

SPM 11kV Network Group Fault Level Mitigation

ED2 Engineering Justification Paper

ED2-LRE-SPM-007-CV3-EJP

Issue	Date	Comments	
Issue 0.1	Apr 2021	Issue to SRG and external assurance	
Issue 0.2	May 2021	Reflecting comments from SRG	
Issue 0.3	Jun 2021	Reflecting assurance feedback	
Issue 1.0	Jun 2021	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	Final Business Plan Submission	
Scheme Name	SPM 11kV Network Group Fault Level Mitigation		
Activity	11kV Network Group Reconfiguration		
Primary Investment Driver	Fault Level constraints		
Reference	ED2-LRE-SPM-007-CV3-EJP		
Output	Fault Level		
Cost	£1.309m		
Delivery Year	2025-26		
Reporting Table	CV3		
Outputs included in ED1	Yes/No		
Business Plan Section	Maintaining a Safe & Resilient Network		
Primary Annex	Annex 4A.2: Load Related Expenditure Strategy: Engineering Net Zero Annex 4A.6: DFES		
Spend Apportionment	ED1	ED2	ED3
	-	£1.309m	-





Technical Governance Process

Project Scope Development

IPI(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:	SPM 11kV Network Group Fault Level Mitigation
Project Reference:	ED2-LRE-SPM-007-CV3-EJP
Decision Required:	To give concept approval to split and reconfigure the Kelco– News Int.– Palco –Southdene 11kV group to mitigate the existing fault level issues.

Summary of Business Need:

The Kelco – News International – Palco – Southdene primary group in the Knowsley area in Merseyside is supplied from the upstream Gillmoss – Kirkby – Simonswood 33kV network via 5 x 7.5MVA, 33/11kV primary transformers. This 11kV (HV) network group supplies to ca. 2225 customers, mainly industrial/commercial type.

The 11kV group is currently experiencing fault level issues, the fault duties at several HV substations exceeding the design limits of 250MVA/13.12kA under intact operating scenario. Currently, the fault levels in the group are managed operationally, by running the group in a depleted state, i.e., with Palco primary transformer on open-standby and the group is operating with very little (<3%) headroom. Additionally, the group is currently run under a diminished firm capacity is 30MVA, compared to 40MVA in intact and the Palco primary transformer risks being an underutilised asset.

In order to mitigate the existing fault level issues and to create an additional fault level headroom in the group, an enduring conventional solution is proposed, to establish a new primary infeed and split the group into two group of 3 primary transformers.

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

The primary driver for the investment decision and the proposed scheme is to mitigate the fault level issues in the the Kelco – News International – Palco – Southdene 11kV group. Split the existing Kelco – News International – Palco – Southdene primary group of 5 primary transformers into two groups of 3 primary transformers by establishing a new primary infeed at Ainsworth Lane HV substation. The works include,

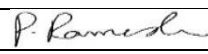

- Establish a 33kV infeed to Ainsworth Lane HV substation by looping into the Kirkby – Palco 33kV circuit, via 2 x 0.8km 400 sq. mm XLPE AL cables.
- Install a new 7.5 / 10 MVA 33/11kV (primary) transformer Ainsworth Lane HV substation (use the existing spare CB).
- Establish split points at Ainsworth Lane (new) and News International primary substations to split the groups

The estimated cost of the proposed scheme is £1.309m (2020/21 prices), which will be fully funded by SPEN in the ED2 period under the fault level reinforcement (CV3) category.

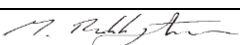
Expenditure Forecast (in 2020/21 prices)

Licence Area	Reporting Table	Description	Total (£m)	Incidence (£m)				
				2023/24	2024/25	2025/26	2026/27	2027/28
SPM	CV3	Fault Level Reinforcement	1.309	-	0.654	0.655	-	-
Total Expenditure within RIIO-ED2			1.309					

PART B – PROJECT SUBMISSION

Proposed by	Ramesh Pampana	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
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1 Introduction

The Kelco – News International – Palco – Southdene primary group lies in the Knowsley area in Merseyside and supplied from within the Kirkby GSP and Gillmoss – Kirkby – Simonswood 33kV networks via 5 x 7.5MVA, 33/11kV primary transformers. This 11kV (HV) network group supplies to ca. 2225 customers, predominantly industrial / commercial type.

The primary driver for the investment decision and the proposed scheme is to mitigate the fault level issues in the Kelco – News International – Palco – Southdene 11kV group. The 11kV group is currently experiencing fault level issues, the fault duties at several HV substations exceeding the design limits of 250MVA/13.12kA under intact operating scenario. Currently, the fault levels in the group are managed operationally, by running the group in a depleted state, i.e., with Palco primary transformer on open-standby and very little headroom. Due to this, the group is currently run under a diminished firm capacity is 30MVA, compared to 40MVA intact and the Palco transformer risks as underutilised asset.

In order to comply with the ESQCR regulations, section 9 of the Electricity Act and the Condition 21 of the license obligation, “to develop and maintain an efficient, coordinated and economical system for the distribution of electricity, it is proposed to mitigate the fault level constraints in the Kelco – News International – Palco – Southdene group by establishing a new primary infeed at Ainsworth Lane HV substation and splitting the 5 infeed group into 2 x 3 infeed groups.

Summary of the proposed scheme is to split the existing Kelco – News International – Palco – Southdene primary group of 5 primary transformers into two groups of 3 primary transformers by establishing a new primary infeed at Ainsworth Lane HV substation. The works include,

- Establish a 33kV infeed to Ainsworth Lane HV substation by looping into the Kirkby – Palco 33kV circuit, via 2 x 0.8km 400 sq. mm XLPE AL cables.
- Install a new 7.5 / 10 MVA 33/11kV (primary) transformer Ainsworth Lane HV substation (use the existing spare CB).
- Establish split points at Ainsworth Lane (new) and News International primary substations to split the groups.

