

RIIO-ED2 Engineering Justification Paper

New Transmission Capacity Charges

Investment Reference No: 423/SSEPD/LRE/TRANSMISSION_CHARGES



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Definitions and Abbreviations

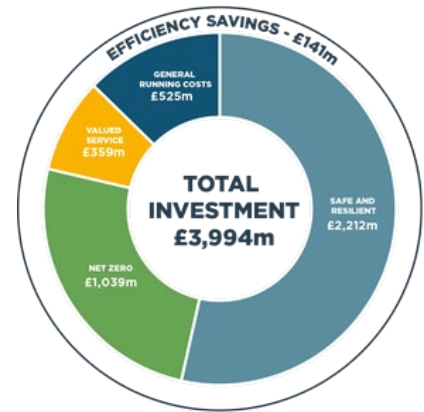
Acronym	Definition
AIS	Air-insulated Switchgear
ASCR	Aluminium Conductor Steel Reinforced
BSP	Bulk Supply Point
CBA	Cost Benefit Analysis
CBRM	Condition Based Risk Management
CEM	Common Evaluation Methodology
CI	Customer Interruptions
CML	Customer Minutes Lost
CT	Consumer Transformation
DFES	Distribution Future Energy Scenarios
DNO	Distribution Network Operator
EJP	Engineering Justification Paper
ESA	Electricity Supply Area
EV	Electric Vehicle
FCO	First Circuit Outage
FES	Future Energy Scenarios
GIS	Geographic Information System
GM	Ground Mounted
GSP	Grid Supply Point
HI	Health Index
IDP	Investment Decision Pack
LCT	Low Carbon Technology
LEP	Local Enterprise Partnership
LI	Load Index
LRE	Load Related Expenditure
LW	Leading the Way
NPV	Net Present Value
OHL	Overhead Line
PM	Pole Mounted
PV	Photovoltaics
RSN	Relevant Section of Network
SCO	Second Circuit Outage
SSEN	Scottish and Southern Electricity Network
SP	Steady Progression
ST	System Transformation
XLPE	Cross-linked Polyethylene

1 Executive Summary

This Engineering Justification Paper (EJP) identifies the need to carry out works at seven boundaries between our SSEN licence areas and relevant Transmission Operator to accommodate the forecast load growth under existing investment drivers. The primary driver for these schemes is load.

The total New Transmission Capacity Charges (NTCC) for SSEN, within RII0-ED2, is £23.2m and the works are planned to be completed between 2024/25 and 2027/28 with base charges also incurred in 2023/24. This sits within our Net Zero Totex ask.

Due to the various drivers of these schemes, there are different risks associated with doing nothing. These risks include non-compliance with ER P2, potential self-derogation, an increased risk of CIs and CMLs due to protection trips and/or asset failure due to thermal breakdown of the conductor. For schemes triggered by generation connections, the associated risk of doing nothing is creating a barrier for renewable generation connections, potentially slowing the progress towards net zero.



The table below shows the scope of the works and the associated NTCC:

SSEN	Project	NTCC (£m)
SEPD	<ul style="list-style-type: none"> Reinforcement of Transformers and Switchgear at Iver 275/132kV GSP 	1.67
SHEPD	<ul style="list-style-type: none"> Build of New Gremista 132/33kV GSP Build of New Errochty 132/33kV GSP Reinforcement of Transformers and Switchgear at Fiddes 132/33kV GSP Reinforcement of Transformers and Switchgear at Dunvegan 132/33kV GSP Reinforcement of Transformers and Switchgear at Tarland 132/33kV GSP Reinforcement of Transformers and Switchgear at Arbroath 132/33kV GSP 	21.51
Total		23.17

Table 1: Option Summary

These schemes facilitate the efficient, economic, and co-ordinated development of the SSEN distribution network for Net Zero and also provide additional security to the Shetland Distribution Network by linking it to the GB Transmission network for the first time through the Gremista GSP.

2 Investment Summary Table

The table below provides a high-level summary of this Engineering Justification Paper (EJP) and the Cost and Volume (CV) impacts within SSEN's Business Plan Data Tables.

Engineering Justification Paper Investment Summary				
Name of Programme	New Transmission Capacity Charges			
Primary Investment Driver	Load			
Scheme reference	423/SSEPD/LRE/TRANSMISSION_CHARGES			
Output reference/type	TCPs reinforced - licensee requirement TCPs new - licensee requirement			
Cost	£23.2m			
Delivery year	2023/24 to 2027/28			
Reporting Table	CV4 - NTCC			
Outputs included in RIIO ED1 Business Plan	Yes			
Spend apportionment	(£m)	ED1	ED2	ED3+
	SSEN	0	£23.2m	Base charges

Table 2 Investment Summary

3 Introduction

SSEN has created forecasts of the Transmission Connection Point Charges (TCPC) during the RIIO-ED2 price control period (2023/24 to 2027/28). These include information supplied by, and discussed with, Scottish Hydro Electric Transmission plc (SHE-Transmission) and National Grid (TO).

