Pre-construction funding Paper – T2BP-PAP-0016

Scottish Hydro Electric Transmission plc

Sept 2020

Scottish & Southern Electricity Networks

Contents

Scottish & Southern Electricity Networks

1. Background

Our RIIO-T2 business plan (Business Plan) 'A Network for Net Zero' sets out a clear pathway for us to facilitate growth in renewable, low carbon energy. We anticipate developing and constructing substantial new infrastructure across our network to accommodate new generation and demand connections over the RIIO-T2 period and beyond. This will build upon the unprecedented growth across our network in the RIIO-T1 period where we are forecasting to double the level of generation connected on our network with over 4GW of new renewable generation connected in the period. **Our track record for delivery of large capital projects on time and within budget has been sector leading during this period.** Our Large Capital Projects governance process provides a structured platform for robust delivery of our schemes; central to this is our structured approach to the pre-construction phase of our project lifecycle. The importance of the pre-construction phase in our project lifecycle is critical and continues to be a key focus for us, ensuring our projects:

- consider all options to ensure the most efficient and robust solutions are taken forward at the right time;
- are developed within required timeframes for our customers and stakeholders; and
- have designs and specifications developed to minimise risk and associated construction costs.

Having access to adequate pre-construction funding (PCF) is essential to ensure timely and efficient **development**, and ultimately, timely and efficient **delivery** of future schemes on our network; both aspects are fundamental in ensuring we can meet the requirements to achieve Net Zero targets through our network. Although PCF historically accounts for a relatively small amount of overall project costs (<10%), the impact of the pre-construction phase on overall project construction costs should not be underestimated.

Ofgem has always stressed the importance of efficient delivery (hence the Totex Incentive Mechanism) but now has placed increased emphasis on timely delivery (hence the Large Capital Project late delivery penalty proposals). The pre-construction phase is critical to ensuring on time delivery.

In response to Ofgem's Draft Determinations (DD) on our RIIO-T2 Business Plan submission, this paper provides an update on the Large Strategic Schemes that we propose should be included within our pre-construction baseline funding for the RIIO-T2 period. Our revised proposal considers the changes in background generation since submission of our Business Plan in late 2019 and recommendations from the 2019/20 Network Options Assessment (NOA) process. Our response to Ofgem's DD is summarised in Table 1 below:

Table 1 – SHE Transmission Response to Ofgem DD proposal for PCF in RIIO-T2

PCF BP Submissions	Total Forecast	DD Decision	SHE Transmission Response
7 x Large Strategic projects – total Forecast (UIOLI Pot): 1. East Coast 400kV Phase 2 Reinforcement 2. 2nd Eastern HVDC Link fom SHET to England 3. Dounreay to Spittal 400kV Double Circuit 4. Beauly to Denny 400kV (Uprating the 275kV cct for 400kV Operation) 5. Spittal to Peterhead HVDC Link 6. Skye / Western Isles Upgrade 7. 1st Eastern HVDC Link, Peterhead to Drax	**£113.4m (based on a 'use it or lose it' pot)**	**Two schemes approved in baseline allowance, UM to cover future uncertain schemes:** 3. Dounreay to Spittal 400kV Double Circuit 7. Eastern HVDC, Peterhead to Drax Total Allowance - £24.7m*	**Revised justification proposed for 5 x schemes for inclusion in our baseline allowances – total forecast £124.5m:** 1. 1st Eastern HVDC Link 2. 2nd Eastern HVDC Link 3. Skye/Western Isles HVDC Link 4. Scotwind OWPL – Dounreay to Spittal double circuit & HVDC Link Spittal to Peterhead 5. Argyll and Kintyre Strategy **Future schemes covered by in period adjustments for further funding when need is demonstrated.**
Annual NOA scheme Development & Regional Plan Development	**£4.5m (based on a 'use it or lose it' pot)**	**Schemes approved**	**Agreed**
Advanced PCF for T3 schemes: 1. T3 LRE schemes 2. T3 NLRE schemes	**£24m (based on a symmetric true up at end of period)**	**T3 LRE approved (£11m),** **T3 NLRE not approved (£13m)**	**T3 pot required for both LRE & NLRE schemes - SHET currently preparing further justification summaries for both LRE & NLRE T3 schemes**

The purpose of this paper is to provide justification, based on the latest NOA and background generation drivers, for the inclusion of five Large Strategic Schemes within our baseline funding for the RIIO-T2 period. In addition, the

following points should also be noted as outlined in our supporting paper - True Up, Logging Up and re-openers: SHE Transmission RIIO-T2 Proposals (ref T2Business Plan-DD-QRD-001):

- We are proposing an annual reopener, 1 month after the annual NOA publication, to allow for additional PCF funding as the need is demonstrated;
- The annual reopener will cover future uncertain schemes not in the baseline proposals and significant changes in scope for baseline schemes; and
- We accept the requirement for an ex-post symmetric (timely and proportionate) true-up of PCF. Our aim is efficient development, not to outperform the allowances. This should give Ofgem confidence in setting our baseline costs.

It should also be noted that all costs in this paper should be labelled "high confidence" for the purposes of the Totex Incentive Mechanism (TIM) and the Business Plan Incentive (Business PlanI). In line with Ofgem Guidance, costs with an appropriate uncertainty mechanism should be considered high confidence.[1] More detail is provided in our supporting documents "SHE Transmission: Totex Incentive Mechanism" and "SHE Transmission – Business Plan Incentive".

Ofgem has acknowledged that a NOA 'Proceed' signal provides the trigger on the need to incur PCF for schemes that provide wider system capacity across transmission boundaries and has invited suggestions on suitable triggers for PCF for other types of schemes not covered within NOA. Given the nature of our network, the capability and performance needs being asked of it and the associated development requirements over the RIIO-T2 period, consideration of PCF for Large Strategic Schemes (LSS) not covered within the NOA process is critical for the RIIO-T2 period. Typical examples of schemes include the development of long radial links to our remote islands and large shared use infrastructure schemes to support renewable generation across our local regions.

Our proposal for the trigger for PCF covering schemes not included in the NOA process is two-fold:

1. A signed connection agreement in place for at least one customer (licence obligation to connect) which triggers the need for the new infrastructure and/or asset intervention requirement identified; and
2. Requirement for delivery of the scheme under the LOTI process (i.e. >£100m)

Since the submission of our Business Plan in December 2019, there have been several changes in the background drivers which impact the pre-construction activities we need to undertake on our network both in the shorter and longer term.

The most significant wider driver was the recent BEIS consultation on future Contracts for Difference (CfD) Allocation Rounds (AR) in March 2020. The consultation provides confidence for ongoing future support across many of the technologies that will be deployed across our network in future years including onshore wind, island wind and offshore wind (inc. floating offshore wind). This confidence has been reflected in the significant increase in both connection applications and acceptances over the past 6-9 months across our network meaning we now have higher certainty on the justification for PCF for five Large Strategic Schemes. The most significant changes since the business plan submission include:

- A significant increase in both the contracted and future generation connections across our Argyll region;
- A signed contract for the 2250MW offshore wind scheme to the west of Orkney; and
- A proceed recommendation for the additional Eastern HVDC link within NOA 2020.

[1] RIIO-2 Sector Specific Methodology Decision, paragraph 11.37 https://www.ofgem.gov.uk/system/files/docs/2019/05/riio-2_sector_specific_methodology_decision_-_core_30.5.19.pdf

Based on these changes and the latest generation drivers, our view is there is a strong justification on the need for PCF expenditure within our RIIO-T2 baseline allowance for five large schemes.

Ofgem has proposed an Uncertainty Mechanism (UM) to allow PCF for future schemes. Although we agree with the principle of a UM for PCF alongside baseline funding, we have significant concerns over the proposals set out within the DD (notably spending PCF at risk until an end of period assessment). We will include our views within our response to the specific DD consultation questions.

This paper sets out the Large Strategic Schemes that require PCF in our baseline allowance for the RIIO-T2 period along with the associated justification based on both wider and local generation connection commitments.

2. Introduction

In our Pre-Construction Methodology (T2Business Plan-MET-0003) paper submitted as part of our Business Plan, we outlined the requirement for additional funding for pre-construction activities during the RIIO-T2 period. This funding was in addition to the pre-construction costs (included within the individual scheme costs in our Business Plan submission) for schemes included in our Certain View.

At the time we anticipated the requirement for additional pre-construction funding to develop and deliver a total of **7** growth (load) driven LSS to achieve our Net Zero ambitions. These are set out in **Table 2.** These schemes were proposed based on the information we had available at the time of submitting the Business Plan and our proposal was for a Use it or Lose it (UIOLI) funding pot which provided flexibility to accommodate future changes. Some of the 7 schemes proposed in our plan provide for wider system boundary benefit and will therefore be considered in the NOA, and some of these LSS are required for generation connections.

Our original Business Plan submission included a total forecast spend of £113.4m for PCF activities associated with seven schemes as part of an overall UIOLI funding pot. Based on feedback in the DD and review of the current background generation requirements, our revised proposal is for £124.5.01m for five schemes. This is shown in **Table 2.**

Table 2 – Proposal for Large Strategic Scheme Baseline Allowance

Large Strategic Scheme	Requirement	Original Business Plan Submission	Ofgem DD	Revised Submission
1st Eastern HVDC link from SHE Transmission to England	Wider system benefit across multiple boundaries including B2 / B4 / B5 / B6 / B7 and B7a	£21.6m	£21.6m	£21.6m No change, as per original Business Plan and Ofgem DD
2nd Eastern HVDC link from SHE Transmission to England	Wider system benefit across multiple boundaries including B2 / B4 / B5 / B6 / B7 and B7a	£32.4m	£0	£32.4m As per SHE Transmission original submission
East Coast Onshore 400kV Phase 2 Reinforcement	Wider system benefit on boundaries B2 and B4	£14.3m	£0	£0 As per Ofgem DD (although should be subject to a revised UM)
Skye/Western Isles upgrade	Generation Connection	£10.8m	£0.8	£17.7m Amended from SHE Transmission original submission
Dounreay to Spittal double circuit	Generation Connection	£3.1m	£3.1m	£31.11m Become collectively: Scotwind OWPL - Dounreay to Spittal double circuit & HVDC link Spittal to Peterhead
HVDC link Spittal to Peterhead	Generation Connection	£28.2m	£0m	

Beauly to Denny 400kV (uprating the 275kV circuit for 400kV operation)	Generation Connection	£3m	£0	£0 As per Ofgem DD.
Argyll and Kintyre 275kV Strategy	Generation Connection	Not part of original Business Plan	NA	£22.7mm New scheme – amended from SHE Transmission original submission
Total		**£117.9m**		**£124.5**

Wider system benefit/NOA driven LSS

Each year the ESO undertakes the NOA, supported by the three onshore transmission licensees. We have an ongoing requirement to provide input into the NOA process. This means an ongoing requirement to carry out early development works to assess technical options and provide associated costs for large-scale strategic upgrades which provide wider system benefit. The NOA is an economic appraisal of the available options to develop the GB transmission system against the ESO GB Future Energy Scenarios (FES). The outcome of the NOA is an investment recommendation as to which options should be progressed in the year ahead, ensuring the options are completed at a time that will deliver the most benefit to the GB consumer. For the 3 NOA-related schemes in our original Business Plan ask which provide boundary benefit:

- the 1st Eastern HVDC link from SHE Transmission to England has been recommended to 'Proceed' from the first NOA in 2015/16 to the most recent NOA (NOA 2019/20);
- the 2nd Eastern HVDC link from SHE Transmission to England was submitted as an option for the first time in NOA 2019/20 and has also been recommended to 'Proceed'; and
- the East Coast Onshore 400kV Phase 2 Reinforcement was also submitted as an option for the first time in NOA 2019/20 but received a 'Do not start' recommendation.

NOA 2019/20 is against the FES 2019 background, where none of the scenarios meet the legislative UK Net Zero targets. Network requirements, especially across the northern boundaries on the GB system, further increase against the FES 2020 background which includes the Net Zero targets. We therefore expect that the two Eastern HVDC links will continue to receive a 'Proceed' recommendation in the next NOA. The recommendation of the East Coast Onshore 400kV Phase 2 Reinforcement is likely to change to 'Proceed' in either the next NOA or during the RIIO-T2 period. However, based on the latest NOA recommendation we have decided to remove this scheme from inclusion in our baseline PCF for the RIIO-T2 period. In addition, we will be submitting (Q3 2020) in collaboration with Scottish Power Transmission (SPT) and National Grid Electricity Transmission (NGET) the Strategic Wider Works (SWW) Initial Needs Case (INC) for two subsea HVDC links on the eastern side of the GB system, which includes the 1st Eastern HVDC link from SHE Transmission to England. This follows the strong and urgent economic need identified in the NOA and subsequent SWW Cost Benefit Analysis (CBA).

Although some options are mutually exclusive in delivery (i.e. only one option can be delivered and cannot be combined with the other option), the NOA may recommend to progress both options in the year ahead as each option may be favoured by different scenarios and proceeding with both options sees the lowest level of economic regret. We expect that the NOA will increasingly require us to keep options open and therefore lead to increased pre-construction costs to maintain the Earliest In Service Dates (EISD). The NOA related schemes in **Error! Reference s ource not found.**1 which provide boundary benefit are not mutually exclusive, however there are alternative options to these schemes (for example, different landing points for the 2nd Eastern HVDC link from our area) which may be required to be kept open during the RIIO-T2 period.

Generation Connection Driven LSS

In addition to removing the East Coast Onshore 400kV Phase 2 Reinforcement from our original PCF request, we have removed the Beauly to Denny 400kV uprate scheme as there is no longer the need for upfront PCF to ensure we can meet our license obligation for the associated generation connection.

Conversely, as a direct result of significant changes in background generation in the South West of the SHE Transmission network since submission of our Business Plan, we now require upfront PCF for the Argyll and Kintyre 275kV strategy to enable timely generation connection. We have also merged the Dounreay to Spittal double circuit & HVDC link Spittal to Peterhead schemes together since they have the same generation driver (Scotwind OWPL).

We feel there is strong justification for PCF for each of the above scheme now and the following sections of this paper sets out:

- Details of the above schemes;
- The background generation drivers for each scheme; and
- The PCF activities required and associated timescales.

The revised total proposal for our baseline PCF for LSS covering the 5 schemes listed above is therefore £124.5mm.

In line with the DD, we propose that funding for other future LSS is covered within the RIIO-T2 PCF UM.

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3. Customer Connections and Future Energy Scenarios

This section introduces the background on customer connections that are either contracted or being offered to connect in the SHE Transmission SHE Transmission area and the ESO GB FES that are used to inform strategic investment planning, including the significant and increasing growth in offshore wind and interconnectors. We use this information to inform the development program for our network and based on the latest information available we are proposing baseline PCF for the LSS we require funding for to allow pre-construction activities to be undertaken from the beginning of the RIIO-T2 period onwards. These schemes are summarised in Table 1 above (see Introduction section) and include schemes driven by both local and wider generation requirements – see section 0 (Large Strategic Schemes – Wider System Need) and section 0 (Large Strategic Schemes – Generation Connections) for scheme details and justification for baseline PCF.

In the short to mid-term, there is an increase in north to south power flows on the SHE Transmission network largely due to generation already contracted to connect in the SHE Transmission area. In the medium to longer term, the FES are used to give a diverse and credible range of future energy landscapes, all of which show increasing north to south power flows. The enduring energy policy seeking to decarbonise energy in GB and achieve the Net Zero targets is driving the generation and demand activity responsible for these changes in power flows, both in the short and long term.

3.1 Connections

Due to the government incentive mechanisms for renewable generation, there are growing capacities of renewable generation seeking to connect to the SHE Transmission network. The bulk of these are onshore and offshore wind and pumped storage. Based on previous generator developers' responses to past announcements on subsidies, we expect increased connection requests following the recent consultation on CfD.