The estimated cost of the proposed scheme is £1.309m (2020/21 prices), which will be fully funded by SPEN in the RIIO-ED2 period under fault level reinforcement (CV3) category. The fault level headroom (RMS Break duty) will be ca. 25 – 35% in each of the new 11kV groups, the firm capacity will 20MVA each claimed at the end of the project completion.

2 Background Information

2.1 Existing/Authorised Network

The Kelco – News International – Palco – Southdene primary group lies within the Gillmoss – Kirkby – Simonswood 33kV group and is supplied by a 5 x 7.5MVA primary transformer, 2 at News International and one each at Kelco, Palco and Southdene primary substation. This group supplies to ca. 2225 LV customers supplied via of 74 secondary substations The primary substation locations are shown in Figure 2.1 the 33kV and 11kV network connectivity is show in Figure 2.2 and Figure 2.3.

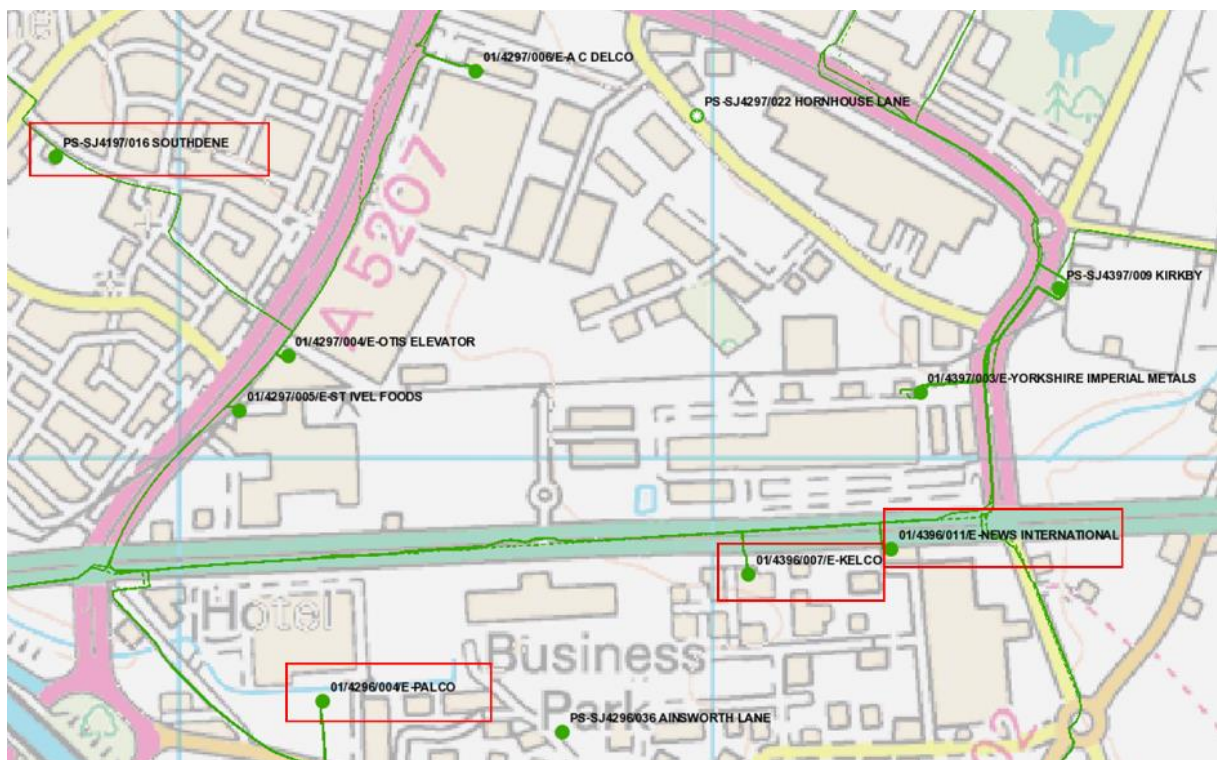


Figure 2.1: Primary substation locations

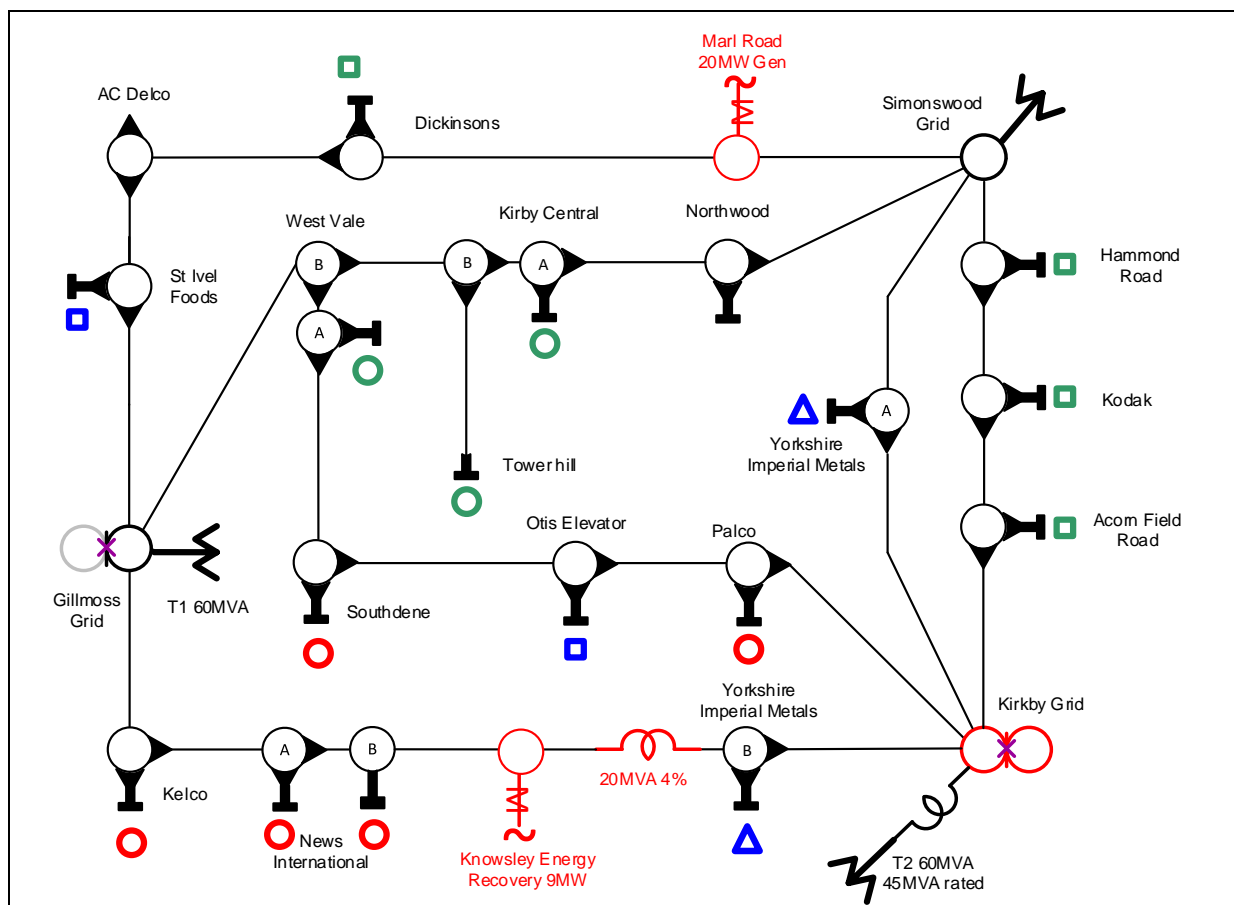


Figure 2.2- Gillmoss – Kirkby – Simonswood 33kV network group

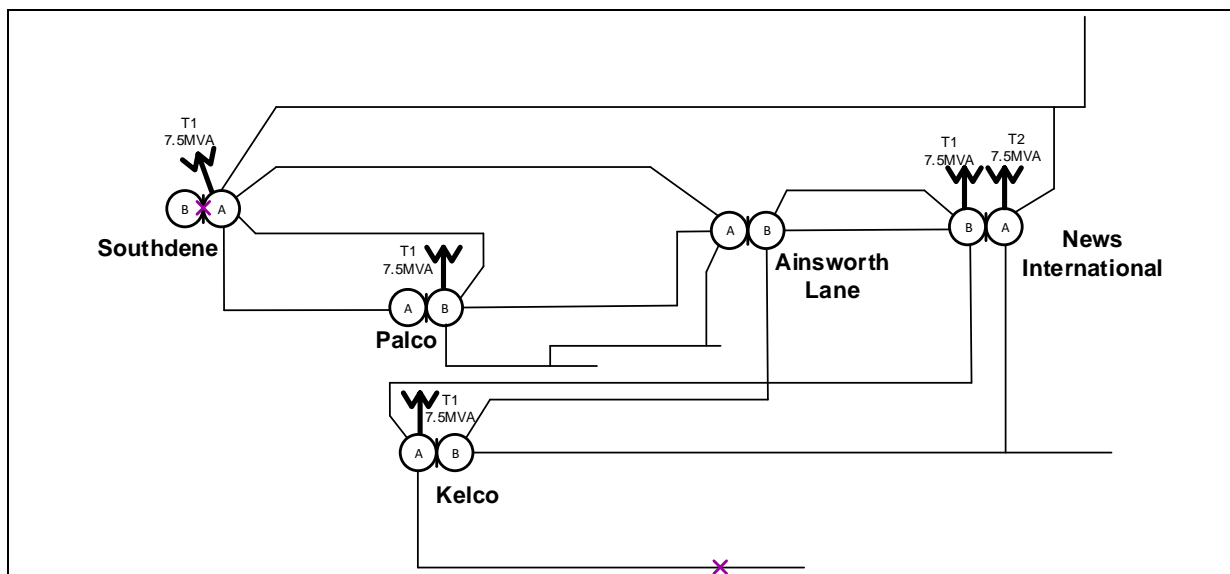


Figure 2.3- Kelco – News Int. – Palco – Southdene 11kV network group

2.2 Network supply / circuit capacity

The existing 11kV network group is classed as EREC P2/7 Group C (>12MW and ≤60MW) with the network demand of 16.87MVA against firm capacity of 30MVA., the current load index position is LII. Table 2-1 shows the existing network supply position of the group.

Table 2-1: Summary of 11kV group network

HV Group	Customers (#)	Scenario	LI firm capacity (MVA)	Maximum demand (MVA)	Load Index	Class of Supply (P2/7)
Kelco – News Int. – Palco – Southdene	2182	N-I	30	16.4	LII	C

The group has an additional contracted demand of 1.8MVA has been accepted. This gives a total group demand of 18.2MVA. The existing generation in the group is ca. 1MW.

2.3 Fault levels

The design fault level limit for 11kV network is 250MVA/13.12kV (RMS Break) and the 11kV switchgear is usually rated equal to the design limits. The group currently is currently experiencing fault level issues, under intact operating conditions. The fault levels overhead line circuit near to the New International primary substation are close to 177MVA., which exceeds the OHL switchgear design limit of 150MVA. Currently, the fault levels in the group are managed operationally, by running the group in a depleted state, i.e., with Palco primary transformer on open-standby. The following Table 2-2, above shows the fault levels in the group with intact and current running arrangements.

