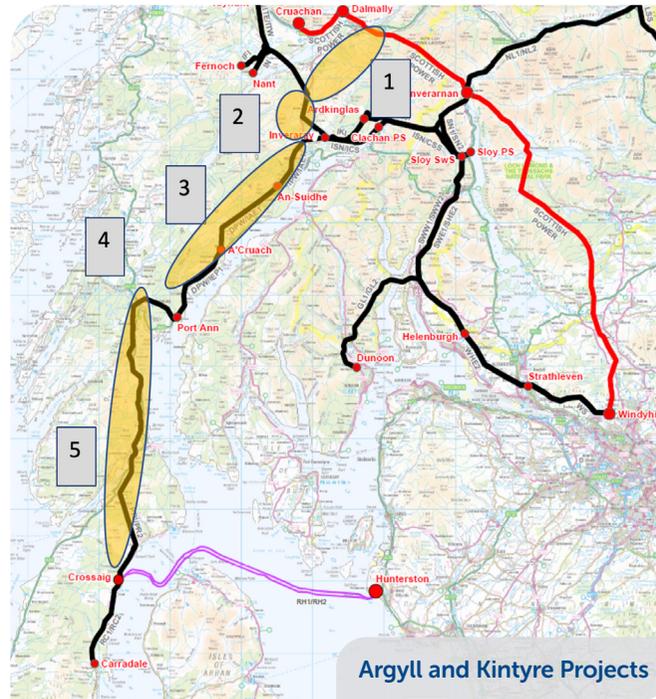
Further investigations are underway to ascertain the level of intervention and timeframe to resolve the asset condition issues. There is also an ongoing engagement with stakeholders to determine non-network solutions to connect additional new customers ahead of the overhead line upgrade.

2.4 Argyll – Kintyre Network Reinforcement

There has been an increase of renewable generation connections and applications in the Argyll and Kintyre region. The region currently has 580 MW of connected generation and there is approximately 670 MW of generation contracted to connect to the network in the area.

Through preapplication meetings and webinars hosted by SSEN Transmission, an extra 1800 MW of generation has been identified. This amount of generation is substantially more than the demand in the region and would need to be exported to the rest of the GB and displace carbon intense energy sources - thereby helping to meet net zero.

However, the capacity of the existing electricity network infrastructure is not sufficient to accommodate increased generation seeking to connect and hence the need for reinforcement.



What we are doing about it

There are 4 viable routes out of the Argyll and Kintyre area to export the excess generation to the rest of the GB network. Through stakeholder engagement that included the ESO, SP Transmission and SSEN Distribution, the most efficient and economical whole system solution is to build new substations at Creag Dhubh and Glen Lochy connected by a new 275 kV line, construct a new 275kV line to connect Creag Dhubh and the existing Inveraray-Crossaig line, construct a new 275kV Craig Murrail substation and upgrade An Suidhe, Craich and Port Ann substations.

Number	Project name
1	North Argyll Reinforcement
2	North Argyll Inveraray Reinforcement
3	North Argyll - Craig Murrail 275kV
4	Craig Murrail Substation
5	Craig Murrail - Crossaig 275kV





Stakeholder engagement and collaboration

We have had extensive engagement and collaboration with different stakeholders to ensure delivery of an efficient and economical whole system solution that supports governments decarbonisation efforts and net zero targets. This project will cut across two network licence areas, as such proper coordination with SP Transmission and SSEN Distribution is critical to avoid negative cross-network impacts, risks of duplication and unnecessary additional costs that are not in the interest of consumers. The information, data as well as feedback gathered from stakeholders, have been critical in our decision-making process so that the preferred option is not only economically viable for the wider society but also that it does not negatively impact on local communities in the region. We will continue to engage with stakeholders in these communities as the project progresses into delivery.