TCPC was introduced in DPCR5 as a hybrid approach with two separate elements: 100% pass through (PTPA) are charges out with the DNO's control, and an incentivised element attached to the TCPC that a DNO can influence known as New Transmission Capacity Charges (NTCC). TCPC and these elements are unchanged in their definition from RIIO-ED1. Further guidance is provided in section 5.1.

The RIIO-ED2 total TCPC forecasts for SHEPD and SEPD are £73,554,098 and £67,718,577 respectively.

For SHEPD, this is split into £52,045,667 PTPA and £21,508,431 NTCC with six schemes identified in ED2. For SEPD, this is split into £66,052,680 PTPA and £1,665,898 NTCC, with only one new scheme within ED2. The breakdown of these costs is detailed in Appendix A and Appendix C.

This paper provides the following:

- TCPC methodology for RIIO-ED2
- Details of how the TCPC forecasts were constructed for SEPD and SHEPD
- Details surrounding the driver for each scheme, based on:
 - a. Increases in Demand or Distributed Generation (DG)
 - b. Connection to new Transmission system infrastructure (HVDC & AC)
- Overview of TCPC allowances submitted in ED1 and ED2.

Further supporting information on the GSP sites involved in this paper is provided in Appendix A to I of this paper.

We recognise that there is uncertainty over whether further GSPs will be created or if reinforcement works at existing sites is required beyond those identified in our submission. However, we have not included any speculative additional sites beyond those that are already contracted, or where multiple current large applications in a given area clearly indicate that a new GSP will be required in the period.

We accept our proposals are conservative and realistic, and we accept that any further uncertainty and associated risk will be mitigated through the Load Related Re-opener Mechanism that is being proposed by Ofgem.

4 Background Information

4.1 Transmission Connection Point Charges (TCPC) in RIIO-ED2

TCPC has two components: 100% Pass Through (PTPA); and New Transmission Capacity Charges (NTCC). The former applies to charges for all connection assets energised before 1 April 2015; and for charges for direct replacement connection assets and for a portion of reinforcement connection assets installed after 1 April 2015. The NTCC apply to new connection assets installed after 1 April 2015 by either building a new GSP or increasing the capacity (MVA) at an existing GSP. In the latter case, the NTCC will be apportioned between PTPA and NTCC by the factor determined by dividing the old aggregate transformer capacity (MVA) by the new aggregate transformer capacity (MVA).

National Grid ESO calculates the TCPC based on the Gross Asset Values (GAV) of the connection assets as set out in Section 14 of the Connection and Use of System Code (CUSC). SSEN calculate the value (£) of the annual PTPA and NTCC costs for Scottish Hydro Electric Power Distribution plc (SHEPD) and Southern Electric Power Distribution plc (SEPD). These are discussed further in Section 3.2 – RIIO-ED2 CV4 Input Forecast, below.

4.2 Scottish and Southern Electricity Networks (SSEN) – RIIO-ED2 CV4 Input Forecast

The steps taken to calculate SSEN's RIIO-ED2 TCPC forecast are outlined below.

- a. Outstanding RIIO-ED1 schemes to be completed and charged for were identified and annual connection charges calculated. These informed the Base Charges for NTCC and PTPA in RIIO-ED2.
- b. The following schemes are forecast for connection in the RIIO-ED2 period:
 - Iver 275/132kV GSP substation (SEPD)
 - Gremista 132/33kV GSP (SHEPD)
 - Errochty 132/33kV GSP (SHEPD)
 - Fiddes 132/33kV GSP (SHEPD)
 - Dunvegan 132/33kV GSP (SHEPD)
 - Arbroath 132/33kV GSP (SHEPD)
 - Tarland 132/33kV GSP (SHEPD)

The below information was gathered for the RIIO-ED2 CV4 forecast:

- Site name
 - Asset ID e.g. SGT1, Cable, FMS metering (electronic, non-electronic)
 - Scheme driver e.g. load
 - Who requested the scheme i.e. TO or DNO
 - Forecast asset removal date
 - Assets being replaced
 - Termination Dates
 - Existing transformer capacity
 - New transformer capacity
 - Forecast energisation date
 - GAVs for each new asset
 - Base year for charges
 - Funding Mechanism
- c. This enabled the application of GB ESO's charging methodology (CUSC Section 14) to forecast:

- TCPC, split by NTCC and PTPA.
 - Termination Fees, where appropriate, and the early removal is requested by the DNO.
- d. Considerations in calculating the forecast charges
- Base Year is 2020-21 for ED2
 - Where forecast GAVs were not provided for FMS Metering and Cable, estimates have been used.
 - Use of the GB ESO methodology and forecast of RPI and Rate of Return for the ED2 period, as provided by NG Charging Analyst.
 - A forty-year (asset lifetime) costs model, downloaded from GB ESO website, has been used to provide a full asset life cost illustration
 - Annual Connection Charges are highly indicative, as NG ESO's standard process is to make an indicative offer, where the GAVs are to be finalised when the project is completed, and the costs are out turned with final GAVs.