Table 2-2: Existing fault levels

Substation	33kV RMS Break		11kV RMS Break		
	Rating(kA)	Duty(%)	Rating(kA)	Duty(%)*	Duty(%)**
Kelco	17.50	65.62	13.12	98.63	89.68
News International A	13.12	88.23	13.12	102.13	92.30
News International B	17.50	66.19	13.12	102.13	92.30
Palco	13.12	82.63	13.12	86.81	72.30
Southdene	13.12	81.94	13.12	76.17	68.34

* Intact operation, 5 primary transformers in service

** 4 primary transformers in service, Palco primary transformer on open-standby

3 Needs Case

The need to reinforce the group is driven by the existing fault level issues. The PI historian data has indicated that the Palco primary transformer is run on open stand by as on enduring basis due to the fault level issues and risks of being an underutilised asset in the group.

As observed in Table 2-2, the intact fault levels exceedances are due to the multiple infeeds in the group. With the current running arrangement, the fault levels are below the design limits, however they are very close to the 95% of the threshold for fault level mitigation (as per SPEN’s fault level mitigation policy).

The fault level exceedances are mainly at New International (has two primary infeeds) and Kelco primary substations. The fault levels overhead line circuit near to the New International primary substation are close to 177MVA which exceeds the 150MVA switchgear rating (the ABSW on the overhead line at Hewitts Lane).

An alternate running arrangement with one of the New International primary transformers on open standby, and Palco primary transformer in service, reduces the fault levels just below the design limits, however, introduces voltage issues on the OHL circuits.

For the reasons mentioned above an enduring and overarching solution is required to mitigate the fault level issues in the group.

3.1 Forecast Demand

3.1.1 Distribution Future Energy Scenarios

The DFES forecast is based on actual system measurement data from the PI system and stakeholder endorsed DFES and considers SPM’s pipeline of known developments. The group demand is forecast to remain within the network capacity through the RIIO-ED2 period and beyond. The winter demand forecast based on the future energy scenarios along with the projected demand from authorised connections is shown in Figure 3.1.

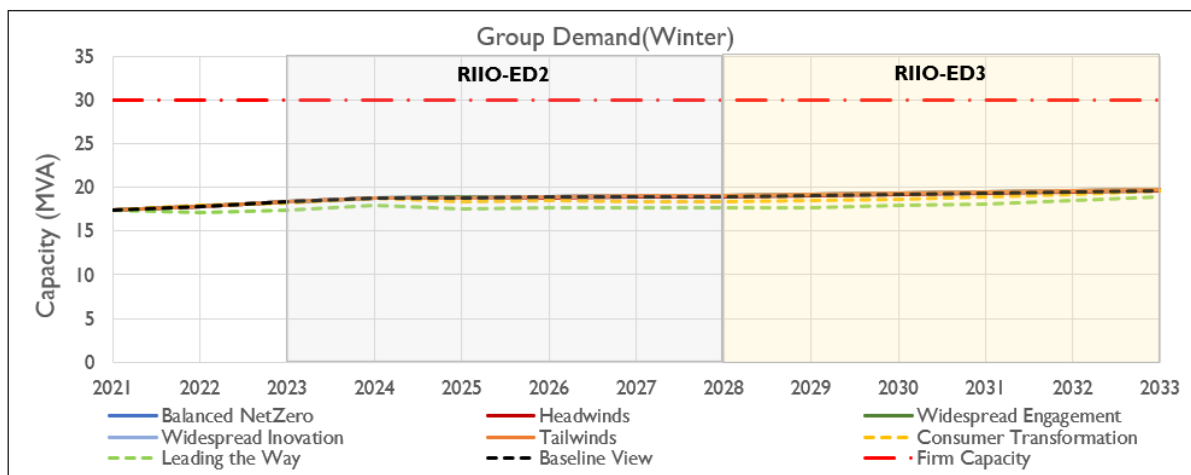


Figure 3.1: Demand forecast for 11kV group

3.1.2 Baseline View

The forecasted demand growth under Baseline View, along with the firm capacity and load index position through RIIO-ED3 period is shown in Table 3-1. The group will remain as Class C by the end RIIO-ED3 and the forecast utilisation is expected to be ca. 61% of the groups firm capacity of 30MVA and load index position of L11.

Table 3-1: Baseline View Demand forecast

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Forecast Demand (MVA)	17	18	18	19	19	19	19	19	19	19	19	19	20
Firm Capacity (MVA)	30	30	30	30	30	30	30	30	30	30	30	30	30
Utilisation (%)	58	60	61	63	63	63	63	63	63	64	64	65	65
Load Index	LII	LII	LII	LII	LII	LII	LII	LII	LII	LII	LII	LII	LII

The forecasted generation growth under Baseline View at 132kV, 33kV and 11kV voltage levels is provided in Table 3-2. The majority of forecast generation growth is expected at the 132kV (GSP) level and additional generation of 44MW is expected to connect at 132kV level.

Table 3-2: Baseline View Generation forecast

Network Group	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Kirkby 132kV GSP	99	109	116	143	146	148	155	160	169	178	187	194	204
Gillmoss – Kirkby – Simonswood 33kV group	3	3	3	3	3	3	3	3	3	3	3	3	4
Kelco – News International – Palco – Southdene 11kV group	1	1	1	1	1	1	1	1	1	1	1	1	1

The forecast demand (in the form of G74 fault contributions) and the additional generation will increase the existing fault levels in the 11kV groups.

3.2 Network Impact Assessment

Detailed network studies covering Intact/ N-1 and fault level assessments were conducted for the 11kV network considering the different demand forecast scenarios. The findings from the network impact assessments are detailed in sections below.

3.2.1 Thermal Constraints

No additional thermal constraints identified in the 11kV group network

3.2.2 Voltage Constraints

No additional voltage constraints identified in the 11kV group network.

3.2.3 Fault Level Constraint

There were no additional fault level related constraints at 11kV due to the forecast demand / generation, however the existing fault levels in the group will be exacerbated due to the increase in fault level infeeds from the upstream 132kV and 33kV network due to the forecast generation.