Innovate to improve

At SSEN Transmission we are committed to innovation and will continue to deploy innovative products and services that deliver value to our customers and communities where we operate. One of these innovative initiatives is the use of alternatives to sulphur hexafluoride gas (SF6) switchgear as described in Section 2.1. It is our intention to use this technology for the Argyll-Kintyre Reinforcement project after a full risk assessment has been done including suppliers meeting the project's in service dates.

Benefits

The main benefit of this project is that the enhanced network capacity will allow connection of renewable generation required to meet UK and Scottish Governments' net-zero emissions target by 2050 and 2045 respectively.

In addition, the work we have done to coordinate plans with SSEN Distribution at Port Anne GSP has resulted in a whole system solution that could realise cost savings to the tune of £35 million⁶. The cost saving will be realised from implementing a combined transmission and distribution solution as compared to a transmission solution alone.

Project status

The project needs case/s will undergo review by Ofgem and upon approval, the internal project governance process will commence to deliver the project in an efficient and timely manner.

⁶ This figure is based on the current assumptions and may change as the project progresses into delivery.

| 2.5 Dundee City Network Strategy

Dundee City Council has high ambitions to decarbonise, aligning its greenhouse emissions reduction targets with the Scottish Government's target of meeting net zero by 2045. Decarbonisation initiatives include investment in charging infrastructure for electric vehicles, electrification of railway, district heating, hydrogen buses and fleet.

The area covered by the Dundee City Council is supplied by five grid supply points (GSPs) which form a 132kV 'ring' from Tealing substation. The network connecting the GSPs is composed of a mixture of overhead lines and underground cables through mostly built-up areas.

Asset condition, demand and generation growth are the drivers for network investment in the City of Dundee. There are several transmission assets that require replacement due to poor condition which if left as is, could affect reliability of supply as well as possibly posing a safety risk to the workforce and the general public. Significant load growth is anticipated as a result of electrification of transport and heat. There has also been an increase in applications to connect battery energy storage systems around the city.

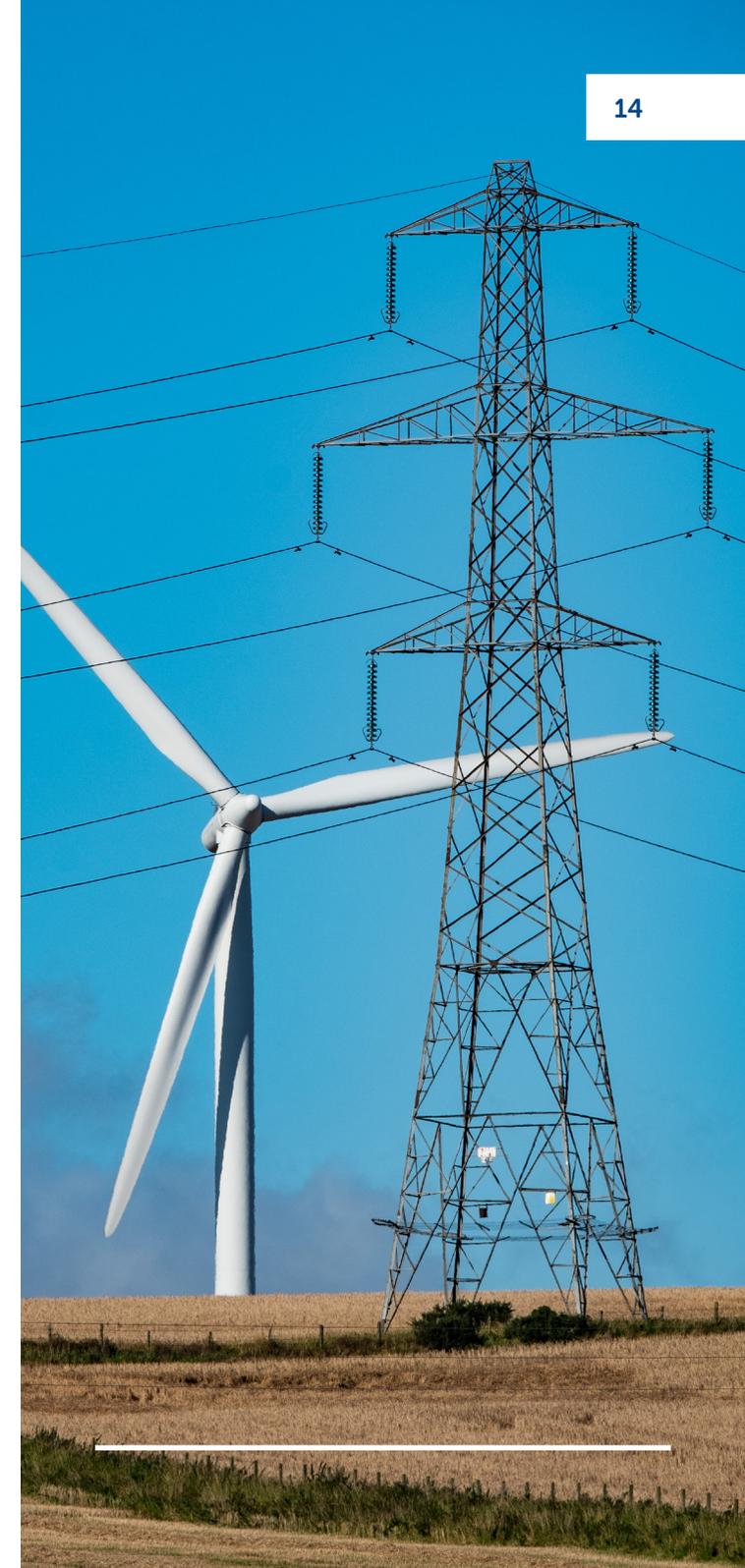
The ageing assets coupled with the growing demand as well as generation require a coordinated, efficient, and economic whole system solution that will meet the energy needs of the city in the long term.