As more fossil fuelled power plants continue to close in England, the balance of demand will need to be met through cleaner generation. This is creating opportunities for renewable generation developers in the SHE Transmission area where there are significant renewable resources, resulting in high contracted generation capacities. In the SHE Transmission area there is currently a total of approximately 12.8GW of generation capacity either contracted or being offered to connect by 2031 and a 1.4GW interconnector (North Connect) from Norway contracted to be operational in 2024. This generation capacity is located on the mainland (6.1GW), the three island groups – Western Isles (330MW), Orkney (201MW) and Shetland (779MW) – and in the Pentland Firth (2487MW), Moray Firth (1760MW) and Firth of Forth (1075MW). Approximately 8.57GW of this generation capacity is made up of individual generation schemes with capacities greater than 200MW. Of this generation, approximately 4.6GW is consented. These large schemes are:

- Moray Offshore Renewables Limited Eastern Development Area (MORL EDA) has a capacity of 900MW. This offshore windfarm is located in the Moray Firth and is contracted to connect in 2021. MORL EDA has consents and a subsidy.
- MORL Western Development Area (MORL WDA) has a capacity of 860MW and is currently contracted to connect in 2 phases. Phase 1 (800MW) is contracted to connect in 2024, and Phase 2 (60MW) is contracted to connect in 2026. This offshore windfarm is located in the Moray Firth to the west of MORL EDA. MORL WDA has consents but no subsidy.
- Firth of Forth Phase 1 has a capacity of 1075MW and is contracted to connect in 2021. This offshore windfarm is part of a bigger scheme located in the Firth of Forth. Firth of Forth Phase 1 has consents. The scheme also has subsidy for circa 450MW.
- Coire Glas pumped storage is currently contracted with a capacity of 612MW to connect in 2025 but has an offer for a total capacity of 1296MW to connect in 2 phases – Phase 1 (612MW) and Phase 2 (684MW) to connect in 2027 and 2029 respectively. This scheme has consents and is not eligible for subsidy.

- MeyGen Limited has a marine capacity of 237MW and is currently contracted to connect in 4 phases. Phase 1 (15MW) and Phase 2 (56MW) are both contracted to connect in 2024 and the third and fourth phases (each 83MW) in 2025 and 2026 respectively. This scheme is located in the Pentland firth.
- Viking onshore windfarm has a capacity of 457MW and is contracted to connect in 2024. This windfarm has consents but no subsidy and is located on Shetland. This scheme is contingent on the Shetland island link.
- Cloiche onshore windfarm has a capacity of 200MW and is currently contracted to connect in 2026 but has an offer to connect in 2025. This windfarm does not have consents or a subsidy.
- Clash Gour onshore windfarm has a capacity of 210MW and is contracted to connect in 2024. This windfarm does not have consents or a subsidy.
- OWPL (Offshore Wind Power Limited), also known as West of Orkney, has a capacity of 2250MW and is currently contracted to connect in 2 phases. Phase 1 (750MW) is contracted to connect in 2029, and Phase 2 (1500MW) is contracted to connect in 2031. This offshore windfarm is located in the Pentland Firth and does not have consents or a subsidy.
- Strathy South onshore windfarm has a capacity of 207.6MW and is currently contracted to connect in 3 phases. Phase 1 (132.6MW) and Phase 2 (25MW) are both contracted to connect in 2024 and the third phase (50MW) is contracted to connect in 2025. This windfarm does not have consents or a subsidy.
- Energy Isles onshore windfarm has a capacity of 200MW and is located on Shetland. Phase 1 (120.3MW) is contracted to connect in 2024 and is contingent on the Shetland island link. Phase 2 (79.7MW) has an offer to connect in 2026 and would be contingent on a second link from Shetland. This windfarm does not have consents or a subsidy.
- Garvary onshore windfarm has a capacity of 226.2MW and has an offer to connect in 2025.
- Red John pumped storage has a capacity of 450MW and has an offer to connect in 2026.

In addition, Crown Estate Scotland is running a leasing round in 2021 where developers bid for rights to develop offshore wind projects in specific areas of seabed around the coast. ScotWind, due to be launched by Crown Estate Scotland this year, will offer seabed rights for up to 15 sites in Scottish offshore waters off the north, north east and east coast of the SHE Transmission area. SHE Transmission has already been approached by several developers looking to make an application to the ScotWind leasing round in 2021to discuss potential options and timeframes for connection (see section 6.1 ScotWind - OWPL (West of Orkney) for more information).

3.2 Future Energy Scenarios

The GB FES are produced annually by the ESO in consultation with stakeholders. These scenarios reflect the continually evolving market intelligence and are used as investment planning backgrounds to inform the TO's network investment strategy. The FES outline different credible pathways for the future of energy for the next 30 years and beyond. These consider how much energy we might need and where it could come from. They look at what the changes might mean for the industry, customers and consumers. All scenarios consider energy demand and supply on a whole system basis, incorporating gas and electricity across the transmission and distribution networks. The GB scenarios continue to evolve and are updated annually, allowing updates to be captured in the annual NOA process and ensuring that we maintain focus on delivering network development plans that deliver the best consumer value against an uncertain future.

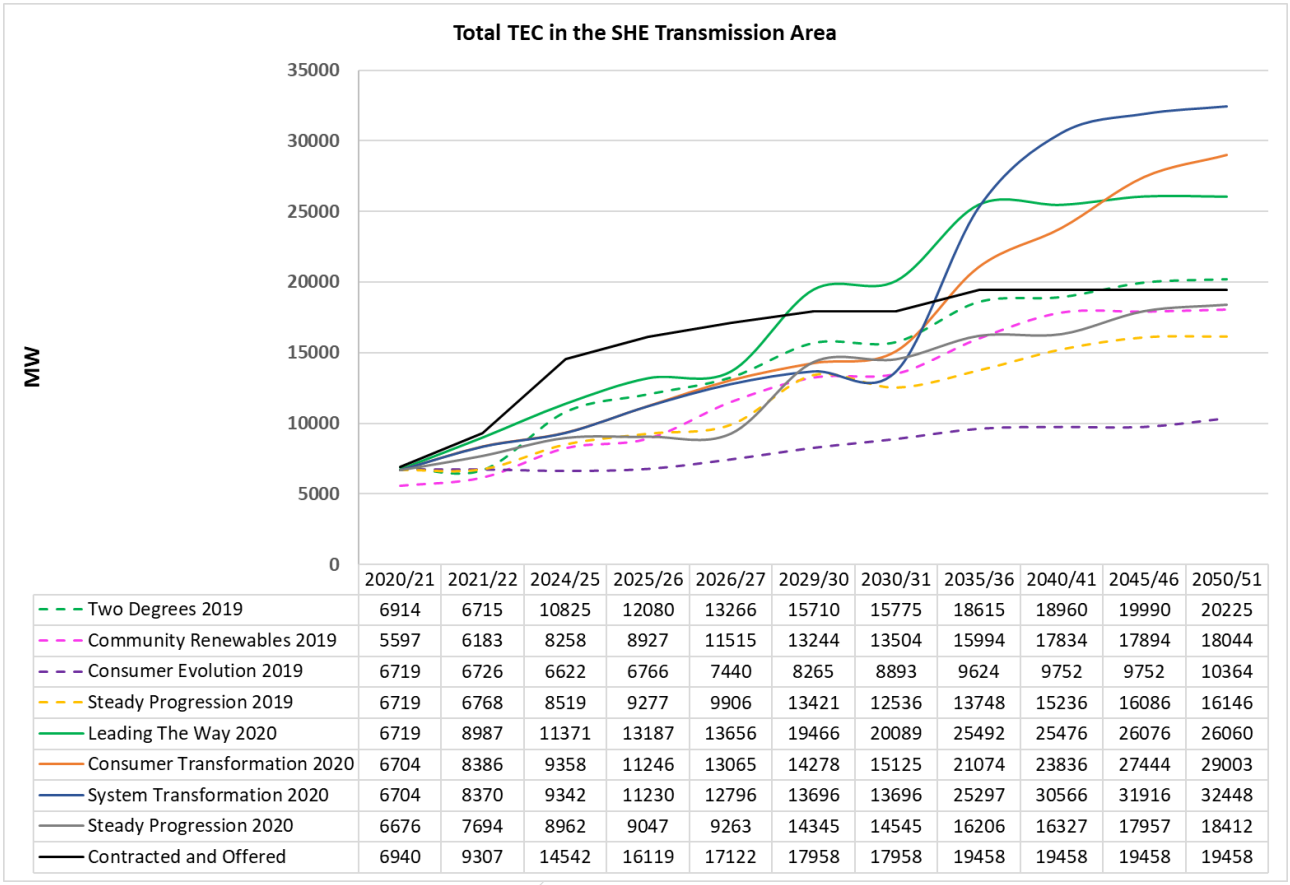
For FES 2019, none of the scenarios meet the legislative UK Net Zero targets, and only the Two Degrees and Community Renewables scenarios meet the previous legislative target of an 80% reduction in Greenhouse Gas (GHG) emissions by 2050 (compared to 1990 levels). A key focus of FES 2020 is the inclusion of the now legally binding UK Government Net Zero target, to bring all GHG emissions to net zero by 2050. FES 2020 includes a scenario (Leading the Way) that will meet the Net Zero target earlier than 2050, two scenarios (Consumer Transformation and System Transformation) that meet the Net Zero target in 2050, and now only one scenario (Steady Progression) that does not meet the Net Zero target. The projected growth in generation capacity (primarily onshore and offshore

wind) from FES 2019 and FES 2020, as well as generation capacity which is either contracted or being offered to connect in the SHE Transmission area, is shown in Figure 1. This includes generation directly connected to the transmission system, large (>10MW) embedded generation and interconnector capacity.

The Leading the Way scenario exceeds total generation contracted or offered to connect in the SHE Transmission area by 2029, and the Consumer Transformation and System Transformation scenarios exceed this in 2032 and 2033 respectively. In 2030, the Two Degrees and Community Renewables scenarios from FES 2019 reach a total capacity of ~15.7GW and ~13.5GW respectively, and the Leading the Way and Consumer Transformation scenarios from FES 2020 reach a total capacity of ~20GW and ~15.1GW respectively. This is an increase in the SHE Transmission area of ~4.3GW for Leading the Way (FES 2020) compared to Two Degrees (FES 2019), and an increase of ~1.6GW for Consumer Transformation (FES 2020) compared to Community Renewables (FES 2019) in 2030. **This is a clear indication of a likely and accelerated capacity increase on top of FES 2019 capacity levels needed in the SHE Transmission area in order to meet UK Net Zero targets.**

We forecast that total generation capacity connected to the SHE Transmission network in the north of Scotland will double during the RIIO-T1 period to 8.1GW by 31st March 2021. For the RIIO-T2 period, our modelling of the requirements to meet Net Zero emissions targets indicates that total generation capacity will increase to between 13.6GW (our Likely Outturn scenario) and 15.7GW (our Proactive Decarbonisation scenario – North of Scotland Net Zero FES) by 31st March 2026. Our Certain View scenario, on which our RIIO-T2 Business Plan is based, indicates that total generation capacity will increase to 11.2GW by 31st March 2026. By 2030 the GB FES 2020 predicts that total generation capacity on our network will need to increase to between 15.2GW (System Transformation scenario including small and medium embedded generation) and 17GW (Consumer Transformation scenario including small and medium embedded generation) to meet UK Net Zero targets, and will need to increase to 21.9GW (Leading the Way scenario including small and medium embedded generation) to achieve UK Net Zero targets earlier than 2050. This is a further increase in total generation on the SHE Transmission network beyond the RIIO-T2 period to 2030 of between 4GW and 5.8GW to meet UK Net Zero targets, and 10.7GW to meet Net Zero earlier than 2050, compared to our Certain View scenario.

The rate of change in total capacity from the end of the RIIO-T2 period to 2030/31 has increased in FES 2020 compared to FES 2019. For Two Degrees the rate of change was ~740MW per year, compared to ~1380MW per year and ~776MW per year for Leading the Way and Consumer Transformation respectively. The rate of change in total capacity of all three FES 2020 scenarios which achieve the Net Zero target by 2050 or earlier then increases significantly in the period 2031-2040. Both FES 2019 and FES 2020 has little change in demand in the SHE Transmission area. As a result, an increase in generation capacity directly correlates to an increase in power transfer requirements from north to south across the B4 boundary between the SHE Transmission and SPT area.



	2020/21	2021/22	2024/25	2025/26	2026/27	2029/30	2030/31	2035/36	2040/41	2045/46	2050/51
Two Degrees 2019	6914	6715	10825	12080	13266	15710	15775	18615	18960	19990	20225
Community Renewables 2019	5597	6183	8258	8927	11515	13244	13504	15994	17834	17894	18044
Consumer Evolution 2019	6719	6726	6622	6766	7440	8265	8893	9624	9752	9752	10364
Steady Progression 2019	6719	6768	8519	9277	9906	13421	12536	13748	15236	16086	16146
Leading The Way 2020	6719	8987	11371	13187	13656	19466	20089	25492	25476	26076	26060
Consumer Transformation 2020	6704	8386	9358	11246	13065	14278	15125	21074	23836	27444	29003
System Transformation 2020	6704	8370	9342	11230	12796	13696	13696	25297	30566	31916	32448
Steady Progression 2020	6676	7694	8962	9047	9263	14345	14545	16206	16327	17957	18412
Contracted and Offered	6940	9307	14542	16119	17122	17958	17958	19458	19458	19458	19458

Figure 1: Total TEC for large generation (>10MW) in the SHE Transmission Area

4. SHE Transmission Wider System Requirements

In **Error! Reference source not found.** below (published by the ESO for the 2020 Electricity Ten Year Statement) the c urrent B4 boundary capability (black line) is plotted alongside anticipated required power transfers across the boundary for the next 20 years. By looking at these required transfers in comparison with boundary capability, it can be seen where future network reinforcement needs across the GB system can be expected. The required power transfers are calculated in accordance with the planning criteria in the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS). The B4 boundary between SHE Transmission and SPT is currently limited to ~3.2GW. The capability of the B4 boundary will rise to ~4.2GW following completion in 2026 of the East Coast 400kV Upgrade. This is the second part of the phased onshore reinforcement on the east coast – the first part is the East Coast 275kV Upgrade which has a completion date of 2023. Boundary capability changes over time as the network generation and demand change. For the purposes of comparing boundary capability with required power transfer, we will assume B4 capability is fixed based on present known conditions – in this case 4.2GW from 2026.

As can be seen in **Error! Reference source not found.**, there is a significant increase in power transfer requirements f rom north to south across the B4 boundary, particularly in FES 2020 after the RIIO-T2 period. As set out in section 3, this is due to the connection of significant additional generation in the SHE Transmission area, primarily onshore and offshore wind. The required power transfers are similar for Two Degrees (FES 2019) and Leading the Way (FES 2020) until 2028. By 2028, the required power transfers of both scenarios are ~9.2GW – 5000MW higher than B4 capability post the East Coast 400kV Upgrade. **This shows the need for significant reinforcement beyond the RIIO-T2 period in the SHE Transmission Area**

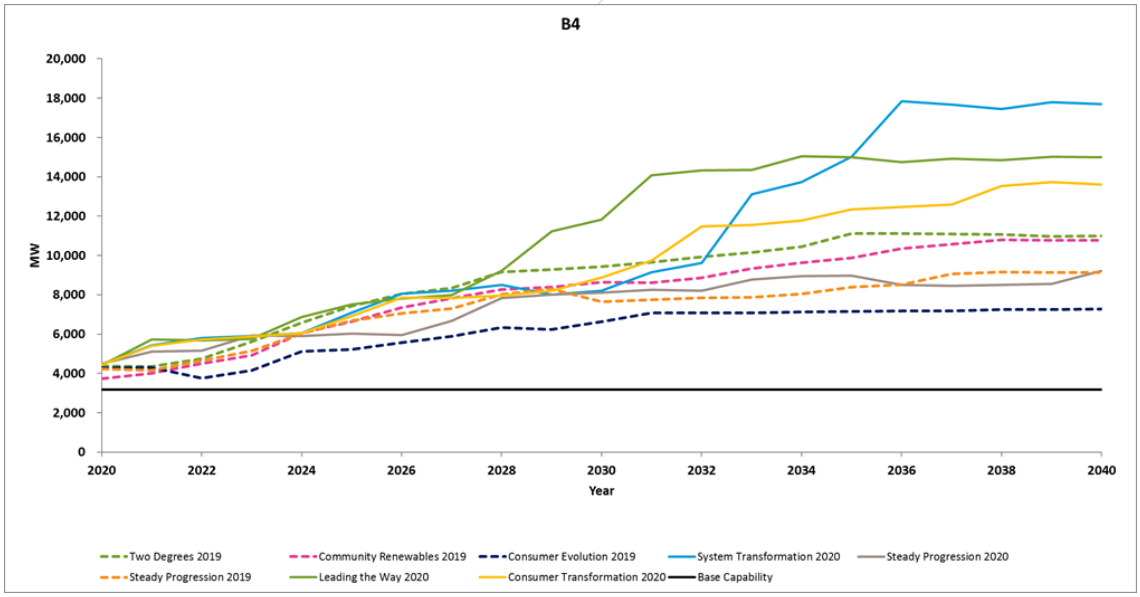


Figure 2: Required Transfers and base capability for boundary B4

The considerable volume of new renewable energy projects, primarily in Scotland but also across GB, has and will continue to have a profound impact on the north to south power flows between Scotland and England. Significant investment is therefore required on the transmission network to accommodate the current and expected growth in renewable electricity generation capacity that will be needed to meet the UK's Net Zero targets. This generation

growth, combined with the capability of the existing transmission system, leads to considerable constraint costs across the system and ultimately to the GB consumer. These constraint costs will increase as greater volumes of generation are connected. **The timely delivery of the transmission infrastructure necessary to facilitate and keep pace with this growth is essential to meeting the UK's Net Zero ambitions and enabling significant constraint savings to the GB consumer. PCF is essential for timely delivery.**

5. Large Strategic Schemes – Wider System Boundary Benefit

This section provides detail to support:

Recommendation: PCF funding totalling £54m to be approved in the baseline funding covering both the Eastern HVDC 1st and 2nd schemes.

