



Title: Canterbury / Sellindge

SPN Regional Development Plan

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

Document History

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2	09/03/14	Minor	Itayi Utah	1	Updated Wording
2	09/03/14	Major	Itayi Utah	1.1	Updated Costs and removed unwanted projects
2	09/03/14	Major	Itayi Utah	1.2	Replaced Costs profile table 1
2	09/03/14	Major	Itayi Utah	1.3	Replaced LI's table 2
2	09/03/14	Minor	Itayi Utah	2.1	Updated wording
2	09/03/14	Major	Itayi Utah	2.2	Replaced Embedded generation table 5
2	09/03/14	Major	Itayi Utah	2.3	Replaced NAMP table 6 and wording update
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2	09/03/14	Major	Itayi Utah	4.1	Removed unwanted projects and added missing projects
2	09/03/14	Major	Itayi Utah	4.2	Replaced NAMP tables 14 & 15 updates
2	09/03/14	Major	Itayi Utah	5	Removed unwanted strategies
2	09/03/14	Minor	Itayi Utah	6	Updated references
2	09/03/14	Major	Itayi Utah	Appendix C	Replaced recommended strategy diagram

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1 INTRODUCTION

1.1 Executive Summary

This Regional Development Plan (RDP) reviews UK Power Networks (UKPN) SPN HV and EHV network supplied from Canterbury North and Sellindge 400/132kV Grid Supply Points (GSP).

The firm capacity for Canterbury North is 276.5 MW Winter (W) and 244.2 MW Summer (S). Sellindge 132kV substation is split to supply local demand - SGT2&3, with a firm capacity of 276.5 (W)/244.2 (S), and the dedicated Eurotunnel demand SGT5&6, with a firm capacity of 276.5 (W)/244.2 (S). The six Super Grid transformers at both sites are rated 240MVA each.

The system consists of ten Grid substations, supplying a further forty five primary substations. Of these fifty five substations, thirty four contain equipment where the condition is likely to deteriorate to health index 4 or 5 by 2023, and therefore requires intervention to replace assets. Five substations including Canterbury North GSP are due to exceed their firm capacity and will therefore require intervention. In all there are 63 projects proposed in this RDP

Geographically the associated electricity network covers parts of East Kent (including Maidstone the county town of Kent) and expands to the west of Kent which comprises the districts of Ashford, Canterbury, Dover, Shepway and Thanet as well as the greater part of the Kent Coast between Folkestone and Deal.

The county is categorised as a combination of rural and urban areas. There is a link between the National Grid owned Sellindge 400kV and France, which can transfer up to 2000MW of electricity to the continent and vice versa. As part of the UKPN network is run in parallel to the NGC network, through flows on the UKPN 132kV and 33kV network can lead to pre and post fault overloading of the UKPN network. These flows can also affect voltage rise and system fault levels.

To prevent these flows from becoming excessive an inter-trip system has been developed that will break the parallel 132kV paths in the event on a supergrid (400kV) system fault. These criteria add considerably to the complexity of running the SPN network in this location.

Additionally there is a proposal to connect a new European interconnector to Richborough, with the requirement for reinforcement to the network.

The captured installed capacity of embedded generation under this RDP is significant at approximately 503MVA with major contributions of 300MVA from Thanet Wind Farm, 90MVA from Herne bay Wind Farm, 40MVA from Allington waste generation and Thanet Earth 30MVA gas generation. More applications for embedded generation connections on this network have been received, which may result in high reverse power flows through both distribution and grid transformers, which is a cause for concern.

The area is also seeing many new housing developments. In consultation with the regional development plans, drafted by local and country councils it has been proposed that 32,100 new dwellings will be built in the next ten years. Although these will be subject to the usual connection arrangements, it is anticipated that further network reinforcement will be required to sustain this development and the expected increased demand of 81MW, especially to the EHV system.