5 Proposed TCPC (PTPA and NTCC) for RIIO-ED2

5.1 Construction of the SEPD and SHEPD TCPC Forecasts for RIIO-ED2

Based on information from, and discussions with, National Grid Electricity Transmission and SHE-Transmission plc, the construction of the RIIO-ED2 TCPC forecasts is detailed below.

For both SEPD and SHEPD, the forecast takes the 2022/23 estimated base TCPC cost, plus estimated additional charges arising from new connection projects forecast to complete before the end of RIIO-ED1. The Base Exit Charge from 1st April 2023 is the 2022/23 forecast outturn figure inflated annually by RPI for each year of RIIO-ED2. The Rate of Return, Site Specific Maintenance and Transmission running cost values used in the calculation of TCPC are consistent across the RIIO-ED2 period.

5.1.1 SEPD

Reinforcement works at Iver GSP is the only scheme forecast to be completed during the RIIO-ED2 period for SEPD. Detailed information is provided in Appendix B.

The new assets have been priced using GAVs provided by National Grid (TO).

All TCPC for assets connected prior to 1st April 2015 are included in the Base TCPC and are subject to 100% pass through. TCPC for replacement assets connecting on, or after, 1st April 2015, have been apportioned based upon the "incremental MVA". This is discussed in detail later in Appendix J.

The tables in Appendix A show the Iver GSP forecast annual charges throughout the RIIO-ED2 period and the apportionment between PTPA and NTCC.

5.1.2 SHEPD

A list of connection projects was obtained from information supplied by, and discussed with, SHE-Transmission. SHEPD has discussed the forecast connection dates and assessed their validity. There are six projects forecast to connect during the RIIO-ED2 period. Two of the projects involve establishing new GSPs forecast to connect after 31st March 2023.

The new assets have been priced using GAVs in TOCA documentation. Projects where finalised TOCAs are not yet available have been priced per Appendix A ("Illustrative Connection Asset Charges") of SHE-Transmission's 2020/21 Basis of Transmission Owner Charges Statement.

All TCPC for assets connected prior to 1st April 2015 are included in the Base TCPC and are subject to 100% pass through. TCPC for replacement assets connecting on, or after, 1st April 2015, have been apportioned based upon the “incremental MVA”. This is discussed in detail later in Appendix J.

Appendix C lists the overall SHEPD costs forecast during the RIIO-ED2 period. The tables show, for each of the GSPs, the forecast annual charges throughout the RIIO-ED2 period and the apportionment between PTPA and NTCC. The following points should be noted:

1. Termination Fees are apportioned in the same way as the annual TCPC (where appropriate) during the RIIO-ED2 period (see Appendix J).
2. The TCPC for each of the GSPs reduce annually: the forecast takes account of the age of the connection assets when calculating the annual return (i.e. Return is calculated on the mid-year NAV).
3. The replacement works at Fiddes GSP are being triggered 132kV to 275kV OHL upgrade works by SHE-Transmission, requiring the early termination of connection assets. Consequently, SHEPD will continue to be charged TCPC for Fiddes based upon the GAVs of the terminated assets (these charges are included in the Base Exit Charge), until the date at which these assets would be fully depreciated (i.e. once they are 40 years old). Effectively, SHE-Transmission must bear the TCPC cost for the new connection assets in the interim years. SHE-Transmission details this process in Part 2 (Site Specific Charges, page 8) of its Statement of “Basis of Transmission Owner Charges”.

Appendices D, E, F, G, H and I provide detailed information for each of the SHEPD projects.

6 Deliverability and Risk

Our **Deliverability strategy (Annex 16.1)** describes our approach to evidencing the deliverability of our overall plan as a package, and its individual components. Testing of our EJPs has prioritised assessment of efficiency and capacity, and this has ensured that we can demonstrate a credible plan to move from SSEN’s ED1 performance to our target ED2 efficiency. We have also demonstrated that SSEN’s in house and contractor options can, or will through investment or managed change, provide the capacity and skills at the right time, in the right locations. This assessment has been part of the regular assessment of our EJPs, IDPs and BPDTs, and we will further refine our bottom up efficiencies and work plan phasing for our final submission in December through the ongoing development of our ED2 Commercial & Deliverability Strategy and engagement with our supply chain.

