New Moffat GSP

ED2 Engineering Justification Paper

ED2-LRE-SPD-021-CV1-EJP

Issue	Date	Comments
Issue 0.1	Jan 2021	Issue to internal governance and external assurance
Issue 0.2	Mar 2021	Reflecting comments from internal governance
Issue 0.3	May 2021	Reflecting external assurance feedback
Issue 1.0	Jun 2021	Issue for inclusion in Draft Business Plan submission
Issue 1.1	Oct 2021	Reflecting updated DFES forecasts
Issue 1.2	Nov 2021	Reflecting updated CBA results
Issue 2.0	Dec 2021	Issue for inclusion in Final Business Plan submission

Scheme Name	New Moffat GSP		
Activity	Primary Reinforcement		
Primary Investment Driver	Thermal and Voltage Constraints		
Reference	ED2-LRE-SPD-021-CV1		
Output	Load Index		
Cost	£2.708m		
Delivery Year	2023-2026		
Reporting Table	CV1/CV4		
Outputs included in ED1	~~Yes~~/No		
Business Plan Section	Develop the Network of the Future		
Primary Annex	Annex 4A.2: Load Related Expenditure Strategy: Engineering Net Zero Annex 4A.6: DFES		
Spend Apportionment	**ED1**	**ED2**	**ED3**
	£m	**£2.708m**	**£1.109m**

Technical Governance Process

Project Scope Development

IP1(S)

To be completed by the Service Provider or Asset Management. The completed form, together with an accompanying report, should be endorsed by the appropriate sponsor and submitted for approval.
IP1 – To request project inclusion in the investment plan and to undertake project design work or request a modification to an existing project
IP1(S) – Confirms project need case and provides an initial view of the Project Scope
IP2 – Technical/Engineering approval for major system projects by the System Review Group (SRG)
IP2(C) – a Codicil or Supplement to a related IP2 paper. Commonly used where approval is required at more than one SRG, typically connection projects which require connection works at differing voltage levels and when those differing voltage levels are governed by two separate System Review Groups.
IP2(R) – Restricted Technical/Engineering approval for projects such as asset refurbishment or replacement projects which are essentially on a like-for-like basis and not requiring a full IP2
IP3 – Financial Authorisation document (for schemes > £100k prime)
IP4 – Application for variation of project due to change in cost or scope

PART A – PROJECT INFORMATION

Project Title:	**New Moffat GSP**
Project Reference:	**ED2-LRE-SPD-021-CV1**
Decision Required:	**To give concept approval to establish a new grid supply point near Moffat Primary in Dumfries and Galloway.**

Summary of Business Need:

Chapelcross 132/33kV Grid Supply Point (GSP) supplies rural network in Dumfries and Galloway District of the SP Distribution licence area, near the Scottish Borders.

The primary driver for investment at Moffat substation is to alleviate voltage and thermal constraints on the 33kV network associated with Lockerbie, Kirkbank and Moffat primary substations fed from Chapelcross GSP.

In order to secure supplies within the group, meet the licence obligations under Energy Network Association (ENA) Engineering Recommendation (EREC) P2/7 and to accommodate future demand growth within the area, it is proposed to carry out system reinforcement in the RIIO-ED2 period.

Summary of Project Scope, Change in Scope or Change in Timing:

It is proposed to establish a new 132/33kV GSP substation connecting into Moffat 132kV transmission network. The GSP will utilise an existing 60MVA transformer installed for the transmission connected Minnygap wind farm.

A second 132/33kV 60MVA transformer will be installed by SP Transmission as part of the scheme. Seven 33kV circuit breakers (CB) will be installed in a new prefabricated housing that provides space for up to 13 CB panels, leaving room for three additional circuit breakers on each side of the switchboard. Moffat and Kirkbank primary substations will be connected to the new switchboard, which is in closer proximity to the demand centre, consequently improving the voltage profile of the network.

IP1 was approved by the DSRG in January 2019; a Modification Application was submitted to National Grid Electricity System Operator (NGESO) in January 2020; an NGESO offer was received in April 2020; IP2 was approved by the DSRG & TSRG in September 2020; IP3 advisory paper was approved and the NGESO offer was accepted in November 2020.

The estimated cost for the above is £2.708m (in 2020/21 prices) with 100% contribution to be included in the RIIO-ED2 load related expenditure. The associated transmission works are included in the RIIO-T2 investment plan. The full cost of transmission works will be charged to SP Distribution under New Transmission Capacity Charges (NTCC), over a 40-year payback period starting from 2025/26.

Expenditure Forecast (in 2020/21)

Licence Area	Reporting Table	Description	Total (£m)	Incidence (£m)				
				2023/24	2024/25	2025/26	2026/27	2027/28
SPD	CV1	Primary Reinforcement	**2.010**	1.206	0.603	0.201	-	-
SPD	CV4	New Transmission Capacity Charges	**0.698**	-	-	0.235	0.233	0.230
SPD	**Total**		**2.708**	**1.206**	**0.603**	**0.436**	**0.233**	**0.230**

PART B – PROJECT SUBMISSION

Proposed by	Mark Friese	Signature		Date:	30/11/2021
Endorsed by	Russell Bryans	Signature		Date:	30/11/2021

PART C – PROJECT APPROVAL

Approved by	Malcolm Bebbington	Signature		Date:	30/11/2021

Contents

1 Introduction

Chapelcross 132/33 kV Grid Supply Point (GSP) is in Dumfries and Galloway District of the SP Distribution (SPD) licence area, near the Scottish Border. The primary driver for investment at Moffat substation is to alleviate thermal and voltage constraints on the 33kV network associated with Lockerbie, Kirkbank and Moffat primary substations fed from Chapelcross GSP. This network is rural, and infrastructure is relatively sparse. It is becoming problematic to accommodate additional demand and generation in this area.

Lockerbie/Kirkbank/Moffat demand group providing supplies to ca. 7,302 customers. It is a class 'C' of supply as per Energy Network Association (ENA) Engineering Recommendation (EREC) P2/7. The group has a firm capacity of 20.86MVA winter. Our baseline View forecasts a peak demand of 24MVA, with an expected uptake of 2,144 electrical vehicles and 1,414 heat pumps by the end of RIIO-ED2 period.

In order to secure supplies within the group, meet the licence obligations under EREC P2/7 and accommodate future demand growth within the area, it is proposed to establish a new 132/33kV 60MVA GSP in the Moffat area. Initially, an innovative solution was investigated as part of a Network Innovation Allowance (NIA) project – "Technical Review of Non-conventional Statcom Applications"[1]. This option did not resolve thermal issues and required a mix of innovation and conventional solution which resulted in a higher NPV compared to the proposed scheme. The proposed reinforcement is a new GSP in the Moffat area which represents the most economic and efficient long-term solution and enables the load growth in the area by smooth deliverability of the network reinforcement.

The SP Distribution works for this solution involves the installation of a new indoor 33kV switchboard and 33kV circuits to connect to the new board. The costs of SPD works are included within the CV1 expenditure. The SP Transmission (SPT) works for this solution involves the installation of 1 x 60MVA 132/33kV grid transformers, 1 x 132kV feeder bay, two transmission incomer breakers and associated cable works. The full cost of transmission works will be charged to SP Distribution under New Transmission Capacity Charges (NTCC), over a 40-year payback period starting in 2025/26 upon GSP energisation based on the accepted Modification Application (ModApp) offer.

SPD submitted a ModApp for this works to National Grid Electricity System Operator (NGESO) in January 2020; an NGESO offer was received in April 2020 and the NGESO offer was accepted in November 2020. The associated transmission works are included in the RIIO-T2 investment plan.

The estimated cost for the above is £2.010m under the CV1 expenditure and £0.698m (in 2020/21 prices) under the CV4 expenditure with 100% contribution to be included in the RIIO-ED2 load related expenditure.

We will continue to retender for flexibility before the reinforcement starts to ensure we are using the most efficient intervention.

Due to the proposed connection date in 2025/26 driven by SP Transmission works, it is proposed to start the distribution works in 2023/24 and the release capacity of 60MVA will be claimed in 2025/26 upon GSP energisation based on the accepted ModApp offer.

[1] https://www.smarternetworks.org/project/nia_spen0018

2 Background Information

2.1 Existing / Authorised Network

The distribution system at Chapelcross GSP substation is fed from two 132/33kV 90MVA grid transformers which serve an indoor 33kV switchboard. This supplies 20,824 customer via eight primary substations at Annan, Gretna, Kirkbank, Langholm, Lockerbie, Middlebie, Moffat, and Newcastleton. A single 33kV interconnector is available to Dumfries GSP. A diagram of the Chapelcross distribution GSP network is shown Figure 1.