Figure 1. Kent South East Area

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

1.2 Proposed projects > £1M

• Canterbury Town ITC	£2.5m
• Canterbury South – install voltage compensation	£1.0m
• Canterbury South – 132kV switchgear replacement	£8.8m
• Canterbury South GT2	£1.4m
• Canterbury North – new switching station	£9.1m
• Etchinghill 132kV – new Switching station	£6.8m
• New Sellindge to Ashford 132kV route	£5.5m
• Ashford centre new 33/11kV substation	£3.2m
• Little Chart ITC	£1.0m
• Ramsgate ITC	£1.1m
• Romney Warren 33/11kV Substation ITC	£1.8m
• Sevington – install 3 rd Transformer	£0.7m
• Lightweight Aggregates – relocation	£2.0m
• Canterbury South to Wingham 33kV pole replacement	£1.0m
• Warehorne – replace 11kV switchboard	£1.0m
• Shepway 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA Units	£1.1m
• Shepway 33kV Reinforcement - Install 3rd 3km x 33kV underground cable Circuit from Maidstone Grid	£1.4m
• Warehorne 33kV/11kV - Install T2 as 7.5/15 MVA, add 2x 11kV panels And install 0.5km of 33kV underground cable circuit	£1.0m
• Thanet Local – replace T1 & T2	£1.2m
• Folkestone Morehall Grid – GT1A and GT2A replacement	£2.2m
• PC - Woodnesborough Junction - Etchinghill T- Reinforcement	£2.4m
• Ashford Development Chilmington Green, New Primary Substation	£4.5m
• Dymchurch 33kV/11kV Reinforcement - Replace T1 with 7.5MVA, add T2 and install 8km of 33kV UGC Circuit	£2.6m
• Project Hop, Manston, Thanet - Refunds to the EKSDC	£3.2m
• St Peters 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 Transformers	£1.6m

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1.3 Costs profile

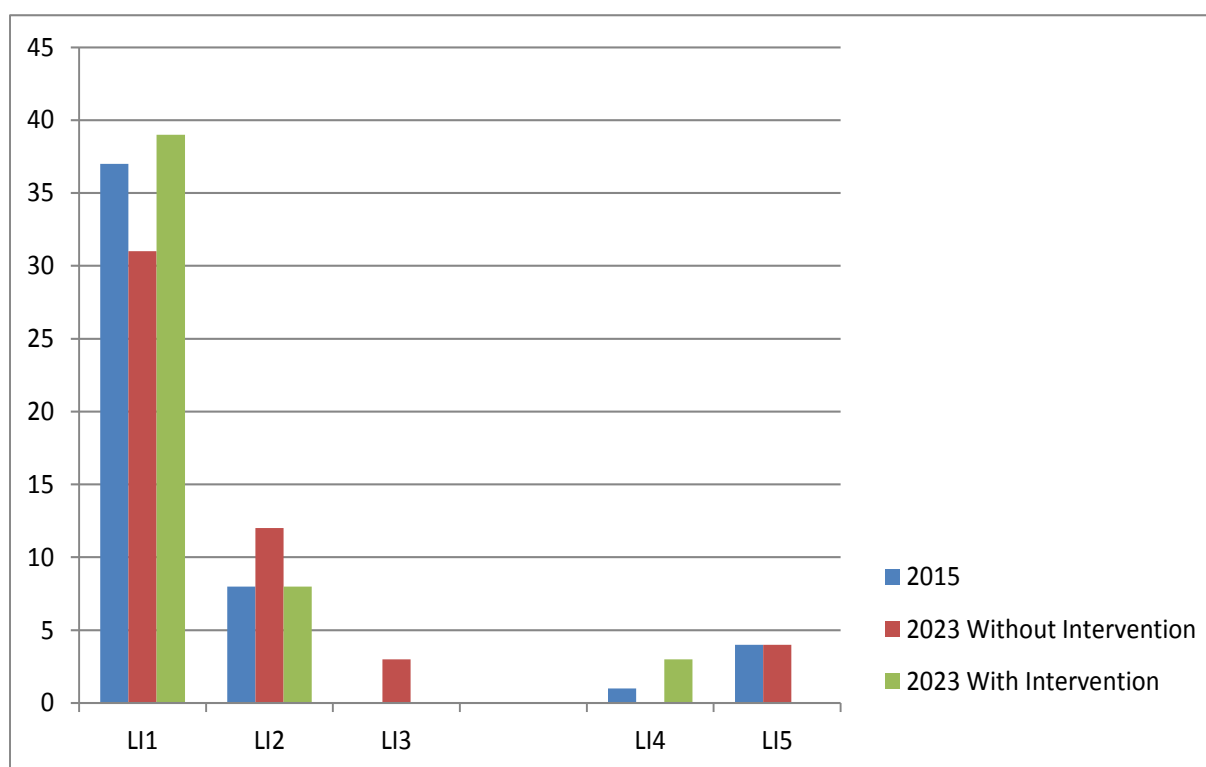
Table. 1 Costs Profile (Thousands of £)