4 Optioneering

Table 4-1 below presents a long list of options considered for this project. Few of the longlist options are rejected based on the technical and commercial rustications, the reasons are provided in the table. The shortlisted options are taken forward for detailed studies and cost benefit analysis. Option I, a new primary infeed and splitting the group is the ‘do minimum’ scheme to mitigate the fault level issues.

Table 4-1: Long list of options considered

Option	Description	Status	Reason for rejection
(a)	No Intervention	Rejected	This option is rejected as it does not address the fault level issues in the group, leads to perpetuation of existing fault level issues.
(b)	Intervention plan using only Energy Efficiency	Rejected	Rejected as it does not address the network fault level issues.
(c)	Replant with higher rated switchgear	Rejected	This option does not provide any additional benefit, as the network is constrained due to the design fault level limits.
(d)	Install series reactors in the tails of primary transformers at News International primary substation	Rejected	Rejected due to space constraints and transient recovery voltage stresses caused due reactor switching on the vacuum type switchgear.
(e)	Replace the primary transformers with higher impedance units.	Considered (Baseline)	
(f)	Group split and reconfiguration	Considered (Option I)	
(g)	Active fault level management and monitoring.	Rejected	This option cannot address the existing fault level issues and does not provide any operational benefits, as the exceedances are being operationally managed.
(h)	Fault Current Limiters	Rejected	Due to the usage of explosive fuse element which is not ‘fail-safe’ and can be a safety issue and requires maintenance & operational costs.
(i)	Superconducting Fault Current Limiting (SFCL) devices	Rejected	The technology is not ready for BaU and present experience from SPEN trials indicate that maintenance requirements for the cryogenic systems is prohibitive.

5 Detailed Analysis

Detailed network studies indicate that the existing fault level issues in the group are exceeding the switchgear ratings of the 11kV network under intact conditions and the operational mitigation is not an enduring solution as the fault level headroom remaining is very small. The detailed analysis is aimed at proposing an enduring and overarching solution to address the fault level issues.

5.1 Proposed Solution – HV group split and reconfiguration

The **proposed solution** aims to mitigate the fault level issues in the existing 5 primary transformer Kelco– News Int.– Palco –Southdene group by establishing a new primary infeed and splitting into 2 groups of three primary transformers each. The newly created primary groups will comprise,

1. Ainsworth Lane, Palco and Southdene
2. Kelco, News International T1 & T2

The new primary infeed location is chosen to be Ainsworth Lane HV substation, as the substation was built with future plan of converting into a primary substation (with a spare circuit breaker and a VT), which minimises the works need on the HV switchboard. On the 33kV side, the required circuit infeed is achieved by laying extra cable of 1.6km (2 x 0.8km sections) to loop into the existing circuit

between Kirkby Grid and Palco primary substations. The primary transformer is accommodated installing a 33kV RMU at Ainsworth Lane substation.

The works under the proposed scheme comprises, Split the existing Kelco – News International – Palco – Southdene primary group of 5 primary transformers into two groups of 3 primary transformers by establishing a new primary infeed at Ainsworth Lane HV substation. The works include,

- Establish a 33kV infeed to Ainsworth Lane HV substation by looping into the Kirkby – Palco 33kV circuit, via 2 x 0.8km 400 sq. mm XLPE AL cables.
- Install a new 7.5 / 10 MVA 33/11kV (primary) transformer Ainsworth Lane HV substation (use the existing spare CB).
- Establish split points at Ainsworth Lane (new) and News International primary substations to split the groups. Split points will be created by opening bus section at Ainsworth Lane and CB02 at News International primary substations.

Figure 5.2 and Figure 5.3 shows the proposed works respectively and Figure 5.4 shows the aerial view of Ainsworth Lane HV substation where a new primary transformer is proposed.