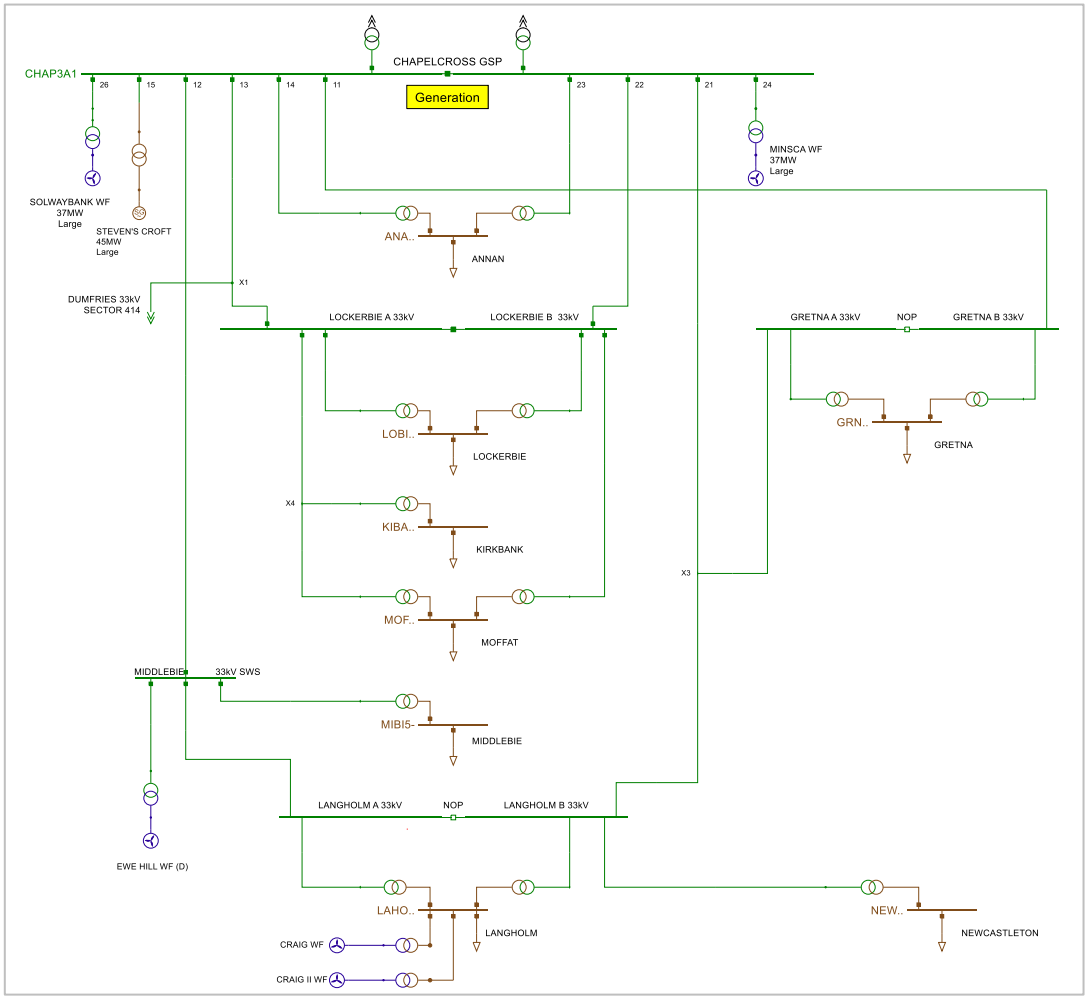

Figure 1. Chapelcross GSP 33kV Network

The existing Moffat 400/132kV substation is located south of Moffat town approximately 34kms north of Dumfries. At present there is no distribution infrastructure connected into Moffat 400/132kV substation with the local distribution system supplied from Chapelcross GSP approximately 34km to the south of the site. Moffat transmission system consists of a 400kV substation containing Mechanically Switched Capacitor with Damping Network (MSCDN), shunt reactor, series compensation equipment and two 240MVA 400/132kV auto transformers. The 132kV network is smaller containing only a connection to Harestanes wind farm and a connection to Minnygap wind farm. In order to facilitate Minnygap wind farm connection, a 60MVA 132/33kV grid transformer (GT1) has been installed at the site.

Moffat grid substation has no associated SP Distribution infrastructure, the 33kV assets at the substation are solely connection assets for the SP Transmission Minnygap wind farm connection. Minnygap wind farm 33kV switchboard was installed in 2016 and is of Siemens NX+ type (Health Index 1). It currently has two installed and utilised bays. The civil foundations have been constructed to allow for a total of seven bays. Table 2.1 shows the electrical data for the Minnygap 132/33kV transformer.

Table 2.1. Minnygap 132/33kV grid transformer GT1 data

	GT1
Manufacturer	ABB
Manufacture Year	2016
Voltage	132/33kV
Size	60MVA
Health Index	1

A site electrical layout of the 132kV network is shown in Figure 2.

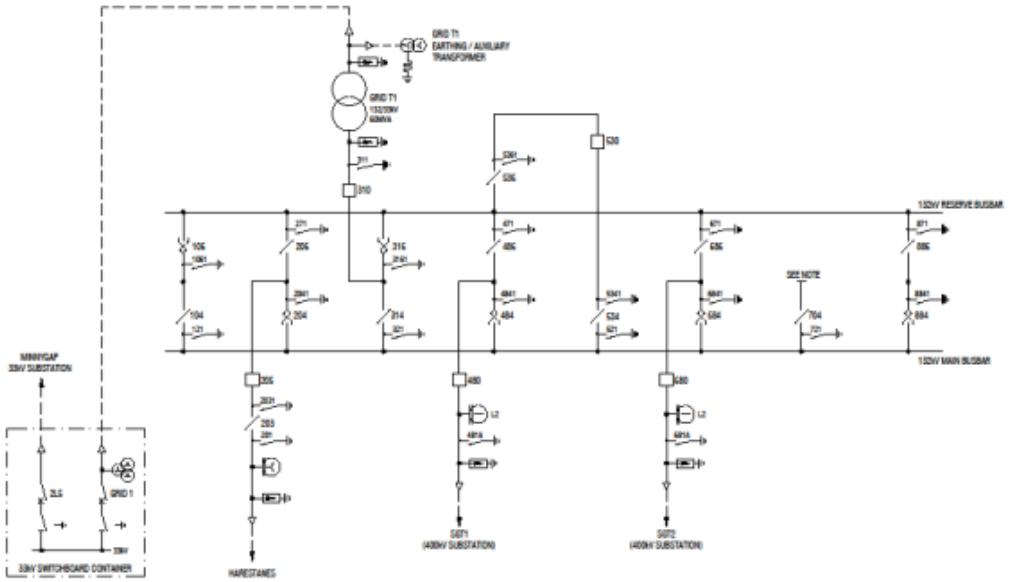

Figure 2. Moffat grid substation electrical layout

2.2 Group Demand & Security of Supply

Currently there is no demand connected at Moffat 132kV network, as no distribution network exists. The current demand groups supplied from Chapelcross are shown in Table 2.2.

Table 2.2. Chapelcross GSP demand groups (Load Index 2021)

Demand Group	Customers (#)	Firm Capacity (MVA)	Max Demand (MVA)	Load Index	P2/7 Class of Supply
Annan	6,149	24.00	12.4	LI	B
Gretna	3,118	24.00	6.05	LI	B
Kirkbank	414	7.50	1.57	LI	B
Langholm	2,420	24.00	3.02	LI	B
Lockerbie	4,577	20.86	15.75	LI	C
Middlebie	1,188	5.00	5.42	L4	B
Moffat	2,311	7.50	4.24	LI	B
Newcastleton	647	5.00	1.27	LI	B
Lockerbie/Kirkbank/Moffat	7,302	20.86	20.5	LI4	C

The existing circuits from Chapelcross to Moffat Primary are listed in Table 2.3.

Table 2.3. Chapelcross GSP to Lockerbie/Kirkbank/Moffat circuit ratings (LTDS 2020)

Substation Group	Circuit Designation		Voltage (kV)	Maximum Continuous Ratings (MVA)		Length (km)
	From	To		Winter	Summer	
Chapelcross	Chapelcross GSP A1	Lockerbie 33kV switching station A	33	24.63	19.71	18.5
	Chapelcross GSP A2	Lockerbie 33kV switching station B	33	20.86	19.71	18.32
	Lockerbie 33kV switching station A	Kirbank Primary	33	21.20	20.40	0.025
			33	11.09	8.87	10.69
	Kirbank Primary	Moffat Primary T1	33	17.78	14.22	17.61
	Lockerbie 33kV switching station B	Moffat Primary T2	33	11.09	8.87	26.78

2.3 Embedded Generation

A list of all connected and contracted distributed generation at Chapelcross GSP is shown in Table 2.4. There are also additional active offers seeking connection to the 33kV network at Chapelcross GSP.

Table 2.4. Embedded generation at Chapelcross GSP

GSP	Voltage (kV)	Site	Export capacity (MW)	Type	Status
Chapelcross	11	Craig wind farm	8	Onshore Wind	Connected
	11	Craig II wind farm	4.7	Onshore Wind	Connected
	33	Ewe Hill wind farm	12	Onshore Wind	Connected
	33	Minsca wind farm	36.8	Onshore Wind	Connected
	33	Steven's Croft biomass	45	Biomass & energy crops (not CHP)	Connected
	33	Solwaybank wind farm	30	Onshore Wind	Connected
	11/LV	Embedded generation (<1MW)	4.1	Solar/Hydro/CHP	Connected
	33	Castlemilk Wind Farm	36	Onshore Wind	Contracted
	Total		176.6		

There are at present two wind farms connected to the transmission network at Moffat GSP which are shown in Table 2.5.

Table 2.5. Moffat transmission generation portfolio

Voltage (kV)	Site	Export capacity (MW)	Type	Status
132	Minnygap wind farm	25	Onshore wind	Connected
132	Harestanes wind farm	136	Onshore wind	Connected
Total		161		

2.4 Fault Levels

The existing fault levels at Chapelcross GSP are within the system design limits. The fault level RMS Break duty at Chapelcross GSP is approaching 95% of the system design rating as shown in Table 2.6.

Table 2.6. Chapelcross GSP fault level (LTDS 2020)

Substation Name	Design Rating (kA)		3-phase Fault Levels (kA)		Duty (%)	
	Make	Break	Make	Break	Make	Break
Chapelcross GSP	50.00	17.50	43.24	15.82	86.48	90.40

3 Needs Case

Our Baseline View forecasts a peak demand by 2028 of 24MVA, with an expected uptake of up to 2,144 electrical vehicles and 1,414 heat pumps. This exceeds the Lockerbie/Kirkbank/Moffat demand group firm capacity of 20.86MVA within the RIIO-ED2 period.