SR _ Table J - S&R - Baseline_Final_RIIO_ED1 Re-Submission_19 th Feb_2014 _15:15 (£)													
Cat	Description	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	DPCR5 Total	ED1Total
A & H	Total Asset Replacement	2,640,212	1,043,200	1,198,351	2,539,147	1,276,338	2,889,554	7,542,548	7,897,214	2,553,327	817,110	3,683,412	26,713,589
Q, R & T	Total Reinforcement	2,707,699	2,599,466	2,964,385	5,274,450	4,951,738	4,525,649	3,031,092	3,306,990	5,695,246	4,344,752	5,307,165	34,094,302
	GRAND TOTAL	5,347,911	3,642,666	4,162,736	7,813,597	6,228,076	7,415,203	10,573,640	11,204,204	8,248,573	5,161,862	8,990,576	60,807,891

1.4 Output Measures – Load Index

Table 2 below provides the expected Load Indices during 2015-2023 for all substations covered in this RDP. Some of the substations with a projected load index of 4 and 5 (LI4 and LI5) will be specifically targeted for reinforcement during RIIO-ED1 and are discussed in this RDP.

Load Indices 2015 - 2023

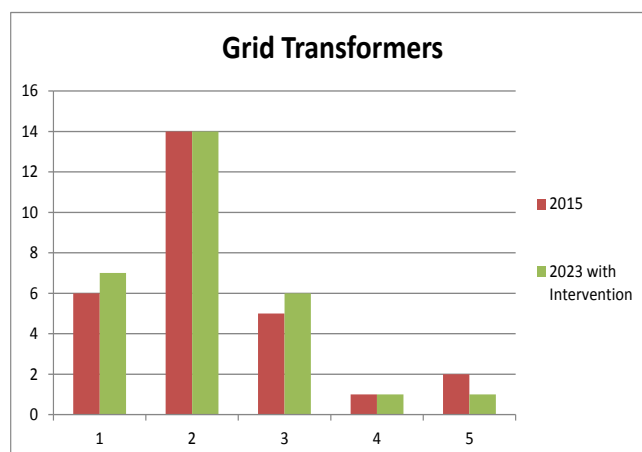
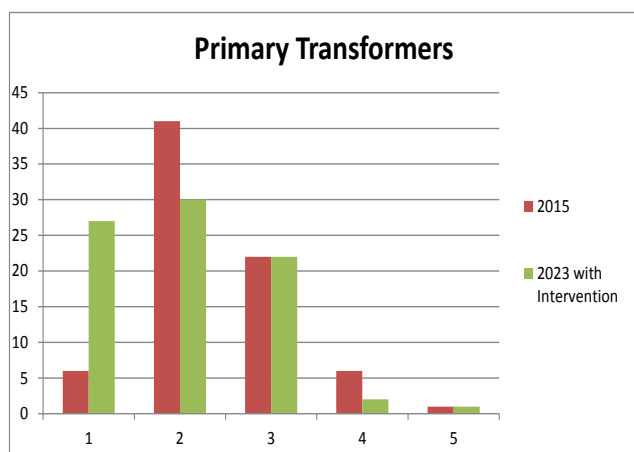
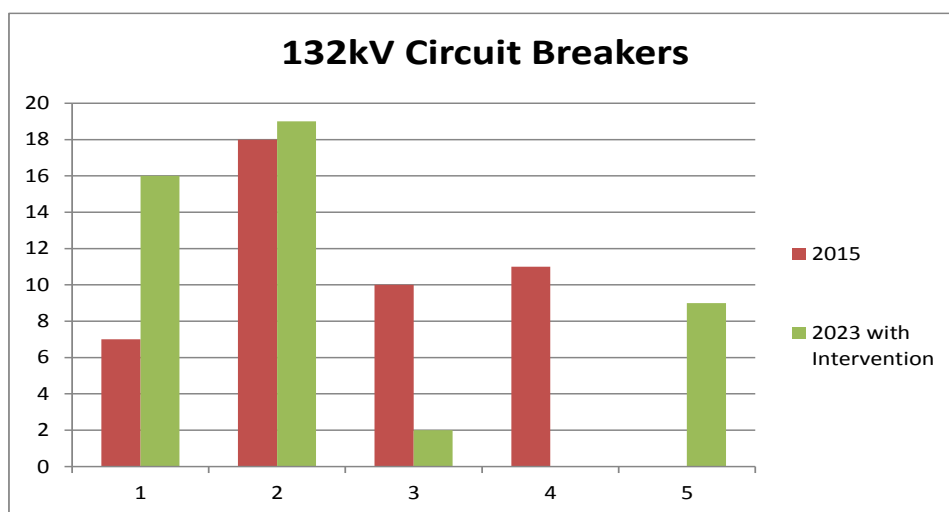
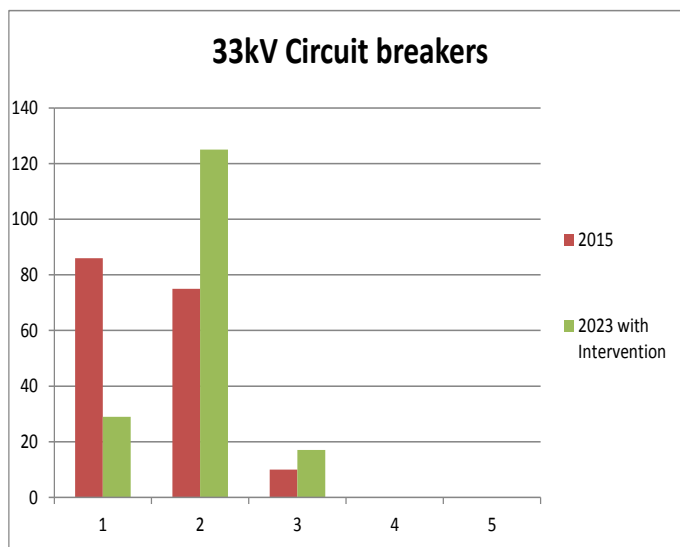
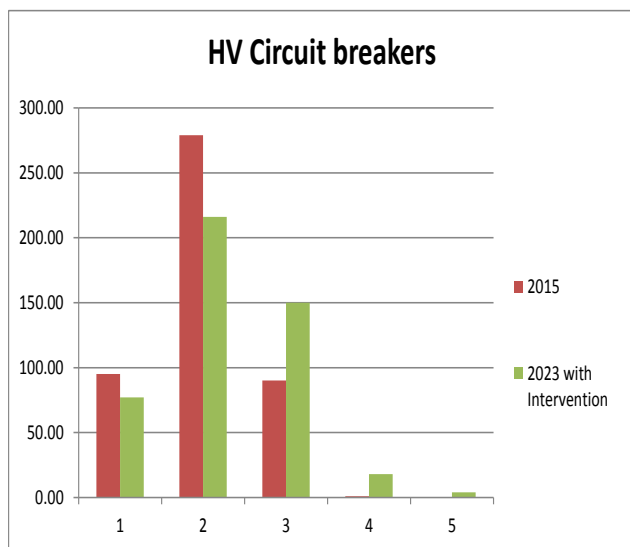