Justification: NOA proceed signal

As detailed in section 4, there is a need for significant reinforcement beyond the RIIO-T2 period triggered by the connection of significant additional generation in the SHE Transmission area, primarily onshore and offshore wind (as set out in section 3). By 2028, required transfers of Two Degrees (FES 2019) and Leading the Way (FES 2020) are ~5000MW higher than B4 capability (4.2GW) following the East Coast 400kV Upgrade. SHE Transmission has outlined that the following wider system LSS are needed beyond the RIIO-T2 period to increase B4 boundary capability and sufficiently lower constraint costs to the GB consumer:

- 1st Eastern HVDC link from SHET to England – for delivery 2029 at an estimated total cost to SHET of £1200m; and
- 2nd Eastern HVDC link from SHET to England – for delivery 2031 at an estimated total cost to SHET of £2000m.

From the first NOA in 2015/16 to the most recent NOA (NOA 2019/20), a 1st Eastern HVDC link from SHET to England – a 2GW offshore link from Peterhead – has been recommended to 'Proceed'. Three options for the 1st Eastern link from SHET were proposed for each NOA which investigated different landing points in England, and therefore different lengths and EISD's of HVDC link. From NOA 2015/16 to NOA 2017-18, the CBA determined that the preferred landing point in England is Hawthorn Pit. For NOA 2018-19 and NOA 2019-20 the preferred landing point in England changed to Drax with an EISD of 2029. Following completion of the 1st Eastern 2GW HVDC offshore link from Peterhead to Drax in 2029, B4 capability increases to ~6.5GW. As can be seen in **Error! Reference source not found.**, anticipated boundary transfers reach ~9.2GW and ~11.8GW for the Two Degrees (FES 2019) and Leading the Way (FES 2020) scenarios respectively in 2030 – a difference of between ~2700MW and ~5300MW compared to B4 capability.

Following the strong and urgent economic need identified in the NOA, further recognised in the subsequent SWW CBA, we will be submitting (Q3 2020) in collaboration with other TO's the SWW INC for two subsea HVDC links on the eastern side of the GB system, which includes the 2GW Eastern HVDC offshore link from Peterhead to Drax. The SWW CBA has demonstrated that a delay of even one year to the Peterhead to Drax HVDC link would cost an average of ~£300m[2] in additional constraint costs to the GB consumer – a cost that is likely to increase further based on the FES 2020 background.

FES 2018 and the NOA 2018/19 process first indicated that further reinforcement in the SHE Transmission area may be required beyond the 1st Eastern HVDC link in 2029. A long-term conceptual option (with a delivery date of 2032 – later than any of the options in NOA 2018/19) was submitted by SHE Transmission in NOA 2018/19, with collaboration from SPT and NGET, to reinforce multiple boundaries (including the B4 boundary between SHET and SPT). This long-term conceptual option was allocated a cost equivalent to an offshore HVDC link (of significant length) and assigned as giving a 2GW capability uplift on each boundary (including B4). The NOA 2018/19 CBA determined that this long-term option was economic and therefore needed to support the long-term future

[2] Cost figure taken from section 6.7 (Eastern Link Delay analysis) of the October 2019 National Grid ESO East Coast CBA report entitled 'East Coast Reinforcement Options Cost Benefit Assessment'

network. As a result, in NOA 2019-20 two options for a 2nd Eastern link from SHET to England – a 2GW link from Peterhead or Blackhillock in SHET to South Humber in England – were submitted. The option for a 2nd Eastern link from Peterhead was recommended to 'Proceed' with an EISD of 2031. Following completion of the 2nd Eastern 2GW HVDC offshore link from Peterhead to South Humber in 2031, B4 capability increases to ~8.7GW – this is still ~500MW and ~3100MW less than anticipated boundary transfers around 2030 for the Two Degrees (FES 2019) and Leading the Way (FES 2020) scenarios respectively.

Considering the required transfers from FES 2020, we expect the cost impact to the GB consumer of delaying the 2nd Eastern link from SHET by one year will be significant – as determined for the 1st Eastern link above. Timely progression of both Eastern links from SHET to England is therefore crucial to minimise costs to the GB consumer. In order to maintain the EISD of 2029 and 2031 for the 1st and 2nd Eastern link respectively, pre-construction activity is required at the very beginning of the RIIO-T2 period. The project delivery timeline and outline of the pre-construction activities required to be undertaken in the RIIO-T2 period to maintain the EISD for these LSS is detailed below.

5.1 Project Delivery Timeline – Eastern HVDC links

An indicative timeline for project delivery of the 1st and 2nd Eastern HVDC link from SHET to England is provided in Table 1 below. Marine seabed surveys are required to be undertaken in 2020 and 2022 with construction due to start in 2024 and 2027 respectively to maintain the EISD of the 1st and 2nd Eastern HVDC links.

Table 1: Indicative Project Delivery Timeline for Eastern links (SHET to England)

Stage	1st Eastern link	2nd Eastern link
Initial Needs Case submission	Q3 2020	Q3 2022
Marine Survey	Q3 2020 – Q3 2021	Q2 2022 – Q2 2023
Final Needs Case submission	Q4 2021	Q1 2024
Consents in place	Q1 2022	Q1 2025
Project Assessment	Q2 2023	Q2 2025
First Contract Award	Q4 2023	Q2 2026
Manufacture	2024-2026	2026 - 2028
Construction Start (First Site Access)	Q3 2024	Q1 2027
Available for Commercial Load	Q4 2029	Q4 2031
Project close out	2030	2032

5.2 Pre-Construction Activity required in the RIIO-T2 period – 1st and 2nd Eastern HVDC links

Following a 'Proceed' signal from NOA, the associated project commences in line with the Large Capital Projects Governance process applied to SHE Transmission Projects of greater than £20 million in value. For pre-construction works this would see the project progress through Gates 0 – 3, with the definition of the project increasing as it progresses towards construction.

In the production of the costs estimated to be incurred a number of metrics have been utilised to determine the rates to apply. For works to be undertaken during Gate 0 -1 for the second Eastern HVDC Link actual costs from the first Eastern HVDC Link during the same phase were utilised to inform the estimates.

For the Gate 1 – 2 Period, the Seabed Surveys and their supporting works for the first Link have been subject to a tender and costs are based upon these, with these utilised to inform the costs for the Second Eastern HVDC Link. Further key works such as Onshore Environmental Studies, Planning Applications and Land and Wayleaves costs are based on actual costs incurred during the recent Peterhead 400kV Busbar project which is adjacent to the proposed Convertor Station sites for both the first and second Links, thus providing a reliable estimate for costs to be incurred

on these projects. Offshore Environmental Surveys and Engineering Design works have been developed from costs incurred on the Shetland HVDC Project which has already undertaken works of the same scope.

Similarly, for the Gate 2-3 activities these have been based on the actual costs incurred on the Shetland HVDC Project and applied accordingly for the first and second Eastern HVDC links.

5.2.1 Gate 0 -1 (1st and 2nd Eastern HVDC links)

Between Gate 0 and 1 the project is in the Opportunity Assessment phase, wherein the objective is to undertake the necessary works to identify the preferred site area(s) or route corridor(s) for the infrastructure required, review and define suitable technologies for the project and begin development of the strategies to gain consents (where required), engage stakeholders and to deliver the projects.

For the 1st Eastern HVDC link, Gate 0 and Gate 1 were completed within RIIO-T1 therefore no costs are apportioned to these works as part of our RIIO-T2 Submission. For the 2nd Eastern HVDC link the following activities would need to be undertaken between Gate 0 and 1:

- Production of internal Governance Documentation required for the management and function of the project. These include: Business Case, Project Development Plan, Safety, Health and Environment Plan, Design Management Plan, Risk Management Plan and Stakeholder Delivery Strategy. These are developed using internal staff resource with the costs included in the overall Staff Rates included in Table 2.
- Review of potential areas suitable to accommodate the required onshore infrastructure, in this instance a Convertor Station, Underground Cabling or overhead line (OHL) and expansion of an existing Gas Insulated Switchgear 400kV Busbar.
- The works to produce a Site Selection Report in line with the Substation Location Guidelines to determine a Convertor Station site are progressed utilising internal staff hours informed by desktop information available in house (Ordnance Survey Mapping, location of Designated Areas, Listed Buildings, Proximity of Dwellings, Existing Roads, Ground Conditions etc) with site visits undertaken to truth the desktop information and identify other potential constraints. Cost included in Staff Rate in Table 2.
- The routing of both Underground Cable and OHL will be undertaken in line with the OHL Routing Guidelines. At this stage the approach is to identify multiple 1km wide corridors for assessment against constraints. These works are progressed utilising internal staff hours informed by desktop information available in house (Ordnance Survey Mapping, location of Designated Areas, Listed Buildings, Proximity of Dwellings, Existing Roads etc) with site visits undertaken to truth the desktop information and identify other potential constraints. Costs are included in Staff Rate in Table 2.
- Development of Offshore Cable Corridors, the project would initially identify multiple 2km wide corridors to accommodate the offshore cables utilising desktop information on known constraints such as designated areas, oil and gas infrastructure and fishing grounds. This initial assessment is then further supplemented with additional desktop information to further refine the corridors, undertaken via a second phase assessment to reduce the corridor widths to 1km and identify a preferred route for taking forward for further development. This activity has generally been supported by external consultants to provide the required specialist knowledge. Costs are included in Table 2.
- Works to determine the current technology available to provide the required solution. This work can involve the engagement of the supply chain to understand current developments and their timescales for delivery, as well as a comparison of the required project parameters e.g. capacity, network fault levels against technology to identify the appropriate solutions. This work is generally undertaken by internal staff supplemented by specialist resource where required to assist with the assessment of appropriate technology. The costs are set out in Table 2.

- Initial Stakeholder Engagement, where appropriate, is undertaken to gain input to inform the Opportunity Assessment process. For example, engagement of Marine Scotland, Scottish Natural Heritage and the Joint Nature Conservation Committee on initial offshore cable corridors to gain their input through one off meetings undertaken by internal staff.

Table 2: Gate 0 - 1 Costs for 2nd Eastern HVDC link

Project Cost Driver	Cost	Basis of Cost Estimate
Internal Staff Costs	£0.24m	Based on Historical 1st Eastern HVDC Link Costs
Initial Offshore Routeing	£0.311m	Based on Historical 1st Eastern HVDC Link Costs
Stakeholder Engagement	£0.005m	Based on Historical 1st Eastern HVDC Link Costs
Technology Selection	£0.06m	Based on Historical 1st Eastern HVDC Link Costs

5.2.2 Gate 1-2 (1st and 2nd Eastern HVDC links)

The works between Gate 1-2 fall under the Development Phase, wherein the objective is to further refine the preferred site, cable corridor or OHL Corridor into an option which, where appropriate, can be taken forward as a Planning Application and then progressed into detailed design through the next phase of the project lifecycle.

For the 1st and 2nd Eastern HVDC links the following activities would be planned to be undertaken between Gate 1 and 2:

- Update of internal Governance Documentation required for the management and function of the project. These include: Business Case, Project Development Plan, Safety, Health and Environment Plan, Design Management Plan, Risk Management Plan, Project Quality Plan, Commercial and Contracting Strategy and Stakeholder Delivery Strategy. These are developed using internal staff resource with the costs included in the overall Monthly Staff rates set out in Table 3.
- Seabed Surveys – This is the undertaking of Geophysical, Geotechnical and Bathymetric surveys to establish the viability of the identified route corridor to accommodate the installation of the subsea cables and to inform the required Marine Planning Applications. This is undertaken by external contractors with the value for a route of this length (circa 500km) with an expected survey corridor of 500m as per Table 3.
- Seabed Survey Support Works – In order to facilitate the Seabed Surveys a number of supporting contracts are required to be placed with external consultants. These include a Fisheries Liaison Officer, Technical Support for the Survey and appointment of a Client Representative to be on board the survey vessel to monitor and instruct the works as required. These will incur costs as identified in Table 3.
- Onshore Environmental Surveys – Surveys include identifying potential impacts from Noise, Landscape and Visual as well as effects on bird, flora and fauna. These would be undertaken for all onshore infrastructure utilising external consultants to provide this service. The expected costs for undertaking these works would be as per Table 3.

- Offshore Environmental Surveys – Surveys include identifying potential impacts on marine mammals, designated areas and other receptors. These will inform either an Environmental Assessment or Environmental Impact Assessment, as required by the Consenting Authorities. These works would be undertaken via an External Consultant due to the specialist knowledge required, with the expected costs for these works being as per Table 3.
- Cable Burial Risk Assessments – Activity undertaken following the Seabed Surveys to assess the requirements for cable burial in the subsea environment. Costs are allowed for this in Table 3 under Offshore Consenting.
- Onshore Ground Investigation for Convertor Station, Cable Routes and OHLs. Building on the Desktop Study previously undertaken intrusive works including trial pits, boreholes and laboratory testing of results will be undertaken to inform design works required for the project. For a convertor station site and associated cable route the costs are expected as per Table 3.
- Engineering Studies – To inform the Planning Application for an Onshore Convertor Station and confirm the site location, additional Engineering Studies are required. These include a Flood Risk Assessment to ensure the infrastructure is not flooded during set flood return periods and Transport Assessment to check the infrastructure can be transported to the location, or if not the improvements required to accommodate these. Additional studies may also include Earthing Studies. The expected costs for undertaking these types of Studies are set out in Table 3.
- Onshore Planning Applications – Town and Country Planning Applications are generally required for new Convertor Stations, costs are calculated based on area up to a cap. Section 37 Applications are required for OHLs, with costs calculated on the length of OHL and Voltage to a cap. The costs associated with these are set out in Table 3.
- Offshore Planning Applications – Marine Licences for Surveys are required and are underpinned by a European Protected Species Risk Assessment, these are undertaken by external Consultants. Additionally, a Marine Licence for Cable Install and Operation is required. Costs for these items are included in Table 3.
- Heads of Terms for Land Purchase – Where a preferred option for a Convertor Site has been identified negotiations will be commenced with the relevant landowner(s) with an agreement being made to purchase the land subject to Planning Consent being provided and the project continuing to proceed. The Heads of Terms usually require 10% of the overall payment to be provided up front, this is set out in Table 3.
- Initial Payments for Wayleaves and Servitudes – These are subject to the same terms as Heads of Terms however are for underground cables or OHLs. Costs are included within Table 3.