The Lockerbie/Kirkbank/Moffat demand group is supplied via long 33kV overhead line circuits from Chapelcross GSP. With the forecast demand growth in RIIO-ED2, power flow analysis indicates that the network will be at risk of steady-state voltage excursions outside of statutory limits. The primary transformer will be at the limits of its tap operation.

In order to secure supplies within the group, meet the licence obligations under EREC P2/7 – Security of Supply, maintain the steady state voltage of the 33kV network to within +/- 6% of the declared voltage under the Electricity Safety, Quality and Continuity Regulations (EQSCR), and to accommodate future demand growth within the area, it is proposed to carry out system reinforcement in the RIIO-ED2 price control period.

3.1 Forecast Demand

The system is forecast to grow and exceed firm capacity within the RIIO-ED2 period. This forecast is based on actual system measurement data from the Process Instrumentation (PI) system and stakeholder endorsed DFES and considers our pipeline of known developments.

3.1.1 Distribution Future Energy Scenarios

DFES includes granular forecasts to 2050 for demand, generation and Low Carbon Technologies. They assess credible future scenarios covering a range of uncertainties, including differing levels of consumer ambition, policy support, economic growth and technology development and the forecasts are underpinned by extensive stakeholder engagement.

The peak demand forecast based on the SPD Distribution Future Energy Scenarios is depicted in Figure 3. The anticipated total electric vehicle and heat pump uptakes based on the future energy scenarios are depicted in Figure 4.

The scenario range considers the range of Net Zero compliant scenarios developed by us, the Electricity System Operator (ESO), and the Climate Change Committee. These are the five scenarios from the CCC 6th carbon budget, and the Leading the Way and Consumer Transformation scenarios from our DFES and the ESO Future Energy Scenarios (FES). We haven't included the System Transformation (ST) scenario as it is an outlier against the other Net Zero compliant scenarios and does not achieve interim carbon targets.

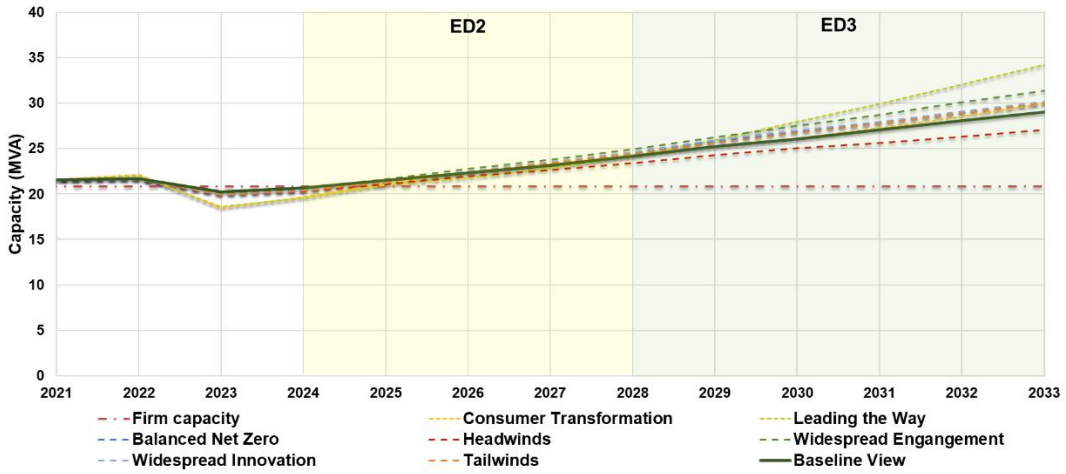

Figure 3. Demand (MVA) forecast for Lockerbie/Kirkbank/Moffat demand group

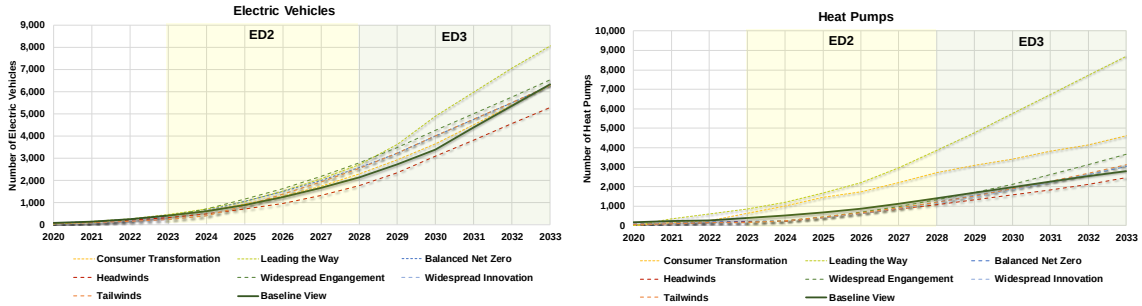

Figure 4. Forecast Electric Vehicle and Heat Pump uptakes for Lockerbie/Kirkbank/Moffat demand group

3.1.2 Baseline View

For the Lockerbie/Kirkbank/Moffat group demand, this forecast demand growth under the Baseline Scenario, along with firm capacity and utilisation are shown in Table 3.1 through to the end of the RIIO-ED3 period.

Table 3.1. Baseline View forecast

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Forecast Demand (MVA)	20.6	21.6	21.2	21.3	21.9	22.5	23.3	24.0	25.2	26.1	27.1	28.1	29.0
Firm Capacity (MVA)	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
Utilisation (%)	99	104	102	102	105	108	111	115	121	125	130	134	139
Load Index	LI3	LI5	LI4	LI4	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5	LI5

3.2 Forecast Generation

As shown in Table 2.4 there is already 140.6MW of connected generation against a firm/non-firm capacity of 90/180MVA. Based on DFES there is around 30-100MW generation forecasted to be connected to Chapelcross GSP by the end of RIIO-ED2.

3.3 Network Impact Assessment

Detailed network studies covering network intact and outage (N-1) conditions and fault level assessments were carried out for the 33kV network fed from the Chapelcross GSP group considering the different demand forecast scenarios.

The network thermal constraint during the most onerous outage was identified and time profile-based simulations (17,520 half-hourly simulations/year) were performed considering the historical half hourly measured Supervisory control and data acquisition (SCADA) data at primary substation overlaid with the DFES demand forecasts for each year through the RIIO-ED2 price control period. These studies identify the risk in terms of the thermal capacity exceedances with the forecast demand, the anticipated annual hours at risk and risk window of the constraint. The half-hourly studies performed for years starting from 2023 through 2028 determined the risk hours and the capacity required to overcome the constraint by using flexibility services.

3.3.1 Thermal Constraints

Table 3.2 shows the identified thermal constraints on the 33kV network. No other thermal constraints were identified in the group.

Table 3.2. Thermal constraints at 33kV level

Network Item	Voltage	Outage	Circuit Loading (%)
Chapelcross GSP – Lockerbie 33kV switching station B in 2028	33	N-1	115
Chapelcross GSP – Lockerbie 33kV switching station B in 2033	33	N-1	138

Under N-1 conditions between Lockerbie 33kV switching station and Chapelcross GSP circuits, the remaining circuit in operation experiences significant overloading. This results in extremely high current flow through the overhead line conductors. Consequently, the overload protection will force a trip of the circuit resulting in a loss of supply to the Lockerbie, Kirkbank and Moffat primary substations.

3.3.2 Voltage Constraints

The Electricity Safety, Quality and Continuity Regulations (EQSCR) require network operators to maintain the steady state voltage of the 33kV network to within +/- 6% of the declared voltage. Table 3.3 shows the voltage results for the Lockerbie/Kirkbank/Moffat network under N-1 conditions. Voltage below statutory limits (<0.94p.u.) are seen at the Lockerbie 33kV switching station under all scenarios as well as low voltage levels at Kirkbank Primary.

Table 3.3. Voltage results at each busbar within the Lockerbie/Kirkbank/Moffat network

Operating Scenario	Busbar	Nominal Voltage (kV)	Voltage (p.u.)
1	Lockerbie Primary	11	1
	Moffat Primary	11	0.96
	Kirkbank Primary	11	0.99
	Lockerbie switching station	33	**0.90**
2	Lockerbie Primary	11	1.01
	Moffat Primary	11	0.98
	Kirkbank Primary	11	0.95
	Lockerbie switching station	33	**0.90**
3	Lockerbie Primary	11	1.01
	Moffat Primary	11	0.99
	Kirkbank Primary	11	0.97
	Lockerbie switching station	33	**0.91**
4	Lockerbie Primary	11	1.01
	Moffat Primary	11	0.99
	Kirkbank Primary	11	0.96
	Lockerbie switching station	33	**0.90**

3.3.3 EREC P2/7 – Security of Supply

The Lockerbie/Kirkbank/Moffat group demand fed from Lockerbie 33kV switching station has a forecast peak load of 23.8MW under the best view by the end of RIIO-ED2. Engineering Recommendation (EREC) P2/7 defines a group demand over 12MW and up to 60MW as a class 'C' of supply.

EREC P2/7 states that a group demand, with a class 'C' of supply, must secure the following minimum demand for a first circuit outage (FCO):

- Smaller of group demand minus 12MW or 2/3 of group demand must be met within 15 minutes;
- Group demand must be met within 3 hours.

The group demand fed from Lockerbie switching station has an FCO security of 20.86MVA. At present, the demand group is compliant with EREC P2/7 but with forecast demand growth this site is predicted to be non-compliant by the end of the RIIO-ED2 price control period; consequently, investment is required.