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1.5 Output Measures – Health Index

The graphs below provide the projected health index status of the various asset categories covered in this RDP by 2023.

2024 HI summary graphs by asset class



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LINE SECTION	LEFT CONDUCTOR	LEFT FITTING	RIGHT CONDUCTOR	RIGHT FITTING	EARTH CONDUCTOR	EARTH FITTING	TOWER STEEL	FOUNDATION
PR	4	1	2	3	5	5	5	5
PMA	5	1	4	2	5	5	5	2
PC	4	5	4	5	4	5	5	2
PU	5	5	No data	No data	5	5	5	2
PV	5	5	5	5	5	5	5	5
PY	3	5	3	4	5	5	5	4
PX	5	5	5	3	4	4	5	4
PHA	4	5	5	5	5	5	5	2
PT	3	5	5	5	5	5	5	4
PAA	4	3	4	3	5	5	5	2
PP	1	1	No data	No data	No data	3	5	5
PKC	3	5	2	4	3	4	5	2

Table. 2 132kV OHL Health Indices 2023 (no intervention)

1.6 Principal Risks, Dependencies and Assumptions

The timing of most of the projects will be dictated by load growth and/or health/load indices. Other factors such as quality of supply, new connections and sustainability may change the overall priorities and add previously unconsidered priorities.

All transformer ratings for new units are taken from EATS 35-02 'Emergency Rated System Transformers 33/11.5kV Delta/Star and Star/Star Connected Issue 5 June 2007, including the impedance envelopes contained therein. This is chosen as the basis for ensuring fault levels are not increased beyond that normally expected for primary and secondary switchgear.

The schemes covered in this RDP have been planned based on the planning load estimates 2013 with the 2011/12 maximum demand. The load forecasts are based on the element energy model. If the economic situation improves there is a risk that there will be shortfall of reinforcement schemes in the plan.

The load forecasts also include an assumed level of embedded generation being connected to the network. Should this generation not materialise, then a larger than forecast load growth could be realised.

Where Demand Site Response has been included at a substation, this is based on an assumption that customers will be willing to accept the scheme. In most cases these customers have not as yet been identified.