Our deliverability testing has identified a major strategic opportunity which is relevant to all EJPs.

- In ED2 SSEN will change the way Capital Expenditure is delivered, maximising synergies within the network to minimise disruptions for our customers. This is particularly relevant for a Price Control period where volumes of work are increasing across all work types.
- The principle is to develop and deliver Programmes of work, manage risk and complexity at Programme level and to develop strategic relationships with our Suppliers and Partners to enable efficiency realisation.
- The Commercial strategy will explore the creation of Work Banks (WB) and identify key constraints. The Load work will be the primary driver for a WB, supplemented by Non-Load work at a given Primary Substation. This approach will capitalise on synergies between the Load and Non-Load work, whereby the associated downstream work from a Primary Substation will maximise outage utilisation, enabling the programme to touch the network in a controlled manner with the objective of touching the network once. Where there is no Primary Load scheme to support the Non-Load work, these will be

considered and packaged separately, either insourced or outsourced dependant on volume, size and complexity.

- Transparency with the Supplier in terms of constraints, challenges, outage planning and engineering standards will capitalise on efficiencies, supported by a robust contracting strategy.

National Grid TO and SHE-Transmission have provided information and been involved in discussions for the above schemes as it will be the responsibility of the relevant Transmission Operator to carry out the work. The risk must be acknowledged that the works will not be delivered by SEPD or SHEPD and will need to coincide with the projects within the RIIO-T2 and RIIO-T3 business plans of the TO.

In addition to the above, the specific considerations for deliverability based on the scope of the New Transmission Connection Charges are detailed below:

- Training
- Location including access issues and civils
- Supply chain
- Work phasing and project interdependencies
- System interfaces for controls, Network operation and SCADA
- Whole System

Appendix A - SEPD RIIO-ED2 CV4 Forecast

100% P-T

	2023-24	2024-25	2025-26	2026-27	2027-28
Base Charge - 100% P-T (20/21 £)	£12,200,007	£12,047,048	£11,899,528	£11,345,256	£10,943,247
Termination Fees - 100% P-T (20/21 £)	£-	£-	£-	£5,530,764	£-
Metering contingency (20/21 £)	£126,987	£133,030	£134,741	£163,715	£163,715

New Charges (100% P-T) £					
Iver		£-	£-	£506,544	£858,098

Total -100% P-T (20-21 £)	£12,326,993	£12,180,078	£12,034,269	£17,546,279	£11,965,060	£66,052,680
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NTCC

	2023-24	2024-25	2025-26	2026-27	2027-28
Base Charge - NTCC (20/21 £)	£223,319	£227,048	£230,805	£234,588	£238,396
Termination Fees - NTCC (20/21 £)					

New Charges (NTCC) £					
Iver		-	-	£189,954	£321,787

Total - NTCC (20/21 £)	£223,319	£227,048	£230,805	£424,542	£560,183	£1,665,898
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Total TCPC

Total Forecast SEPD TCPC in RIIO-ED2 (100% P-T & NTCC) £	£12,550,313	£12,407,126	£12,265,074	£17,970,821	£12,525,243	£67,718,577
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Appendix B - Iver 275/132kV GSP Reinforcement

Iver 275/132kV GSP is located within the SEPD licence area. All four SGTs at Iver 275/132kV GSP are rated 240MVA each, which limits the second circuit outage (SCO) capacity at Iver GSP to 588 MVA after accounting for spring/autumn emergency ratings. To meet the fault level constraints on the Distribution Network Operator's network Super Grid Transformer, SGT 3A will normally be selected on 'hot-standby'. A scheme is installed which will automatically close circuit breaker 380A in the event of a fault on any of the in-service 275/132kV SGTs.

The reinforcement of Iver GSP is driven by the high local demand increase with █████ in the future. We have received the connection agreement from National Grid on 3 September 2020 after submitting Modification Application triggered by the two new data centre connection mentioned above. The Transmission Connection Asset Works comprise the following:

1. Replacement of Iver 275/132kV SGT's 1A, 2A and 4A with higher rated units (360MVA).
2. Upgrading of associated circuit and bay equipment (disconnectors, CT's / VT's, cables and protection) to ensure the circuit rating matches the SGT rating.

And for each of the above:

- a. Protection and control modifications as required.
- b. Associated civil works.
- c. Miscellaneous and minor works.

The offered connection date is 30 August 2026.