3.3.4 Flexibility Services

In order to manage the network risk and security of supply, our assessment indicates that the risk of thermal overload on the circuits feeding the Lockerbie/Kirkbank/Moffat demand group and security of supply constraints in the group starts from the year 2023/24 throughout to the year 2028 for the most onerous scenario including an additional 5% for the asset protection margin. This is shown in Table 3.4. The detailed results from the half hourly profile-based simulations are furnished in Appendix 1.

Table 3.4. Network annual hours at risk and required flexible capacities for the most onerous scenario

Year	2023/24	2024/25	2025/26	2026/27	2027/28
Annual hours at risk (Hrs)	41	140	414	663	1,097
Required Flexible Capacity (MW)	2.11	3.08	4.19	4.95	6.01

3.3.5 Fault Level Constraints

The fault level RMS Break duty at Chapelcross GSP will increase into RIIO-ED2, likely exacerbate with the connection of new load and generation. Table 3.5 shows the 33kV 3-phase fault levels as a percentage of the lowest of switchgear ratings / design limits at the Chapelcross GSP substation by the end of RIIO-ED2.

Table 3.5. Chapelcross GSP fault level (2028)

Substation Name	Design Rating (kA)		3-phase Fault Levels (kA)		Duty (%)	
	Make	Break	Make	Break	Make	Break
Chapelcross GSP	50.00	17.50	43.24	15.82	87.62	92.11

Although, the fault level RMS Break duty at Chapelcross GSP is forecast to increase into RIIO-ED2, it will remain below 95% of the network fault level design limits. Therefore, it is proposed to install a Real Time Fault Level Monitor (RTFLM) device, to monitor the real-time fault levels. More details of this scheme can be found in 'ED2-LRE-SPEN-001-CV3-EJP - Fault Level Monitoring and Management. There are no other fault level issues in the group.

4 Optioneering

Table 4.1 shows a summary of the options considered for this reinforcement. The baseline option represents the lowest cost conventional option, i.e. the minimum level of intervention without application of innovation.

Table 4.1. Longlist of solution options

#	Options	Status	Reason for rejection
(a)	Do nothing	Rejected	Not compliant with security of supply requirements as per P2/7.
(b)	Intervention plan using only Energy Efficiency	Rejected	Discounted due to lower cost effectiveness (peak MW reduction per £) and the number of individual interventions required across the wide area supplied by this network.
(c)	Establish a new GSP near Moffat primary	Shortlisted as **Baseline** option in Detailed Analysis	
(d)	Install Mechanically Switched Capacitor Bank (MSC) and uprate two 18.3km circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Shortlisted as **Option 1** in Detailed Analysis	
(e)	Install STATic synchronous COMpensator (STATCOM) and uprate two 18.3km circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Shortlisted as **Option 2** in Detailed Analysis	
(f)	Install a hybrid option STATCOM/MSC and uprate two 18.3km circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Shortlisted as **Option 3** in Detailed Analysis	
(g)	Connect Steven's Croft biomass to Lockerbie 33kV switching station (via a loop-in)	Rejected	This option results in increased fault levels at Chapelcross GSP and does meet requirements of SPEN design policy "ESDD-02-014 Design for System Fault Levels and Equipment Capabilities".

5 Detailed Analysis & Costs

5.1 Proposed Option (Baseline) – New Moffat GSP

The proposed option for this scheme is to establish a new 132/33kV 60MVA GSP in the Moffat area. Table 5.1 shows the scheme summary.

Table 5.1. Proposed option summary

Category	Scheme Name	Scheme Summary	Reporting Table	RIIO-ED2 Contribution (£m)	Post RIIO -ED2 (£m)	Customer Contribution (£m)
Conventional	New Moffat GSP	Establish a new 132/33kV 60MVA GSP in the Moffat area	CV1 Expenditure	2.010	-	-
			CV4 Expenditure	0.698	6.646	-

This option would utilise existing assets installed for the Minnygap wind farm connection, however, would keep separate the 33kV transmission assets associated with the existing Minnygap wind farm connection. The second 132/33kV 60MVA grid transformer would be installed at Moffat 400/132kV substation. Both the new and existing transformers at the site would then be connected to a new Moffat GSP 33kV switchboard as shown in Figure 5.

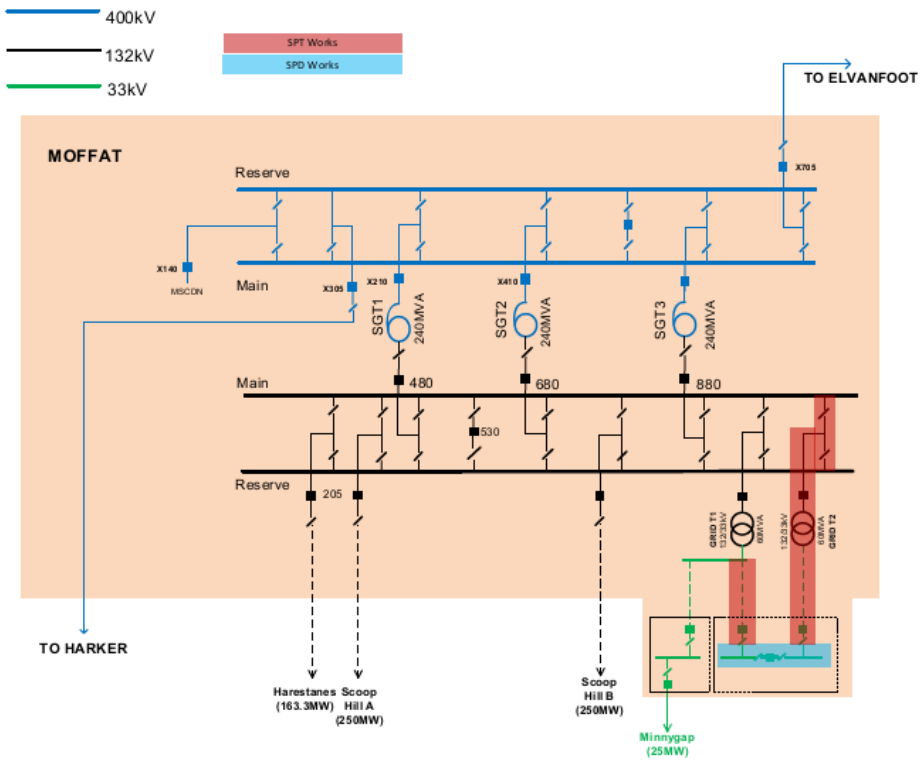

Figure 5. Proposed Moffat GSP layout

The new Moffat GSP 33kV switchboard will provide space for up to 13 panels. Initially, seven circuit breakers will be installed as part of the proposed works. The existing demand centres in the area shall

be split between Chapelcross GSP and Moffat GSP, according to location. Table 5.2 shows the proposed configuration at the new Moffat GSP.

Table 5.2. Moffat GSP 33kV Switchboard

Panel No	Panel Name
1	Space for future extension
2	Space for future extension
3	Space for future extension
4	Lockerbie No.1 33kV SW/STN/Kirkbank Primary
5	Moffat Primary 1
6	GT 1
7	Bus Section
8	GT 2
9	Moffat Primary 2
10	Lockerbie No.2 33KV SW/STN
11	Space for future extension
12	Space for future extension
13	Space for future extension

The proposed layout of the network at Moffat is illustrated in Figure 6 and its geographical location in Figure 7. Four circuits with a total length of circa 2.4km will be required to split the existing 33kV circuits, providing a dedicated supply to Moffat Primary and interconnection to Chapelcross GSP. This will facilitate transferring the demand at Moffat Primary from Chapelcross to the new Moffat GSP.

The SP Distribution works for this solution involves the installation of a new indoor 33kV switchboard and 33kV circuits to connect to the new board. The costs of SPD works are included within the CV1 expenditure.

The SP Transmission works for this solution involves the installation of 1 x 60MVA 132/33kV grid transformers, 1 x 132kV feeder bay, two transmission incomer breakers and associated cable works. The full cost of transmission works will be charged to SP Distribution under New Transmission Capacity Charges (NTCC), over a 40-year payback period starting in 2025/26 upon GSP energisation based on the accepted ModApp offer.

SPD submitted a Modification application for this works to National Grid Electricity System Operator (NGESO) in January 2020; an NGESO offer was received in April 2020 and the NGESO offer was accepted in November 2020. The associated transmission works are included in the RIIO-T2 investment plan.