Canterbury / Sellindge

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PT, Canterbury North – Maidstone double circuit overhead line via Wormshill Tee point, which feeds the following substations:

- a. Maidstone North, 2x20/30/40MVA 132/11kV
Connection is done via PT overhead line. The site has firm capacity of 37MW (W) and 28.8MW (S). Primary substations fed from Maidstone North include Fairmeadow (11kV).
- b. Maidstone South, 2x20/30/40MVA 132/11kV
Connection is done via PT overhead line. The site has firm capacity of 37MW (W) and 29.1MW (S). Primary substations fed from Maidstone South include Fairmeadow (11kV).
- c. Maidstone, 2x60MVA 132/33 kV
Connection is done via PT overhead line. The site has firm capacity of 71.8MW (W) and 55.2MW (S). Primary substations fed from Maidstone 132/33 kV include Shepway (33/11kV), Barming (33/11kV), Allington Waste Generation and Waterside (33/11kV).

PU, Canterbury North – Sellindge/Folkestone single circuit overhead line via Etchinghill Tee point.

Richborough 132kV grid substation includes the following feeders:-

- a. Thanet Grid, 2x45MVA 132/33kV
Connection is via PY double circuit overhead line. The site has firm capacity of 113.5MW (W) and 66.8MW (S). Primary substations fed from Thanet Grid include Westgate (33/11kV), Thanet (33/11kV), Margate (33/11kV), St. Peters (33/11kV), Ramsgate (33/11kV), Stelrad (33/11kV).
- b. Monkton, 2x20/30/40MVA 132/11kV
Connection is via PY double circuit overhead line.
- c. Richborough Grid, 2x90 MVA 132/33kV
Connection is via two 132kV circuits from Richborough 132kV and two 33kV feeders from Thanet Grid. The site has a firm capacity of 110.9MW (W) and 87.3MW (S). Primary substations fed from Richborough Grid include Pfizers 312 (33/11kV), Pfizer 139 (33/11kV), Richborough (33/11kV) and Manston (33/11kV).
- d. Betteshanger Grid, 2x60 MVA 132/33kV
Connection is via PHA double circuit overhead line and two 33kV lines from Richborough Grid. The site has a firm capacity of 72.5MW (S) and 55.8 MW (W). Primary substations fed from Betteshanger Grid include Dover (33/11kV), Betteshanger Local (33/11kV), and Deal (33/11kV).
- e. Folkestone, 1x40/60/80MVA and 1x60MVA 132/33kV
Connection is via PHA-PC-PV double circuit overhead lines. The site has a firm capacity of 75.7MW (W) and 58.2MW (S). Primary substations fed from Folkestone include Dover (33/11kV), Folkestone East (33/11kV), Hythe Main (33/11kV), Stanford (33/11kV) and Folkestone Morehall (132/11kV).
- f. Thanet 132kV wind onshore circuit.

Sellindge GSP

Sellindge 400/132kV substation comprises of 4x240 MVA super grid transformers and includes the following 132kV feeders:-

- a. PV 132kV double circuit connection to Folkestone Grid via Etchinghill Tee point.

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b. Ruckinge Grid, 2x45MVA 132/33kV

Connection is via PR double circuit overhead line. The firm capacity of the site is 57.9MW (W) and 44.6MW (S). Primary substations fed from Ruckinge Grid include Romney Warren (33/11kV), Warehorne (33/11kV), Kenardington (33/6.6kV), Tenterden (33/6.6kV) and Dymchurch (33/11kV).

c. Sellindge Local, 1x45MVA 132/33kV

The firm capacity of the site is 49MW (W) and 43.2MW (S). Primary substations fed from Sellindge local include Stanford (33/11kV), Dymchurch (33/11kV), Sellindge Converter Station, Smeeth (33/11kV) and Sevington (33/11kV).

d. Ashford Grid, 2x45MVA and 1x90MVA 132/33kV

Connection is via PR-PAA double circuit overhead lines. The firm capacity of the site is 108.8MW (W) and 83.7MW (S). Primary substations fed from Ashford Grid include Sevington (33/11kV), Ashford Central (33/6.6kV), Ashford East (33/11kV), Singleton (33/6.6kV), West Ashford (33/6.6kV), Little Chart (33/6.6kV) and Harrietsham (33/11kV).

e. Eurotunnel, 2x240MVA 132kV – Connection is two 132kV underground cables. The site has firm capacity 230.4MW (W&S).