Connection Site	New Asset Description	GAV (2020/21)
Iver	180A Bay CT & VTs	████
Iver	280A Bay CT & VTs	████
Iver	480A Bay CT & VTs	████
Iver	Upgraded Disconnector H13A in	████
Iver	Upgraded Disconnector H23A in	████
Iver	Upgraded Disconnector H43A in	████
Iver	SGT1A 275/132kV 360MVA	████
Iver	SGT1A Cable 70M	████
Iver	SGT2A 275/132kV 360MVA	████
Iver	SGT4A 275/132kV 360MVA	████
	Total	£16,242,911.00

Appendix C - SHEPD RIIO-ED2 CV4 Forecast

100% P-T

	2023-24	2024-25	2025-26	2026-27	2027-28
Base Charge - 100% P-T (20/21 £)	£10,483,395	£10,208,332	£9,876,727	£9,789,725	£9,682,674
SPEN DSCP Energy Charge (20/21 £)	£59,752	£55,790	£50,618	£44,627	£38,232
Termination Fees - 100% P-T (20/21 £)		£389,620	£-	£361,230	£-
Metering contingency (20/21 £)	£59,825	£64,731	£67,813	£69,406	£71,125

New Charges (100% P-T) £

Fiddes - Electronic Metering only		£7,722	£7,590	£7,436	£7,283
Errochty		£-	£-	£-	£-
Gremista		£-	£-	£-	£-
Dunvegan			£-	£-	£-
Tarland				£116,357	£115,469
Arbroath				£205,879	£204,309

Total -100% P-T (20-21 £)	£10,602,972	£10,726,195	£10,002,748	£10,594,660	£10,119,092	£52,045,667
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NTCC

	2023-24	2024-25	2025-26	2026-27	2027-28
Base Charge - NTCC (20/21 £)	£2,414,206	£2,387,889	£2,202,654	£2,331,360	£2,303,412
SPEN DSCP Energy Charge (20/21 £)					
Termination Fees - NTCC (20/21 £)					

New Charges (NTCC) £

Fiddes - Electronic Metering only		£2,574	£2,530	£2,479	£2,428
Errochty		£1,166,209	£1,157,143	£1,144,873	£1,132,603
Gremista		£195,555	£583,760	£577,623	£571,485
Dunvegan			£825,705	£819,359	£810,744
Tarland				£232,714	£230,939
Arbroath				£205,879	£204,309

Total - NTCC (20/21 £)	£2,414,206	£3,752,227	£4,771,792	£5,314,285	£5,255,920	£21,508,431
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Total TCPC

Total Forecast SHEPD TCPC in RIIO-ED2 (100% P-T & NTCC) £	£13,017,178	£14,478,422	£14,774,541	£15,908,945	£15,375,012	£73,554,098
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Appendix D - New 132kV/33kV GSP Gremista

Shetland is presently not connected to the GB Transmission network and power is supplied from diesel/gas generation on the island, mainly from Lerwick Power Station and Sullom Voe Terminal.

It was recognised in 2010/11 that an enduring solution for Shetland should be sought, and a new obligation was placed in SHEPD's licence, Charge Restriction Condition (CRC) 2Q, to require SHEPD to bring forward an integrated plan to manage supply and demand. Three enduring solution recommendations have been made by SHEPD since this time in response to the obligation: the original Integrated Plan (IP) in 2013, the NES recommendation in 2017, and the Whole System contribution recommendation in 2018. The IP and NES recommendations were rejected; however, the Whole System contribution recommendation was approved.

Ofgem has now approved the Needs Case for the Shetland Transmission link and the SHEPD contribution towards the Transmission link, confirming the need for standby and triggering the requirement for arrangements to be implemented, including establishing the Gremista GSP to connect the transmission and distribution networks on Shetland¹. Further details on the background and work carried out to date by the Shetland Standby project can be found in the SHEPD Shetland Standby Recommendation paper issued to Ofgem in December 2020.

In order to connect the existing SHEPD distribution network to the new SHE-Transmission network it will require a new GSP to be established. SHEPD has applied to SHET/NGESO for a new GSP on Shetland and accepted the corresponding connection offer in summer 2020 to establish the Gremista GSP and provide supplies to SHEPD from November 2024, when the Shetland HVDC Link will be available.

The project is to connect to the new 132kV AC network which will be available from the SHE-Transmission system once the HVDC connection is established to Mainland Scotland. It will require the connection of existing 33kV circuits and substations to Gremista GSP on Shetland. The Transmission Connection Asset Works comprise the following:

Establish a new GSP (Gremista GSP) adjacent to the existing Gremista 33kV substation, install two 90MVA grid transformers and a suitable 33kV indoor switchroom within the Gremista GSP substation to connect to the existing Shetland 33kV Infrastructure as the point of interconnection between the present island network and the mainland.