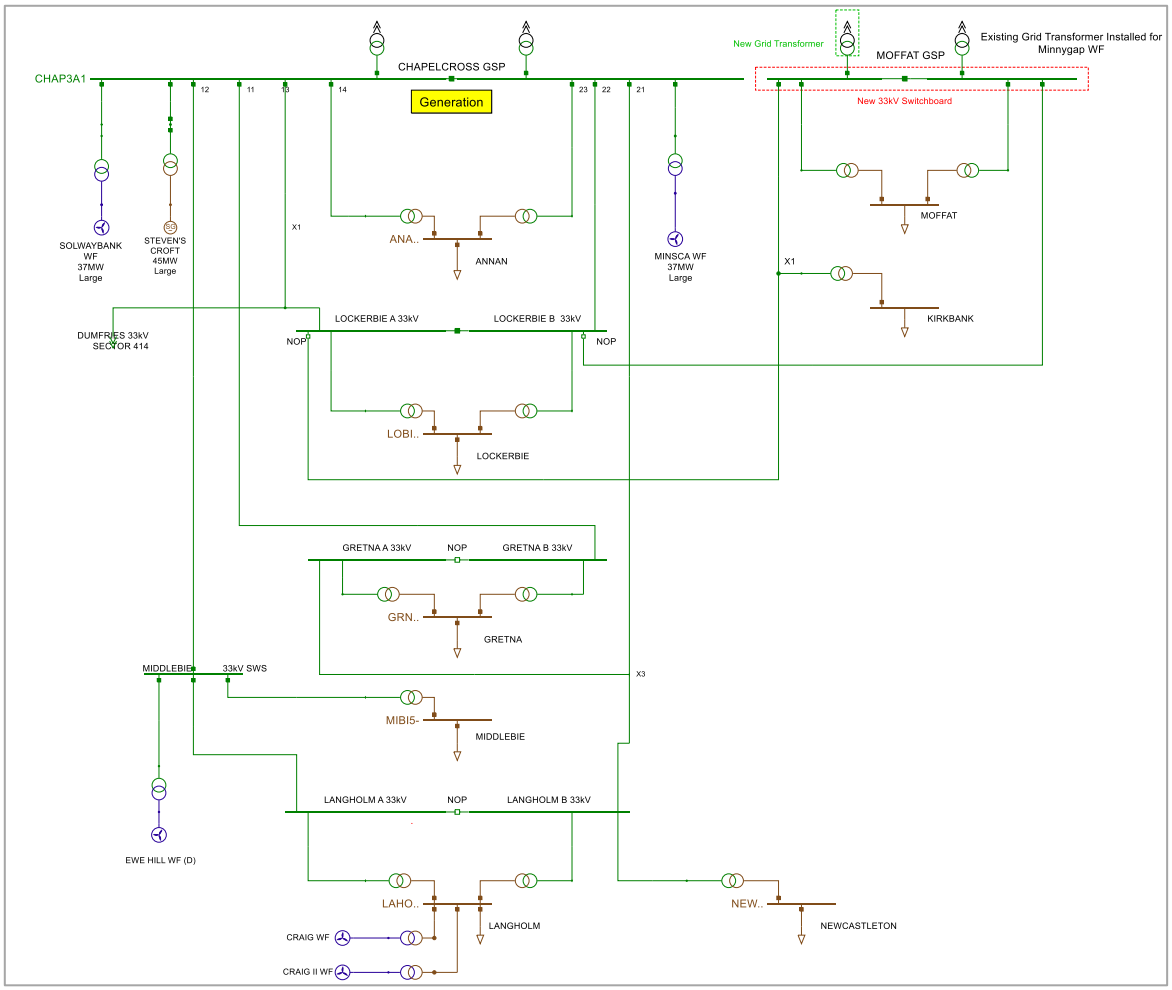

Figure 6. Proposed Moffat GSP 33kV network arrangement

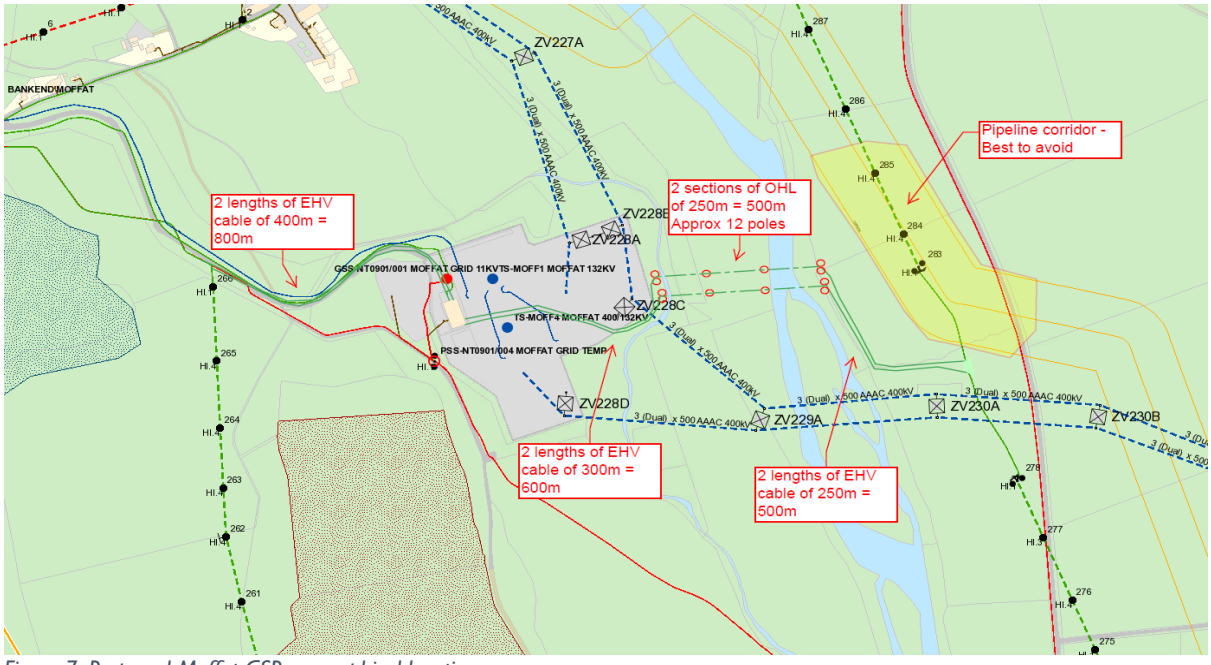

Figure 7. Proposed Moffat GSP geographical location

Table 5.3 shows a summary of reinforcement costs and volumes for the proposed scheme under RIIO-ED2.

Table 5.3. Proposed option summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Post RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV OHL (Pole Line) Conductor	0.5	0.013	0.013	-	-
33kV Pole	12	0.036	0.036	-	-
33kV UG Cable (Non Pressurised)	1.9	0.379	0.379	-	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	5	0.835	0.835	-	-
Pilot Wire Overhead	0.5	0.013	0.013	-	-
Pilot Wire Underground	1.9	0.210	0.210	-	-
Civil Works at 33 kV & 66 kV Substations		0.060	0.060	-	-
Wayleaves/Easements/Land Purchase		0.056	0.056	-	-
Other Costs CV1 (Identify Below)		0.407	0.407	-	-
Other Costs CV4 (Identify Below)		7.344	0.698	6.646	-
Total Costs		9.354	2.708	6.646	-
Identify activities included within other costs (please provide high-level detail of cost areas)					
CV1 – Planning and design (£50k)					
CV1 – Remote end protection (£105k)					
CV1 – Telecoms infrastructure (£252k)					
CV4 – NTCC (New Transmission Capacity Charges) (£698k)					

Due to the proposed connection date in 2025/26 driven by SP Transmission works, it is proposed to start the distribution works in 2023/24 and the release capacity of 60MVA will be claimed in 2025/26 upon GSP energisation based on the accepted ModApp offer.

5.2 Option 1 – Install MSC and Uprate 33kV Circuits

Option 1 considers the installation of a Mechanically Switched Capacitor Bank (MSC) to resolve voltage issues associated with the Lockerbie/Kirkbank/Moffat demand group. Additionally, this option proposes to restring two 18.3km 33kV OHL circuits between Chapelcross GSP and Lockerbie 33kV switching station, to resolve thermal constraints identified in section 3.3.1. Table 5.4 shows the scheme summary. This option would enable 12.35MVA of additional network capacity.

Option 1 is rejected based on cost and a much smaller capacity uplift in RIIO-ED2 than the baseline.

Table 5.4. Option 1 summary

Category	Scheme Name	Scheme Summary	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
Innovation/Smart	New Moffat GSP	Install MSC and restring 33kV OHL circuits between Chapelcross GSP and Lockerbie 33kV switching station	5.731	-

The proposed configuration of the Chapelcross GSP 33kV network is shown in Figure 8.