2.2 Embedded Generation (G59/2)

Table. 3 Output of generating plants used in the analysis

Customer Name (MAVIS)	Site Name	Type	Installed DG (MW)	Operating Voltage (kV)	Substation Name
ARJO WIGGINS FINE PAPERS LTD		CHP	6.000	11.000	Canterbury Local 11kV
KENT & MEDWAY NHS PARTNERSHIP TRUST	TREVOR GIBBENS RESIDENTIAL UNIT	CHP	0.650	0.400	Barming 11kV
MID KENT WATER	THANNINGTON PUMPING STATION	Diesel	0.480	11.000	Canterbury Town 11kV
MRC J R LOWE	THE WELL	PV	0.002	0.230	Canterbury Local 11kV
MRS P LEUTNER	MISELTOE COTTAGE	PV	0.001	0.230	Folkestone East 11kV
MRS P LEUTNER	MISELTOE COTTAGE	Wind	0.005	0.230	Folkestone East 11kV
PFIZER LTD	STONAR WORKS	CHP	6.500	33.000	Betteshanger Local 11kV
CUMMINS ENGINE CO LTD	MANSTON BUSINESS PARK	Diesel	4.000	11.000	Thanet 11kV
MAIDSTONE LEISURE CENTRE	MOTE PARK	CHP	0.206	0.400	Shepway 11kV
SOUTHERN WATER SERVICES	BYBROOK SEWAGE WORKS PHS II	Biogas	1.000	11.000	Ashford East 11kV
SOUTHERN WATER SERVICES	STATION BBR59A KINGS SE, BBR59 A & BBR59B	Biogas	0.900	11.000	Herne Bay 11kV
SOUTHERN WATER SERVICES	MAY STREET SEWAGE WORKS	Biogas	1.250	11.000	Herne Bay 11kV
SOUTHERN WATER SERVICES	RAMSGATE SEWAGE PUMPING STATION	Biogas	1.000	11.000	Thanet 11kV
SOUTHERN WATER SERVICES	WEATHERLEES WTW	Diesel	0.600	11.000	Manston 11kV
SOUTHERN WATER SERVICES	FORNESS POINT PUMPING STATION	Diesel	1.800	11.000	St Peters 11kV
KENTISH FLATS WINDFARM PROJECT	HERNE BAY GRID SITE	Wind	90.000	132.000	Herne Bay Grid 33kV
THAMES ENERGY LTD	BROCKHILL	CHP	0.030	0.400	Hythe Main 11kV
GREENCURRENT LTD	PLUCKLEY LANDFILL SITE	Landfill gas	0.800	6.600	West Ashford 6.6kV
SOUTHERN WATER SERVICES	SEWAGE DISPOSAL WORKS	Biogas	0.750	11.000	Canterbury Local 11kV
ALLINGTON GENERATION	ALLINGTON GENERATION	Diesel	40.000	33.000	Maidstone Grid 33kV
THANET ENERGY LIMITED	EXEMPT DISTRIBUTION NETWORK BOUNDARY, THANET EARTH EXEMPT NETWORK	Gas	30.000	11.000	Thanet Grid 33kV
Dover Harbour Board	HARBOUR HOUSE	Diesel	0.150	11.000	Folkestone East 11kV
OCASU RAO ON SITE	DUKE OF YORK'S MILITARY SCHOOL	PV	0.005	0.400	Folkestone East 11kV
Thorn Farm	THORN FARM	Wind	0.011	0.400	Stanford 11kV
SOUTHERN WATER SERVICES	BYBROOK SEWAGE WORKS PHS II	Diesel	1.950	11.000	Ashford East 11kV
Vattenfall (SIEMENS)	THANET WINDFARM S/S	WIND	300.000	132.000	
ARQUIVA	DOVER TRANSMITTER STATION	Diesel	0.350	0.400	FOLKESTONE EAST 11kV
KINGS SCHOOL CANTERBURY	RECREATION CENTRE	PV	0.050	0.400	CANTERBURY TOWN 11kV
VELCOURT LTD	MARTIN LODGE FARM	PV	0.050	0.400	BETTESHANGER LOCAL 11kV
M3 Solar	Goose Farm	PV	0.050	0.400	CANTERBURY LOCAL 11kV
LEDGER FARMS LTD	Ripple Fm	PV	0.050	0.400	BETTESHANGER LOCAL 11kV
JAMES THOMPSON T/A R DOCKERAY & SONS	BOUGHTON CORNER FARM	PV	0.050	0.400	ASHFORD EAST 11kV
Solar Focus Technologies	Mole End Fm	PV	0.038	0.400	SHEPWAY 11kV
ORBITAL MARKETING SERVICES GROUP LTD	Orbital Park	PV	0.049	0.400	SEVINGTON 11kV
ESSENTIALLY HOPS	Chalkpit Farm	PV	0.049	0.400	WINGHAM 11kV
Beba Energy	FGS Agri, Stanford Bridge Barn	PV	0.050	0.400	WEST ASHFORD 6.6kV
Blue Sky (Kent) Ltd	Pleasant Farm	PV	0.038	0.400	SHEPWAY 11kV
Blue Sky (Kent) Ltd	Home Farm	PV	0.050	0.400	ASHFORD EAST 11kV
Ecolution	Vine Medical Centre	PV	0.022	0.400	BARMING 11kV
SUNSA Regional Development Plan	SUNSAVE6 MANSTON LTD	PV	7.600	11.000	MANSTON 11kV

