Title: Kemsley

SPN Regional Development Plan

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Version: 2.0

Date: March 2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.9	12/3/14	Minor	PH	Cover	Title Page: Date change from June 2013 to March 2014
1.9	11/3/14	Major	PH	1	Reinforcement - Rainham 33/11kV Substation ITC updated cost to 19_Feb NAMP 19_Feb
1.9	11/3/14	Major	PH	1	Reinforcement - Faversham 33/11kV 3rd transformer and switchgear change (2012-2014) added. Due to NAMP cost >1M
1.9	11/3/14	Major	PH	1	Reinforcement - Sittingbourne West 33/11kV substation ITC (2012-2014) added. Due to NAMP 19_Feb cost >1M
1.9	11/3/14	Major	PH	1	Asset Replacement – Sittingbourne Grid GT3 replacement. Cost updated to NAMP 19_Feb
1.9	11/3/14	Major	PH	1	Asset Replacement – Eastchurch Prison 6.6kV switchgear replacement, reference removed due to NAMP 19_Feb cost reduced to <1M
1.9	11/3/14	Major	PH	1	Asset Replacement – Minster 6.6kV switchgear replacement, reference removed due to NAMP 19_Feb cost reduced to <1M
1.9	10/3/14	Major	PH	1	Proposed Projects - Replaced Table J NAMP 19_Feb
1.9	10/3/14	Minor	PH	2.1	Aerial photo – Google picture replaced by NetMap picture. Copyright compliance.
1.9	10/3/14	Major	PH	2.3	Table updated to NAMP 19_Feb
1.9	10/3/14	Minor	PH	2.3	Wording changed to say, “Eight projects”, “In addition there are 3 reinforcement projects which are 3707, 3772 and 8103.
1.9	10/3/14	Minor	PH	3.2	Table 7 - HI Profile Primary Transformers - Update Sheerness Replace corresponding chart Primary Transformers
1.9	10/3/14	Minor	PH	3.3	Update LI Profile (without intervention) table 10. (PLE 6 Sep 13)
1.9	10/3/14	Minor	PH	4.2	Remove note 3 – Grovehurst Road. Note refers to correction in ‘next’ issue i.e. this issue. Remove corresponding section of PLE

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Version	Date	Revision Class	Originator	Section Update	Details
					Re-number notes to correct.
1.9	10/3/14	Minor	PH	4.2	Amend note 4 wording – to more closely correspond with ED1 mini-paper for Rainham
1.9	10/3/14	Major	PH	4.4	Cost & phasing table Update to NAMP 19_Feb
1.9	12/3/14	Minor	PH	5.2	Correction to Sheerness Steel 132kV switchgear replacement: "…predicted to become HI4 " not HI5
1.9	12/3/14	Minor	PH	5.3	Correction of HI forecast for Kemsley Grid 132kV circuit breakers
1.9	14/3/14	Minor	PH	5	Remove Sheerness Grid note referring to P2/6 analysis Remove Rolling mills note and PLE table
1.9	12/3/14	Minor	PH	5.4	Remove Leysdown Reinforcement as not in NAMP until ED2. Remove from Contents list. Re-set section numbering
1.9	12/3/14	Minor	PH	6	References table correction and Section re-numbering to sec. 6
2.0	22/3/14	Minor	PH	2.3	Projects in Progress. Re-wording notes on Faversham and Sittingbourne West
2.0	22/3/14	Minor	PH	4.1.1	Switchgear. Re-wording notes on: Eastchurch, Rainham, Minster and Sittingbourne Grid
2.0	22/3/14	Minor	PH	4.1.2	Transformers. Re-wording note on Sittingbourne Grid
2.0	22/3/14	Minor	PH	4.2	Reinforcement. Re-wording notes on: Rainham, Sittingbourne, Leysdown and Sittingbourne North
2.0	22/3/14	Minor	PH	5	Alternatives considered. Re-wording notes on Kemsley 132kV busbars, Sheerness Steel 132kV and switchgear and Kemsley Grid switchgear

Contents

1 Introduction

1.1 Executive Summary

This Development Plan reviews the EHV and HV networks connected to Kemsley GSP point which supplies the north Kent district of Swale, including the major towns of Sittingbourne, Sheerness and Faversham, with a total area of 370 km^2 and population of circa 135,000.

Two supergrid transformers supply the local network which comprises 11 primary substations, two Network Rail supply points and 2 customer substations. The aggregated peak demand is 145MW which is forecast to increase to 154MW by 2023 (Element Energy). There is 132kV and 33kV interconnection to the adjacent Canterbury and Kingsnorth substations respectively. A dedicated spur connected 3rd SGT supplies the redundant Sheerness steel works and Ridham Dock.

Embedded generation in the area includes Grovehurst Paper Mills CHP power plant with a total capacity of 42MVA.

Part of the supply area falls within the Thames Gateway development zone and the Local Development Plan predicts the construction of 9,100 new dwellings during the next 5 years which may require the establishment of a new Sittingbourne North primary substation.

Major uncertainties are the future of Sheerness Steel works which entered receivership in 2012 and the possible 4th London airport 'off shore' to the east of the isle of Sheppey.

Figure 1. Map of Kent, with Swale highlighted

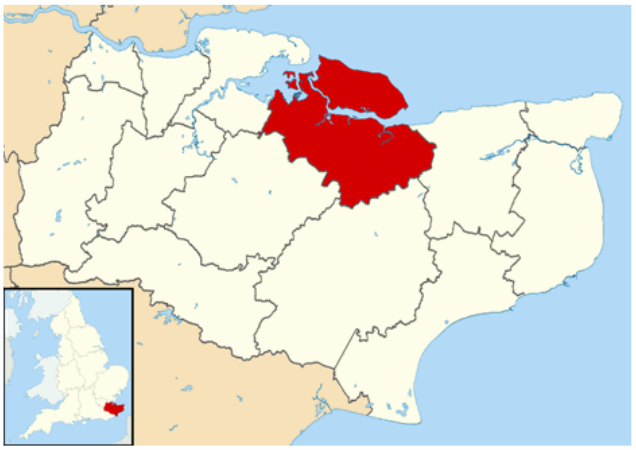

Figure 2. Swale main areas

The ED1 strategy proposal is formulated to ensure continued adherence to Engineering Recommendation P2/6 together with management of load index (LI) and health index (HI) profiles to ensure reliable and secure network performance. Adopting this approach results in no major network reconfigurations with proposed works contained within the boundary of the existing network and substation sites.

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1.2 Proposed projects > £1M

Reinforcement

- Rainham 33/11 kV Substation ITC £1.2M
- Faversham 3rd Transformer and switchgear change (2012-14) £1.1M
- Sittingbourne West 33/11kV Substation ITC (2012-2014) £1.4M

Please note that the load growth forecasted at Kemsley has not been realised. Therefore the project to install the third SGT on the Kemsley's 132kV bar (SGT4) has been deferred to ED2

Asset Replacement

- Sittingbourne Grid – 33kV Switchgear Replacement £1.6M
- Sittingbourne Grid – GT3 Replacement £1.5M
- Rainham 11kV Switchgear Replacement £1.1M

1.3 Costs Profile

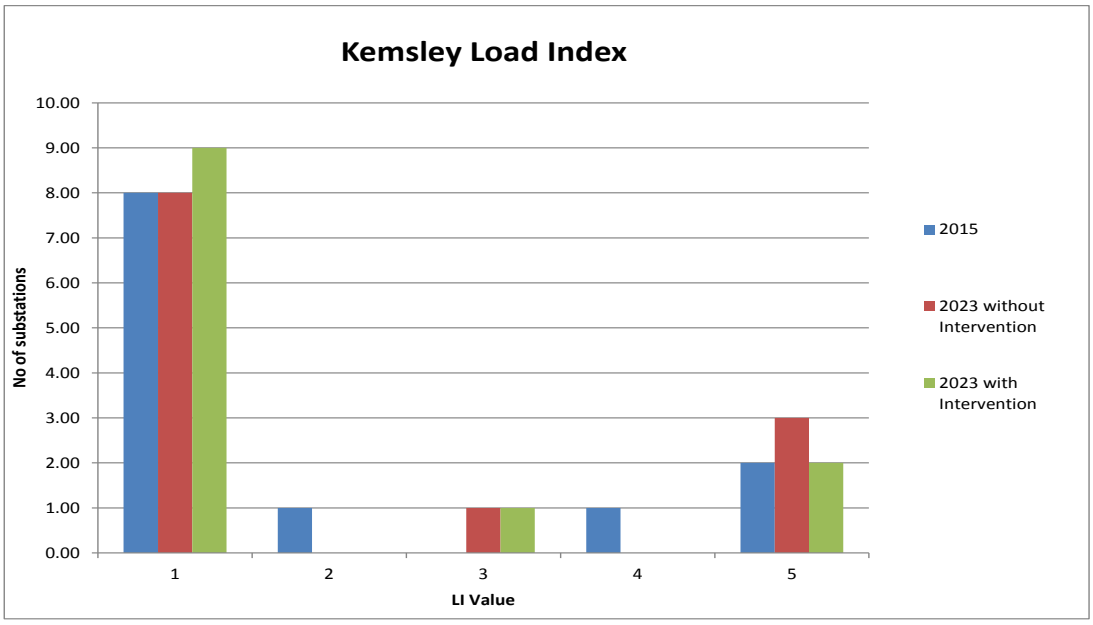
NAMP Table J less Indirect 19th February 2014