Figure 8. Schematic of Option 1 33kV network

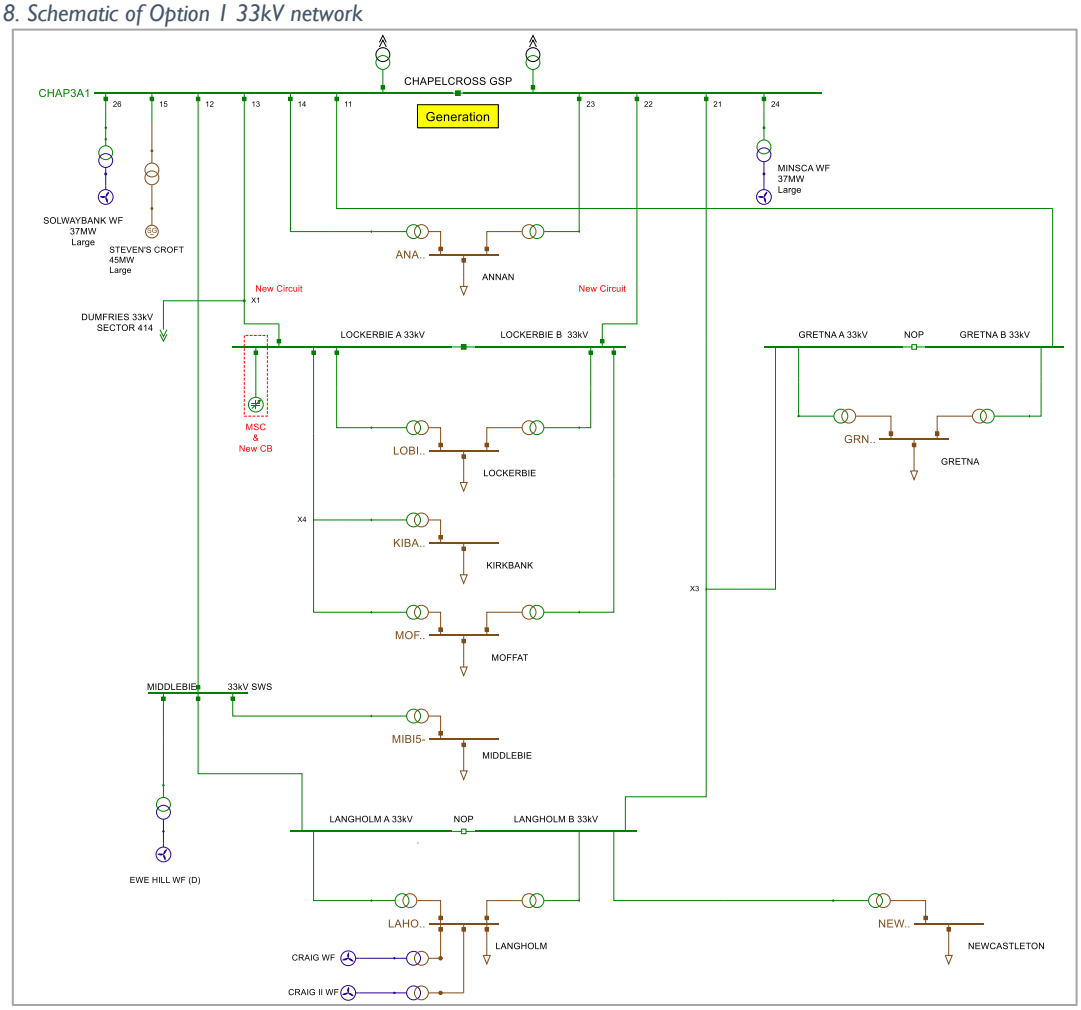

Table 5.5 shows a summary of reinforcement costs and volumes for Option 1 under RIIO-ED2.

Table 5.5. Option 1 summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV OHL (Pole Line) Conductor	36.6	0.955	0.955	-
33kV Pole	366	1.095	1.095	-
33kV UG Cable (Non Pressurised)	0.5	0.100	0.100	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	1	0.167	0.167	-
Pilot Wire Overhead	36.6	0.987	0.987	-
Pilot Wire Underground	0.5	0.055	0.055	-
Civil Works at 33 kV & 66 kV Substations		0.301	0.301	-
Wayleaves/Easements/Land Purchase		0.217	0.217	-
Other Costs (Identify Below)		1.854	1.854	-
Total Costs		5.731	5.731	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£100k)				
17.5MVAr MSC (including cranage) (£1.5m)				
Remote end protection (£21k)				
Detailed Dynamic Compensation and Power Quality assessment studies (£25k)				
RTU/SCADA (£5k)				
Environmental consideration (£203k)				

5.3 Option 2 – Install STATCOM and Uprate 33kV Circuits

Option 2 considers the installation of a STATic synchronous COMpensator (STATCOM) to resolve voltage issues associated with the Lockerbie/Kirkbank/Moffat demand group. Additionally, this option proposes to restring two 18.3km 33kV OHL circuits between Chapelcross GSP and Lockerbie 33kV switching station to resolve thermal constraints identified in section 3.3.1. Table 5.6 shows the scheme summary. This option would enable 12.35MVA of additional network capacity.

Option 2 is rejected based on cost and a much smaller capacity uplift in RIIO-ED2.

Table 5.6. Option 2 summary

Category	Scheme Name	Scheme Summary	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
Innovation/Smart	New Moffat GSP	Install STATCOM and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	8.567	-

The proposed configuration of the Chapelcross GSP 33kV network is shown in Figure 9.

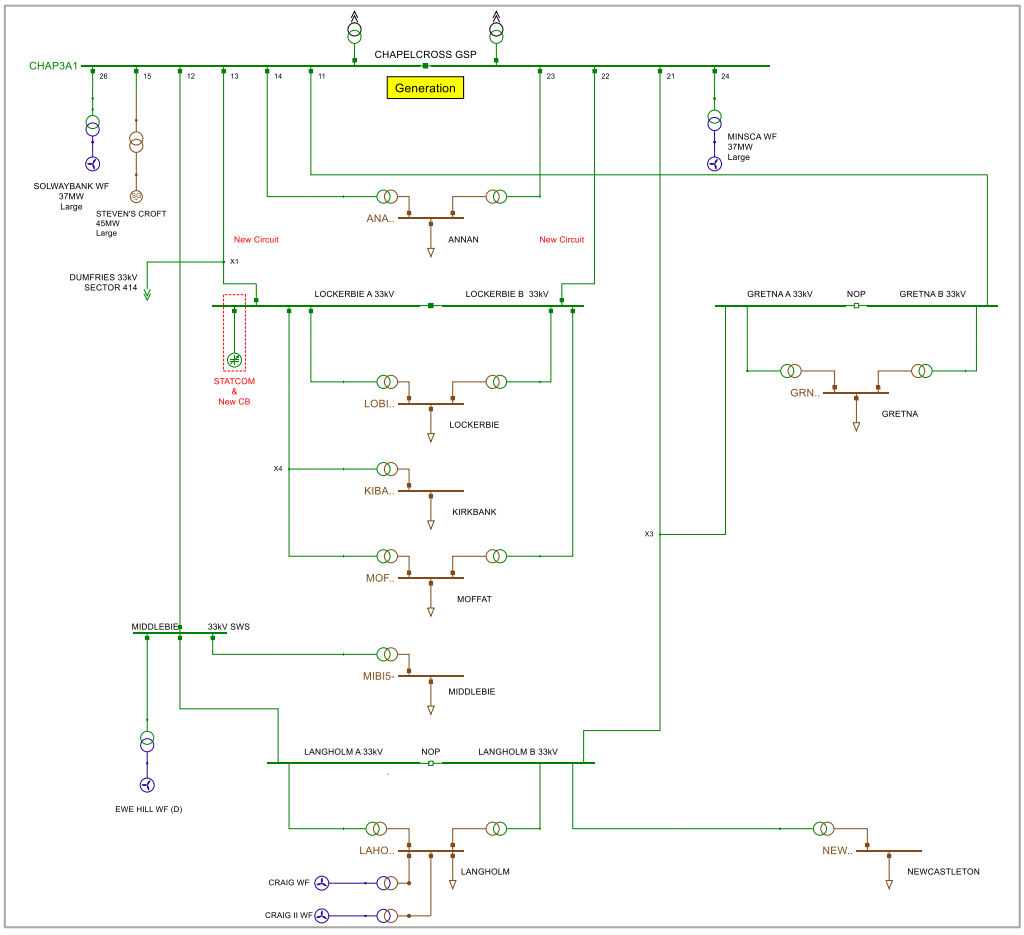

Figure 9. Schematic of Option 2 33kV network

Table 5.7 shows a summary of reinforcement costs and volumes for Option 2 under RIIO-ED2.

Table 5.7. Option 2 summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV OHL (Pole Line) Conductor	36.6	0.955	0.955	-
33kV Pole	366	1.095	1.095	-
33kV UG Cable (Non Pressurised)	0.5	0.100	0.100	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	1	0.167	0.167	-
Pilot Wire Overhead	36.6	0.987	0.987	-
Pilot Wire Underground	0.5	0.055	0.055	-
Civil Works at 33 kV & 66 kV Substations		0.292	0.292	-
Wayleaves/Easements/Land Purchase		0.187	0.187	-
Other Costs (Identify Below)		4.729	4.729	-
Total Costs		8.567	8.567	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£100k)				
17.5MVAr STATCOM (including cranage) (£4.375m)				
Remote end protection (£21k)				
Detailed Dynamic Compensation and Power Quality assessment studies (£25k)				
RTU/SCADA (£5k)				
Environmental consideration (£203k)				

5.4 Option 3 – Install a Hybrid MSC/STATCOM and Uprate 33kV Circuits

Option 3 considers the installation of a STATCOM/MSC hybrid system to resolve voltage issues associated with the Lockerbie/Kirkbank/Moffat demand group. Additionally, this option proposes to restring two 18.3km 33kV OHL circuits between Chapelcross GSP and Lockerbie 33kV switching station to resolve thermal constraints identified in section 3.3.1. Table 5.8 shows the scheme summary. This option would enable 12.35MVA of additional network capacity.

Option 3 is rejected based on cost and a much smaller capacity uplift in RIIO-ED2.

Table 5.8. Option 3 summary

Category	Scheme Name	Scheme Summary	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
Innovation/Smart	New Moffat GSP	Install a hybrid option STATCOM/MSC and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	7.392	-

The proposed configuration of the Chapelcross GSP 33kV network is shown in Figure 10.