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The captured installed capacity of embedded generation under this RDP is approximately 503MVA with major contributions from Thanet Wind Farm, 300MVA Herne bay Wind Farm, 90MVA , Allington waste generation 40MVA and Thanet Earth 30MVA generation.

2.3 Projects in progress

Table. 4 DPCR 5 Projects due to be initiated in DPCR5

Cat	GWPID	Description	2013/2014	2014/2015	2015/2016	2016/2017
R	1.11.12 3090	Lightweight Aggregates - Relocation (New Snowdown 33/11kV Primary)	855,463	1,173,895	0	0
R	1.35.01 3187	Ashford - Sellindge - 33kV Reinforcement	815,328	0	0	0
T	3.33.01 3222	Sevington 33/11kV Substation - Install 3rd 33/11kV Transformer	453,750	247,500	0	0
R	1.34.02 3271	Wingham 33/11kV 11kV Load Transfer	178,038	267,056	0	0
A	1.51.01 3309	Folkestone Grid (Morehall) 132/11kV - Replace GT1A & GT2A	1,347,107	896,080	0	0
R	1.33.01 3719	Romney Warren 33/11kV Reinforcement - Replace T1/T2 with 12/24 MVA Units & Replace 8 Panel GEC VMX SWB (Optimised)	23,807	344,254	966,873	444,978
A	1.51.03 3829	Kenardington - Replace T1 33/6.6 kV Tx	200,251	0	0	0
A	1.02.03 4111	PMA Canterbury North-Canterbury South 132kV OHL Refurbishment, 1-3 All	0	17,689	70,754	53,066
A	1.02.05 5539	100MW20 - Dover/Folkestone Grid - Foundation Refurbishment	720,876	0	0	0
R	1.34.01 5761	Herne Bay 33/11kV-Install Auto Close Scheme for 11kV T1 Breaker	50,056	0	0	0
A	1.55.02 5828	Ruckinge 132kV Grid - Refurbish 3 x 132kV Circuit Breakers	61,875	0	0	0
A	1.51.11 7882	Deal Primary 33/11kV - Refurbish Primary Transformer (T1, T2)	0	113,672	187,958	0
A	1.02.03 7964	Canterbury North to Canterbury South 132kV Tower Line (PGA) - 132kV Tower Line Refurbishment	0	15,758	29,832	0
A	1.51.01 8003	Herne Bay Grid - Replace Grid Transformer (Gt1)	310,103	0	0	0
R	1.33.01 8087	Shepway 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA Units	331,257	544,208	237,362	0
R	1.37.07 8629	Shepway 33kV Reinforcement - Install 3rd 3km x 33kV UGC Circuit From Maidstone Grid	0	22,553	248,080	750,556

3090: Lightweight aggregates –relocations.

SEEDA is planning to redevelop the old pit head at the former Snowdown Colliery site where the existing Lightweight Aggregates 33/11kV substation is located. The present land owners have asked that the substation be removed from the leased site and are proposing an alternative location at the opposite end of the site. This substation is a single transformer site that can only be supported from the interconnected 11kV network via long rural feeders. The needs for a second 12/24 MVA 33/11kV transformer are under review. The existing T1 is a new 12/24MVA unit that replaced the original failed 5MVA unit some time ago. This project also provides for the installation of new 11kV switchgear at the new site location.

The new Snowdown substation will split the teed feeders, to supply two 11/118/24MVA transformers onto a new 11kV switchboard. The incoming feeder has a rating of 11.0MVA thus limiting the sites firm capacity of 11MVA.

On completion of these works the sites new firm capacity will be sufficient to meet the forecast PLE for the RDP period. The risk associated with switch gear HI is remove as it will be replaced

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3187: Ashford to Sellindge 33kV reinforcement.

Approved works to install 3rd 33/11kV transformer. PLE for Sellindge Grid is expected to go out of firm by 2015 however a reinforcement project is under review to cater for this growth and thus additional reinforcement has not been subscribed

3222: Sevington Total 33kV/11kV – ITC 2013 - 14

This project is a customer driven and involves installing 1 x 24 MVA additional transformer and 3 panels of 11kV switchboard in order to meet anticipated load growth from a proposed new housing development in Ashford.