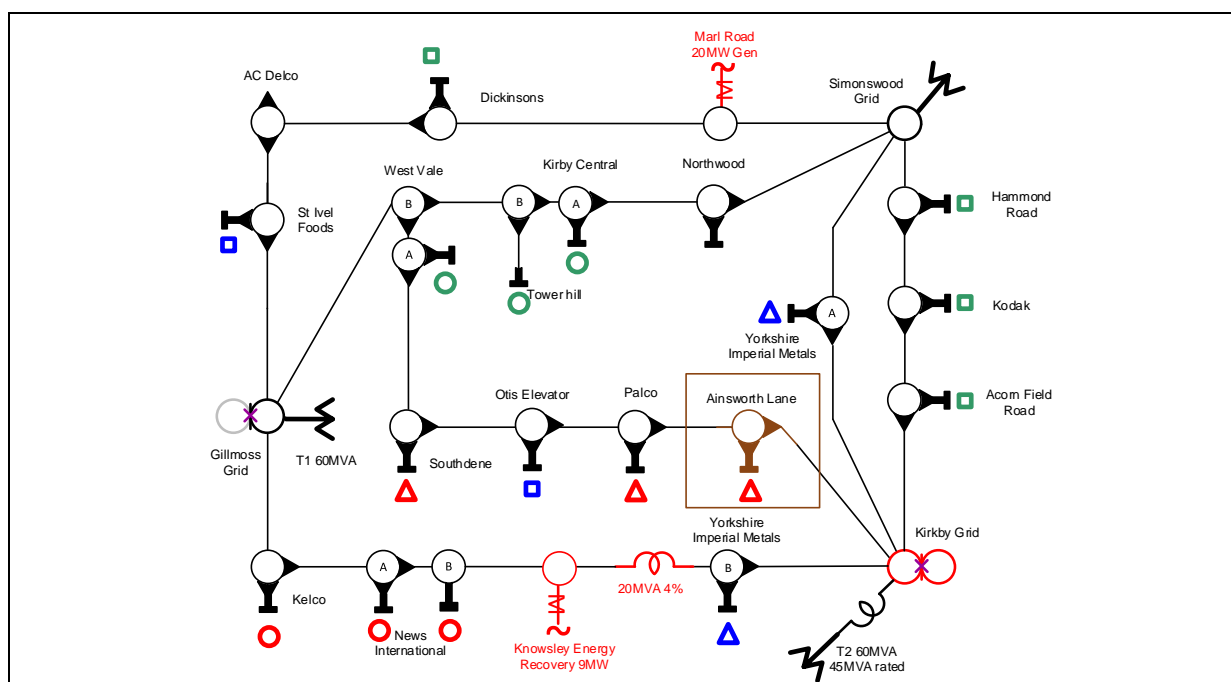


Figure 5.1: Proposed 33kV works

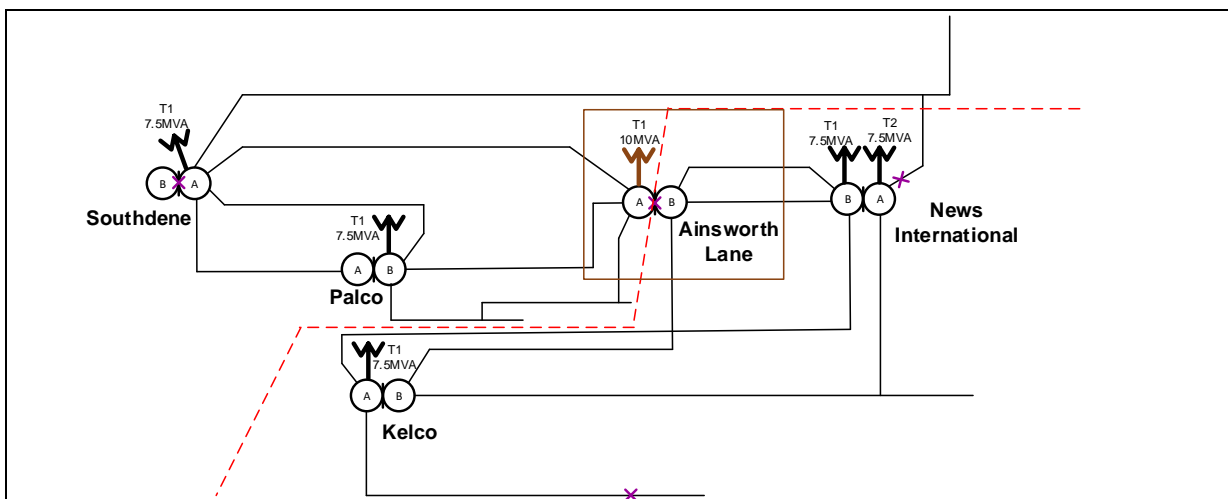


Figure 5.2: Proposed 11kV works

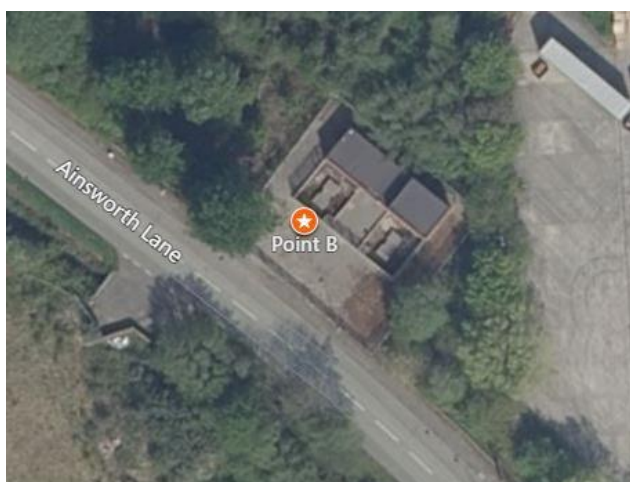


Figure 5.3: Ainsworth Lane HV substation aerial view

With the groups split, the thermal headroom of each of the split group is 20MVA (40MVA in total) , considering the loss of one primary transformer(N-I condition), thereby providing a 10MVA uplift in headroom. Please note that there could be limitations on the HV circuits(the HV circuits might overload before reaching the groups’ firm capacity) due to future connections in the groups; however, this would be addressed as part of customer connections.

5.1.1 Fault Levels

The proposed scheme is effective in mitigating the fault level issues in the group post reconfiguration. Table 5-1 shows the fault levels at each of the primary substation post splitting and reconfiguration. The introduction of new primary substation does not impact the 33kV fault levels significantly.

Table 5-1: Fault level in the split groups

HV Group	Substation Name	11kV RMS Break		
		Rating (kA)	Fault Level (kA)	Duty (%)
Ainsworth Lane – Palco-Southdene	Ainsworth Lane	13.12	8.31	63.34
	Palco	13.12	8.85	67.45
	Southdene	13.12	7.81	59.53
Kelco - News International T1 & T2	Kelco	13.12	9.75	74.31
	News International A	13.12	9.88	75.30
	News International B	13.12	9.88	75.30

5.1.2 Proposed scheme costs and apportionment

The costs for the proposed solution are presented in Table 5-2.

Table 5-2: Proposed solution costs

Asset Description	Volumes	Prime Costs (£m)	RIO-ED2 Contribution (£m)	Customer Contribution (£m)
33kV UG Cable (Non-Pressurised with 19pr pilot)	1.60	0.441	0.441	-
33kV RMU	1	0.234	0.234	-
33kV Transformer (GM)	1	0.314	0.314	-
Batteries at 33kV Substations	1	0.008	0.008	-
Civil Works at 33 kV & 66 kV Substations	-	0.125	0.125	-
Wayleaves/Easements/Land Purchase	-	0.016	0.016	-
Remote Protection changes and SCADA/RTU	-	0.170	0.170	-
Total Costs		1.309	1.309	-

5.2 Baseline Solution – Replace the primary transformers with high impedance units

The **baseline solution** aims to mitigate the fault level issues in the existing 5 primary transformer Kelco – News International – Palco – Southdene group by replacing the primary transformers with higher impedance units and bring back the Palco open-standby transformer into service. The primary transformer is excluded from the option, as there is sufficient fault level headroom (see Table 2-2)