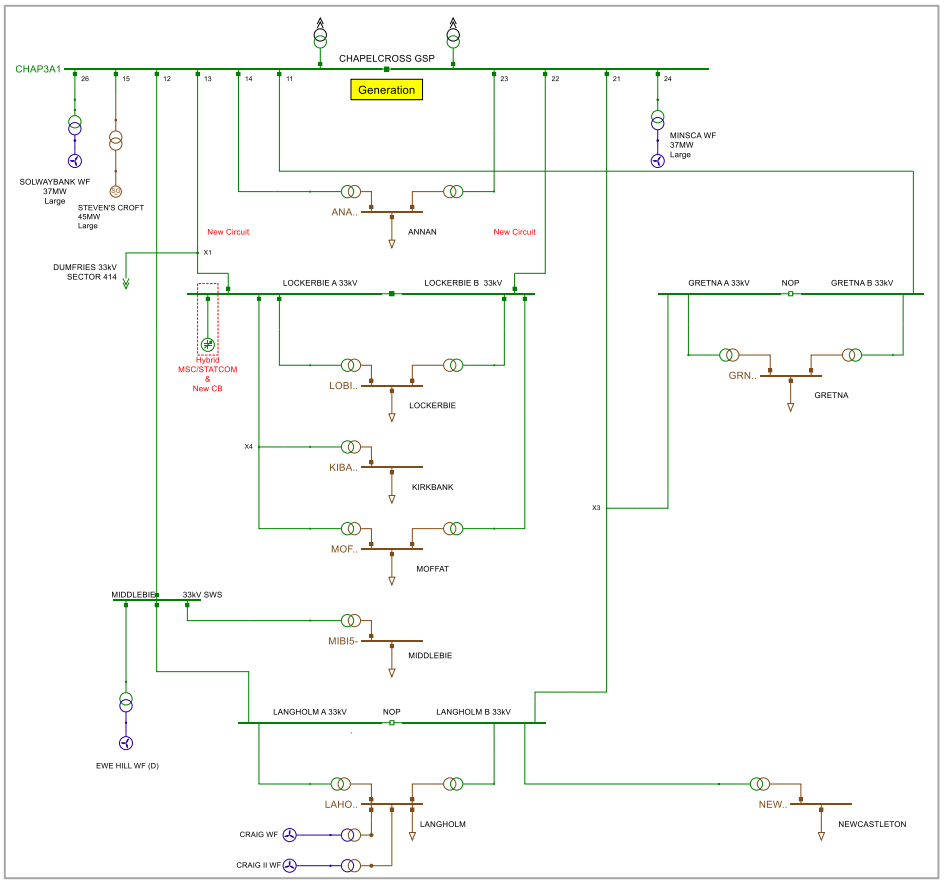

Figure 10. Schematic of Option 3 33kV network

Table 5.9 shows a summary of reinforcement costs and volumes for Option 3 under RIIO-ED2.

Table 5.9. Option 3 summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV OHL (Pole Line) Conductor	36.6	0.955	0.955	-
33kV Pole	366	1.095	1.095	-
33kV UG Cable (Non Pressurised)	0.5	0.100	0.100	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	1	0.167	0.167	-
Pilot Wire Overhead	36.6	0.987	0.987	-
Pilot Wire Underground	0.5	0.055	0.055	-
Civil Works at 33 kV & 66 kV Substations		0.292	0.292	-
Wayleaves/Easements/Land Purchase		0.187	0.187	-
Other Costs (Identify Below)		3.554	3.554	-
Total Costs		7.392	7.392	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£100k)				
10MVAr STATCOM (including cranage) (£2.5m)				
7.5MVAr MSC (including cranage) (£0.7m)				
Remote end protection (£21k)				
Detailed Dynamic Compensation and Power Quality assessment studies (£25k)				
RTU/SCADA (£5k)				
Environmental consideration (£203k)				

5.5 Options Cost Summary Table

Summary of the costs for each of the evaluated options is presented in Table 5.10.

Table 5.10. Cost summary for considered options

Options	Option Summary	RIIO-ED2 Cost (£m)
Baseline	Establish a new GSP near Moffat primary	2.708
Option 1	Install MSC and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	5.731
Option 2	Install STATCOM and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	8.567
Option 3	Install a hybrid option STATCOM/MSC and 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	7.392

Derivation of costs for these options are based on the SPEN RIIO-ED2 Unit Cost Manual for intervention. This is based on bottom up cost assessment of the components of activity detailed within the RIGs Annex A for the above activities, SPEN's contractual rates for delivery, market available rates and historic spend levels.

6 Deliverability & Risk

6.1 Preferred Options & Output Summary

The adopted option is the baseline option to establish a new 132/33kV 60MVA GSP in the Moffat area.

6.2 Cost Benefit Analysis Results

A cost benefit analysis (CBA) was carried out to compare the NPV of the options discussed in the previous sections. Considering the lowest forecast capital expenditure, the proposed option has the highest total NPV against other options. The summary of the cost benefit analysis is presented in Table 6.1. The full detailed CBA is provided within 'ED2-LRE-SPD-021-CV1-CBA – New Moffat GSP'.

The proposed option represents the most economic and efficient long-term solution and enables the load growth in the area by smooth deliverability of the network reinforcement.

Table 6.1. Cost benefit analysis results

Options considered	Decision	Comment	NPVs based on payback periods, £m (2020/21 prices)			
			10 years	20 years	30 years	45 years
Baseline – Establish a new grid substation near Moffat primary	**Adopted**					
Option 1 – Install MSC and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Rejected	Discounted based on NPV and a much smaller capacity uplift.	-1.49	-1.28	-0.83	-0.20
Option 2 – Install STATCOM and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Rejected	Discounted based on NPV and a much smaller capacity uplift.	-2.86	-3.26	-3.17	-2.82
Option 3 – Install a hybrid option STATCOM/MSC and uprate 33kV circuits of OHL between Chapelcross GSP and Lockerbie 33kV switching station	Rejected	Discounted based on NPV and a much smaller capacity uplift.	-2.23	-2.38	-2.14	-1.68

6.3 Cost & Volumes Profile

Table 6.2 shows the breakdown of expenditure for the proposed scheme (in 2020/21 prices) and the cost incidence (in 2020/21 prices) over the RIIO-ED2 period is shown in Table 6.3. The total cost of the proposed scheme is £2.504m.

Table 6.2: Summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Post RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV OHL (Pole Line) Conductor	0.5	0.013	0.013	-	-
33kV Pole	12	0.036	0.036	-	-
33kV UG Cable (Non Pressurised)	1.9	0.379	0.379	-	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	5	0.835	0.835	-	-
Pilot Wire Overhead	0.5	0.013	0.013	-	-
Pilot Wire Underground	1.9	0.210	0.210	-	-
Civil Works at 33 kV & 66 kV Substations		0.060	0.060	-	-
Wayleaves/Easements/Land Purchase		0.056	0.056	-	-
Other Costs CV1 (Identify Below)		0.407	0.407	-	-
Other Costs CV4 (Identify Below)		7.344	0.698	6.646	-
Total Costs		9.354	2.708	6.646	-
Identify activities included within other costs (please provide high-level detail of cost areas)					
CV1 – Planning and design (£50k)					
CV1 – Remote end protection (£105k)					
CV1 – Telecomms infrastructure (£252k)					
CV4 – NTCC (New Transmission Capacity Charges) (£698k)					

Table 6.3: Cost incidence over the RIIO-ED2 period, £m (2020/21 Prices)

Total Investment	Total (£m)	Incidence (£m)				
		2023/24	2024/25	2025/26	2026/27	2027/28
CV1 Expenditure	**2.010**	1.206	0.603	0.201	-	-
CV4 Expenditure*	**0.698**	-	-	0.235	0.233	0.230

*The full cost of transmission works will be charged to SP Distribution under New Transmission Capacity Charges (NTCC), over a 40-year payback period starting in 2025/26 upon GSP energisation based on the accepted ModApp offer.

6.4 Risks

All major connections will be secure during the construction period. However, during the changeover from the existing to the proposed system, the demand associated with individual 11kV circuits will be on reduced security of supply. This risk will be minimised by using an offline build approach and having suitable plans for the reconnection of lost supplies in the event of loss of remaining infeed's during construction outages.

Additionally, the delivery of this scheme will be co-ordinated with the delivery of SP Transmission works for operational efficiencies and to minimize the network impact.

6.5 Outputs Included in RIIO-ED1 Plans

There are no outputs expected to be delivered in RIIO-ED1 that are funded within this proposal.

6.6 Future Pathways – Net Zero

6.6.1 Primary Economic Driver

The primary drivers for this investment are insufficient thermal headroom and voltage violation which is mainly due to the DFES demand forecast.

6.6.2 Payback Periods

The CBA indicates that for the proposed option demonstrates better NPV results in all assessment periods (10, 20, 30 & 45 years) against other two options. As the intervention is forecast to carry at least a 45-year asset life expectancy, the CBA at this time justifies the intervention. Consumers will also benefit from reduced network risk immediately on completion of the project.

6.6.3 Sensitivity to Future Pathways

The network capacity and capability that result from the proposed option is consistent with the network requirements determined in line with the section 9 of the Electricity Act and Condition 21. Additionally, the proposed option is consistent with the SPEN's Distribution System Operator (DSO) Strategy and Distribution Future Energy Scenarios.

Table 6.4 shows electric vehicle and heat pump uptakes across a range of future pathways and Table 6.5 shows the sensitivity of the proposed solution and Table 6.6 shows the sensitivity of the proposed RIIO-ED2 expenditure against the full ranges of Net Zero complaint future pathways other Climate Change Committee (CCC) scenarios.

Table 6.4: Electric Vehicle and Heat Pump uptakes for Lockerbie/Kirkbank/Moffat demand group across a range of future pathways

End of RIIO-ED2	SPEN	DFES			CCC				
	Baseline	System Transformation*	Consumer Transformation	Leading the Way	Balanced Net Zero Pathway	Headwinds	Widespread Engagement	Widespread Innovation	Tailwinds
EVs	2,144		2,287	2,693	2,572	1,771	2,798	2,549	2,549
HPs	1,414		2,722	3,863	1,187	1,074	1,329	1,154	1,187

*Note: We have excluded System Transformation from our future pathways assessment as it does not meet interim greenhouse gas emission reduction targets.

Table 6.5: Sensitivity of the proposed solution against future pathways

	RIIO-ED1				RIIO-ED2					RIIO-ED3				
Solution Requirements	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Baseline							R[1]							
Consumer Transformation					F	F	R[1]							
Leading the Way							R[1]							
Balanced Net Zero Pathway							R[1]							
Headwinds							R[1]							
Widespread Engagement						F	R[1]							
Widespread Innovation							R[1]							
Tailwinds							R[1]							

R[1] – New Moffat GSP
F[1] – Utilise flexibility services

The proposed solution is robust across a wide range of pathways. In all cases this solution is expected to endure beyond RIIO-ED3. Under higher uptake scenarios additional flexibility services may be required in early RIIO-ED2.