Connection Site	New Asset Description	GAV (2019/20)
Gremista	90MVA 132/33kV Grid Transformer	
Gremista	90MVA 132/33kV Grid Transformer	
Gremista	33kV Circuit Breaker	
Gremista	33kV Circuit Breaker	
Gremista	FMS Electronic Metering	
Gremista	FMS Electronic Metering	
Gremista	FMS Non-Electronic Metering	
Gremista	FMS Non-Electronic Metering	
	Total	£8,407,000.00

¹ <https://www.ofgem.gov.uk/publications-and-updates/update-decision-approve-shepds-proposed-methodology-contribute-shetland-transmission-project>

Appendix E - New 132kV/33kV GSP Errochty

In early 2020, studies confirmed that the existing 132/11kV grid transformers, at Tummel GSP, were overloaded with connected generation under normal operating conditions and further under abnormal N-1 conditions. SHEPD made the decision to move approximately 3.3MW of generation to Rannoch GSP which reduced the intact network generation capacity under the capacity of the two GTs and minimum demand. Intertrips were also installed to prevent transformer overload under N-1 conditions.

In April 2020, [REDACTED] applied to increase their generator capacity at [REDACTED], currently connected to Tummel GSP. They accepted this offer in December 2020. With intertrips and movement of generation already being used to constrain generation, the decision was made to propose an increase in GSP capacity to facilitate the connected and contracted generation.

Considering the Whole System approach, discussions between SHE-Transmission and SHEPD resulted in the proposal of a new GSP at Errochty, approximately 1km East of the existing Tummel GSP. This option was chosen due to space limitations at the existing site for larger GTs and the opportunity to reconfigure the network to a conventional 132/33kV GSP, allowing for easier generator connections in future. The Transmission Connection Asset Works comprise the following:

1. Install two 90MVA 132/33kV transformers; each with a GIS 33kV transformer Circuit Breaker and a 33kV Switch Disconnector, on suitable level platforms at the new site adjacent to the existing Errochty 132kV Substation; along with the associated cabling/metering/protection equipment. The 33kV Circuit Breakers and 33kV Switch Disconnectors will be owned and operated by the Relevant Transmission Licensee.
2. Install a double circuit 132kV underground cable from the 132kV busbar at the new site adjacent to the existing Errochty 132kV Substation compound, via 132kV switchgear, for a distance of approximately 0.2 km to a termination at two new bays on the existing 132kV double busbars at the Errochty 132kV Substation.
3. The User's busbar side terminal of the 33kV Switch Disconnector will represent the ownership boundary between the Relevant Transmission Licensee and the User.

The proposed connection date is 31 October 2024.

Connection Site	New Asset Description	GAV (2018/19)
Errochty	90MVA 132/33kV Grid Transformer	[REDACTED]
Errochty	90MVA 132/33kV Grid Transformer	[REDACTED]
Errochty	33kV Circuit Breaker	[REDACTED]
Errochty	33kV Circuit Breaker	[REDACTED]
Errochty	33kV Disconnector	[REDACTED]
Errochty	33kV Disconnector	[REDACTED]
Errochty	Double Circuit 132kV Underground Cable	[REDACTED]
Errochty	FMS Electronic Metering	[REDACTED]
Errochty	FMS Non-Electronic Metering	[REDACTED]
Errochty	FMS Electronic Metering	[REDACTED]
Errochty	FMS Non-Electronic Metering	[REDACTED]
	Total	£16,050,826.00

Appendix F - 132kV/33kV GSP Fiddes

The reinforcement of Fiddes GSP is triggered by the proposed East Coast 132kV upgrade works by SHE-Transmission. The primary driver for the upgrade works is the connection of contracted and scoping generators which export power onto the transmission system. The addition of just one of these contracted schemes results in the exceedance of existing asset ratings. Intertrip solutions across grid supply points (GSP) have been offered to customers to facilitate connections ahead of the completion of the East Coast 132kV upgrade.

In addition to the load driver the asset health of this overhead line (OHL) provides a secondary non-load driver for this project. The circuit was constructed in 1951 and re-conducted in 1981/2. Recent asset condition assessments carried out (March 2019) identified probable deterioration of these assets. Further condition data gathering is ongoing to confirm this position however the current recommendation is to replace these assets early in the RII0-T3 price control period, current position is 2027.

The SHE-Transmission scheme will see Fiddes GSP being supplied by the Kintore-Tealing 275kV circuit. This will require new 275/33kV transformers to be installed at Fiddes GSP with associated switchgear.