One of EV charging points in Dundee

What we are doing about it

We are working with SSEN Distribution to develop a long-term strategy to address asset condition as well as provide network capacity to accommodate the growing electricity demand in the city.



Stakeholder engagement and collaboration

There will be engagement and collaboration with different stakeholders to ensure delivery of efficient and economical whole system solution that supports Dundee City's decarbonisation efforts and net zero targets. These stakeholders include SSEN Distribution, Dundee City local authority, Transport Scotland, Network Rail and the ESO. The information, data as well as feedback gathered from stakeholders is critical in the investment decision-making process to ensure that the preferred option is properly coordinated across different stakeholders and benefits local communities. We will continue to engage with stakeholders as the project progresses into delivery.

Innovate to improve

We are supporting SSEN Distribution in the development and implementation of the RESOP project. This is an innovative project that SSEN Distribution and Transmission are working on in partnership with the City of Dundee to develop a tool that will support the city's green recovery and net zero ambitions. The project known as Regional Energy System Optimisation Planning (RESOP) is funded under the Network Innovation Fund (NIA) to develop a whole system planning tool which will be used to model different future scenarios to support local decisions critical for sustainable economic development.

Benefits

The benefits of the project are as follows:

- Increased security and reliability of electricity supply to homes and businesses in the city of Dundee.
- Enhanced network capacity to support the growing electricity demand and generation to meet the city's net-zero emissions targets through electrification of heat and transport.
- The enhanced network capacity will allow SSEN Distribution to connect its customers to their network who require transmission access.

Project status

The project strategy paper will be completed by March 2022 and upon obtaining all the required approvals the internal project governance process will commence with a plan to deliver the work in the next price control period (RIIO-T3).

| 2.6 Significant Code Review (SCR): Reform of Network Access and Forward-Looking Charges.

In December 2018 Ofgem launched a Significant Code Review 'Reform of Electricity Network Access and Forward-looking Charging'⁷, with the intent to fully revise the commercial arrangements (mainly for distribution connected customers) by April 2023 to 'ensure electricity networks are used efficiently and flexibly, reflecting users' needs and allowing consumers to benefit from new technologies and services while avoiding unnecessary costs on energy bills.'