Table 3: Gate 1 - 2 Costs for 1st and 2nd Eastern HVDC links

Project Cost Driver	1st Eastern HVDC link Cost	2nd Eastern HVDC link Cost	**Basis of Cost Estimate**
Internal Staff Costs	£1.68m	£1.68m	Based on Current 1st Eastern HVDC Link and Historical Shetland HVDC Link Costs
Seabed Surveys and Supporting Works	£3.804m	£12.33m	Based on Tendered Rates for 1st Eastern HVDC Link Rate Estimated from 1st Eastern HVDC Link Tenders for 2nd Eastern HVDC Link
Engineering Studies and Design Works	£0.5m	£1.25m	Based on Historical Shetland HVDC

Offshore Environmental Surveys and Consenting	£1m	£1.02m	Based on Historical Shetland HVDC Rates
Onshore Environmental Surveys and Consenting	£0.225m	£0.225m	Based on Historical Peterhead 400kV Busbar Costs
Land and Wayleaves	£0.35m	£0.35m	Based on Historical Peterhead 400kV Busbar Costs
Stakeholder Engagement	£0.04m	£0.04m	Based on Historical Peterhead 400kV Busbar Costs

5.2.3 Gate 2-3 (1st and 2nd Eastern HVDC links)

The works between Gate 2-3 fall under the Refinement Phase, wherein the objective is to secure the required Consents and discharge Conditions associated with these, undertake a Tender for the required Design and Construction Works and commence the Detailed Design phase to prepare for entering the Execution Phase.

For the 1st and 2nd Eastern HVDC links the following activities would be planned to be undertaken between Gate 2 and 3:

- Update of internal Governance Documentation required for the management and function of the project. These include: Business Case, Project Development Plan, Safety, Health and Environment Plan, Design Management Plan, Risk Management Plan, Project Quality Plan, Commercial and Contracting Strategy and Stakeholder Delivery Strategy. These are developed using internal staff resource with the costs included in the overall Staff Rate set out in Table 4.
- Tender of the Works Packages – A Tender Event would be run for the key infrastructure items e.g. Convertor Stations, Subsea Cable, Onshore Cable. The costs for these works would be included in the overall Staff Rates in Table 4.
- Detailed Design Works – Detailed design works would be undertaken for each of the key infrastructure packages, including the Convertor Stations, Onshore Underground Cable or OHL and Offshore Subsea Cable. The costs expected to undertake these activities are as per Table 4.
- Planning Consent Condition Discharges – Discharge of any conditions classed as Pre-Commencement associated with the Consents for the project.
- Advance Procurement of Materials and Reservation of Factory Slots – In order to ensure that the programme dates can be met, it is necessary to reserve slots for key items of infrastructure with long lead times such as the Convertor Transformers and the Subsea Cable. Costs for securing these slots and reserving the dates for commencement of the manufacturing are estimated as per Table 4.

Table 4: Gate 2 - 3 Costs for 1st and 2nd Eastern HVDC links

Project Cost Driver	1st Eastern HVDC link Cost	2nd Eastern HVDC link Cost	**Basis of Cost Estimate**
Internal Staff Costs	£2.4m	£2.4m	Based on Historical Shetland HVDC Rates
Engineering Studies and Design Works	£6.76m	£6.76m	Based on Historical Shetland HVDC Rates
Supply Chain Engagement	£3m	£3m	Based on Historical Shetland HVDC Rates
Risk (Available across all Phases)	£1.77m	£2.657m	Based on Historical Risk Rates from SHE-T Projects

5.2.4 Total Gate 0-3 Costs (1st and 2nd Eastern HVDC links)

The total of the Gate 0 – 3 Costs comprising the activities set out above is as below:

Table 5: Total Pre-Construction Costs for 1st and 2nd Eastern HVDC links

Project Phase	1st Eastern HVDC link Cost	2nd Eastern HVDC link Cost	**Summary of Cost Basis**
Gate 0 -1 Opportunity Assessment	N/A	£0.616m	100% Based on Historical Incurred Costs
Gate 1 -2 Development	£7.599m	£16.895m	1st Eastern HVDC Link has a 50/50 Split of Tendered Rates and Historical Incurred Rates. 2nd Eastern HVDC Link has a 73/27 Split of Rates Estimated from Recent Tenders and Historical Incurred Rates
Gate 2 -3 Refinement	£13.925m	£14.81m	100% Based on Historical Incurred Costs
Total	£21.525m	£32.32m	1st Eastern HVDC Link has a 18/72 Split of Tendered Rates and Historical Incurred Rates. 2nd Eastern HVDC Link has a 38/62 Split of Rates Estimated from Recent Tenders and Historical Incurred Rates

In conclusion, we are seeking £21.52m in PCF for the First Eastern HVDC Link across Gates 0-3. This comprises £3.8m of costs based on recent tenders and £17.7m of costs from previously incurred rates on relevant projects. We are seeking £32.32m in PCF for the Second Eastern HVDC Link across Gates 0-3. This comprises £12.33m of costs derived from recent tenders and £19.99m of costs from previously incurred rates on relevant projects. In line with Ofgem guidance, these costs should be categorised as "high confidence" for the purposes of the TIM sharing factor and the Business Plan Incentive. Recently returned tenders are market based evidence of costs, and costs that reflect historical expenditure are predictable which Ofgem consider the "strongest evidence a company could provide" [3] in determining high confidence baseline costs. Further, as we propose an end of period symmetric true-up as well as PCDs for pre-construction this adds weight to the ability of Ofgem to deal with uncertainty, allowing costs to be set as high confidence.[4]

[3] RIIO-2 Sector Specific Methodology Consultation page 93, paragraph 9.44 bullet 1.

[4] RIIO-2 Sector Specific Methodology Consultation page 93, paragraph 9.44 bullet 2.

6. Large Strategic Schemes – Generation Connection

As outlined previously, the nature of our network means that we are required to develop large and complex infrastructure to accommodate new generation and potentially demand across our regional networks, including new infrastructure to connect our islands. These schemes don't provide boundary uplift capacity and therefore aren't covered by the annual NOA process. The scope and costs associated with these scheme means that a similar level of PCF is required to cover the pre-construction activities necessary to develop these schemes. Our proposal for the trigger for PCF funding is two-fold:

1. A signed connection agreement in place for at least one customer (licence obligation to connect) which triggers the need for the new infrastructure and/or asset intervention requirement identified; and
2. Requirement for delivery of the scheme under the LOTI process (i.e. >£100m)

The following sections provide an overview of the background drivers and development activities required for three schemes – Scotwind OWPL (Dounreay to Spittal & Spittal to Peterhead HVDC scheme), Skye/Western Isles Upgrade and Argyll & Kintyre 275kV Strategy.

6.1 ScotWind - OWPL (West of Orkney)

This section provides detail to support:

Recommendation: PCF funding totalling £31.11m be approved in the baseline funding covering both the Dounreay to Spittal double circuit and Spittal to Peterhead HVDC link schemes.

Justification: a signed generator contract is in place and scheme will be delivered under LOTI.

The Committee on Climate Change (CCC) estimate that 75GW of offshore wind would be required by 2050 to achieve Net Zero GHG emissions. The UK Government pledged extensive support for the offshore wind industry in 2019 with the Department for Business, Energy & Industrial Strategy's Offshore Wind Sector Deal, aiming to achieve up to 30GW of installed capacity by 2030. This target was increased to 40GW as part of the new UK Government's policy package announced in December 2019. The Crown Estate and Crown Estate Scotland are both running leasing rounds in 2020 where developers bid for rights to develop offshore wind projects in specific areas of seabed around the coast. *ScotWind*, due to be launched by Crown Estate Scotland this year, will offer seabed rights for up to 15 sites in Scottish offshore waters off the north, north east and east coast of the SHE Transmission area as shown in Figure 3[5] (subject to the outcome of the Sectoral Marine Plan which was under consultation until March 2020). Each site has been assigned a maximum realistic generation capacity, as detailed in

[5]Source: Figure 1, Draft Sectoral Marine Plan for Offshore Wind Energy (2019), Scottish Government, December 2019

Table *6*. The first cycle of *ScotWind* leasing is anticipated to support the development of up to approximately 10GW of offshore wind capacity in Scotland.

As can be seen in

Table *6*, there is the realistic potential for up to 6GW to be situated in the E1 - E3 sites to the east, up to 12GW in the NE1 - NE8 sites to the north east, and up to 7GW in the N1 - N4 sites to the north of the SHE Transmission area – totalling 25GW of offshore wind capacity. We expect a proportion of this total to connect to the SHE Transmission network by the end of 2030, triggering reinforcement that will require pre-construction activity in the RIIO-T2 period. SHE Transmission has already been approached by several developers looking to make an application to the *ScotWind* leasing round in 2021 to discuss potential options and timeframes for connection (as detailed in **Error! R eference source not found.**). The total estimated capacity of the schemes which have already approached SHE Transmission ranges from 14.5GW to 15.7GW, with a number of these schemes looking to connect before 2030.

One scheme, Offshore Wind Power Limited (also known as West of Orkney), has a capacity of 2250MW and has already completed the connection application process. This scheme is contracted to connect in 2 phases; Phase 1 (750MW) in 2029, and Phase 2 (1500MW) in 2031. This offshore windfarm is located in the Pentland Firth and does not have consents or a subsidy. In addition, SHE Transmission has now received connection applications from Scottish Power Renewables (SPR) for a 2GW offshore windfarm in the same region as West of Orkney and a 3GW offshore windfarm in the North East with a requested connection date of 2028.

The works required to connect West of Orkney to a landing point near Dounreay on the SHE Transmission network (as included in their connection agreement) are outlined in the next section. Given the size of the offshore windfarm, the required works for connection are LSS which will require pre-construction activity at the very beginning of the RIIO-T2 period to meet the agreed phase 1 and phase 2 connection dates of 2029 and 2031 respectively. Similar

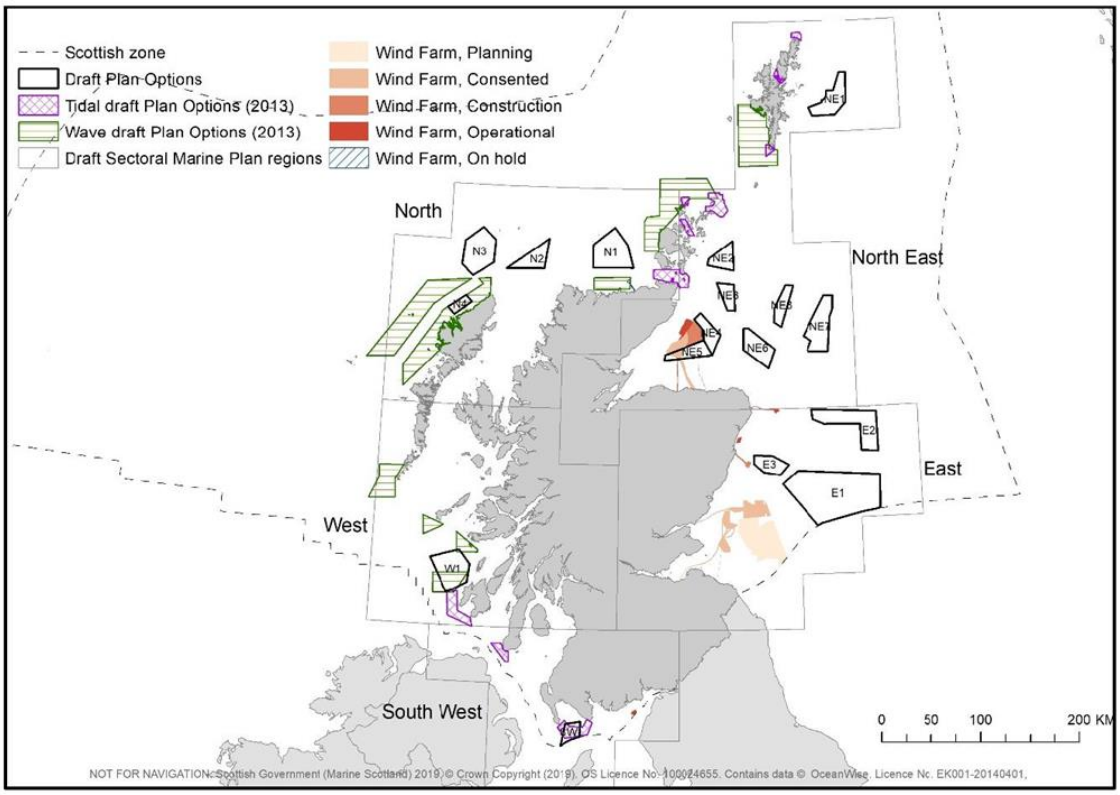


Figure 3: Current and planned offshore energy generation

works would also be needed to enable the connection of the 2GW SPR scheme near Dounreay. As such if one of these schemes were to fall away, there will still be an immediate need for these works (requiring pre-construction

activity at the very beginning of the RIIO-T2 period). The associated pre-construction cost of these works (comprising 2 of the 7 schemes in **Error! Reference source not found.**) has therefore been included in our requirement for pre-c onstruction funding.

Table *6: Sectoral Marine Plan site data*

Site	Region	Area (km²)	Max scenario (GW)	Max as % of total area
E1	East	3816	3	16%
E2	East	1287	2	31%
E3	East	474	1	42%
NE1	North East	776	2	52%
NE2	North East	464	1	43%
NE3	North East	339	1	59%
NE4	North East	440	1	45%
NE5	North East	496	1	40%
NE6	North East	699	2	57%
NE7	North East	1027	3	58%
NE8	North East	401	1	50%
N1	North	1163	2	34%
N2	North	560	2	71%
N3	North	1106	2	36%
N4	North	200	1	100%

Table 7: ScotWind related developers who have already approached SHE Transmission

Developer	Estimated TEC (MW)	Potential SHE Transmission Connection	Date Requested	Comments	Region
Offshore Wind Power Limited (West of Orkney)	750 Ph1, 1500 Ph2	Dounreay	31st October 2029 Ph1, 31st October 2031 Ph2	Contracted (offer signed)	North
Quaybridge Ltd	1500-2000	Dounreay	Phased 500MW in 2027, 2028, 2029 and 2031	Feasibility Study completed	North
Scottish Power Renewables	3000	Peterhead	1st February 2028	Connection Application received	North East
	2000	Dounreay	1st February 2028	Connection Application received	North
	2x1500	Fetteresso / Tealing	Not specified by developer	Pre-app discussions held	East
Univergy	500	Fetteresso	2028	Pre-app discussions held	East
EOLFI	1000	Dounreay / Spittal / Peterhead / Kintore or New Deer	2029	Pre-app discussions held	North, North East
Mainstream Renewables	500, 800 or 1200	Dounreay	Not specified by developer	Pre-app discussions held	North

Vattenfall	750	Dounreay / Peterhead or Fetteresso	Not specified by developer	Pre-app discussions held	North, North East, East
Total	**14500-15700MW**				

6.1.1 Connection Solution

The works required to connect West of Orkney to a landing point near Dounreay on the SHE Transmission network (as included in their connection agreement) are as follows:

- Dounreay to Spittal double circuit – for delivery 2029 at an estimated total cost of £115m;
- HVDC link from Spittal to Peterhead – for delivery 2029 at an estimated total cost of £1045m.

The existing Dounreay 275kV substation is the closest suitable network connection point for West of Orkney, which is expected to be predominantly located within the N1 *ScotWind* site. Given the size of the offshore windfarm, new substations are needed at Dounreay and Spittal with a new double circuit rated at 2400MVA required to connect the two substations. In addition, a 145km 2250MVA HVDC link from the new Spittal substation in Caithness across the Moray firth to Peterhead 400kV substation on the north east coast of the SHE Transmission network is needed (including an HVDC converter station at Spittal and Peterhead).

This connection solution enables Phase 1 of West of Orkney (750MW) to connect in 2029, and the remaining 1500MW (Phase 2) to connect in 2031 following completion of the 2nd Eastern HVDC link from SHE Transmission to England – a 2GW offshore link from Peterhead to South Humber. Hence, completion of the 2nd Eastern HVDC link from SHE Transmission by 2031 is not only needed for wider system boundary benefit to reduce constraint costs for the GB consumer (as detailed in section 0), but is also required to enable the connection of an additional 1500MW of offshore wind capacity.

An optioneering process is currently underway – known as the Connection and Infrastructure Options Note (CION) process which is co-ordinated by the ESO – to determine the best onshore point of connection for West of Orkney. Multiple landing points and associated works have been assessed in a CBA which considers the impact on GB constraint costs. The CION CBA has determined that the above connection solution from Dounreay to Peterhead, via an onshore double circuit to Spittal and HVDC link from Spittal, is the preferred solution. This solution is the lowest cost solution, considering the associated developer works, which can meet the 2029 connection date.