Table 6.6: Sensitivity of the proposed RIIO-ED2 expenditure

	Baseline	Uncertain
RIIO-ED2 Expenditure (£m)	2.708	+0.170
Comment	Proposed option	Flexibility services

6.6.4 Asset Stranding Risks & Future Asset Utilisation

Electricity demand and generation loadings are forecast to increase under all scenarios. The stranding risk is therefore considered to be low.

6.6.5 Losses / Sensitivity to Carbon Prices

Losses have been considered in accordance with Licence Condition SLC49 and the SP Energy Networks Losses Strategy and Vision to "consider all reasonable measures which can be applied to reduce losses and adopt those measures which provide benefit for customers". Reasonable design efforts have been taken to minimise system losses without detriment to system security, performance, flexibility or economic viability of the scheme. This includes minimising conductor lengths/routes, the choice of appropriate conductor sizes, designing connections at appropriate voltage levels and avoiding higher impedance solutions or network configurations leading to higher losses.

Losses have not been evaluated as part of optioneering the optimum solution for the scheme. As the proposed scheme involves reactive compensation equipment which is primarily to support the voltage issues in the grid group, the impact of the voltage support on the network losses involves a complex network analysis. As such. the detailed losses assessment will be carried out during the design stage of the proposed. scheme.

During the evaluation of the options associated with the proposed scheme, we have embedded within the CBA, where data are available, an assessment of the embodied carbon and the associated carbon cost to inform our NPV evaluation. The mass of carbon dioxide emitted (CO2e) during the manufacture of the main equipment deployed to deliver this scheme is estimated to be 35.6 tonnes. The monetised embodied carbon value associated with this emission is £1.7k. It should be noted that the embodied carbon evaluation undertaken has only considered the manufacture and supply of materials. Further collaborative industry-wide work is planned for the RIIO-ED2 price review period to better understand the overall embodied carbon values including, for example installation and commissioning services, decommissioning and disposal activities as well as refurbishment opportunities. More information regarding this can be found in Section 3.1.2 of our Environmental Action Plan[2].

6.6.6 Whole Systems Benefits

Whole system solutions have been considered as part of this proposal. The completion of this scheme will maintain the integrity of the distribution network and its enduring ability to facilitate wider whole system benefits.

[2] Annex 4C.3: Environmental Action Plan, SP Energy Networks, Issue 2, 2021.

6.7 Environmental Considerations

6.7.1 Operational and Embodied Carbon Emissions

The New Moffat GSP reinforcement programme has limited potential to impact on SPEN's Business Carbon Footprint (BCF) and on the embodied carbon resulting from the delivery of the programme.

Upfront costs associated with this programme (e.g. embodied carbon from the manufacture and supply of components and associated civil engineering works) should be considered against our ongoing operational need to maintain the resilience of our assets and networks.

6.7.2 Supply Chain Sustainability

For us to take full account of the whole-life carbon impact of our New Moffat GSP reinforcement programme, we need access to reliable data to be provided by our suppliers. The need for carbon and other sustainability credentials to be provided now forms part of our wider sustainable procurement policy.

We believe that such a requirement sends a strong message to our suppliers that we take sustainability seriously, and that such positive engagement is key to improving the overall sustainability of our collective supply chain.

6.7.3 Resource Use and Waste

The New Moffat GSP reinforcement programme will result in the consumption of resources and the generation of waste.

Where waste is produced it will be managed in accordance with the waste hierarchy which ranks waste management options according to what is best for the environment. The waste hierarchy gives top priority to preventing waste in the first instance, then preparing for re-use, recycling, recovery, and last of all disposal (e.g. landfill).

6.7.4 Biodiversity / Natural Capital

The New Moffat GSP reinforcement programme involves development on currently undeveloped land. However, the impact on, and the opportunity to improve biodiversity and natural capital is expected to be minimal.

6.7.5 Preventing Pollution

SPEN will always follow all relevant waste regulations and will make sure that special (hazardous) waste produced or handled by our business is treated in such a way as to minimise any effects on the environment.

6.7.6 Visual Amenity

SPEN continually seeks to reduce the landscape and visual effects of our networks and assets.

6.7.7 Climate Change Resilience

In addition to our efforts to minimise our direct carbon emissions in line with our Net Zero ambitions, we are also conscious of the need to secure the resilience of our assets and networks in the face of a changing climate. We have also modified our policy on vegetation control in the face of higher temperatures and longer growing seasons.

7 Conclusion

Chapelcross 132/33kV Grid Supply Point supplies rural network in Dumfries and Galloway District of the SP Distribution licence area, near the Scottish Borders.

The primary driver for investment at Moffat substation is to alleviate thermal and voltage constraints on the 33kV network associated with Lockerbie, Kirkbank and Moffat primary substations fed from Chapelcross GSP. This network is rural, and infrastructure is relatively sparse. It is becoming problematic to accommodate additional demand and generation in this area.

It is proposed to establish a new 132/33kV GSP substation connecting into Moffat 132kV transmission network. The GSP will utilise an existing 60MVA transformer installed for the transmission connected Minnygap wind farm. The second 132/33kV 60MVA transformer will be installed by SP Transmission as part of the scheme. Seven 33kV circuit breakers will be installed in a new prefabricated housing that provides space for up to 13 circuit breakers panels, leaving room for three additional circuit breakers on each side of the switchboard. Moffat and Kirkbank primary substations will be connected to the new switchboard, which is in closer proximity to the demand centre, consequently improving the voltage profile of the network.

The SP Distribution works for this solution involves the installation of a new indoor 33kV switchboard and 33kV circuits to connect to the new board. The costs of SPD works are included within the CV1 expenditure. The SP Transmission works for this solution involves the installation of 1 x 60MVA 132/33kV grid transformers, 1 x 132kV feeder bay, two transmission incomer breakers and associated cable works. The full cost of transmission works will be charged to SP Distribution under New Transmission Capacity Charges (NTCC), over a 40-year payback period starting in 2025/26 upon GSP energisation based on the accepted ModApp offer.

SPD submitted a Modification application for this works to National Grid Electricity System Operator (NGESO) in January 2020; an NGESO offer was received in April 2020 and the NGESO offer was accepted in November 2020. The associated transmission works are included in the RIIO-T2 investment plan.

The estimated cost for the above is £2.010m under the CV1 expenditure and £0.698m (in 2020/21 prices) under the CV4 expenditure with 100% contribution to be included in the RIIO-ED2 load related expenditure.

We will continue to retender for flexibility before the reinforcement starts to ensure we are using the most efficient intervention.

Due to the proposed connection date in 2025/26 driven by SP Transmission works, it is proposed to start the distribution works in 2023/24 and the release capacity of 60MVA will be claimed in 2025/26 upon GSP energisation based on the accepted ModApp offer.

8 Appendices

Appendix 1. System Study Results

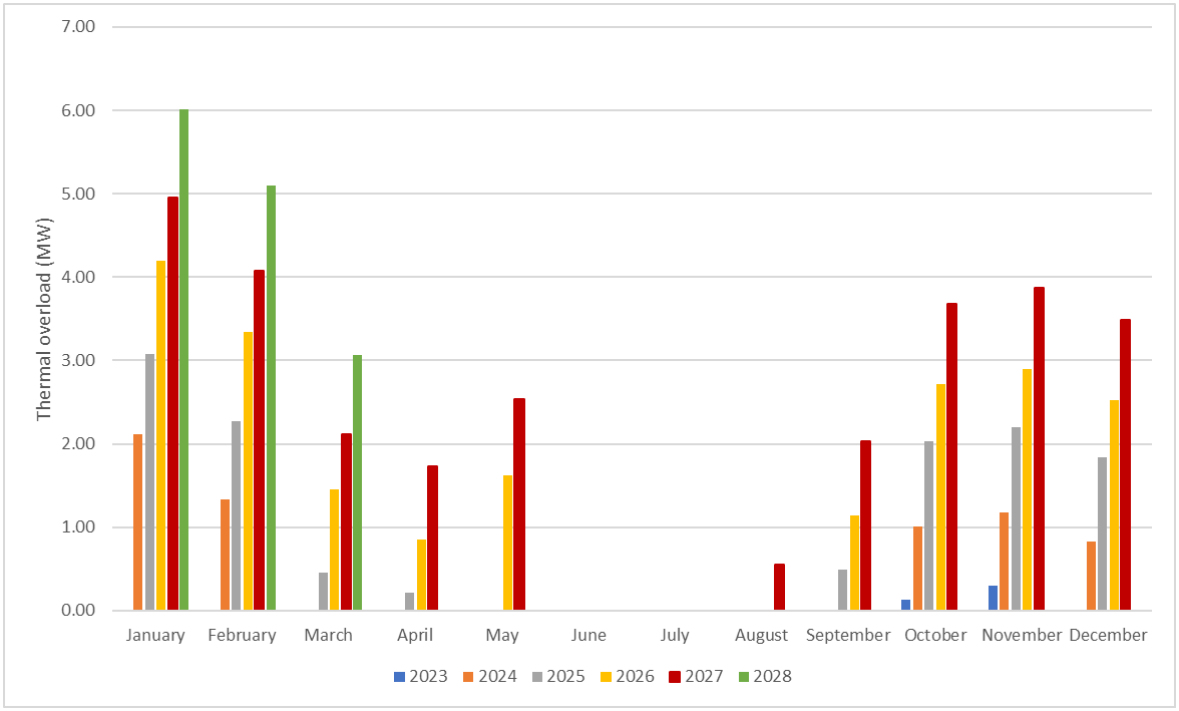

Figure 11. Monthly maximum overload for Lockerbie/Kirkbank/Moffat demand group