As Ofgem worked through their priority areas, the scope of the SCR somewhat narrowed. In June 2021 Ofgem published their minded-to decision⁸ in which they detail that there will be no change to transmission access rights, however Ofgem are minded implementing time profiled and the choice of firmness at distribution.

They also intend to reform the connection boundary at distribution, moving to a shallower boundary for generation and shallow boundary for demand.

SCR project status

Ofgem has acknowledged that there is a need for a wider review of TNUoS charges and we will continue to support the case for reform to ensure that network charging is fit for delivering the renewable generation required for the GB society to reach net zero. The SCR is ongoing, and we expect to hear a final decision from Ofgem early this year.

What we are doing about it

We are supportive of the progression of Ofgem's reform of access options at distribution. These options are already broadly available at transmission. The move to a shallower boundary at distribution, rather than adopting a similar connection boundary to transmission, will not fully address the distortion between distribution and transmission. However, we are aware our stakeholders have faced barriers relating to securities and liabilities, a key component of changing the connection boundary, and therefore believe this is a suitable approach on balance. Whilst we welcome the access options, it is difficult to assess the impact of such changes without further details on how charges will reflect them and with DUoS and TNUoS reform being delayed this provides further uncertainty for the industry. This uncertainty can affect the effectiveness of developing whole system solutions as the impact on generation connections and hence network constraints become unclear.

Stakeholder engagement and collaboration

Although the SCR minded-to position does not affect us directly, it is a whole system problem. It is important to us as we need to understand how these changes will affect embedded generation connections and hence network requirements so as to develop efficient and economic whole system solutions. As a stakeholder led business, it is also important to us that our stakeholders' views are represented. As such from the inception of the SCR, we have been actively involved at both working group and delivery group level, thus ensuring that the interests of our stakeholders are represented. This also ensures that expertise from the whole system is involved in the working of the SCR so that whole system is considered in any decisions.

Benefits

The benefits of our engagement in the code review include the opportunity to shape regulation so as to create a level cost playing field for Scottish projects to make our ambition for net zero a reality. Although we agree that all users of the transmission network should contribute to the costs through TNUoS and that introducing TNUoS charges to distributed generation will go towards removing distortions, we foresee that if the minded-to position is progressed in its current format, similar concerns by our stakeholders regarding high, volatile and unpredictable TNUoS charges will be raised for distributed generation. It is therefore important to raise and get these issues resolved now so that they do not create a barrier to our ambitions to reach net zero.

What we have learned

This is the first time the concept of whole electricity system has been formally introduced in the Transmission and Distribution licences and therefore there are lessons to be learnt by network companies as they undertake these activities. In the course of pursuing whole electricity system solutions, we have learnt that there are challenges that need to be overcome to ensure that a whole electricity system approach is successful and embedded into our BaU activities. These challenges present us with the opportunity to lead and be part of the energy transformation that will benefit our customers and stakeholders. Below we give examples of key challenges we have encountered, what we have learnt from them and what we are doing in collaboration with our stakeholders to ensure that these challenges do not frustrate our commitment to employing a whole system approach to how we operate and develop the network for net zero.

Whole system needs to be better understood across the industry

Exploring whole electricity system solutions requires coordination and cooperation with other network licensees as well as considering proposals from network users where there is benefit to the total system. Since whole electricity system has just been incorporated in the Transmission and Distribution licences, it is still in its nascent stage within network companies. As such, we have experienced challenges and delays in exploring whole system options with other network licensees. On our part, we have a Whole System Strategy which clearly defines what whole system means to us. We also have a dedicated whole system team that is working with other teams across the organisation to ensure that whole system becomes business as usual so that individuals seek whole system solutions as well as not create undue barriers or difficulties for other electricity network licensees seeking whole system solutions with us. We have taken an active role in the Energy Networks Association and will continue to do so to ensure that there are appropriate mechanisms that enable better coordination and cooperation between network licensees around whole system.