In order to complete this LSS for connection of OWPL by 2029, pre-construction activity is required at the very beginning of the RIIO-T2 period. The project delivery timeline and outline of the pre-construction activities required to be undertaken in the RIIO-T2 period for this LSS detailed below.

6.1.2 Project Delivery Timeline – OWPL Connection Solution

An indicative timeline for project delivery of the Dounreay to Spittal double circuit and the Spittal to Peterhead HVDC link is provided in

Table *8* and Table 9 below. Both schemes need to be delivered together to enable the connection of OWPL. The timeframes highlight that pre-construction activities need to be initiated now to meet the required connection date for OWPL.

Table 8: Indicative Project Delivery Timeline for Dounreay to Spittal double circuit

Stage	Gate	Timeline
Start project	0	Q3 2022
Options Assessment complete	0-1	Q3 2023
Surveys/EIA complete	1-2	Q1 2025
Planning Submission and consent	2-3	Q1 2026
Construction Start	3	Q2 2026
Construction Complete	3-4	Q1 2029
Energisation	4	Q3 2029
Project Close	5	Q1 2030

Table 9: Indicative Project Delivery Timeline for Spittal to Peterhead HVDC Link

Stage	Gate	Timeline
Project Start	0	Q4 2020
Initial Needs Case submission	0-1	Q4 2021
Options Assessment complete	0-1	Q2 2021
Surveys/EIA complete	1-2	Q2 2023
Final Needs Case submission	1-2	Q3 2023
Planning Submission	1-2	Q1 2025
Project Assessment	2-3	Q1 2025
Planning Consent granted	2-3	Q1 2026
Construction Start	3	Q2 2026
Construction period	3-4	Q2 2029
Energisation	4	Q4 2029
Project Close	5	Q1 2030

The costs estimate for both schemes have used different metrics to determine each gate stage estimate. The Dounreay to Spittal and Spittal to Peterhead project design work is due to begin in Q3 2022 and Q4 2020 respectively. The preconstruction work costs have been based on incurred rates for historical projects which have been used to estimate activity durations and costs. Framework costs and internal rates have also been used. A description of the main tasks is provided in the sections below.

6.1.3a Pre-Construction Activity required in the RIIO-T2 period – Dounreay to Spittal double circuit

Town and Country Planning applications will be required for the new Dounreay and Spittal substations but are deemed low risk of planning refusal, a S37 planning application will be required for the new double circuit between Dounreay and Spittal as this has been deemed a high risk of planning application refusal. The project will follow the SSE Large Capital Projects (LCPs) governance framework. The pre-construction activities in the LCP governance framework occur between Gate 0 and 3, a description of the expected activities is provided below:

6.1.3a.1 Gate 0-1 (Dounreay to Spittal double circuit)

This is the initial phase of the project, the potential technologies and ratings for the engineering design of the substations at Dounreay and Spittal and the double circuit will be identified followed by desktop data gathering and review of the engineering design, environmental constraints and land ownership boundaries. This will inform the substation site assessment and circuit routing assessment which are key deliverables during this phase. Site visits,

site investigations and stakeholder discussions will follow the desk top analysis to confirm the substation and circuit options or provide alternative options. The Gate 0-1 phase concludes with preferred options for both substations and the double circuit. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the initial phase of the Dounreay to Spittal double circuit are:

- Review governance documentation to confirm scope; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Investigate the technology and ratings for the new substations at Dounreay and Spittal and for the double circuit connecting the substations.
- Undertake a substation site selection and routing exercise to confirm preferred substation sites and circuit routes.
- Confirm the landowners in the area of any substation extensions and the potential landowners along the circuit route
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders

Table 12: Gate 0 - 1 Dounreay to Spittal double circuit

Project Cost Driver	Cost	**Basis of Cost Estimate**
Internal Staff Costs	£0.38m	Internal staff rates
Stakeholder Engagement	£0.01m	Framework rates and historical incurred rates
Technology Selection	£0.1m	Internal staff rates

6.1.3a.2 Gate 1-2 (Dounreay to Spittal double circuit)

The works between Gate 1-2 falls under the Development phase, the objective during this phase for the project is to further develop the preferred site and circuit route into one option that can be taken forward to Planning. Within this phase of the project ground investigation surveys and additional environmental surveys will be undertaken and further engineering design will also be undertaken to confirm the substation sites and the number of towers (if OHL), type and alignment. Further engagement will be sought with landowners to agree and negotiate a wayleave, the supporting information from the circuit design will be used to aid these discussions. The deliverables from the technical design, outcome of the environmental studies and further engagement with stakeholders during this phase will support completion of the Environmental Impact Assessment which will be submitted to the Planning Authority, the second pre-construction phase is normally concluded after planning application submission. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the second pre-construction phase of works for the Dounreay to Spittal double circuit are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Undertake an alignment study to confirm tower types and initial placement of towers (if OHL)
- Undertake ground investigation surveys to confirm potential substation sites at Spittal and Dounreay; undertake ground investigation along the Dounreay to Spittal corridor to narrow the circuit route.
- Undertake further environmental studies such as noise, ornithological, habitat and landscape and visual
- Write and tender the contractor design scope for the next phase of works; this can occur pre or post Gate 2 but for most high value LCP projects this task is undertaken pre-gate 2 with the negotiation and award of contract post gate 2.

- Begin negotiation with landowners to agree wayleaves and Heads of Terms based on the outcome of the alignment study and substation site confirmation
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Finalise the environmental surveys and complete the Environmental Impact Assessment, when finalised, submit the Town and Country planning applications to the Highland Council and the S37 planning application to the ECU.

Table 13: Gate 1 - 2 Dounreay to Spittal double circuit

Project Cost Driver	Cost	**Basis of Cost Estimate**
Internal staff cost	£0.45m	Internal Staff rates
Engineering Studies	£0.4m	Framework rates
Environmental surveys	£0.44m	Framework rates
Land and Wayleaves	£0.17m	Internal rates and historical incurred rates
Stakeholder Engagement	£0.03m	Framework rates and historical incurred rates

6.1.3a.3 Gate 2-3 (Dounreay to Spittal double circuit)

Gate 2 -3 is the last of the 3 pre-construction phases that the project will complete. This phase is referred to as detailed design, the main deliverables are the 1st stage of contractor design, confirmation of planning approval and signed Heads of Terms agreements with landowners. When these deliverables are confirmed, reviewed and agreed the project will be ready to start construction. For the Dounreay to Spittal double circuit project the contractor will present the construction design for the new substations at Dounreay and Spittal and the design of the double circuit, confirming all engineering parameters and equipment placement. The contractor design will utilise all of the previous design, environmental information and land owner agreements gained during the earlier phases to refine the design.

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the construction phase, this will include construction programme, risk and a Class 3 estimate to confirm required finance for the project.
- Undertake the initial contractor design, confirming engineering equipment, construction alignment for the double circuit and indicative construction costs for the project
- Further ground investigation may be undertaken to refine the circuit alignment or re-orientate the substation
- Write and tender the contractor construction scope for construction.
- Finalise all negotiations with landowners and have all Heads of Terms signed
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Receive feedback from the planning authority on the status of the planning applications; if successful prepare to discharge conditions.

Table 14: Gate 2 - 3 Dounreay to Spittal double circuit

Project Cost Driver	Cost	Basis of Cost Estimate
Internal staff cost	£0.375m	Internal Staff rates
Engineering Studies and detailed design	£0.38m	Framework rates
Land and Wayleaves	£0.07m	Internal rates and historical incurred rates
Risk available across all phases	£0.254m	Internal rates and historical incurred rates

Table 15: Gate 0 -3 Pre-construction cost Dounreay to Spittal double circuit

Project Cost Driver	Cost	Basis of Cost Estimate
Gate 0-1	£0.49m	Framework rates, historical incurred rates and internal staff rates
Gate 1-2	£1.489m	Framework rates, historical incurred rates and internal staff rates
Gate 2-3	£1.079m	Framework rates, historical incurred rates and internal staff rates

6.1.3b Pre-Construction Activity required in the RIIO-T2 period – Spittal to Peterhead HVDC link

This project consists of a 145km 2250MVA HVDC link from Spittal in Caithness to Peterhead 400kV substation on the East Coast of Scotland. The double circuit between Dounreay and Spittal will be required to export generation from the Dounreay area in the north of Caithness to Spittal. The project will require a new double busbar substation at Spittal, HVDC converters at Spittal and Peterhead, and additional bays at Peterhead 400kV substation. The equipment for Spittal will be provided at the same time as the Dounreay to Spittal double circuit project. Town and Country Planning applications will be required at both substations but are deemed low risk of planning refusal, a marine licence will be required for the new HVDC link between Spittal and Peterhead. The project will follow the SSE Large Capital Projects (LCPs) governance framework. The pre-construction activities in the LCP governance framework occur between Gate 0 and 3, a description of the expected activities is provided below:

6.1.3b.1 Gate 0-1 (Spittal – Peterhead HVDC link)

This is the initial phase of the project, the potential technologies and ratings for the technical design of the HVDC Converter stations at Spittal and Peterhead and the HVDC cable link will be identified followed by desktop data gathering and review of the engineering design, environmental constraints and land ownership boundaries. This will inform the substation site assessment and marine cable routing assessment which are key deliverables during this phase. Site visits, site investigations and stakeholder discussions will follow the desk top analysis to confirm the HVDC converter site and marine cable options or provide alternative solutions. The Gate 0-1 phase will conclude with the preferred options for both the HVDC converter site ay both Spittal and Peterhead and marine cable route for the HVDC link. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the initial phase of the Spittal to Peterhead HVDC link are:

- Review governance documentation to confirm scope; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.

- Investigate the technology and ratings for the HVDC converter sites at both Spittal and Peterhead substations and for the HVDC cable link connecting both substations.
- Undertake a HVDC site selection and HVDC marine cable subsea route selection to confirm preferred HVDC converter sites and marine cable routes.
- Confirm the landowners in the area of any substation extensions and the potential constraints along the marine cable route
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders

Table 16: Gate 0 - 1 Spittal to Peterhead HVDC Link

Project Cost Driver	Cost	**Basis of Cost Estimate**
Internal Staff Costs	£0.24m	Internal staff rates
Initial Offshore routing	£0.3m	Framework rates and historical incurred rates
Stakeholder Engagement	£0.01m	Framework rates and historical incurred rates
Technology Selection	£0.06m	Internal staff rates

6.1.3b.2 Gate 1-2 (Spittal – Peterhead HVDC link)

The works between Gate 1-2 falls under the Development phase, the objective during this phase for the project is to further refine the preferred site and route into one option that can be taken forward to Planning. Within this phase of the project ground investigation surveys, further environmental surveys and further engineering design tasks will be undertaken to confirm the HVDC converter site and the exact cable narrowing the subsea corridor information from the last phase. Further engagement will be sought with landowners to agree and negotiate a wayleave for the HVDC converter sites and land cable routes and discussions with the Crown Estate will be progressed for the subsea cable route. The deliverables from the technical design, outcome of the environmental studies and further engagement with stakeholders during this phase will support completion of the Environmental Impact Assessment which will then be submitted to the Planning Authorities for Town and Country planning for the HVDC converter sites and Marine Scotland for the Marine Licence. The second pre-construction phase is normally concluded after submission of the planning application. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the second pre-construction phase of works for the Spittal to Peterhead HVDC link project are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Undertake seabed surveys, this would normally include geophysical, geotechnical and bathymetric surveys to establish the viability of the route corridor to accommodate the installation of the subsea cables and to inform the required Marine Planning application. There will be external support required during these works; a Fisheries Liaison Officer will be required to discuss and agree terms with local fishermen and a Client Representative will be required on the vessel during the surveys
- Onshore and Offshore environmental studies, they will include surveys for visual and landscape, noise and habitat. The offshore surveys will include confirmation of existing designated areas on the sea bed or coastal areas as well as the types of fish and mammals that inhabit the area around the route proposed route corridor
- Undertake ground investigation surveys to confirm the HVDC converter sites at Spittal and Peterhead and land cable corridors to the coastal at Caithness and from the coast in the Peterhead area.

- Further engineering design will be required to inform the HVDC Converter station operation and design for planning.
- Write and tender the contractor design scope for the next phase of works; this can occur pre or post Gate 2 but for most high value LCP projects this task is undertaken pre-gate 2 with the negotiation and award of contract post gate 2.
- Begin negotiation with landowners to agree wayleaves and Heads of Terms based on the outcome of the cable route confirmation and HVDC Converter site confirmation
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Finalise the environmental surveys and complete the Environmental Impact Assessment, when finalised, submit the Town and Country planning applications to the Highland Council and the Marine Licence application to the Marine Scotland.

Table 17: Gate 1 - 2 Spittal to Peterhead HVDC Link

Project Cost Driver	Cost	**Basis of Cost Estimate**
Internal staff cost	£1.68m	Internal Staff rates
Seabed surveys & supporting works	£3.035m	Framework rates and historical incurred rates
Engineering design studies	£2.5m	Framework rates and historical incurred rates
Offshore Environmental studies and consent	£1.0m	Framework rates and historical incurred rates
Onshore environmental studies and consent	£0.325m	Framework rates and historical incurred rates
Land and Wayleaves	£0.6m	Internal rates and historical incurred rates
Stakeholder Engagement	£0.09m	Framework rates and historical incurred rates

6.1.3b.3 Gate 2-3 (Spittal – Peterhead HVDC link)

Gate 2-3 is the last of the 3 pre-construction phases that the project will complete. This phase is referred to as detailed design, the main deliverables are the 1st stage of contractor design, confirmation of planning approval and signed Heads of Terms agreements with landowners. When all of these deliverables are confirmed, reviewed and agreed the project will be ready to start construction. For the Spittal to Peterhead HVDC link project the contractor will present the construction design for the HVDC Converter sites at Spittal and Peterhead and the subsea and land cable design, confirming all engineering parameters and equipment placement. The contractor design will utilise all of the previous engineering design, environmental information and land owner agreements to refine the design.

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the construction phase, this will include construction programme, risk and a Class 3 estimate to confirm required finance for the project.
- Undertake the initial contractor design, confirming HVDC converter equipment, construction cable design for the subsea and land cable and indicative construction costs for the project
- Further ground investigation may be undertaken to refine the land cable or HVDC converter sites
- Write and tender the contractor construction scope for construction.
- Reservation of factory cable slots where required due to the long lead time for cable.
- Finalise all negotiations with landowners and have all Heads of Term signed
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders

- Receive feedback from the planning authority on the status of the planning applications; if successful prepare to discharge conditions.

Table 18: Gate 2 - 3 Spittal to Peterhead HVDC Link

Project Cost Driver	Cost	**Basis of Cost Estimate**
Internal staff cost	£2.4m	Internal Staff rates
Engineering design studies	£8m	Framework rates and historical incurred rates
Supply chain engagement	£3m	Framework rates and historical incurred rates
Public road improvements	£1.5m	Framework rates and historical incurred rates
Risk (all phases)	£2.313m	Framework rates and historical projects

In conclusion, we are seeking £30.11 (£3.1m approved in Draft Determination for Dounreay-Spittal) in PCF for combined projects Dounreay to Spittal and Spittal to Peterhead across gates 0-3. This comprises 100% of costs from framework rates and previously incurred rates and staff costs. In line with Ofgem guidance, these costs should be categorised as "high confidence" for the purposes of the TIM sharing factor and the Business Plan Incentive. Costs that reflect historical expenditure are predictable which Ofgem consider the "strongest evidence a company could provide" [6] in determining high confidence baseline costs. Further, as noted above, as we propose an end of period symmetric true-up as well as PCDs for pre-construction this adds weight to the ability of Ofgem to deal with uncertainty, allowing costs to be set as high confidence.[7]

Table 19: Pre-construction cost

Project Cost Driver	Cost	**Basis of cost estimate**
Gate 0-1	£0.61m	Framework rates, historical project costs and internal staff rates
Gate 1-2	£9.23m	Framework rates, historical project costs and internal staff rates
Gate 2-3	£17.21m	Framework rates, historical project costs and internal staff rates

[6] *RIIO-2 Sector Specific Methodology Consultation page 93, paragraph 9.44 bullet 1.*

[7] *RIIO-2 Sector Specific Methodology Consultation page 93, paragraph 9.44 bullet 2.*

6.2 Skye / Western Isles Upgrade

This section provides detail to support:

Recommendation: PCF funding totalling £17.7m be approved in the baseline funding covering the Skye scheme.