Table 1. Total Project Expenditure

Table J Less Ind Baseline 19 Feb 2014 15:15 Official Frozen NAMP													
Cat.	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
A&H	Total Asset Replacement	526	548	812	521	2,395	2,152	0	0	268	634	0	0
R	Total Reinforcement	1,932	1,685	119	0	4	15	15	15	15	15	107	980

1.4 Output Measures Load Index

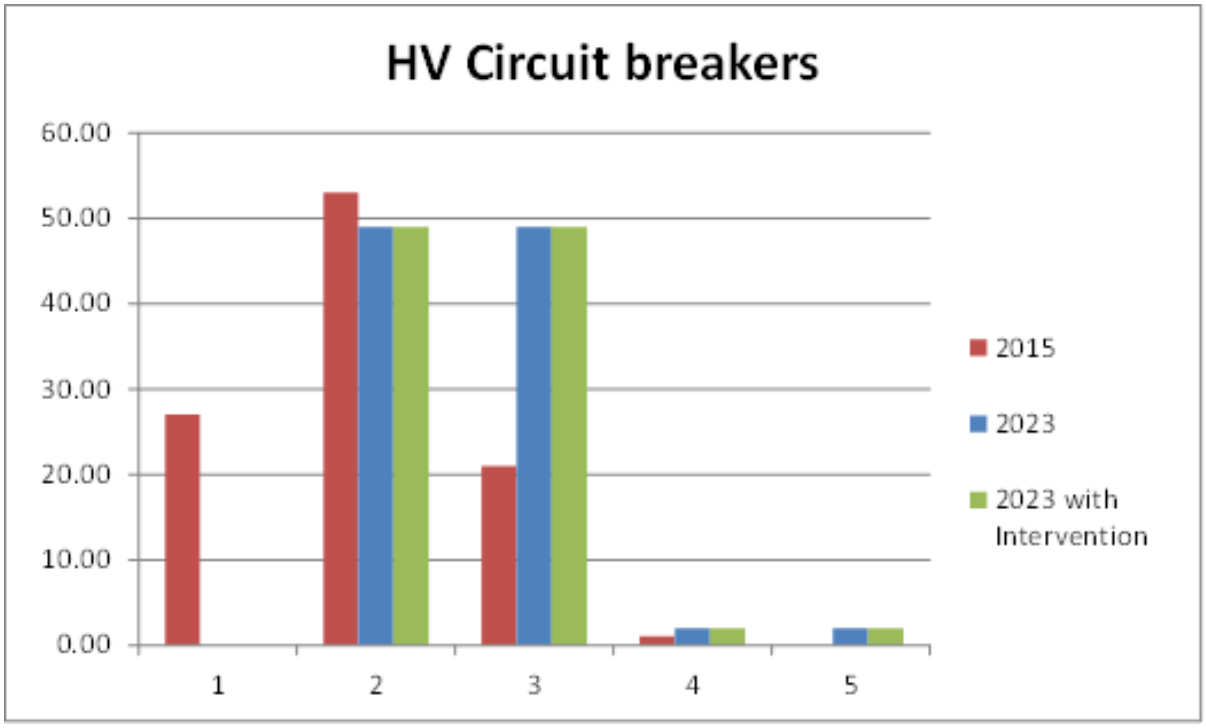
The forecast load indices for 2023, with and without intervention, are detailed below:

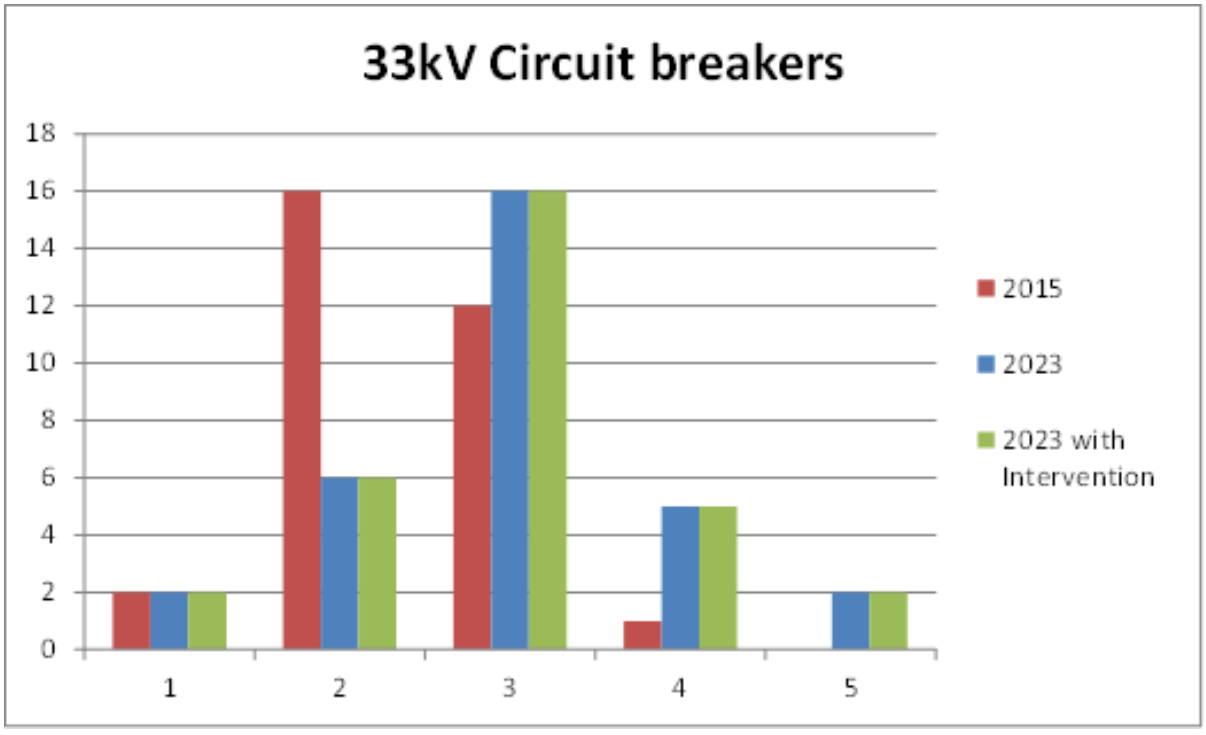


All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

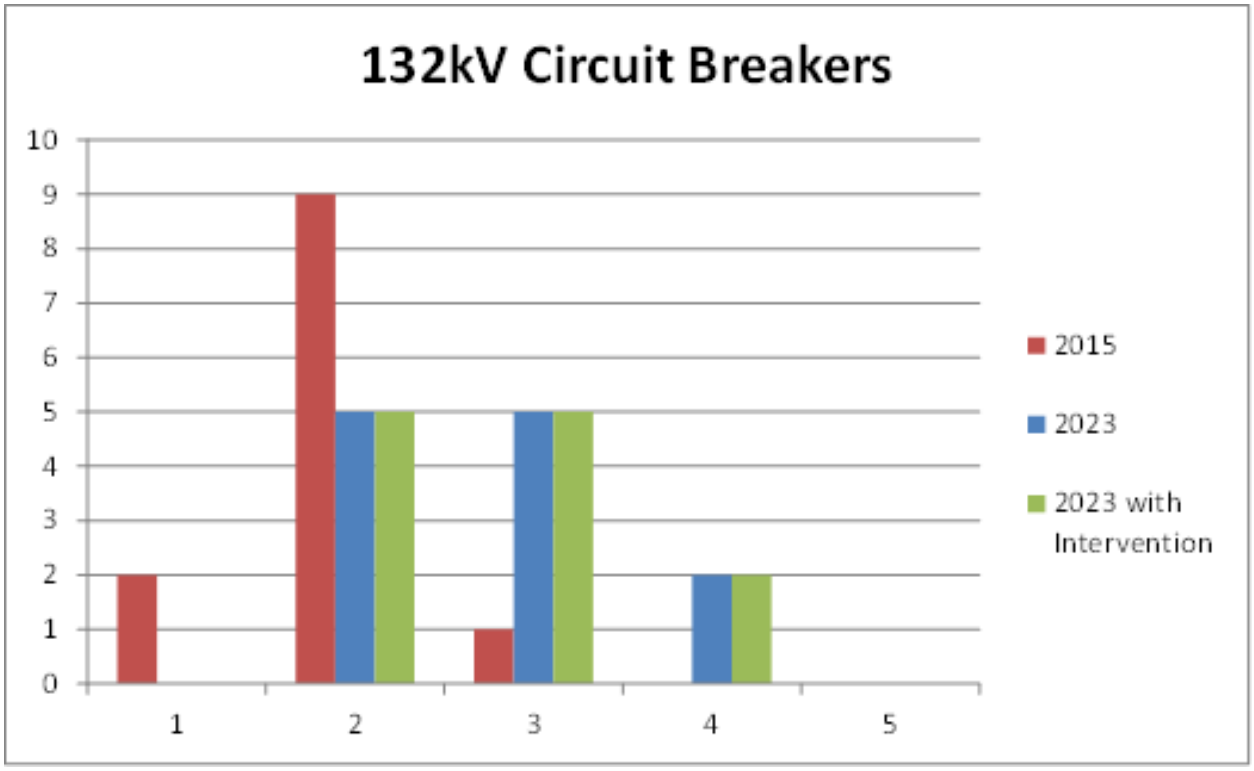
1.5 Output Measures Health Index

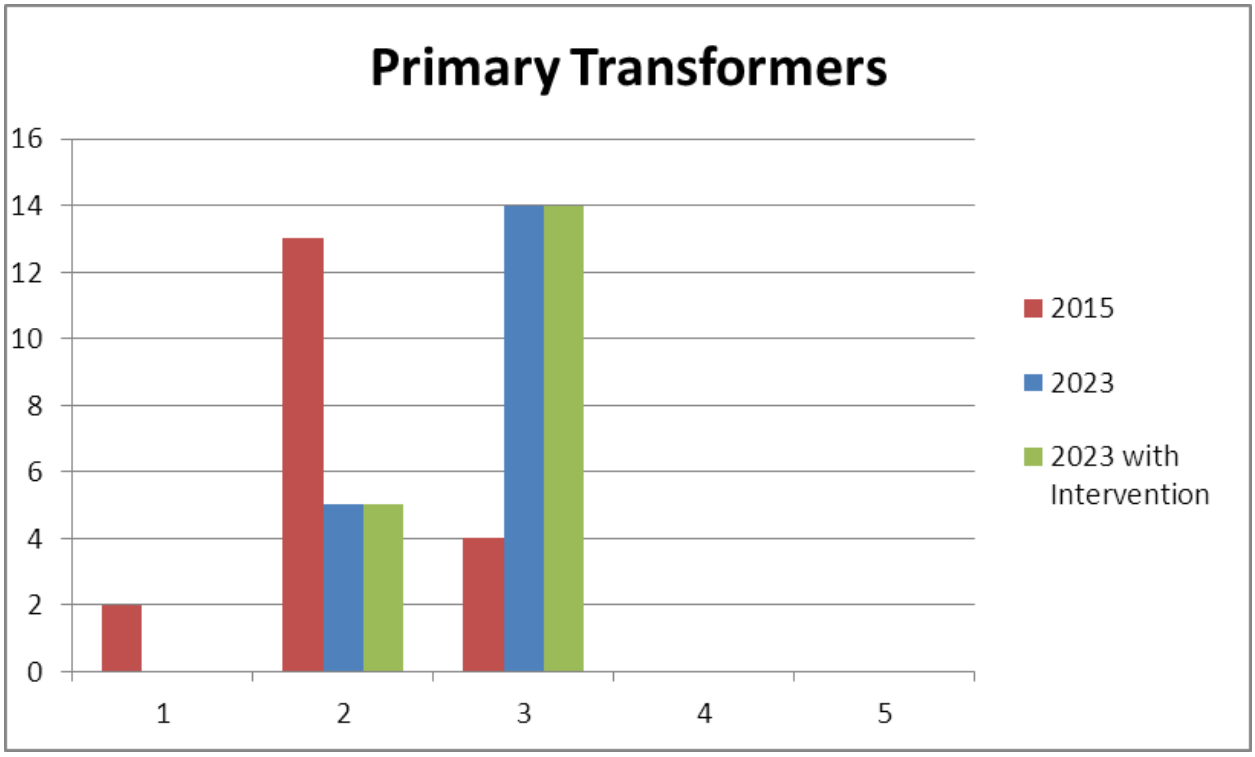
The forecast health indices for 2023, with and without intervention, for each plant category are detailed below:



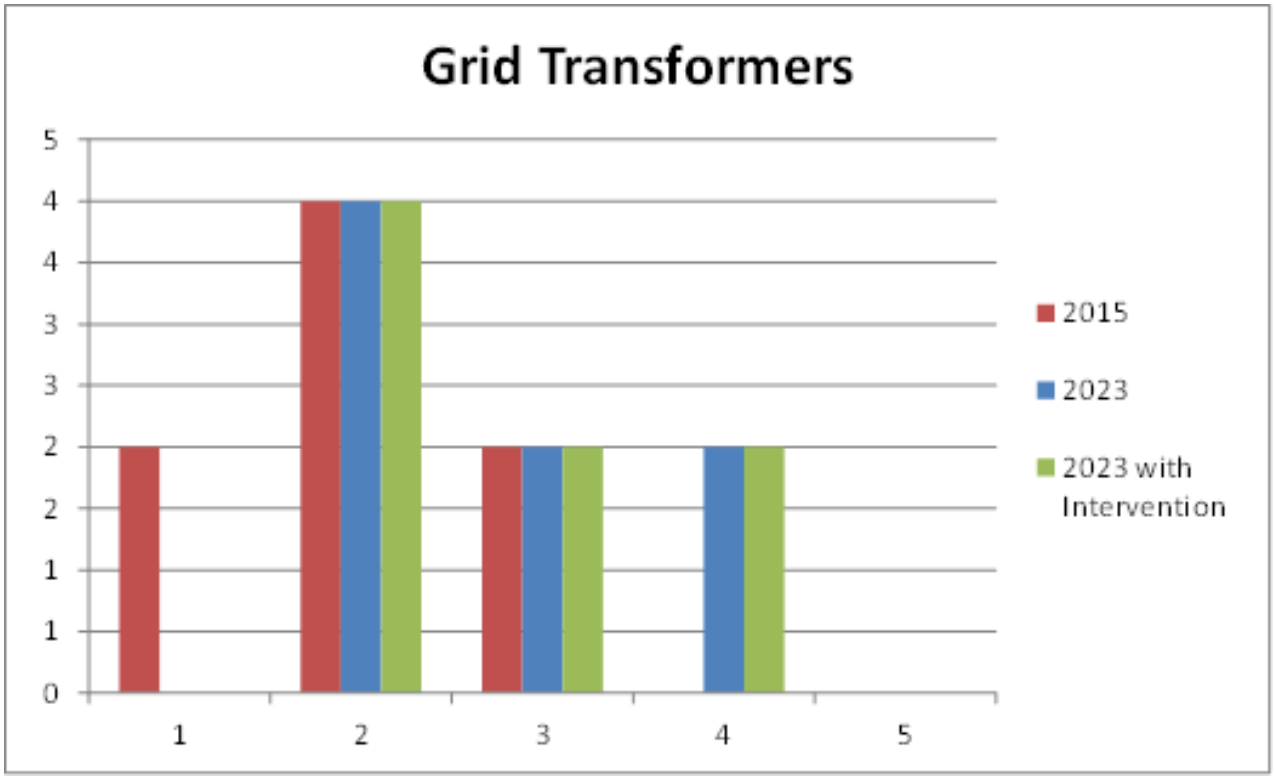


All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.





All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.



1.6 Principal Risks and Dependencies

The timing of most of these projects is dependent on load growth and on-going condition assessment of the plant. In particular, the future load of Sheerness Steelwork will significantly affect the configuration of our network.

Additional risks and dependencies include the rise of embedded generation on our network and changes to the network occurring in the areas bordering Kemsley's network.

2 Network Configuration

2.1 Existing Network

This Development Plan reviews the SPN EHV and HV network supplied from Kemsley 400/132kV Grid Supply Point which supplies the Swale District of north-east of Kent including Sittingbourne, Faversham (mainland) and Sheerness and Queenborough on the Isle of Sheppey.

Geographic and network diagrams are attached in Appendix A & B

Figure 3. Kemsley GSP Site Map

Kemsley Grid Supply Point (GSP)

Kemsley 132kV substation is supplied by 2 x 240MVA super grid transformers (SGT's). Sheerness Steel and Ridham Dock are supplied independently from a 3rd SGT

The GSP 132kV substation connects to:

Sheerness Grid 33kV, 2x45MVA 132/33kV

The connection is via a double circuit overhead line Route PD. The site has a firm capacity of 56.2MW in winter and 41.4MW in summer. Primary substations fed from Sheerness Grid include Sheerness (6.6kV), Queenborough (6.6kV), Minster (6.6kV) and Eastchurch Prison (6.6kV).

Grovehurst, 2x90MVA 132/33kV

The connection is via the Kemsley-Grovehurst Energy 132kV overhead line (route PWM). The site has a firm capacity of 95MW in winter and 90MW in summer and is connected to the local embedded generation from Grovehurst CHP power plant. The only Primary substation fed from Grovehurst Energy 33kV is Grovehurst Local primary (33/11kV).

Sittingbourne Grid 132kV 4 Switch Mesh & Grid Substation 1x45 MVA and 2x60/90 MVA

The connection is via Kemsley-Sittingbourne 132kV double circuit overhead line (Route PSK). Primary substations supplied from Sittingbourne Grid include Rainham (33/11 kV), Sittingbourne Town (33/11kV), Sittingbourne West (33/11kV), Faversham (33/11kV) and Leysdown (6.6kV).

Sheerness Steelworks (Route PKB & PRE) overhead lines and cable section

Sheerness Steelworks and Ridham Docks are both supplied by a dedicated 132kV circuit from third super grid transformer at Kemsley (SGT3). Sheerness Steelworks is an arc furnace while Ridham Dock is primarily a car crushing plant and both are classified as dirty load (i.e non-linear load) which is why they are supplied by the dedicated SGT3 at Kemsley.