The Transmission Connection Asset Works for the East Coast 132kV Upgrade comprise the following:

1. Rebuild the Brechin to Arbroath/Tealing Tee 132kV single circuit OHL as a 132kV double circuit OHL (~26km), with UPAS pre-fault rating of 203MVA per circuit.
2. Construct a new Fiddes 275kV substation adjacent to the existing Fiddes GSP. This will require a new 275kV double busbar setup with two 120MVA 275/33kV transformers. Two new 275kV terminal towers will be required and the XT1/XT2 275kV circuits diverted to the new substation. The existing 33kV busbar at Fiddes will be diverted to the new 275/33kV transformers.
3. Dismantle and decommission the Craigeibuckler Tee to Fiddes to Brechin to Arbroath / Tealing Tee 132kV OHL and the 132kV equipment, including PSTs, at Fiddes. (SHE-T)
4. This option assumes that there will be PST's installed at Tealing on the XT1 and XT2 275kV circuits prior to these works via the East Coast onshore 275kV upgrade (SHET-RI-009) reinforcement. (SHE-T)

Connection Site	New Asset Description	GAV (2020/21)
Fiddes	1T0 Bay (Single 33kV)	
Fiddes	2T0 Bay (Single 33kV)	
Fiddes	115 Bay (Single 132kV)	
Fiddes	215 Bay (Single 132kV)	
Fiddes	GT1 275kV/33kV 120MVA	
Fiddes	GT2 275kV/33kV 120MVA	
Fiddes	SGT1 Cable 20m	
Fiddes	SGT2 Cable 20m	
Fiddes	Electronic Metering	
Fiddes	Electronic Metering	
Fiddes	Non Electronic Metering	
Fiddes	Non Electronic Metering	
	Total	£11,232,628.00

As stated previously, SHE-Transmission have triggered the reinforcement of Fiddes GSP therefore SHEPD will continue to be charged TCPC for Fiddes based upon the GAVs of the terminated assets (these charges are included in the Base Exit Charge) until the date at which these assets would be fully depreciated. The exception to this is the costs associated with electronic metering which are included in the overall TCPC costs for SHEPD. All other costs for Fiddes are not included.

Appendix G - 132kV/33kV GSP Dunvegan

Dunvegan 132/33kV GSP is located within the Highland Region of SHEPD's licence area and current has a single 60MVA transformer. The reinforcement of Dunvegan GSP is triggered by the connection of contracted and scoping generators which export power onto the transmission system.

The Transmission Connection Asset Works for the 132kV/33kV GSP Dunvegan comprise the following:

1. Replace the existing 33kV Transformer Circuit Breaker 1T0 located within Dunvegan 132/33kV GSP substation compound with the equivalent new equipment rated appropriately.
2. Install a new 120MVA transformer and associated switchgear at Dunvegan GSP, extending the 132kV busbar appropriately. Supply and install circuit breaker 2T0.
3. Protection and control modifications as required.
4. Associated civil works.
5. Miscellaneous and minor works.

It is anticipated that the 33kV busbar will routinely be operationally split, to balance the load across the unmatched transformers.

The proposed connection date is 31 July 2026.

Connection Site	New Asset Description	GAV (2020/21)
Dunvegan	SGT 1 132/33kV 30MVA	
Dunvegan	1T0 Single Switch Bay	
Dunvegan	SGT1 33kV 30MVA Cable 32m	
Dunvegan	132/33kV 120MVA Transformer	
Dunvegan	33kV Switch Bay	
Dunvegan	SGT 1 FMS Non Electronics	
Dunvegan	SGT 1 FMS Electronics	
Dunvegan	FMS Electronic Metering	
Dunvegan	FMS Non-Electronic Metering	
Dunvegan	FMS Electronic Metering	
Dunvegan	FMS Non-Electronic Metering	
	Total	£12,928,113.27

Appendix H - 132kV/33kV GSP Tarland

Tarland 132/33kV GSP is located within the North Caledonian Region of SHEPD's licence area and currently has two 30MVA transformers. The reinforcement of Tarland GSP is triggered by the connection of contracted and scoping generators which export power onto the transmission system.

The Transmission Connection Asset Works for the 132kV/33kV GSP Tarland comprise the following:

1. At Tarland 132/33kV GSP substation, remove the existing 30MVA transformers and install two new 90MVA 132/33kV transformers and ancillary items. The transformers will be installed within the existing substation and cabled to the existing 33kV switchboard.

The proposed connection date is 31 October 2026.

Connection Site	New Asset Description	GAV (2020/21)
Tarland	SGT2 33kV 30MVA Cable 50m	
Tarland	2TO Single Switch Bay	
Tarland	SGT1 33kV 30MVA Cable 50m	
Tarland	1TO Single Switch Bay	
Tarland	132/33kV 90MVA Transformer	
Tarland	132/33kV 90MVA Transformer	
Tarland	SGT 2 FMS Non Electronics	
Tarland	SGT 2 FMS Electronics	
Tarland	SGT 1 FMS Non Electronics	
Tarland	SGT 1 FMS Electronics	
Tarland	FMS Electronic Metering	
Tarland	FMS Non-Electronic Metering	
Tarland	FMS Electronic Metering	
Tarland	FMS Non-Electronic Metering	
	Total	£5,309,293.72

Appendix I - 132kV/33kV GSP Arbroath

Arbroath 132/33kV GSP is located within the South Caledonian Region of SHEPD's licence area and current has two 45MVA transformers. The reinforcement of Arbroath GSP is triggered by the connection of contracted and scoping generators which export power onto the transmission system.