Justification: signed generation contracts are in place, there are asset condition drivers and the scheme will be delivered under LOTI.

The Skye transmission network consists of a single 132kV OHL that extends over 160km of challenging terrain from Fort Augustus 400kV substation to Ardmore on Skye (as detailed in **Error! Reference source not found.**). From A rdmore, there are two Scottish Hydro Electric Power Distribution (SHEPD) owned 33kV subsea cables; one to Loch Carnan on South Uist and the other to the Isle of Harris. The 132kV transmission circuit continues from Harris to Stornoway. The security of supply on Skye and the Western Isles is dependent on the Skye circuit as the only connection to the main GB electricity grid.

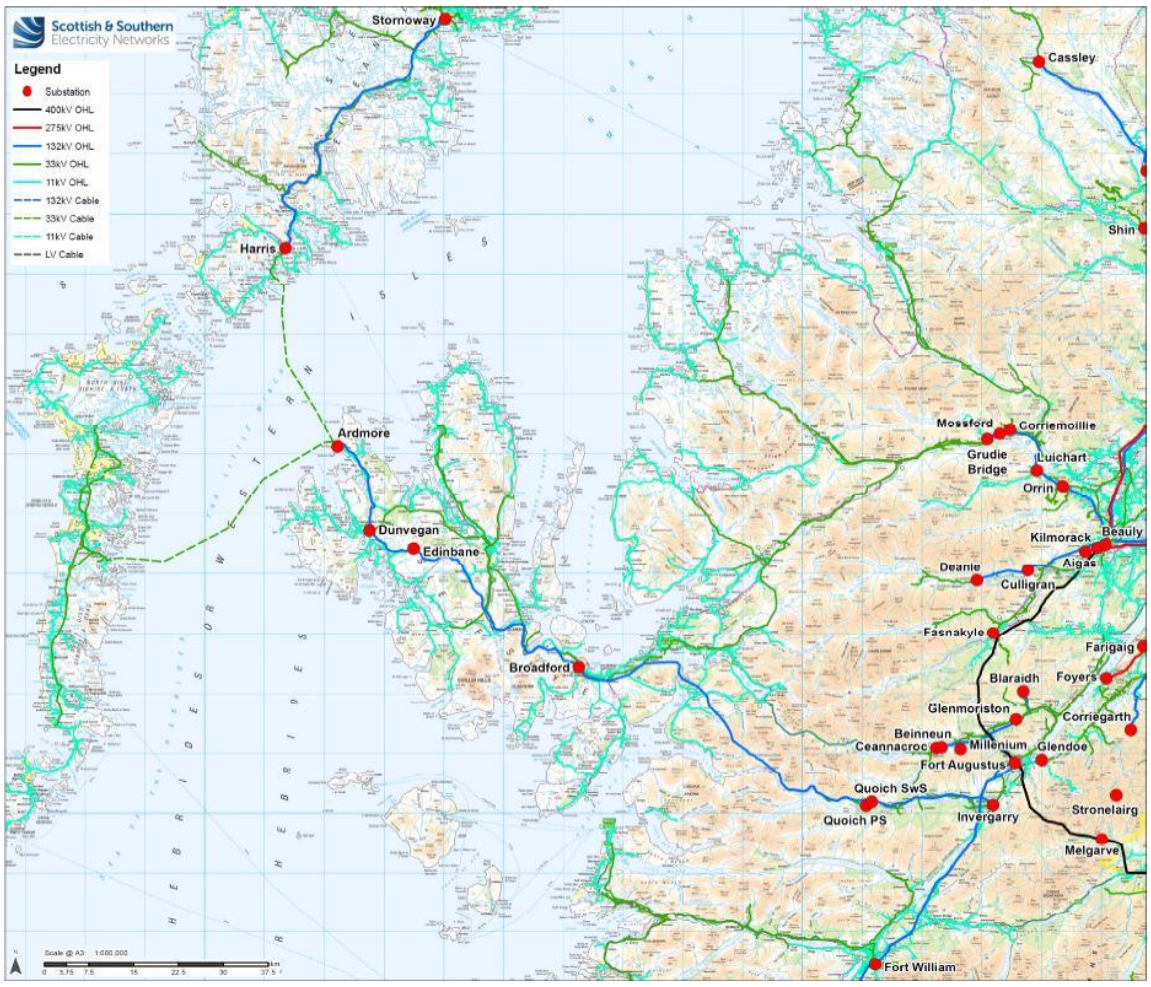


Figure 4: Existing Skye Overhead Line Route

The 9km line section from Fort Augustus to the Skye Tee point is of trident wood pole construction, completed in June 2017. From Skye Tee to Quoich, we are currently installing 19km of trident wood pole to replace single circuit steel lattice towers dating from 1956. The 64km line section from Quoich to Broadford is supported by double circuit steel lattice tower structures, strung on one side only, completed in 1980. The last 68km section from Broadford to Ardmore is of trident wood pole construction, built in 1989. Asset condition monitoring and assessments undertaken over the last twelve months has indicated a strong need for intervention on the existing 132kV Skye circuit between Quoich and Ardmore before 2030.

In addition to asset risk, there are both demand and generation needs to be met on the Skye transmission network. To restore supplies during prolonged outages of the Skye transmission circuit, SHEPD relies on mobile and fixed diesel generators on Skye and the Western Isles. Given the light construction of the transmission line, over the most challenging terrain, its reliability is poorer than other lines. Working with SHEPD, there is an opportunity to improve security of supply. The amount of generation connected to the existing Skye single 132kV circuit (137MW) exceeds the rating of the existing line when considering the level of demand connected (as detailed in Figure 4), making this part of our network noncompliant with the NETS SQSS. Based on the condition that the ESO can manage the generation on this line economically, we applied to Ofgem for derogation from the relevant criteria of the SQSS and this was granted in 2010[8]. Connection of additional generation beyond what was assessed at the time was contingent upon undertaking the necessary reinforcement to the line in accordance with the relevant NETS SQSS criteria.

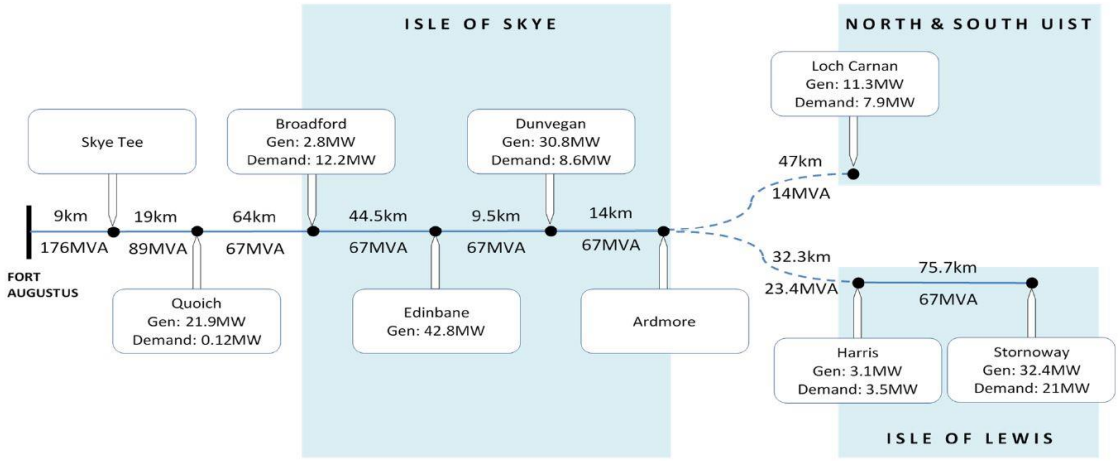


Figure 4: Existing generation and demand background and associated technical details of the Skye and Western Isles network

Projected growth in renewable generation in the SHE Transmission area (as detailed in section 3) is also prevalent on Skye, where there is currently an additional 124.9MW of contracted generation with a connection date of 2025, with a significant further volume (349.2MW) having expressed interest to connect, as detailed in Table.

[8]The Ofgem letter on the granting of the derogation is available online at https://www.ofgem.gov.uk/ofgem-publications/52816/100709shetl-western-isles-decisionpdf

Table20: Connected, contracted and offered generation on the Skye circuits

Project	Connection Point	Connected (MW)	Contracted (MW)	Scoping (MW)	Contracted Date
Quoich	Quoich GSP	21.9			
Broadford	Broadford GSP	2.8			
Edinbane wind	Edinbane	42.8			
Glen Ullinish wind	Edinbane		49.9		Dec 2025
Glen Ullinish Extension	Edinbane			240	
Edinbane area	Edinbane			50	
Ben Aketil	Dunvegan GSP	28			
Dunvegan GSP	Dunvegan GSP	2.8			
Ben Sca	Dunvegan GSP		40.8		May 2026
Ben Sca Extension	Dunvegan GSP			50	
Glen Eoighainn wind	Dunvegan GSP		25		Dec 2025
Struan II	Dunvegan GSP		9.2		Dec 2025
Struan II add cap	Dunvegan GSP			9.2	
Harris GSP*	Harris GSP	2.9			
Stornoway GSP*	Stornoway GSP	35.5			
Total (MW)		**137**	**124.9**	**349.2**	

**Harris and Stornoway import to Skye is limited by the existing subsea cable. The table excludes large (10MW and above) contracted and scoping generation on the Western Isles*

In developing potential solutions to meet the identified need (generation, demand and asset risk), SHE Transmission has considered technical, environmental and geographic constraints on the design and safe operation of the assets along with views expressed by stakeholders. SHE Transmission has undertaken a CBA against a credible range of future generation growth scenarios for Skye and the Western Isles. Based on the outcome of this analysis, further detailed analysis was undertaken considering line section capacity requirements, more localised environmental constraints and stakeholder feedback to date.

This work has identified certainty over the need to intervene and the economic appraisal confirms the benefit of replacing the OHL between Quoich and Ardmore as soon as possible. In addition, a significant volume of contracted generation (124.9MW) requires the Skye OHL to be reinforced by the end of 2025, beginning of 2026 to enable connection. As a result, there is certainty on the need to invest in this part of the system during the RIIO-T2 period and pre-construction activity is required at the very beginning of the RIIO-T2 period. The project delivery timeline and outline of the pre-construction activities required to be undertaken in the RIIO-T2 period for this LSS is detailed below.

More information on the need for the Skye/Western Isles upgrade and the associated CBA can be found in the 'Skye Overhead Line Reinforcement Strategy' paper submitted as part of our RIIO-T2 Business Plan.

6.2.1 Skye OHL Reinforcement Strategy

Three different approaches to reinforcing the Skye 132kV OHL have been considered:

- Baseline solution – this solution only involves intervention to address asset condition. This solution replaces the existing wood pole with a new single circuit wood pole (~176MVA capacity) and therefore provides more capacity along the route compared to the existing line, however this solution will not meet the load requirements by the mid-2020s and the single circuit configuration will not provide the required demand security at Broadford.
- Incremental approach – above option but with a high capacity double circuit steel structure between Fort Augustus and Broadford (~2x348MVA). This solution meets load requirements up to Broadford in the mid-term but does not provide enough capacity beyond Broadford by the mid-2020s.
- Balanced strategic long-term approach – this solution replaces the existing wood pole with a high capacity double circuit steel structure between Fort Augustus and Broadford (as above incremental approach) and a high capacity single circuit steel structure between Broadford and Edinbane (~1x348MVA), with the option for a second circuit to be added when triggered by load requirements. The existing wood pole between Edinbane and Ardmore will be replaced with a new single circuit wood pole (as above baseline solution), with allowance for a second single circuit on this section to be added when triggered by load requirements.

Based on the volume of contracted generation and generation where we have received an expression of interest, SHE Transmission are developing the balanced strategic long-term approach for delivery 2025 at an estimated total cost of £400m.

6.2.2 Project Delivery Timeline – Skye / Western Isles Upgrade

An indicative timeline for project delivery of the Skye 132kV OHL reinforcement is provided in Table below. The timeline highlights that pre-construction activities need to be initiated now to meet required connection dates.

Table21: Indicative Project Delivery Timeline for Skye 132kV OHL reinforcement

Stage	Gate	Timeline
Appoint contractor	0-1	Q3 2020
Submit Initial Needs Case	0-1	Q4 2020
Complete Initial contractor design	1-2	Q2 2021
EIA start	1-2	Q2 2021
Submit Needs Case	2-3	Q4 2021
Planning Submission and consent	2-3	Q3 2022
Submit Project Assessment	2-3	Q3 2022
Construction Start	3	Q3 2023
Energisation	4	Q4 2025
Project Close	5	2026

6.2.3 Pre-Construction Activity required in the RIIO-T2 period – Skye / Western Isles Upgrade

The costs estimates have used different metrics to determine each gate stage estimate. The Skye Western Isles project design work is currently in the A1 design phase, the technical design works for both the A1 and A2 design has been competitively tendered. The remainder of the preconstruction works has been based on historical incurred rates informing durations and costs, framework rates and internal costs. A description of the main tasks is provided below.

The engineering design is focussing on the replacement of the existing 160km 132kV OHL between Fort Augustus and Ardmore on Skye with a new 132kV OHL recognising that due to engineering, environmental and stakeholder

constraints cable may be required in some areas. The project will follow the SSE Large Capital Projects (LCPs) governance framework. The pre-construction activities in the LCP governance framework occur between Gate 0 and 3, a description of the expected activities is provided below:

6.2.3.1 A1 Design (Skye / Western Isles Upgrade)

The Skye project is currently within this initial phase of design, due to the length and high risk of objection for the new OHL S37 planning application, an approach of early detailed design definition has been taken to facilitate detailed discussions with stakeholders earlier in the planning process and aid and support minimising risk of time delay and objection to the planning application. Within this phase the project will confirm the OHL and cable technologies and capacities, undertake ground investigation works across 20% of the OHL route and confirm the initial alignment of the OHL using a contractor's design. Site visits, site investigations and stakeholder discussions will follow the site investigations and OHL design to agree on a preferred alignment. The gate 0-1 phase for the Skye Reinforcement project will conclude with an initial alignment for the 132kV OHL and confirm any cable sections required, this alignment will be based on the engineering contractor design, initial results of the environmental assessment and multiple engagements with stakeholders. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the initial phase of the Skye 132kV OHL reinforcement are:

- Review governance documentation to confirm scope; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Confirm the technologies for the 132kV OHL
- Undertake an OHL routing to confirm the OHL routes
- Write and tender the contractor design scope; award scope of work to undertake ground investigation of the OHL route and initial OHL alignment and cable design during this phase
- Environmental surveys that include visual and landscape, noise and habitat along the OHL route and substation tie-ins
- Engage with 80 landowners along the OHL route
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Regulatory submission of the Initial Needs Case

Table 22: Skye/Western Isles upgrade – A1 Design

Project Cost Driver	Cost	Basis of Cost Estimate
Internal Staff costs	£0.20m	Internal Staff rates
Environment and Consent	£0.29m	Framework costs
Land and Legal	£0.15m	Framework rates and historical incurred rates
Stakeholder Engagement	£0.01m	Framework rates and historical incurred rates
Ground Investigation	£0.95m	Competitively tendered costs
OHL Alignment and Access (Initial Design)	£1.30m	Competitively tendered costs