Table 2. Grid and Primary Substations

Substation & Voltage
Kemsley 132kV
Grovehurst 132/33kV
Grovehurst Local 11kV
Grovehurst Energy 33kV
Sheerness Grid 132/33kV
Minster T2 6.6kV
Queenborough (Network Rail) 33kV
Queenborough 6.6kV
Sheerness 33/6.6kV
Eastchurch Prison T2 6.6kV
Sittingbourne Grid 132/33kV
Eastchurch Prison T1 6.6kV
Faversham 11kV
Leysdown 6.6kV
Rainham 11kV
Sittingbourne Grid (Network Rail) 33kV
Sittingbourne North 11kV
Sittingbourne Town 11kV
Sittingbourne West 11kV
Minster T1 6.6kV

Notes:

The supply area contains a significant proportion of 6.6kV distribution network.

Eastchurch Prison and Minster are both 2 transformer primary substations with one transformer at each site supplied from Sheerness and the other from Sittingbourne (SLD Appendix A refers). To avoid parallel connection via the 6.6kV network the site is run split with security of supply maintained by a bus section auto close scheme.

33kV interconnection to the adjacent Kingsnorth GSP is available via Rainham.

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132kV interconnection to Canterbury GSP is available via Sittingbourne 132kV mesh substation.

2.2 Embedded Generation

The total installed capacity of G59/2 embedded generation under this RDP is 95.7MVA. Table 2 provides an overview of the contributing schemes.

Grovehurst Energy is the principal contributor with a maximum export of 42MW as part of their paper mill steam production facility.

Adjacent to Grovehurst Energy, there is a proposal by a developer to install a plant which will burn pre-treated waste comprising solid recovered fuel waste, commercial and industrial waste and municipal waste at Kemsley Marsh. Depending on the calorific yield of the fuel, the power generation capability from this plant will be approximately 48.5MWe net.

Table 3. Embedded Generation

Site Name	Type	Mode of Operation	Installed DG (MW)	No. of Generators	Operating Voltage (kV)	Substation Name	Grid Group	GSP/BSP
WASTE WATER TREATMENT WORKS	Diesel	LONG TERM PARALLEL	1.600	1	11.000	Rainham 11kV	Sittingbourne Grid	Kemsley SGT1 & 2
THANET NURSERIES	CHP	LONG TERM PARALLEL	10.000	1	11.000	Faversham 11kV	Sittingbourne Grid	Kemsley SGT1 & 2
SAINSBURY'S SUPERSTORE	PV	LONG TERM PARALLEL	0.170	1	11.000	Sittingbourne West 11kV	Sittingbourne Grid	Kemsley SGT1 & 3
GROVEHURST ENERGY LTD	CHP	LONG TERM PARALLEL	84.000	1	33.000	Grovehurst 33kV	Grovehurst Grid	Kemsley SGT1 & 4

2.3 Projects in Progress

There are currently eight live projects which are detailed in Table 3.

Table 4. Projects in Progress

Table J Less Baseline Final ED1 Re-submission 19th February 2014 15:15						
Cat.	**GWP**	**Ref.**	**Description**	**2013/14**	**2014/15**	**2015/16**
A	1.20	1.20.09.8545	Sheerness Grid 132kV Asbestos Removal	42	0	0
A	1.26	1.26.10.5289	BT21CN Mitigation - Kemsley/Grovehurst	201	226	0
A	1.26	1.26.10.5291	BT21CN Mitigation - Kemsley/Sheerness	58	0	0
A	1.26	1.26.10.5434	BT21CN Mitigation - Maidstone/Ashford/Canterbury North	225	0	0
A	1.50	1.50.01.7840	Rainham - Replace 11kV Switchgear	0	323	812
R	1.33	1.33.01.3707	Faversham 33/11kV Reinforcement – Third 12/24 MVA Transformer and Switchgear Change	692	418	0
R	1.33	1.33.01.3772	Sittingbourne West 33/11kV Reinforcement - Third 12/24 MVA Unit & 33kV OHL Circuit	888	521	0
R	1.33	1.33.01.8103	Rainham 33kV/11kV Reinforcement - 3rd 12/24MVA Transformer, 33kV RMU	352	746	119

Projects 5289, 5291 & 5434 are BT21 migration works involving installation of optical fibre pilot connections. In addition there are 3 reinforcement projects which are 3707, 3772 and 8103.

3707: Faversham – 3rd 33/11 kV Transformer and Switchgear Change (2012-2014)

Work to install an additional transformer and associated higher rated switchgear is at construction stage, having passed through feasibility and detailed design in the earlier part of DPCR5. Completion of this project will see a third transformer installed and the existing switchboard replaced.

3772: Sittingbourne West 33/11 kV Substation ITC (2013-2014)

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Work to install a third 33/11kV transformer and new 33kV circuit from Sittingbourne Grid using an existing redundant 33kV overhead line is at construction stage. On completion, this site will be operated within firm capacity and will provide additional support to adjacent primary substations including Sittingbourne Town.

3 Network Development Considerations

3.1 Development areas

The Structure Plan housing target for Swale from 2001 to 2016 is 9,100 new dwellings, which equates to 606 new dwellings per year during the plan period. This target has been divided between the planning areas as follows:

- Thames Gateway Planning Area – 8,100 new dwellings;
- Faversham and Rest of Swale Planning Area - 1,000 new dwellings.
- Queenborough and Rushenden Regeneration – proposed new dwellings and regeneration of area with plans yet to be confirmed

Power supply enhancement to support the above planning has been ensured through projects 3707 (Faversham 3rd transformer and Switchgear Change) and 3065 (Sittingbourne North – New Substation). In addition there are proposals for a wind turbine manufacturing facility in located at the Port of Sheerness.

(http://maps.swale.gov.uk/LocalPlans/LP_document/section_253182312823.html)

Sheerness Steel Works (Isle of Sheppey)

Originally owned by Canadian-based Co-Steel, the steel works were sold to ASW Holdings Ltd of Cardiff in 1998 and taken over by Thamesteel in 2003.

The steelworks utilises an electric arc furnace to recycle scrap metal into coils and rods for use in reinforced concrete with a capacity to process 180,000 tons per annum. Much of the scrap originated from Mayer Parry Recycling of Erith and was transported down the Thames.

The works entered receivership in January 2012 and was bought by the Saudi based Al-Tuwairqi Group (ATG) in June 2012. Despite the change of ownership the plant remains shutdown with no publicised plans to reopen.

The future of the site either as a steel works, other factory or property development is likely to have a significant impact on the Isle of Sheppey demand. At present UKPN is actively monitoring developments with the steelworks. If it does re-open continues to run the arc furnace to the registered demand, then the non-firm connection to the works will continue provide electricity from Kemseley. However, if the plant re-opens with reduced clean load (e.g. if the use of the plant is significantly changed or there is a change of use for the site), there are options which will be considered which include re-configuring the running arrangement of super grid infeeds from the existing 3 SGTs at Kemsley.

4th London Airport

The Isle of Sheppey is the closest landing point should a 4th London airport be developed in the Thames Estuary. Public consultation may be initiated during ED1 with possible requirement for temporary building supplies (TBS) to evaluate the off shore construction options. If plans to construct the 4th London airport in the Thames Estuary materialise, then Kemsley could be developed as the nearest transmission connection point and Canterbury North as the alternative source.

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3.2 Asset Health

It should be noted that HIs presented in the RDP will not align with the RIGS. HIs presented in the RDP are the outcome of our ARP model on an asset by asset basis. Different rules are applied for the RIGs reporting, as agreed with Ofgem, where assets may be grouped and all assets in the group take the same HI.

The forecast health indices 2015 – 2023 without intervention are detailed overleaf:

Table 5. HI Profile 11kV & 6.6kV Circuit Breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
EASTCHURCH PRISON 33/6.6KV		8						8		
FAVERSHAM 33/11KV		11						11		
GROVEHURST LOCAL 33/11KV	2	7					9			
LEYSDOWN 33/6.6KV		4					4			
MINSTER 33/6.6KV		6		1				6		1
QUEENBOROUGH 33/6.6KV	1	12					11	2		
RAINHAM		4	9					10	2	1
RIDHAM DOCK 132 KV		1					1			
SHEERNESS 33/6.6KV	12						12			
SITTINGBOURNE TOWN 33/11KV	12						12			
SITTINGBOURNE WEST 33/11KV		12						12		

Table 6. HI Profile 33kV Circuit Breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
GROVEHURST GRID 132 KV		2					2			
GROVEHURST LOCAL 33/11KV		2						2		
QUEENBOROUGH SW STN 33KV		1					1			
SHEERNESS GRID		7					2	5		
SHEERNESS GRID 132 KV		2					1	1		
SITTINGBOURNE GRID	2	2	9	1		2		5	5	2
SITTINGBOURNE GRID 132 KV			3					3		

Table 7. HI Profile 132kV Circuit Breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
KEMSLEY GRID 132 KV		7					1	5	1	
SHEERNESS STEELWORKS 132 KV			1						1	
SITTINGBOURNE GRID 132 KV	2	2					4			

Table 8. HI Profile Primary Transformers

	2015					2023 with Intervention				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
EASTCHURCH PRISON 33/6.6KV			2					2		
FAVERSHAM 33/11KV		2					1	1		
GROVEHURST LOCAL 33/11KV		2					2			
LEYSDOWN 33/6.6KV		1						1		
MINSTER 33/6.6KV		2						2		

QUEENBOROUGH 33/6.6KV	2	2
RAINHAM	2	2
SHEERNESS 33/6.6KV	2	2
SITTINGBOURNE TOWN 33/11KV	2	2
SITTINGBOURNE WEST 33/11KV	2	2

Table 9. HI Profile Grid Transformers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
GROVEHURST GRID 132 KV		2					2			
RIDHAM DOCK 132 KV			1						1	
SHEERNESS GRID 132 KV		2						2		
SITTINGBOURNE GRID 132 KV	2		1				2		1	

3.3 Security of Supply and Load Index Analysis

The table below shows the result of the P2/6 analysis conducted on substations supplied from Kemsley.