The Transmission Connection Asset Works for the 132kV/33kV GSP Arbroath comprise the following:

1. Directional Overcurrent settings at Arbroath 132/33kV GSP will be required to be checked and updated.
2. At Arbroath 132/33kV GSP substation, remove the existing 45MVA transformers and install two 90MVA 132/33kV transformers within the existing substation. Install protection, control, metering, and ancillary equipment. The new equipment will be installed to meet current Fire Separation Standards.
3. Protection and control modifications as required.
4. Associated civil works.
5. Miscellaneous and minor works.

The proposed connection date is 31 October 2026.

Connection Site	New Asset Description	GAV (2020/21)
Arbroath	2TO Single Switch Bay	
Arbroath	1TO Single Switch Bay	
Arbroath	1 x 90MVA Grid Transformer	
Arbroath	1 x 90MVA Grid Transformer	
Arbroath	SGT 2 FMS Non Electronics	
Arbroath	SGT 2 FMS Electronics	
Arbroath	SGT 1 FMS Non Electronics	
Arbroath	SGT 1 FMS Electronics	
Arbroath	FMS Electronic Metering	
Arbroath	FMS Non-Electronic Metering	
Arbroath	FMS Electronic Metering	
Arbroath	FMS Non-Electronic Metering	
	Total	£6,168,233.57

Appendix J - Apportioning TCPC

The TCPC for assets connecting during RIIO-ED2 have been apportioned based upon the “incremental MVA” of the transformer(s). The portion of the TCPC associated with the MVA of the replaced assets is then included in the 100% pass through TCPC; and the portion of the TCPC resulting from the additional MVA [of the new assets] is included in the allowance subject to the ex-ante adjustment. For example, when a 30MVA transformer is replaced by a 45MVA transformer, 67% of the TCPC is attributed to the 100% pass through and the other 33% is allocated to the allowance subject to the ex-ante adjustment.

This approach is consistent with the definition of Transmission Connection Point Charges in the RIIO-ED2 Business Plan Data Template – Glossary (published 17 December 2020)

Appendix K - TCPC Allowances

Table 1 – TCPC Allowances submitted for RIIO-ED1 (March 2014 - in 2012/13 £m)

DNO Area	Total TCPC in RIIO-ED1	100% P-T in RIIO-ED1	NTCC in RIIO-ED1
SHEPD	£184.6m	£131.6m	£53.0m
SEPD	£108.8m	£107.0m	£1.8m

Table 2 – Projected TCPC Spend for RIIO-ED1 (April 2021 - in 2012/13 £m)

DNO Area	Total TCPC in RIIO-ED1	100% P-T in RIIO-ED1	NTCC in RIIO-ED1
SHEPD	£121.6m	£114.1m	£7.5m
SEPD	£110.4m	£109.6m	£0.8m

We are continuing to use our ED1 allowance to cover incremental increases in TCPC. There has not been the anticipated level of spend in this area; the volume of Distributed Generation connections has been less than expected. Therefore, it is projected that we will not spend the full ED1 allowance and any monies not required will be returned to customers through the relevant Load Related mechanisms or the Totex Incentive Mechanism.

Table 3 – TCPC Allowances submitted for RIIO-ED2 (July 2021 - in 2020/21 £m)

DNO Area	Total TCPC in RIIO-ED2	100% P-T in RIIO-ED2	NTCC in RIIO-ED2
SHEPD	£71.6m	£54.2m	£17.4m
SEPD	£55.5m	£53.5m	£2.0m

Table 4 – TCPC Allowances submitted for RIIO-ED2 (December 2021 - in 2020/21 £m)

DNO Area	Total TCPC in RIIO-ED2	100% P-T in RIIO-ED2	NTCC in RIIO-ED2
SHEPD	£73.6m	£52.1m	£21.5m
SEPD	£67.7m	£66.0m	£1.7m

SSEN recognise the potential underspend within this area during ED1 and have factored this into the ask for ED2. Our submitted allowance for ED2 only includes sites with contracted connections, or where multiple current large applications in the area clearly indicate that a new/reinforced GSP will be required in the period.

We accept our proposals are more conservative than ED1 and potentially more realistic given the current demand for distributed generation. We accept that any further uncertainty and associated risk will be mitigated through the Load Related Re-opener Mechanism that is being proposed by Ofgem.