The proposed higher impedance units will reduce the fault infeed due to the higher impedance of the units, thereby creating fault level headroom. The higher impedance units were of 15% impedance compared to the standard 10% impedance units; for impedances >15%, the groups start experiencing voltage issues. The proposed works for the option are shown in Figure 5.4 and the costs of the option are shown in Table 5-3

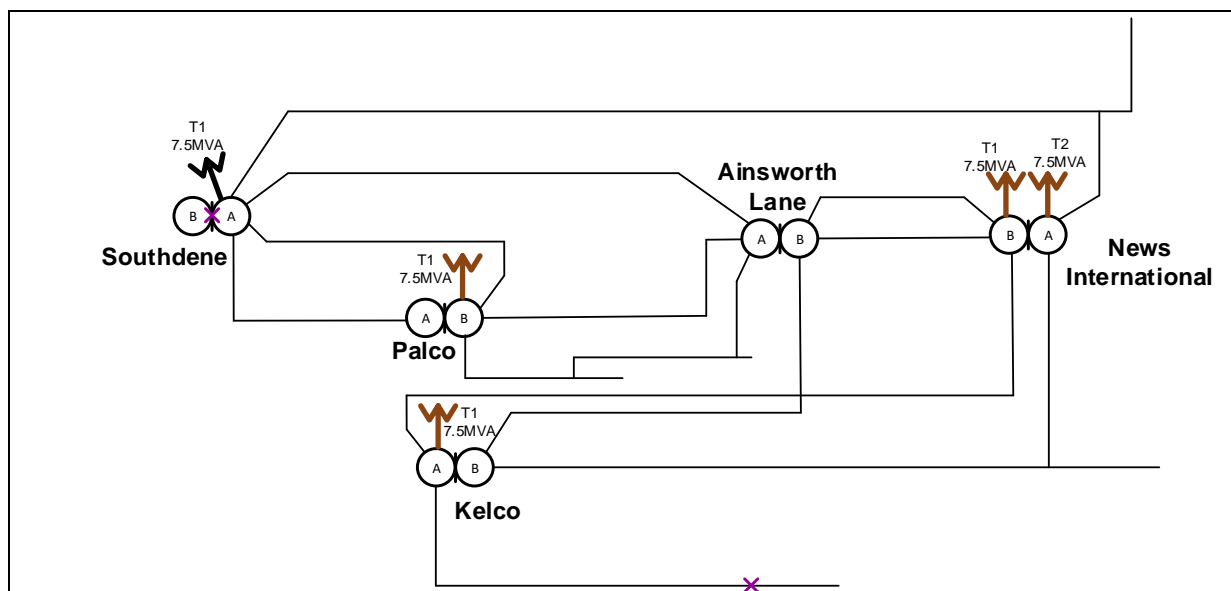


Figure 5.4: Baseline option proposed 11kV works

Table 5-3: Baseline option costs

Asset Description	Volumes	Prime Costs (£m)	RIO-ED2 Contribution (£m)	Customer Contribution (£m)
Batteries at 33kV Substations	4	1.447	1.447	-

Civil Works at 33 kV & 66 kV Substations	-	0.276	0.276	-
Associated protection, control or SCADA equipment located at a site and remote ends (as required)	-	0.110	0.110	-
Environmental considerations	-	0.025	0.025	-
Total Costs		1.857	1.857	-

5.3 Options Cost Summary Table

Summary of the costs for each of the evaluated options is presented in Table 5-4.

Table 5-4: Costs summary for considered options

Options	Option Summary	Total Costs (£m)
Baseline	Replace the primary transformers with higher impedance units.	£1.857
Option I	Group split and reconfiguration	£1.309

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 **Option I** to mitigate the existing fault levels in the 5-primary group by splitting into two groups with 3 primary infeeds each. This an enduring solution as it addresses the fault levels issues as well as creates additional fault level headroom in each of the groups.

The project is aimed to be started in 2024/25 and finish in 2025/26, the costs are allocated uniformly across the project delivery period. Post completion, the fault level headroom will be ca. 25 – 35% in each of the new 11kV groups, the firm capacity will 20MVA each claimed at the end of the project completion.

6.2 Cost Benefit Analysis Results

A cost-benefit analysis was carried out to compare the NPV of the two options discussed in the previous sections. Considering the lowest forecast capital expenditure, the proposed option has the highest NPV compared to the baseline and represents the lowest-cost option. Based on the outcome of the CBA, the proposed option is to split the 5 primary group and reconfigure into 2x3 primary groups. The summary of the cost benefit analysis is presented in Table 6-1. The full detailed CBA is provided within 'ED2-LRE-SPM-007-CV3-CBA - SPM 11kV Network Group Fault Level Mitigation.'

Table 6-1: Summary of Cost Benefit Analysis

Options	Decision	Comment	NPVs based on payback periods from 2023/24 (£m)			
			10 years	20 years	30 years	45 years
Baseline – Replace the primary transformers with higher impedance units.	Rejected	Rejected as the solution is not cost efficient. The fault level headroom uplift is low compared to the proposed option and increases the losses in the group.	-	-	-	-
Option I - Group split and reconfiguration	Adopted		0.37	0.47	0.54	0.58

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 £1.309m.

Table 6-2: Summary of reinforcement Costs and Volumes, £m (2020/21 Prices)

Asset Description	Volumes	RIIO-ED2 Contribution (£m)
33kV UG Cable (Non-Pressurised with 19pr pilot)	1.60	0.441
33kV RMU	1	0.234
33kV Transformer (GM)	1	0.314
Batteries at 33kV Substations	1	0.008
Civil Works at 33 kV & 66 kV Substations	-	0.125
Wayleaves/Easements/Land Purchase	-	0.016
Remote Protection changes and SCADA/RTU	-	0.170
Total Costs		1.309

Table 6-3: Cost incidence over the RIIO-ED2 period, £m (2020/21 Prices)

Investment Category	Total (£m)	2023/24	2024/25	2025/26	2026/27	2027/28
CV3 – Fault Level Reinforcement	1.309	-	0.654	0.655	-	-

6.4 Risks

The current scheme involves establishing a new primary infeed at Ainsworth Lane HV substation and a new 2 x 0.8km long 33kV cable circuits between Palco primary and Kirkby grid substations.