Table 10. P2/6 Assessment Table

Kemsley

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Sub-station	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	Winter 12/13 Summer 2012 (MW)	Winter 13/14 Summer 2013 (MW)	Winter 14/15 Summer 2014 (MW)	Winter 15/16 Summer 2015 (MW)	Winter 16/17 Summer 2016 (MW)	Winter 17/18 Summer 2017 (MW)	Winter 18/19 Summer 2018 (MW)	Winter 19/20 Summer 2019 (MW)	Winter 20/21 Summer 2020 (MW)	Winter 21/22 Summer 2021 (MW)	Winter 22/23 Summer 2022 (MW)
Kemsley SGT 3A	NO	400kV	0.00	0.00	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18	4.18
Kemsley SGT 3A	NO	400kV	0.00	0.00	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56
Ridham Dock	YES	6.6kV	19.20	0.00	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Ridham Dock	YES	6.6kV	19.20	0.00	3.74	3.74	3.74	3.74	3.74	3.74	3.74	3.74	3.74	3.74	3.74
Sheerness Arc Furnace	YES	132kV	230.40	0.00	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Sheerness Arc Furnace	YES	132kV	230.40	0.00	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56	75.56
Eastchurch Prison T1	YES	6.6kV	4.80	0.00	2.59	2.59	2.61	2.63	2.65	2.66	2.66	2.67	2.68	2.69	2.71
Eastchurch Prison T1	YES	6.6kV	3.50	0.00	181	181	183	184	185	186	186	187	187	188	189
Eastchurch Prison T2	YES	6.6kV	4.80	0.00	2.62	2.62	2.64	2.66	2.68	2.68	2.69	2.70	2.70	2.72	2.74
Eastchurch Prison T2	YES	6.6kV	3.50	0.00	2.81	2.82	2.84	2.86	2.88	2.88	2.89	2.90	2.90	2.92	2.94
Eastchurch Prison Total	YES	6.6kV	9.30	0.00	5.03	5.04	5.08	5.12	5.16	5.17	5.18	5.19	5.21	5.24	5.27
Eastchurch Prison Total	YES	6.6kV	6.98	0.00	4.47	4.48	4.51	4.55	4.58	4.59	4.60	4.61	4.62	4.65	4.68
Faversham	YES	11kV	20.40	2.30	18.45	18.44	18.59	18.77	18.95	18.95	18.97	18.99	19.01	19.18	19.36
Faversham	YES	11kV	15.87	2.02	12.03	12.02	12.12	12.23	12.34	12.34	12.35	12.36	12.38	12.48	12.59
Grovehurst	YES	33kV	95.04	0.00	50.84	51.12	51.98	52.89	53.68	53.80	53.94	54.09	54.26	54.75	55.24
Grovehurst	YES	33kV	90.00	0.00	66.87	67.25	68.39	69.61	70.67	70.83	71.02	71.22	71.45	72.10	72.76
Grovehurst Energy	YES	33kV	76.80	0.00	45.09	45.09	45.09	45.09	45.09	45.09	45.09	45.09	45.09	45.09	45.09
Grovehurst Energy	YES	33kV	76.80	0.00	56.10	56.10	56.10	56.10	56.10	56.10	56.10	56.10	56.10	56.10	56.10
Grovehurst Local	YES	11kV	23.54	0.00	14.87	14.96	15.23	15.51	15.76	15.80	15.84	15.89	15.94	16.09	16.25
Grovehurst Local	YES	11kV	17.46	0.00	12.29	12.36	12.57	12.80	13.00	13.03	13.06	13.10	13.15	13.27	13.39
Kemsley SGT1 & 2	YES	132kV	276.50	0.00	142.33	142.50	143.66	145.01	146.27	146.51	146.82	148.24	149.69	151.99	154.29
Kemsley SGT1 & 2	YES	132kV	244.20	0.00	148.01	148.27	149.64	151.19	152.61	152.85	153.16	154.61	156.09	158.36	160.63
Leysdown	YES	6.6kV	1.80	1.81	148	149	152	155	157	158	159	160	161	163	166
Leysdown	YES	6.6kV	2.20	2.17	167	168	170	174	176	177	178	179	180	183	186
Minster T1	YES	6.6kV	6.60	0.00	3.37	3.37	3.39	3.42	3.45	3.46	3.48	3.50	3.51	3.56	3.61
Minster T1	YES	6.6kV	5.23	0.00	2.05	2.04	2.06	2.08	2.10	2.10	2.11	2.12	2.13	2.16	2.19
Minster T2	YES	6.6kV	6.60	0.00	4.21	4.21	4.23	4.26	4.30	4.31	4.32	4.34	4.36	4.41	4.46
Minster T2	YES	6.6kV	5.23	0.00	2.45	2.45	2.47	2.48	2.50	2.51	2.52	2.53	2.54	2.57	2.59
Minster Total	YES	6.6kV	13.17	0.00	7.58	7.58	7.62	7.69	7.75	7.78	7.81	7.84	7.88	7.98	8.08
Minster Total	YES	6.6kV	10.47	0.00	4.50	4.49	4.52	4.56	4.60	4.61	4.63	4.65	4.67	4.73	4.79
Queenborough	YES	6.6kV	20.60	0.00	9.43	9.47	9.60	9.74	9.86	9.88	9.90	9.92	9.95	10.02	10.09
Queenborough	YES	6.6kV	15.53	0.00	10.42	10.47	10.61	10.76	10.89	10.91	10.93	10.96	10.99	11.06	11.14
Queenborough RT	NO	kV	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Queenborough RT	NO	kV	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Rainham	YES	11kV	21.34	7.47	24.14	24.07	24.05	24.07	24.12	24.16	24.20	24.25	24.30	24.50	24.69
Rainham	YES	11kV	17.10	4.53	16.58	16.51	16.49	16.51	16.54	16.56	16.59	16.62	16.66	16.79	16.92
Rolling Mills 1&2	NO	33kV	0.00	0.00	175	175	175	175	175	175	175	175	175	175	175
Rolling Mills 1&2	NO	33kV	0.00	0.00	16.52	16.52	16.52	16.52	16.52	16.52	16.52	16.52	16.52	16.52	16.52
Sheerness 33/6.6kV	YES	6.6kV	15.40	2.22	10.48	10.55	10.74	10.94	11.13	11.16	11.20	11.24	11.29	11.41	11.54
Sheerness 33/6.6kV	YES	6.6kV	13.40	2.02	9.80	9.86	10.03	10.21	10.37	10.41	10.44	10.48	10.52	10.63	10.74
Sheerness Grid	YES	33kV	56.16	0.00	27.34	27.44	27.78	28.14	28.47	28.54	28.61	28.70	28.78	29.03	29.27
Sheerness Grid	YES	33kV	41.40	0.00	37.67	37.77	38.07	38.40	38.70	38.75	38.82	38.89	38.97	39.17	39.38
Sittingbourne 132kV	NO	132kV	0.00	0.00	96.54	96.40	96.63	97.01	97.45	97.56	97.72	99.23	100.75	102.85	104.93
Sittingbourne 132kV	NO	132kV	0.00	0.00	66.79	66.65	66.80	67.04	67.33	67.40	67.51	68.91	70.32	72.10	73.86
Sittingbourne Grid	NO	33kV	96.60	0.00	96.54	96.40	96.63	97.01	97.45	97.56	97.72	99.23	100.75	102.85	104.93
Sittingbourne Grid	YES	33kV	96.60	0.00	66.79	66.65	66.80	67.04	67.33	67.40	67.51	68.91	70.32	72.10	73.86
Sittingbourne Grid RT	YES	33kV	15.36	0.00	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56	9.56
Sittingbourne Grid RT	YES	33kV	15.36	0.00	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57
Sittingbourne North	YES	11kV	36.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	2.76	4.14	5.52
Sittingbourne North	YES	11kV	28.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	2.76	4.14	5.52
Sittingbourne Town	YES	11kV	24.50	0.00	17.23	17.22	17.26	17.32	17.39	17.41	17.44	17.48	17.51	17.63	17.75
Sittingbourne Town	YES	11kV	22.70	0.00	11.62	11.60	11.63	11.67	11.72	11.73	11.75	11.78	11.80	11.88	11.96
Sittingbourne West	YES	11kV	22.30	7.98	22.87	22.81	22.81	22.86	22.93	22.97	23.01	23.06	23.12	23.33	23.53
Sittingbourne West	YES	11kV	16.22	9.81	16.38	16.32	16.32	16.35	16.40	16.43	16.46	16.49	16.53	16.67	16.81

Key

Compliant with P2/6

Approaching limit of P2/6 compliance

Table 11. LI Profile (Without Intervention)

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Substation	Voltage kV	Load Index	
		2015	2023
Grovehurst 132/33kV			
Grovehurst Local	11	1	1
Sheerness Grid 132/33kV	33	1	1
Minster T2	6.6	1	1
Queenborough	6.6	1	1
Sheerness	6.6	1	1
Eastchurch Prison T2	6.6	1	1
Sittingbourne Grid 132/33kV	33	4	5
Eastchurch Prison T1	6.6	1	1
Faversham	11	4	5
Leysdown	6.6	5	5
Rainham	11	5	5
Sittingbourne Town	11	1	1
Sittingbourne West	11	5	5
Minster T1	6.6	1	1

3.4 Operational and technical restrictions

No restrictions have been identified.