Data and information sharing between networks needs to improve

Data and information sharing between network companies is critical in understanding cross-network impacts in order to achieve optimal efficiencies across total system. Although networks are obligated to share certain information, we believe that more needs to be done to simplify the process. The whole system approach presents us with the opportunity to reinforce and close the gaps in the data and information sharing channels with network licensees and other stakeholders.

At SSEN Transmission we are working with other network licensees to develop business to business processes that will make it easier to share data and information that can be used in making coordinated, efficient and economic whole system investment decisions without violating competition laws.

Deterministic network planning methods not suitable for new generation technologies

The transmission network requires ongoing investment to meet changing generation and demand patterns. Network requirements have traditionally been determined using methodologies based on deterministic rules to assess network performance and compliance. The increasing volume of intermittent and variable renewable generation means that the deterministic approach is becoming insufficient to fully assess network reinforcement requirements and, consequently, is unable to provide a firm basis to justify network investments. Techniques that consider the variable characteristics of renewable generation output and demand side flexibility will help underpin network investment decision making in the future by using probabilistic approaches to modelling generation and demand.

The ESO uses elements of a probability-based approach to sample for generation output within its BID3 tool that is used to determine the level of network constraint as part of the NOA process for strategic network investment. However, this technique is not currently employed for local networks. We are seeing an increase of variable small-scale generation including batteries seeking to connect to these local networks and the use of deterministic planning methods is not effective as it does not allow connection of these new technologies ahead of network reinforcement thereby creating barrier to net zero. This presents us with the opportunity to try other innovative ways that will benefit our customers and stakeholders. We are currently working on a probabilistic planning methodology to be used in such cases which can be scaled for wider industry use.

Misalignment of Transmission and Distribution planning standards has a potential to create barriers to whole system

Transmission and Distribution networks are governed by different planning standards and codes. Whilst the spirit behind these standards and codes is that they work to complement each other, changes to one could affect the others. Since these planning standards and codes have different governance frameworks, changes are unlikely to occur simultaneously. This can result in misalignment which can act as a barrier to whole electricity system. For example, Engineering Recommendation P2/7 now includes the use of flexibility services like demand side response to contribute to demand security, but this is not explicitly stated or referenced in the Security and Quality of Supply Standards (SQSS). We have expressed our concern on these issues to relevant parties and will continue to work with stakeholders to ensure that necessary changes are made to the planning standards and codes so that they do not pose barriers to implementing whole system solutions.

Potential misalignment of investment plans due to differences in Transmission and Distribution price control periods

Price control periods for Transmission and Distribution (RIIO-T and RIIO-ED) start and end at different times. This may result in misalignment in the network investment plans for transmission and distribution thereby creating challenges in whole electricity system planning. There are currently no plans by the regulator OFGEM to align the two price control periods. As such, networks will need to be proactive and collaborate more with each other as they develop their business plans. We did this when we developed our RIIO-T2 Business Plan and will do likewise when we prepare our business plan for the next price control period. We have been transparent with our network investment plans (where necessary) through coordination and cooperation with network licensees and other stakeholders so that cross-network impacts are understood and resolved earlier in the process.

We want to hear from you

In this report we have outlined our commitment to delivering value to our stakeholders and communities where we operate through the work we are doing where whole system approach is central to our investment decision making process. We want to thank all our stakeholders for continuing to support us in our effort to operate and develop a network for net zero.

Now you know what we are doing as regards whole system and at this point, we would like to hear from you. In particular, we would like to know where you think we have missed it and areas where we should improve. We would also like to hear your suggestions on activities we should do that would benefit whole system. You can contact us through the following ways.

- **Email:** WholeSystemTransmission@sse.com
- **Telephone:** 07584 011 998
- **Twitter:** @SSETransmission
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