The Ainsworth Lane HV substation ideally suited for the new primary infeed as there is enough space to accommodate a new primary transformer (see Figure 5.3), does not require major civil works. Also, the HV substation is equipped with a spare HV CB, so does not require extension of the existing HV switchboard, overall requiring minimum works at this substation.

The overall risk associated with delivering the scheme is expected to be quite low based on above reasons and also due the fact these are BaU activities in general.

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 driver for this investment is the existing fault level in the HV group and lack of fault level headroom to the future customer connections.

6.6.2 Payback Periods

The CBA indicates that a positive NPV result in all assessment periods (10, 20, 30 & 45 years) which are consistent with the lifetime of the intervention. Consumers benefit from reduced network risk immediately on completion of the project, as well increased fault level headroom will facilitate additional generation capacity in the groups.

6.6.3 Sensitivity to Future Pathways

The network capacity and capability that result from the proposed option has been tested against and has been found to be 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 SPENs DSO vision and future energy strategy.

For the Kelco – News International – Palco – Southdene 11kV group, 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.

Table 6.4: Electric Vehicle and Heat Pump uptakes across a range of future pathways

End of RIIO-ED2	SPEN	DFES			CCC				
	Baseline	System Transformation*	Consumer Transformation	Leading the Way	Balanced Net Zero	Headwinds	Widespread Engagement	Widespread Innovation	Tailwinds
EVs	258	190	328	370	373	258	405	405	370
HPs#	-	-	-	-	-	-	-	-	-

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

There is no HP uptake in the group, as the customer base is industrial / commercial type.

Table 6.5: Sensitivity of the proposed solution against future pathways

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

R¹ – Reinforcement (New primary infeed and group split)

The proposed solution is robust across all pathways. As this is the minimum requirement to mitigate the fault levels in the group, it is not sensitive to the future pathways and is expected that proposed solution is required under all the future pathways. In all cases this solution is expected to endure beyond RIIO-ED3.

Table 6.6: Sensitivity of the proposed RIIO-ED2 expenditure

	Baseline	Uncertain
RIIO-ED2 Expenditure (£m)	£1.309m	N/A
Comment	Proposed option	

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 License 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.

The proposed solution involves adding a new primary transformer at Ainsworth Lane primary substation. Due to the load sharing between the primary transformers and as well as reinforcing the 11kV circuit sections will reduce the network losses in the group.

6.6.6 Whole Systems Benefits

Whole system benefits have been considered as part of this proposal as the recommended solution enables to defer additional reinforcement into R110-ED3 price control period. The capacity and capability of the preferred option is consistent with the provision of whole system solutions.

6.7 Sustainability and Environmental Considerations

The project will take account of sustainability initiatives that are relevant to this site and reflect wider licenced business sustainable development objectives set out in the Environmental Action Plan. The project will avoid environmental impacts where possible and provide mitigation and improvements when required, and all relevant environmental and planning consents will be secured.

6.7.1 Operational and embodied carbon emissions

The Kelco – News Int. – Palco – Southdene Group Fault Level Mitigation programme has the potential to impact on the embodied carbon resulting from the delivery of the programme. The installation of a new primary transformer at Ainsworth Lane primary substation which will result in load sharing between the primary transformers, as well as reinforcing the 11kV circuit sections will reduce the network losses in the group.

The whole-life carbon footprint of the new primary transformer, including both the upfront embodied emissions and the operational emissions from fixed and variable losses, will inform the procurement process.

6.7.2 Supply chain sustainability

For us to take full account of the sustainability impacts associated of the Kelco – News Int. – Palco – Southdene Group Fault Level Mitigation programme, we need access to reliable data from our suppliers. The need for carbon and other sustainability credentials to be provided now forms part of our wider sustainable procurement policy.

6.7.3 Resource use and waste

The Kelco – News Int. – Palco - Southdene Group Fault Level Mitigation programme will result in the consumption of resources and the generation of waste materials from end of life assets.

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 Kelco – News Int. – Palco - Southdene Group Fault Level Mitigation programme will only affect developed sites containing existing assets. Therefore, 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 but recognises that the nature of our substations makes it challenging to minimise their visual impact.

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

The Kelco – News International – Palco – Southdene primary group lies in the Knowsley area in Merseyside and supplied from the upstream Gillmoss – Kirkby – Simonswood 33kV network via 5 x 7.5MVA, 33/11kV primary transformers.

The 11kV group is currently experiencing fault level issues, the fault duties at several HV substations exceeding the design limits of 250MVA/13.12kA under intact operating scenario. Currently, the fault levels in the group are managed operationally, by running the group in a depleted state, i.e., with Palco primary transformer on open-standby and the group is operating with very little (<3%) headroom.

The proposed scheme is aimed to mitigate the existing fault level in the HV group and create fault level headroom by providing a new primary infeed at Ainsworth Lane HV substation and splitting the group in two with 3 primary infeeds each. The estimated cost of the proposed scheme is £1.309m (2020/21 prices), which will be fully funded by SPEN in the RIIO-ED2 period under fault level reinforcement (CV3) category.

The proposed solution is an enduring, represents the lowest cost and is an efficient solution to mitigate the fault level issues when compared with the identified alternative scheme. The fault level headroom (RMS Break duty) will be ca. 25 – 35% in each of the new 11kV groups, the firm capacity will 20MVA each claimed at the end of the project completion.