3.5 National Grid

National Grid is proposing to install a circuit breaker and busbar selector isolators to SGT3 at Kemsley 400kV. This will allow the transformer to be selected to either main or reserve bar thereby increasing the operational flexibility of the site and remove outage planning constraints on this transformer.

3.6 Network constraints

None identified.

4 Recommended strategy

The network strategy is formulated to ensure:

- Continued adherence to the security of supply criteria defined in Engineering Recommendation P2/6
- A stable load index (LI) profile over the ED1 period subject to Element Energy growth assumption and Imperial College Model core 3 assumptions
- Maintaining reliable network operation by selective asset replacement, or refurbishment of poorly performing equipment identified through asset condition monitoring (HI) techniques

Adopting this approach results in modest network reconfigurations with proposed works contained within the boundary of the existing network and substation sites.

The proposals are summarised below:

4.1 Asset Replacement

4.1.1 Switchgear

Based on the health index (HI) analysis, asset replacement is proposed at the following sites:

Eastchurch Prison 6.6kV switchgear Replacement (Project 7812): It is proposed to asset replace the complete 8 panel single busbar switchboard.

Rainham 11kV Switchgear Replacement (Project 7840): It is proposed to asset replace the switchboard as a combined project with the transformers reinforcement scheme 1.33.01.8103.

Minster 33/6.6 kV – Replace 6.6kV Switchgear (Project 7831): It is proposed to replace the switchgear to comply with the health assets standards.

Sittingbourne Grid 132/33 kV - Replace 33kV circuit breakers (Project 7811): It is proposed to replace the 17 panel switchboard. The site works are to be coordinated with the asset replacement of T3 under project 1.50.01.7906

4.1.2 Transformers

In total 2 grid transformer are predicted to become HI4 during the review period. One transformer is at Ridham Dock and the other is at Sittingbourne Grid.

Sittingbourne Grid 132/33kV (T3): Asset replacement of T3 (1.51.01.7906) is harmonised with the reinforcement requirement by installing a 60/90MVA unit which matches the rating of the other 2 transformers.

4.1.3 Circuits

Route PG 7.9km 132kV double circuit OHL Refurbishment (Project 4112): It is proposed to refurbishment the OHL including conductors, fixtures and fittings within the review period.

Sittingbourne Grid T3 132kV cable replacement (Project 7971):. To achieve efficient outage planning and project management the work is to be harmonised with the T3 combined asset replacement & ITC project 7906.

4.2 Reinforcement

The following sites are identified in this RDP as reinforcement projects to improve network reliability and resilience:

1. Faversham 11kV: Installation of a 3rd 33/11kV transformer is currently work in progress under scheme 1.33.01.3707, Section 2.3 refers.

2. Sheerness 33/11kV-This marginal growth site has been identified as a candidate site for 1MVA DSR from 2017 to 2023 to defer plant reinforcement.

3. Rainham 33/11kV It is proposed to reinforce the substation by harmonising two projects i) Asset replacement and addition of new section of the 11kV switchboard and (project 7840). ii) Installation of a 3rd 24 MVA transformer (project 8103).

5. Sittingbourne Grid 33kV: Reinforcement of substation harmonised with asset replacement of 45MVA transformer with a 60/90MVA unit, matching the other two existing transformers.

6. Sittingbourne West 11kV: Reinforcement of the site is schedule in DRCR5 under scheme 1.33.01.3772, Section 2.3 refers.

7. Leysdown 6.6kV: Reinforcement of substation harmonised with asset replacement of 5MVA transformer and installation of 2 x 7.5MVA units.

8. Sittingbourne North – New Primary Substation (Project 3065): Thames Gateway development area, North Kent, has an estimated maximum new demand of circa of 40MVA. The substation would be customer funded with a potential contribution required from UK Power Networks if any capacity headroom is incorporated into the existing network.

4.3 Summary of Proposed interventions

Table 12. Intervention Summary (Winter firm capacities quoted)

Substation	Driver	Commissioning Year	Scope of Works	Existing Firm Capacity	New Firm Capacity
Faversham	Load Related Reinforcement	2014	Add new transformer 24MVA	20MVA	41MVA
Sittingbourne West	Load Related Reinforcement	2014	Add new transformer 24MVA	23MVA	46MVA
Leysdown	Load Related Reinforcement	2026	Increase transformer capacity	1.9MVA	7MVA
PG 132 kV OHL	Asset Replacement	2017	Refurbish OHL Conductor	-	-
Rainham 33/11kV	Asset Replacement	2018	11kV Switchgear Replacement	22MVA	22MVA
Sittingbourne Grid 33kV	Asset Replacement	2017	Switchgear Replacement	100MVA	114MVA
Rainham 33/11 kV	Reinforcement	2018	Add new transformer 24MVA	22MVA	48MVA
Eastchurch Prison	Asset Replacement	2019	6.6kV Switchgear Replacement	9MVA	15MVA

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Sheerness 33/6.6 kV	Reinforcement	2017	1MVA DSR	16MVA	17MVA
Sittingbourne Grid	Asset Replacement	2020	GT3 replacement	100MVA	114MVA
Minster 33/6.6kV	Asset Replacement	2023	6.6kV Switchgear Replacement	14 MVA	14MVA
Sittingbourne Grid	Asset Replacement	2024	Cable Replacement	100MVA	114MVA

4.4 Costs and phasing

Table 13. NAMP Extract – 19th February 2014 Table J Less Indirects

Cat	GWP	Ref	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A	1.20	1.20.09.8545	Sheerness Grid 132kV Asbestos Removal	42	0	0	0	0	0	0	0	0	0
A	1.26	1.26.10.5289	BT21CN Mitigation - Kemsley/Grovehurst	201	226	0	0	0	0	0	0	0	0
A	1.26	1.26.10.5291	BT21CN Mitigation - Kemsley/Sheerness	58	0	0	21	191	0	0	0	0	0
A	1.26	1.26.10.5434	BT21CN Mitigation -	225	0	0	65	588	0	0	0	0	0
A	1.48	1.48.11.7811	Sittingbourne Grid - Replace 33kV Switchgear	0	0	0	435	1,198	0	0	0	0	0
A	1.50	1.50.01.7812	Eastchurch Prison 33/6.6kV - Replace 6.6kV	0	0	0	0	225	556	0	0	0	0
A	1.50	1.50.01.7831	Minster 33/6.6kV - Replace 6.6kV Switchgear	0	0	0	0	0	0	0	0	221	543
A	1.50	1.50.01.7840	Rainham - Replace 11kV Switchgear	0	323	812	0	0	0	0	0	0	0
A	1.51	1.51.01.7906	Sittingbourne Grid 132kV - Replace Grid Transformer	0	0	0	0	78	1,408	0	0	0	0
A	1.51	1.51.11.7900	Rainham Mark 33/11kV - Refurbish Primary	0	0	0	0	114	188	0	0	0	0
R	1.33	1.33.01.3707	Faversham 33/11kV Reinforcement – Third 12/24 MVA Transformer and Switchgear Change	692	418	0	0	0	0	0	0	0	0
R	1.33	1.33.01.3772	Sittingbourne West 33/11kV Reinforcement - Third	888	521	0	0	0	0	0	0	0	0
R	1.33	1.33.01.8100	Eastchurch Prison 33kV/6.6kV - ITC	0	0	0	0	0	0	0	0	0	0
R	1.33	1.33.01.8102	Leysdown 33/6.6kV Reinforcement	0	0	0	0	0	0	0	0	0	0
R	1.33	1.33.01.8103	Rainham 33kV/11kV Reinforcement - 3rd 12/24MVA	352	746	119	0	0	0	0	0	0	0
R	1.33	1.33.01.8104	Sheerness Primary Demand Side Response	0	0	0	0	4	15	15	15	15	15
H	1.29	1.29.02.7971	Sittingbourne Grid T3-3 - 132kV Fluid Filled Cable	0	0	0	0	0	0	0	0	47	92
T	3.33	3.33.07.3065	Sittingbourne North - New Primary	0	0	0	0	8	33	25	0	0	0
Grand Total				2,459	2,233	931	521	2,407	2,201	40	15	283	649

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

4.5 HI / LI Profile Post Intervention

Table 14. 6.6kV &11kV Circuit Breakers

	2015					2023 with Intervention				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
EASTCHURCH PRISON 33/6.6KV		8				8				
FAVERSHAM 33/11KV		11						11		
GROVEHURST LOCAL 33/11KV	2	7					9			
LEYSDOWN 33/6.6KV		4					4			
MINSTER 33/6.6KV		6		1		7				
QUEENBOROUGH 33/6.6KV	1	12					11	2		
RAINHAM		4	9			13				
RIDHAM DOCK 132 KV		1					1			
SHEERNESS 33/6.6KV	12						12			
SITTINGBOURNE TOWN 33/11KV	12						12			
SITTINGBOURNE WEST 33/11KV		12						12		