6.2.3.2 A2 Design (Skye / Western Isles Upgrade)

The works between Gate 1-2 for Skye 132kV OHL reinforcement will include detailed engineering design and confirmation of each tower position based on the initial overhead alignment confirmed at Gate 1, bore holes and trial pits at each tower location will be undertaken foundation, access and accommodation design will also be confirmed. Further engagement will be sought with landowners to agree and negotiate a wayleave, the supporting information from the OHL design will be used to aid these discussions. The deliverables from the technical design, outcome of the environmental studies and further engagement with stakeholders during this phase will support

completion of the Environmental Impact Assessment which will then be submitted as a S37 application to the Energy Consents Unit (ECU) for review and determination. During this phase the Needs Case will be submitted to Ofgem. The second pre-construction phase is normally concluded after planning application submission. The LCP governance documentation will be referred to and updated throughout this phase of the project. The key milestones for the second pre-construction phase of works for the Skye 132kV OHL reinforcement are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Undertake the final pre-construction alignment study to confirm all tower positions
- Undertake bore holes and trial pits at each OHL tower location
- Write and tender the contractor construction scope for construction.
- Continue negotiation with landowners to agree wayleaves and Heads of Terms based on the outcome of the alignment study and substation site confirmation
- Undertake stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Finalise the environmental surveys and complete the Environmental Impact Assessment, when finalised, submit the S37 planning application to the ECU.
- Regulatory submission of Needs Case referring to the refined design work within this phase

Table 23: Skye/Western Isles upgrade – A2 Design

Project Cost Driver	Cost	Basis of Cost Estimate
Internal Staff costs	£0.42m	Internal Staff rates
3rd Party Support	£0.24m	Framework rates and historical incurred rates
Environment and Consent	£0.59m	Framework costs
Land and Legal	£0.22m	Framework rates and historical incurred rates
Stakeholder Engagement	£0.04m	Framework rates and historical incurred rates
Ground Investigation	£2.61m	Competitively tendered costs
OHL and Construction Access Detail Design	£2.85m	Competitively tendered costs
Under Ground Cable Detail Design	£0.28m	Competitively tendered costs

6.2.3.3 Gate 2-3 (Skye / Western Isles Upgrade)

Gate 2-3 is the last of the 3 pre-construction phases that the project will complete. This project will have undertaken most of the detailed design within the previous phase, the main deliverables will be any changes to the detailed design arising from stakeholder discussions after the previous phase and confirmation of expected construction costs, confirmation of planning approval and signed Heads of Terms agreements with landowners. The construction design will be tendered during this phase to support efficient movement to construction at Gate 3. When all these deliverables are confirmed, reviewed and agreed the project will be ready to start construction. The key milestones for the last phase of pre-construction activity are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the construction phase, this will include construction programme, risk and a Class 3 estimate to confirm required finance for the project.
- Undertake any additional engineering studies required before Gate 3 this would include changes to engineering design for landowners, and any engineering requirements required to discharge planning conditions

- Confirmation of expected detailed construction costs for the project post Gate 3
- Further ground investigation may be required if the detailed design is amended
- Write and tender the contractor construction scope for construction
- Finalise all negotiations with landowners and have all Heads of Term signed
- Continue to engage with stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Receive feedback from the planning authority on the status of the planning applications; if successful prepare to discharge conditions.
- Regulatory submission of Project Assessment referring to the design work from Gate 1-2 and any further refinement within Gate 2

Table 24: Gate 2-3 Skye/Western Isles upgrade

Project Cost Driver	Cost	Basis of Cost Estimate
Internal Staff costs	£0.80m	Internal Staff rates
3rd Party Support	£0.24m	Framework rates and historical incurred rates
Environment and Consent	£0.52m	Tendered framework costs
Land and Legal	£4.60m	Framework rates and historical incurred rates
Stakeholder Engagement	£0.12m	Framework rates and historical incurred rates
Construction civils detail design	£0.55m	Competitively tendered costs
Construction OHL Detail	£0.57m	Competitively tendered costs
Construction Under Ground Cable Detail	£0.16m	Competitively tendered costs

In conclusion, we are seeking £17.7m in PCF for Skye (Western Isles) upgrade across gates 0-3. This comprises 52% of costs from tenders and 48% of costs from previously incurred rates. For the reasons previously noted, we believe this should give Ofgem confidence to mark these as “high confidence” costs.

Table 25: Pre-construction cost for Skye 132kV OHL reinforcement

Project Cost	Cost	**Basis of Cost Estimate**
A1 design	£2.90m	Tendered costs, framework rates, historical incurred rates and internal staff rates
A2 design	£7.25m	Tendered costs, framework rates, historical incurred rates and internal staff rates
Gate 2-3	£7.55m	Tendered costs, framework rates, historical incurred rates and internal staff rates

6.3 Argyll and Kintyre 275kV Strategy

This section provides detail to support:

Recommendation: PCF funding totalling £22.7m to be approved in our baseline funding covering the development of the Argyll and Kintyre 275kV strategy.

Justification: Signed generation contracts are in place and the scheme will be delivered under LOTI.

The transmission network in Argyll and Kintyre, in the south west of the SHE Transmission system, has historically been a radial network until the completion of the Kintyre – Hunterston project in 2015. This was an SWW project that was required to enable the connection of new renewable generators to the local network. As of now there are effectively two routes to export power out of the Argyll and Kintyre area. These are the three 132kV overhead line circuits from Inveraray to Sloy and the two 220kV subsea cables from Crossaig – Hunterston. These two routes are coupled together by the Inveraray – Crossaig 132kV double circuit. From Crossaig there is a radial 132kV double circuit overhead line connected to Carradale GSP, and from Inveraray there is a radial 132kV double circuit overhead line connected to Taynuilt GSP.

The 132kV double circuit overhead line between Inveraray and Carradale was constructed in 1960, with the section between Crossaig and Carradale upgraded as part of the Kintyre – Hunterston project in 2015. The remaining OHL between Inveraray – Port Ann – Crossaig, approximately 84km, has been identified from condition assessments to be in a poor condition and in need of intervention. In addition to this asset condition driver is a secondary load driver. Contracted and scoping generators in the local area were consider as part of the optioneering for this asset intervention. The result of the analysis, including a Cost Benefit Analysis (CBA), was to construct the new double circuit overhead line with the capability for operating at 275kV, but initially operated at 132kV. The section between Inveraray and Port Ann is currently being replaced within the RIIO T1 period on an asset condition basis. The section between Port Ann and Crossaig has been identified for replacement in the RIIO T2 period on an asset condition basis and has been given approval in the RIIO T2 Draft Determination.

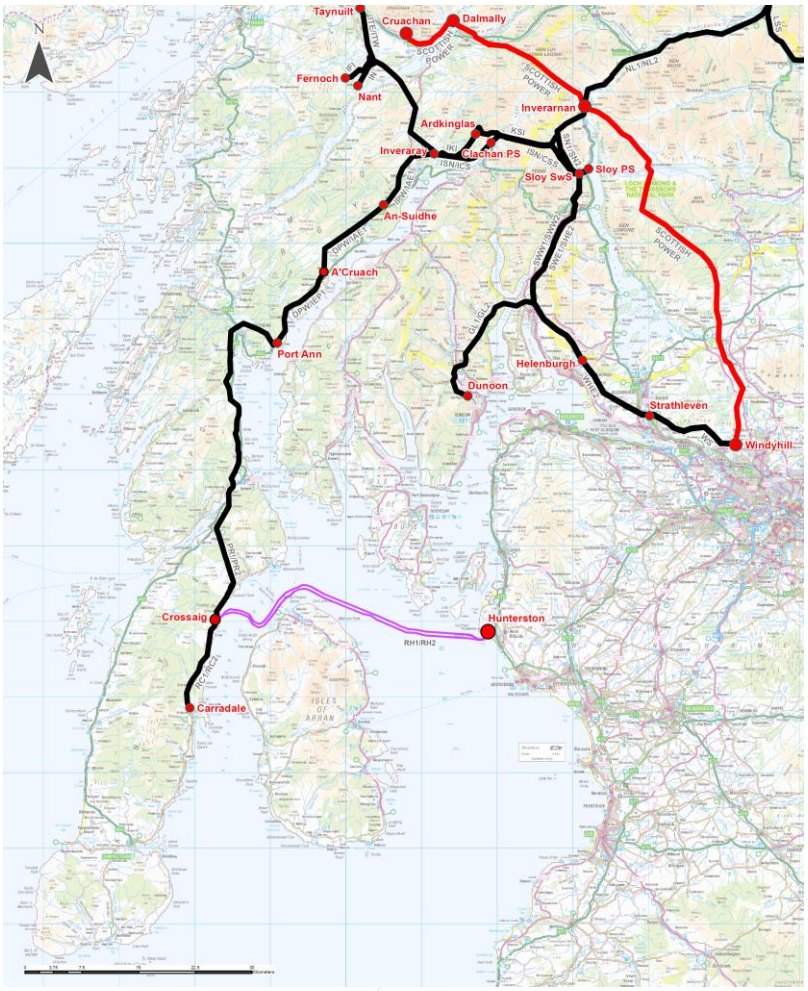


Figure 5: The existing South West SHE Transmission network overlaid on a geographic diagram

The replacement of the Inveraray – Crossaig overhead with a new circuit is required to meet the asset condition requirement on this circuit, but it is also consistent with the long-term strategy for the Argyll and Kintyre network. There has been significant interest from new renewable generation seeking to connect to the network following the completion of the Kintyre – Hunterston. This increase resulted in an optioneering process being undertaken in 2016 to consider a range of long-term solutions for the south west network to enable the connection of the next tranche of renewable generation, with the Inveraray – Crossaig rebuild forming part of it.

The optioneering work undertaken considered a number of significant reinforcements in the south west area to enable the connection of large volumes of generation as part of a long-term development strategy of this network. As can be seen from the map in Figure 5, potential reinforcement options are very much influenced by the geography in this area and is an important part of assessing the viability of options. The region comprises a varying landscape of craggy upland and mountains cut through by deep glens, lochs and sea lochs. SHE Transmission has taken this into consideration when designing and assessing options under a multi criteria assessment. This has been considered alongside option costs, system performance, engineering, and environmental constraints. Based on the

outcome of this analysis, the long-term strategy solution for the Argyll and Kintyre network is to consider an upgrade to 275kV, with a new connection to ScottishPower's network in North Argyll area to enable the export of large volumes of generation from the area to the Main Interconnected Transmission System (MITS).

The contracted generation in this area this has fluctuated over the past few years. The increase seen from 2013 to 2015 was followed by a noted reduction. Between 2016 and 2017 there were a number of generator scheme terminations and Modification Applications following the withdrawal of subsidies for onshore wind. This resulted in a reduction of the amount of generation contracted to connect in the area. There has been a steady increase in the contracted generation in the south west in the years since then. However, the past nine months has seen a marked increase in the volume of contracted, applied and scoping generation seeking connection to the Argyll and Kintyre network.

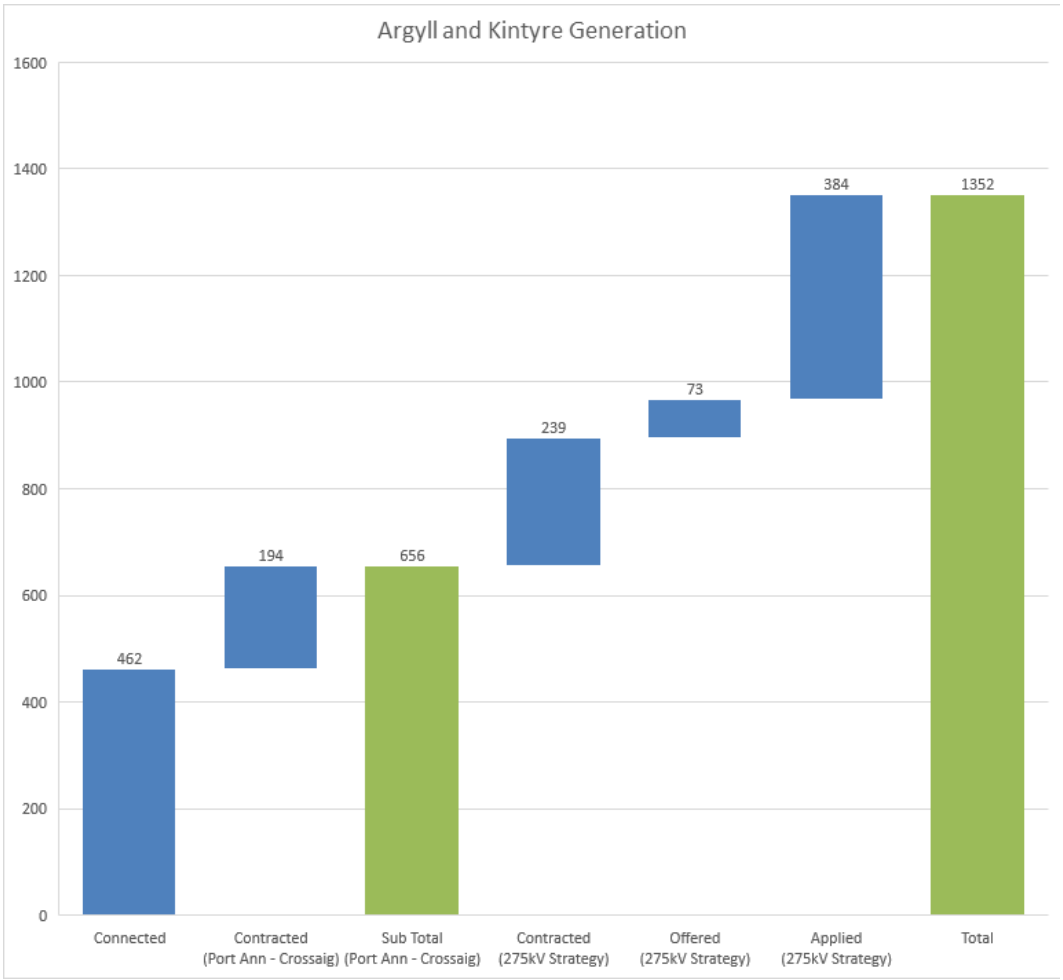


Figure 6: The existing South West SHE Transmission network overlaid on a geographic diagram

As can be seen from Figure 6, the total volume of contracted and connected in the area that does not require further reinforcement beyond the Port Ann – Crossaig OHL reinforcement is 656MW. Power system studies undertaken have shown that generation over and above this requires further reinforcement of the Argyll and Kintyre network. 239MW is contracted which requires upgrade of the network to 275kV. This is made up of three generators all of

which contracted within the last nine months, and two of which totalling 155MW contracted in the past four months. Further to this there are a significant number of generators that are in the application process for a connection offer. One generator, 73MW, has an issued offer that is open for acceptance. Four generators, totalling 384MW, have offers in progress that will be issued within the next two months. These additional generators in the application process all require the Argyll and Kintyre 275kV strategy. This increase in contracted and applied generation from the past nine months totals 696MW. This would see the generation in the south west more than double from the total post completion of the Port Ann – Crossaig reinforcement. Over and above this there continues to be pre-app discussions with developers interested in connecting to the Argyll and Kintyre network.

As a result of the generation activity in the area, there is certainty on the need to invest in this part of the system during the RIIO-T2 period. The generation driving this reinforcement have contracted dates ranging from 2025 to 2026 and therefore pre-construction activity is required at the very beginning of the RIIO-T2 period. The project delivery timeline and outline of the pre-construction activities required to be undertaken in the RIIO-T2 period for this LSS is detailed below.

6.3.1 Argyll and Kintyre 275kV Reinforcement Strategy

The Argyll and Kintyre 275kV Reinforcement Strategy consists of the upgrade of the network to 275kV, the connection of this network to the Dalmally – Windyhill 275kV overhead line and works at Crossaig to split the network. The strategy has been developed as a result of optioneering undertaken on this network. The reinforcement considers three main parts, as indicated on the diagram in Figure 6;

- Reinforcement in the north Argyll area with the establishment of a new 275/132kV substation at Creag Dhubh, and the construction of a new 275kV double circuit overhead line to Dalmally switching station (SPEN) . This is highlighted in blue on the diagram
- Connection between the new Creag Dhubh substation and the existing Inveraray – Crossaig overhead line. This requires the construction of a new 275kV double circuit overhead line from Creag Dhubh substation and a Tower close to Inveraray switching station. This is highlighted in yellow on the diagram
- Upgrade of the Inveraray – Crossaig overhead line to 275kV operation. This will require substation and transformer works at An Suidhe and Crarae substations. Establish a new 275/132kV substation at Craig Murrail and connection to Port Ann GSP, and establish a new double busbar at Crossaig substation to enable the radialisation of the network. This is highlighted in green on the diagram

Based on the volume of contracted generation and currently in the application process, SHE Transmission are developing the Argyll and Kintyre 275kV reinforcement strategy for delivery in 2026 at an estimated total cost of circa £400m.