Table 15. HI Profile 33kV Circuit Breakers

	2015					2023 with Intervention				
Substation	**No. HI1**	**No.HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
GROVEHURST GRID 132 KV		2					2			
GROVEHURST LOCAL 33/11KV		2						2		
QUEENBOROUGH SW STN 33KV		1					1			
SHEERNESS GRID		7					2	5		
SHEERNESS GRID 132 KV		2					1	1		
SITTINGBOURNE GRID	2	2	9	1		14		5	5	2
SITTINGBOURNE GRID 132 KV			3			3				

Table 16. 132kV Circuit Breakers

	2015					2023 with Intervention				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
KEMSLEY GRID 132 KV		7					1	5	1	
SHEERNESS STEELWORKS 132 KV			1						1	
SITTINGBOURNE GRID 132 KV	2	2					4			

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Table 17. Primary Transformers

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
EASTCHURCH PRISON 33/6.6KV			2					2		
FAVERSHAM 33/11KV		2					1	1		
GROVEHURST LOCAL 33/11KV		2					2			
LEYSDOWN 33/6.6KV		1						1		
MINSTER 33/6.6KV		2						2		
QUEENBOROUGH 33/6.6KV		2						2		
RAINHAM		2					2			
SHEERNESS 33/6.6KV			2					2		
SITTINGBOURNE TOWN 33/11KV	2						2			
SITTINGBOURNE WEST 33/11KV		2						2		

Table 18. HI Profile Grid transformers

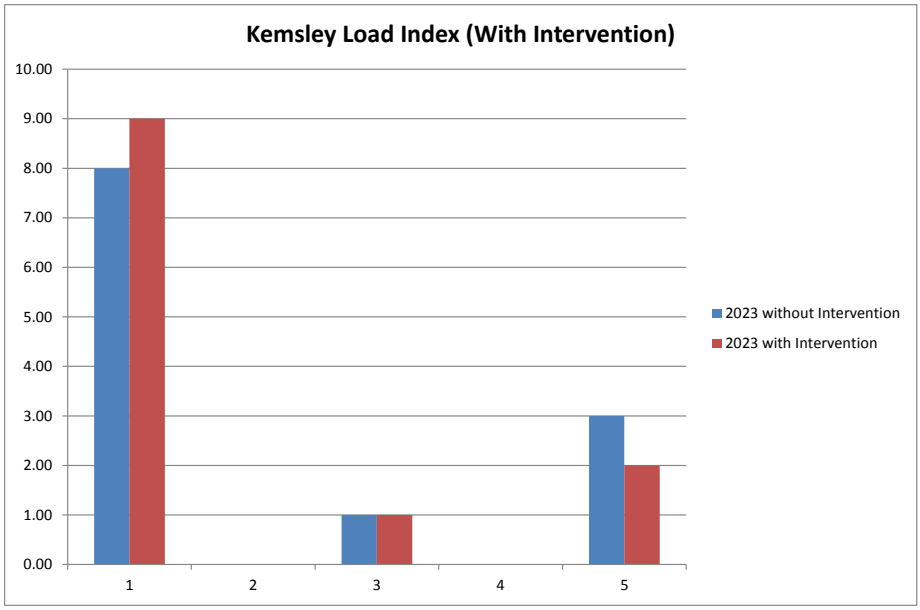
Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
GROVEHURST GRID 132 KV		2					2			
RIDHAM DOCK 132 KV			1						1	
SHEERNESS GRID 132 KV		2						2		
SITTINGBOURNE GRID 132 KV	2		1			1	2			

Table 19. Load Indices Post Intervention (Assumes Load Related Reinforcement only)

LI Profile (With Intervention)

Substation	Voltage kV	Load Index	
		2015	2023
Grovehurst 132/33kV			
Grovehurst Local	11	1	1
Sheerness Grid 132/33kV	33	2	3
Minster T2	6.6	1	1
Queenborough	6.6	1	1
Sheerness	6.6	1	1
Eastchurch Prison T2	6.6	1	1
Sittingbourne Grid 132/33kV	33	5	5
Eastchurch Prison T1	6.6	1	1
Faversham	11	1	1
Leysdown	6.6	5	5
Rainham	11	5	1
Sittingbourne Town	11	1	1
Sittingbourne West	11	1	1
Minster T1	6.6	1	1

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.



5 Alternatives considered

Kemsley 132kV Busbar Reconfiguration

Incorporation of the existing Sheerness Steel/Ridham Dock dedicated SGT3 in to the 132kV system network by extending the 132kV busbar and switchgear to establish a 3 SGT substation. The advantages would be the increased security and flexible outage management.

This option has been deferred to ED2 on financial criteria and the uncertainty of the future Sheerness Steel works.

Sheerness Steel 132kV Switchgear Asset Replacement

The UK Power networks owned 132kV circuit breaker supplying Sheerness Steel is predicted to become HI4 during the period. A decision on whether intervention is required is to be postponed until there is greater certainty about the future of the plant with any intervention programmed for early ED2.

Kemsley Grid 132kV Switchgear Asset Replacement

All seven Kemsley 132kV circuit breakers have been assessed as HI2 at the beginning of the period and it is therefore not proposed to undertake intervention during ED1 in favour of regular condition monitoring with provision for replacement or refurbishment in early ED2.

6 References

References	Description
Reference 1	Planning Load Estimates SPN Area 2012 – 2023 (27 February 2013) Element Energy
Reference 2	SPN 132kV System Diagram
Reference 3	SPN LTDS Network Schematics
Reference 4	NAMP SPN Table J less Baseline Final ED1 re-submission 19 Feb 2014

6.1 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	132kV Single Line Diagram – Existing network
Appendix D	Geographical Network Diagram

6.2 Document History

Version	Date of Issue	Author	Details
1.0	Dec 2012	URS Ltd	First Draft
1.2-1.4	Feb-March 13	Chris Winch	Updated and revised
1.5-1.6	11 March 2013	Chris Winch	Final revisions for formal review
1.7	23 June 2013	Tendai Matiringe & Zivanayi Musanhi	Aligned with 5th June NAMP and updated with the PA's 1st review comments
1.8	24 June 2013	Tendai Matiringe & Zivanayi Musanhi	Updated with PA's 2nd review comments
1.9	15 March 2014	Peter Hoche	Updated: NAMP 19 Feb 2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

7 Document sign off

Sign-off of this Mandate certifies that the Sponsor has ratified the above and approval is sought to proceed to the development of the necessary PG&C Gate B documentation.

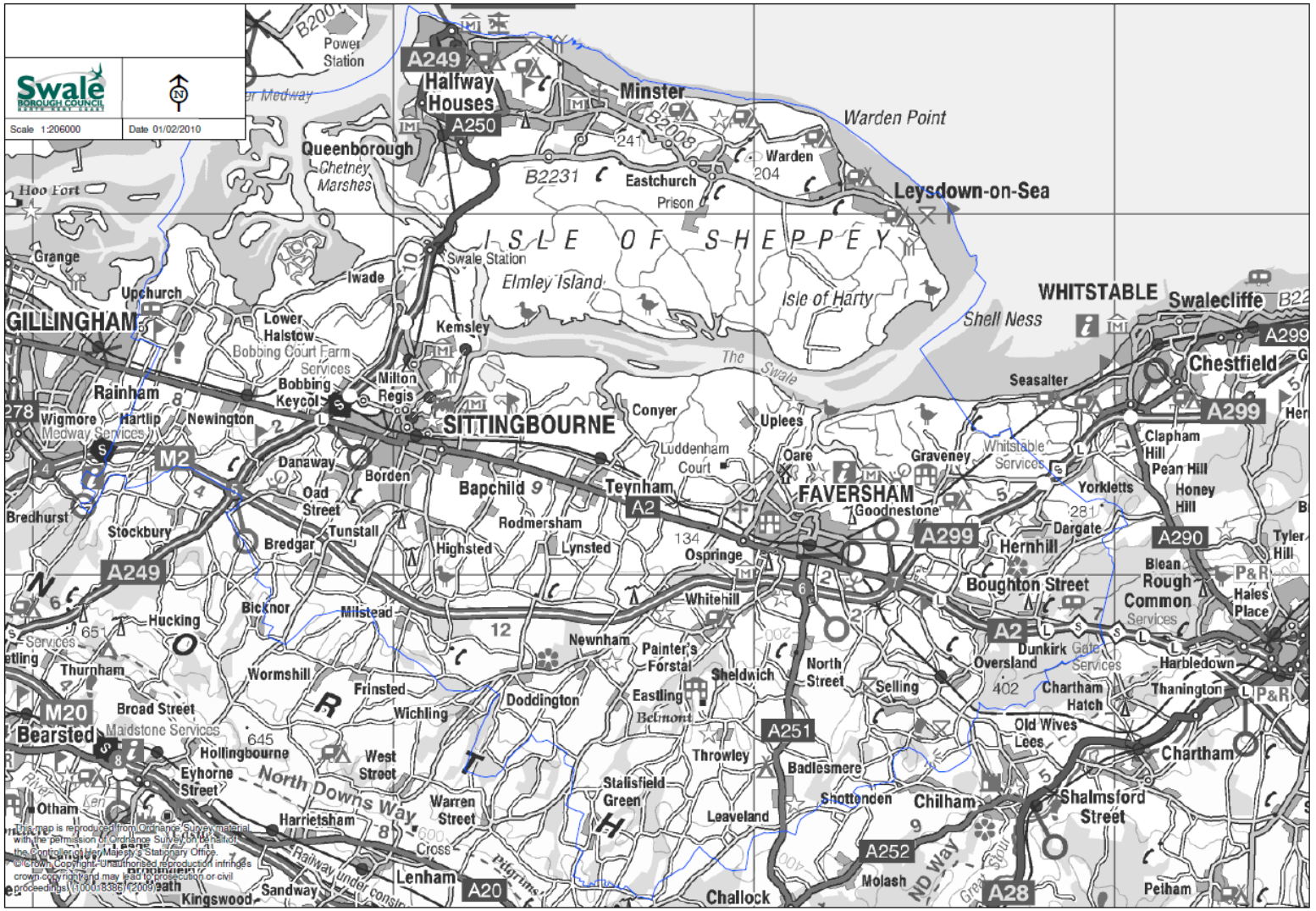
Recommended by:

Name	Role	Signature	Date
Chris Winch	Infrastructure Planner		
Tendai Matiringe	IDP Coordinator SPN		
Chris Winch	Planning Manager South		

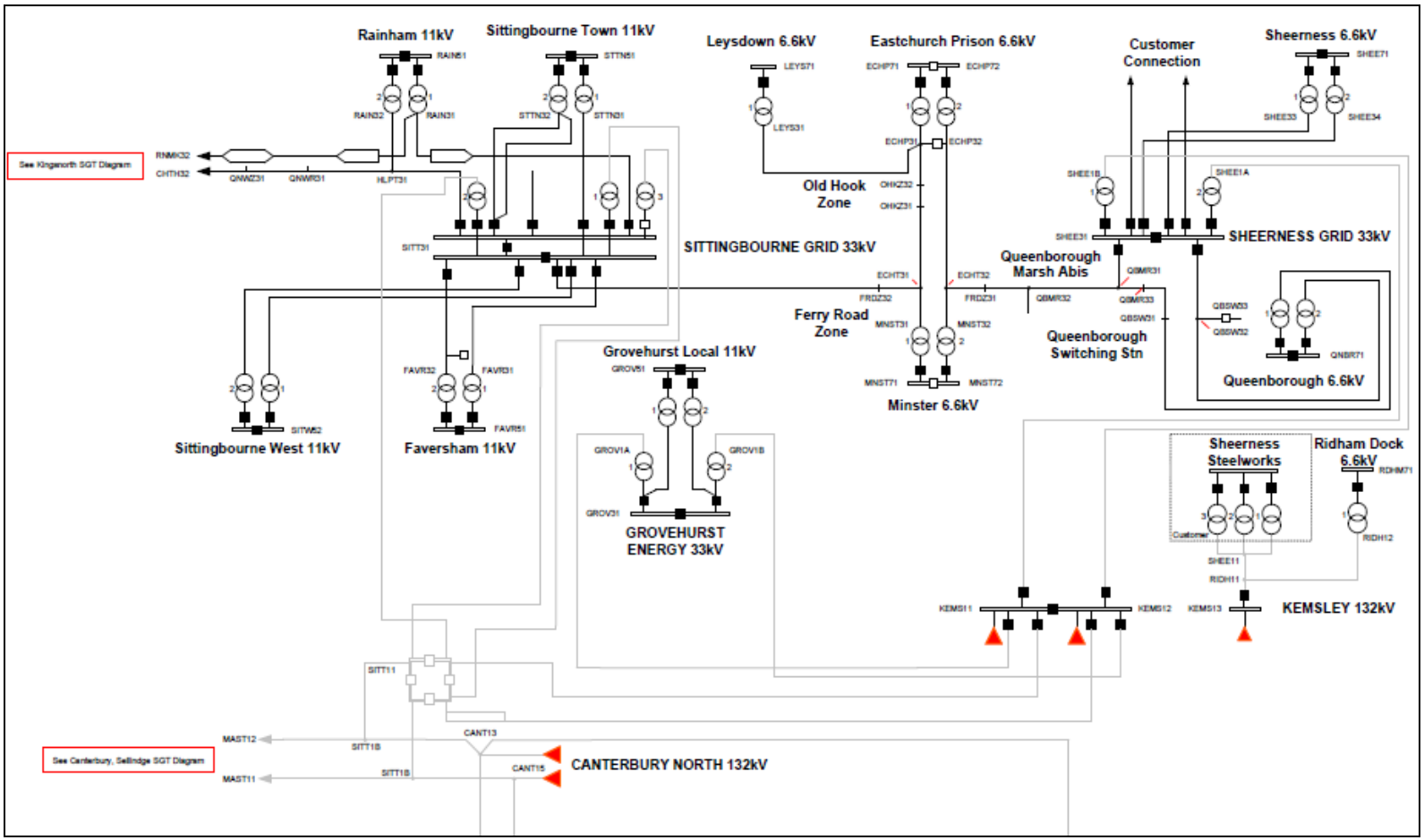
Approval by:

Name	Role	Signature	Date
Robert Kemp	Head of System Development	Robert Kemp	
Barry Hatton	Director of Asset Management		

APPENDIX A: GEOGRAPHICAL DIAGRAM



APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK



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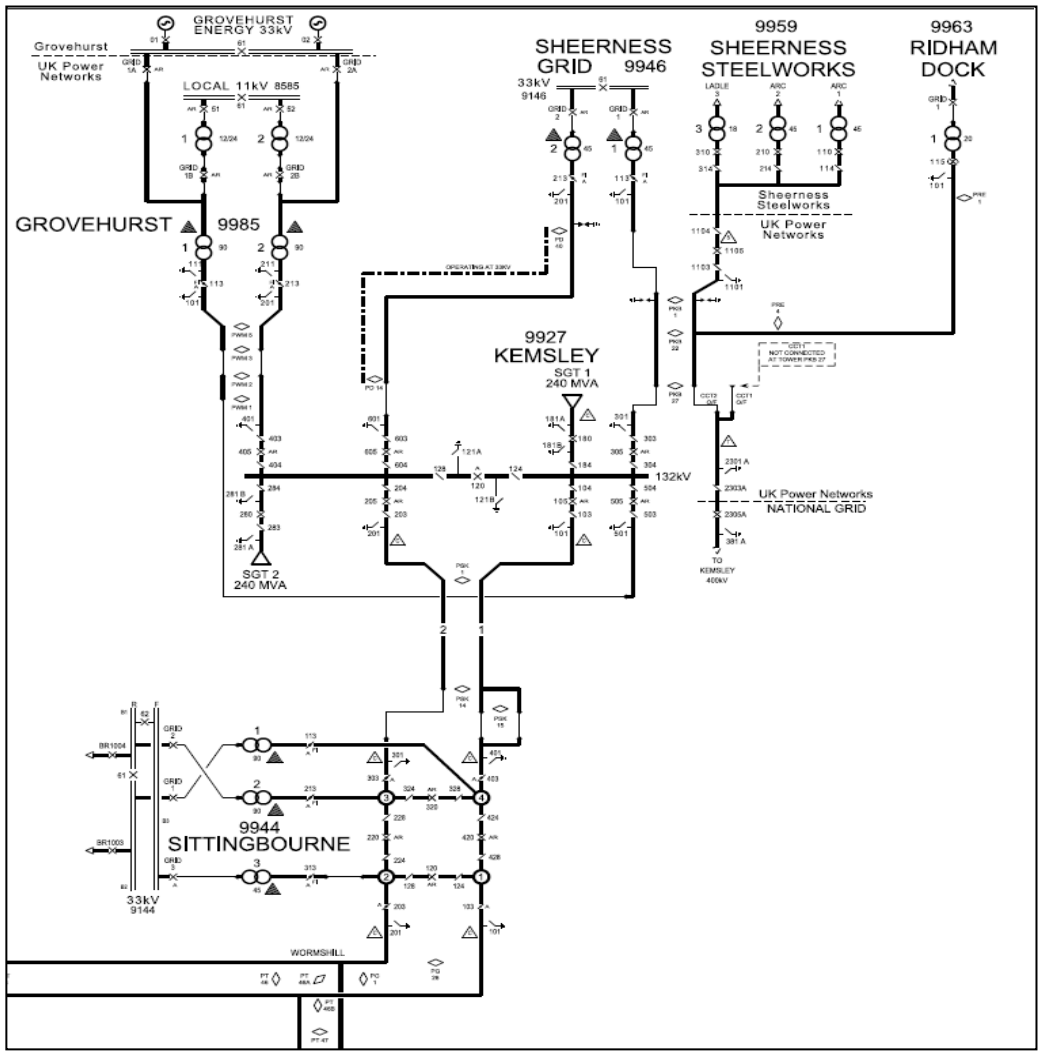
APPENDIX C: 132KV SINGLE LINE DIAGRAM 132KV – EXISTING NETWORK



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APPENDIX D: GEOGRAPHICAL NETWORK DIAGRAM