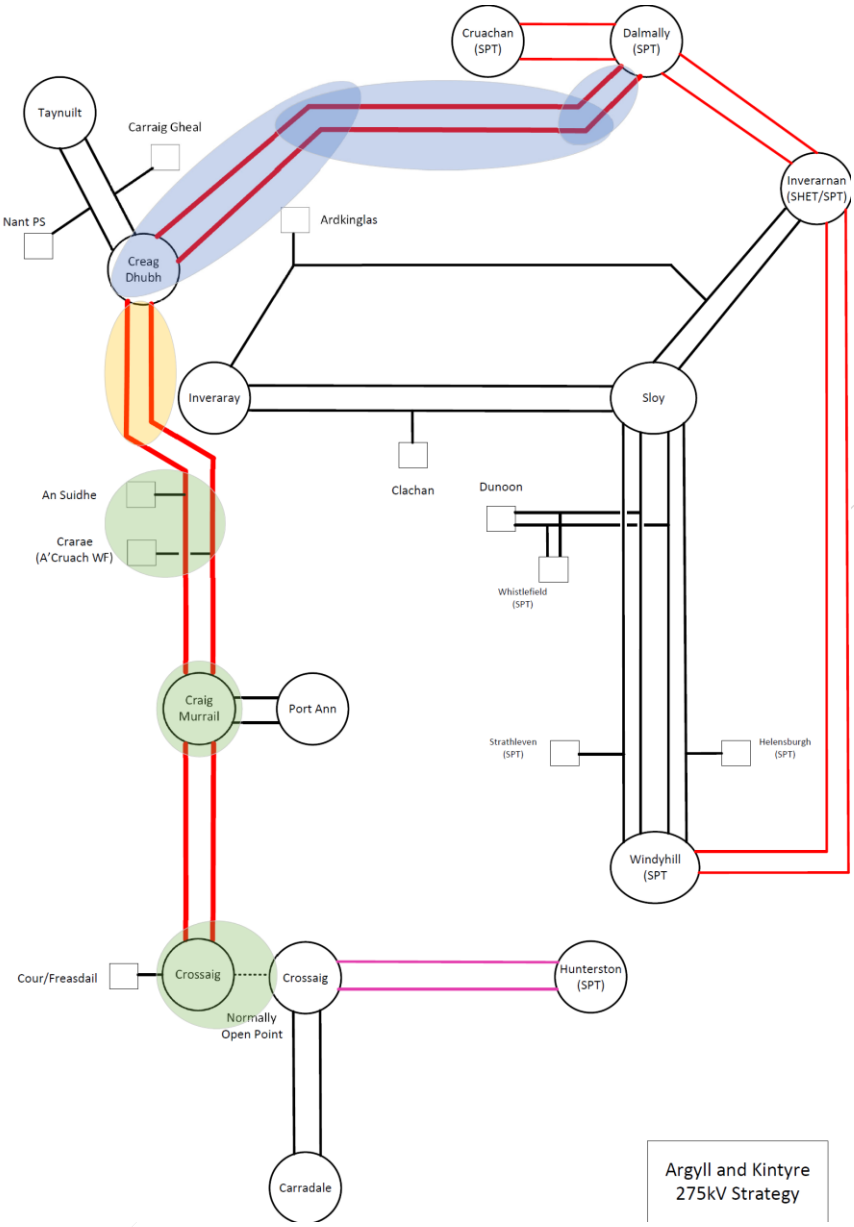


Figure 7: Diagram showing the proposed Argyll and Kintyre 275kV reinforcement strategy

6.3.2 Project Delivery Timeline – Argyll and Kintyre 275kV Strategy

Table 26: Indicative Project Delivery Timeline for the Argyll and Kintyre 275kV strategy

Stage	Gate	Timeline
Appoint contractor	0-1	Q4 2020
Submit Initial Needs Case	0-1	Q2 2021
Complete Initial contractor design	1-2	Q2 2021
EIA start	1-2	Q3 2021
Submit Needs Case	2-3	Q2 2022
Planning Submission and consent	2-3	Q4 2022
Submit Project Assessment	2-3	Q2 2023
Construction Start	3	Q2 2024
Energisation	4	Q3 2026
Project Close	5	2027

6.3.3 Pre-Construction Activity required in the RIIO-T2 period – Argyll and Kintyre 275kV Strategy

The work being undertaken for the Argyll and Kintyre 275kV Strategy is at an earlier stage of definition than Eastern HVDC and Sky/Western Isles, however SHET has developed knowledge regarding the terrain, constraints and potential stakeholder feedback based on other major Argyll & Kintyre SSEN projects such as Kintyre Hunterston and Inveraray to Port Ann. The experience gained by SHET over the last 10 years has informed our pre-construction methodology, project timing and task durations. The costs are based on internal staff costs, historical project costs and framework rates. As the design progresses these costs will be finalised using current framework rates for call off contracts or project tendered costs. This refinement is acceptable from a consumer risk perspective as we are proposing an end of period true up for PCF; consumers will not pay for PCF outputs not delivered.

The engineering design is focused on the upgrade of the existing 84km 132kV overhead between Crossaig and Inveraray, to a 275kV overhead line and the construction of a new 275kV connection between Inveraray and Dalmally. There is an existing 275kV overhead line in Dalmally that connects to Inverarnan and finally to Windyhill in Glasgow, which is owned by ScottishPower Energy Networks. There are three existing 132kV substations that will require upgrade to 275kV; and two new 275kV substations and one new 275kV switching station will be required for 275kV operation by 2026.

The Argyll and Kintyre 275kV strategy has obtained development consent for the Inveraray to Crossaig 275kV Reinforcement, which is the replacement of the existing 132kV overhead line from Inveraray to Crossaig, with a 275kV capable overhead line, that will initially operate at 132kV. Phase 1 began construction in September 2019 and Phase 2 is due to begin construction in 2021. This initial phase of works is primarily driven by the condition of the existing asset and is included within our baseline funding for both T1 and T2 periods.

The works for the Argyll and Kintyre 275kV reinforcement strategy that are in pre-construction development:

- Creag Dhubh (North Argyll) to Dalmally 275kV Connection. The new Creag Dhubh 132/275kV GIS substation and a 13.5km new 275kV overhead line to Dalmally, with a possible new 275kV switching station in Dalmally area.
- Creag Dhubh (North Argyll) to Inveraray 275kV Connection. A new 10km 275kV overhead line (initially operating at 132kV) between Creag Dhubh substation and a tower 3km to the west of Inveraray, on the new Inveraray to Crossaig 275kV Reinforcement. This will allow the overhead line from Crossaig to Creag Dhubh to bypass Inveraray 132kV switching station.

- Craig Murrail substation, a new 132/ 275kV AIS substation, to be established to the north of the Port Ann tee point. Turn in the Inveraray to Crossaig double circuit into the new Craig Murrail substation. Disconnect Port Ann from tee points on the 132kV OHL and connect Port Ann GSP into the new substation.
- Crossaig substation, a new double busbar at Crossaig substation to enable the network to be radialised. This is likely to require the construction of a new Crossaig Substation (North) connect to 132/220kV existing Crossaig substation (South) by normally open 132kV cable circuits.
- An Suide substation. Rebuild of the existing 33/132kV substation with a 275/33kV transformer. Construct a new 275/33kV substation at An Suidhe to connect the existing An Suidhe windfarm and to maintain connection of the windfarm following the line upgrade to 275kV.
- Crarae substation. Rebuild the existing 33/132kV substation with a 33/275kV transformer. Construct a new 275/33kV substation at Crarae to connect the existing A'Cruach windfarm and to maintain connection of the windfarm following the line upgrade to 275kV.
- Creag Dhubh (North Argyll) to Taynuilt 132kV connection. Rebuild of 12.5km of existing 132kV double circuit steel tower line between the new Creag Dhubh 132/275kV substation and the existing Taynuilt 33/132kV substation.

The project will follow the SSE Large Capital Projects (LCPs) governance framework. The pre-construction activities in the LCP governance framework occur between Gate 0 and 3, a description of the expected activities is provided below.

6.3.3.1 Gate 0-1 (Argyll and Kintyre 275kV Strategy)

Within this phase the project will confirm the OHL routes, technologies and capacities and undertake site selection for substation and switching station sites. Some initial ground investigation works will be conducted to verify the choice of preferred route and sites. Site visits, site investigations and stakeholder consultation will be completed to confirm the choice of preferred route and sites. The Gate 0-1 phase for the Argyll and Kintyre 275kV strategy will conclude with a proposed overhead line route and substation/switching station site for further detailed survey and investigation in Gate 1-2. The LCP governance documentation will be referred to and updated throughout this phase of the project.

The key milestones for the Gate 0-1 phase for the Argyll and Kintyre 275kV strategy are:

- Review governance documentation to confirm scope; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Creag Dhubh (North Argyll) to Dalmally 275kV Connection. Overhead line route options have been progressed for this section and a consultation exercise will commence in September 2020 to finalise the preferred route.
- Creag Dhubh (North Argyll) to Inveraray 275kV Connection; and, Creag Dhubh (North Argyll) to Taynuilt 132kV connection. Undertake an OHL routing assessment to determine potential OHL routes. Write and tender the contractor design scope; award scope of work to undertake initial ground investigation of the OHL route. Environmental surveys to include visual and landscape, noise and habitat along the OHL route and substation tie-ins. Engagement with directly affected landowners along the OHL route options. Complete stakeholder engagement with landowners, statutory stakeholders, local government, community and other interested stakeholders to confirm preferred route.
- Craig Murrail substation; Crossaig substation; An Suide substation and Crarae substation. Complete site selection assessment. Engagement with directly affected landowners along the OHL route options. Complete stakeholder engagement with landowners, statutory stakeholders, local government, community and other interested stakeholders to confirm preferred site.

6.3.3.2 Gate 1-2 (Argyll and Kintyre 275kV Strategy)

The works between Gate 1-2 for Argyll and Kintyre 275kV strategy will include more detailed engineering design and initial identification of each tower position based on the preferred route confirmed at Gate 1. Bore holes and trial pits at each tower location and substation/switching station site location will be undertaken and then initial foundation, access and accommodation design will also be completed. Further engagement will be sought with landowners to agree and negotiate a wayleave or land purchase for substation/switching station sites. The deliverables from the technical design, outcome of the environmental studies and further engagement with stakeholders during this phase will confirm the final tower locations and site details and support completion of the Environmental Impact Assessment which will then be submitted as a Section 37 application to the Energy Consents Unit (ECU) for review and determination. During this phase the Needs Case will be submitted to Ofgem. The LCP governance documentation will be referred to and updated throughout this phase of the project.

The key milestones for the Gate 1-2 phase for the Argyll and Kintyre 275kV strategy are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the next phase, this will include programme, risk and finance project information for the project.
- Undertake the initial alignment study to confirm all tower positions.
- Undertake bore holes and trial pits at each OHL tower location and site.
- Write and tender the contractor construction scope for construction.
- Continue negotiation with landowners to agree wayleaves and Heads of Terms based on the outcome of the alignment study and substation/switching station site confirmation.
- Undertake stakeholder engagement with landowners, statutory stakeholders, local government, community and other interested stakeholders to confirm final tower positions and substation site location and orientation.
- Complete the environmental surveys and write the Environmental Impact Assessment, when finalised, submit the S37 planning application to the ECU.

6.3.3.3 Gate 2-3 (Argyll and Kintyre 275kV Strategy)

Gate 2-3 is the last of the pre-construction phases that the project will complete. This project will have undertaken most of the detailed design within the previous phase, the main deliverables in this phase will be any changes to the detailed design arising from stakeholder discussions after the previous phase and confirmation of expected construction costs, confirmation of planning approval and signed Heads of Terms agreements with landowners. The construction design will be tendered during this phase to support efficient movement to construction at Gate 3. When all these deliverables are confirmed, reviewed and agreed the project will be ready to start construction.

The key milestones for the last phase of pre-construction activity are:

- Review governance documentation to confirm work undertaken within the previous phase; update governance documentation at the end of this phase in preparation for the construction phase, this will include construction programme, risk and a Class 3 estimate to confirm required finance for the project.
- Undertake any additional engineering studies required before Gate 3 this would include changes to engineering design for landowners, and any engineering requirements required to discharge planning conditions
- Confirmation of expected detailed construction costs for the project post Gate 3
- Further ground investigation may be required if the detailed design is amended
- Write and tender the contractor construction scope for construction
- Finalise all negotiations with landowners and have all Heads of Term signed
- Continue to engage with stakeholder engagement throughout this phase with landowners, statutory stakeholders, local government, community and other interested stakeholders
- Receive feedback from the planning authority on the status of the planning applications; if successful prepare to discharge conditions.

We are seeking £22.7m in PCF for Argyll and Kintyre 275kV strategy upgrade across gates 0-3. This comprises 100% of costs estimated from previously incurred rates. We believe these costs should be categorised as "high confidence" for the purposes of the TIM sharing factor and the Business Plan Incentive. While they are not tendered rates, they are based on rates incurred in previous projects. Of particular importance for these less mature costs, as is the case for all our PCF, they will be subject to an uncertainty mechanism to protect consumers from any windfall company gains (i.e. underspend of allowances); we propose an ex post true up. We are also working with Ofgem to determine pre-construction PCDs which protect consumers from inefficient overspend as we will be held fully accountable to efficient delivery of outputs. The non-delivery of any PCDs means the full return of allowances to consumers. These combined regulatory mechanisms – true-up and PCDs - protect consumers and is in line with both Ofgem's requirements to classify costs as high confidence and SHE Transmission's position on pre-construction, i.e. our core aim of PCF is efficient project development, not to outperform allowances.

Table 27: Pre-construction cost for the Argyll and Kintyre 275kV strategy

Project Cost	Cost	**Basis of cost estimate**
Gate 0-1	£4.6m	Framework rates, historical project costs and internal staff rates
Gate 1-2	£11.31m	Framework rates, historical project costs and internal staff rates
Gate 2-3	£6.79m	Framework rates, historical project costs and internal staff rates

7. Conclusion

Our updated review taking account of both contracted and wider generation forecasts provides the justification for inclusion of PCF within our RIIO-T2 baseline allowance for the schemes listed below:

Large Strategic Scheme	Requirement	**PCF Funding**
1st Eastern HVDC link from SHE Transmission to England	Wider system benefit across multiple boundaries including B2 / B4 / B5 / B6 / B7 and B7a	£21.6m
2nd Eastern HVDC link from SHE Transmission to England	Wider system benefit across multiple boundaries including B2 / B4 / B5 / B6 / B7 and B7a	£32.4m
Skye/Western Isles upgrade	Generation Connection	£17.7m
Scotwind OWPL - Dounreay to Spittal double circuit **&** HVDC link Spittal to Peterhead	Generation Connection	£31.1m
Argyll and Kintyre 275kV Strategy	Generation Connection	£22.7m

Our total funding request for LSS for inclusion in our RIIO-T2 baseline allowance is therefore £124.5m. This funding is in addition to the other baseline funding request set out in our RIIO-T2 plan covering:

Annual NOA scheme Development - £2m;

Regional Plan Development - £2.5m;

Advanced PCF for T3 LRE schemes - £11m; and

Advanced PCF for T3 NLRE schemes - £13.0m

Our proposal is based on the regulatory mechanisms set out in our supporting paper – True Up, Logging Up and re-openers: SHE Transmission RIIO-T2 Proposals (ref T2Business Plan-DD-QRD-001):

- PCF for LSS will be subject to symmetrical true up of costs at RIIO-T2 for baseline schemes based on –
  1. Ring fencing the five projects from in-period additional schemes.
  2. All are subject to PCD framework. Ensure PCDs delivered.
  3. Next, if PCD delivered true up applies as normal.
  4. Subject to materiality (£1-2m) and ex post efficiency assessment, underspent allowances returned, overspent allowances permitted.

- Additional PCF funding for significant changes in scope to existing baseline schemes and future LSS scheme to be considered in annual reopener period, 1 month after publication of the annual NOA results.

- PCF for Annual NOA scheme Dev, Regional Plan Development, Advanced PCF for T3 LRE & NLRE schemes will be subject to symmetrical logging up at RIIO-T2 close out.

Our total updated baseline request for PCF funding in the RIIO-T2 period is therefore £153m.