3271: Wingham 33/11kV Load Transfer.

The predicted load at Wingham Primary substation will exceed the existing rating. Whilst it is possible to increase the capacity a more economical solution would be to transfer approx. 3MVA of load permanently and to also increase the post-fault transfer capability by 2MVA. It is therefore proposed to install the necessary 11kV circuits and 11kV circuit breaker(s) to provide the required transfer and transfer capability.

3309: Folkestone Grid (Morehall) 132/11kV - Replace GT1A & GT2A.

Folkestone Grid (Morehall) 132/11kV substation is equipped with two 30 MVA transformers. They are equipped with obsolete tap-changers and are suffering from high acid and moisture levels according to oil samples taken. GT1A and GT2A have been condition assessed and classified as having a health index of HI4. Therefore, it is proposed to replace them with new or recovered 60MVA units from APCM.

3829: Kenardington - Replace T1 33/6.6 kV TX.

Kenardington primary is a single transformer primary equipped with a 5MVA transformer dating from 1949. It is equipped with a slow speed tap-changer, is leaking severely and the oil acidity is high. T1 has been condition assessed as having a health index of 120. Therefore, it is proposed to replace it with a new or recovered unit.

4111: 132kV Canterbury North to Canterbury South (PMA) OHL refurbishment.

Works approved within the DPR5 period. Although no reinforcement needed to complete current scope the possible conductor up-rating to be considered during Gate B stage. Line PMA Canterbury North-Canterbury South 132kV OHL Refurbishment, 1-3

All PMA Canterbury North-Canterbury South 132kV OHL Refurbishment - Subject to CORMON test results, the refurbishment of the 132kV OHL is required. The OHL is approximately 1km long.

5539: Dover Folkestone, Tower Footing Refurbishment.

A footing inspection carried out in the second quarter of 2007 revealed the following:

Most of the footings had a high degree of corrosion; heavy pitting in large areas. Most of the muffs were in poor condition and in need of renewal.

Babcock Networks Ltd. proposes to use driven steel piles and a frame arrangement to support the towers independent of the existing footings, thus minimising the environmental disturbance during installation.

Approved, works in progress and nearing completion.

5761: Herne Bay Herne Bay 33/11kV-Install Auto Close Scheme for 11kV T1 Breaker.

The 12/24 MVA transformers at Herne Bay have a higher impedance than the remaining 10 MVA unit. Therefore under N-1 at Herne Bay, it is not possible to run a 12/24MVA transformer and 10 MVA transformer in parallel as the smaller unit will pick up a larger proportion of the load. It is proposed to install an auto close scheme so that the 11kV bus bar can be run split without putting connected customers at risk. The auto close scheme will enable the modified running arrangement

5828: Ruckinge 132kV Grid - Refurbish 3 x 132kV Circuit Breakers.

Canterbury / Sellindge

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

The condition assessment of 3 x OFA 11 BO E 132kV CBs installed at Ruckinge Grid has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends the refurbishment of this equipment Completion of this project will see 3 x 132kV CBs refurbished

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

3.1 Development areas

According to Kent and Medway structure plan (ver. Sep.2006) a development scheme for new dwellings has been adopted which assumes the following housing allocation between the areas of South East:

1. South East Kent dwellings development scheme

District	Annual Average Rate per annum	Total to 2024	Average increase in MW*	Serving Substation
Ashford	1100	11000	27.5	Ashford
Canterbury	500	5000	12.5	Canterbury Local
Herne Bay	100	1000	2.5	Herne Bay
Shepway	280	2800	7.0	Maidstone South
Dover	420	4200	10.5	Dover
Thanet	440	4400	11.0	Thanet Local
Maidstone	400	4000	10.0	Maidstone South
Total	3060	32100	81.0	

Therefore, the above substations may require uprating or be subjected to a new connection arrangement.

Herne Bay Area Action Plan 2010 – development plan from the local council to include 100 new homes and 12,000m² of retail development

Canterbury council Development Requirements Study January 2012 – to include up to 500 houses per annum.

The Dover Local Development Framework (LDF), identifies the possible additional construction of 14000 dwellings in Dover between 2010 and 2026

3.2 Asset Health

Current and forecast HI profiles without intervention.

Table 6. 6.6kV and 11kV Circuit breakers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ASHFORD CENTRAL 33/6.6KV	1	13				1	13			
ASHFORD EAST		4	7				1	6	4	
ASHFORD WEST 33/6.6KV		7						7		
BARMING 33/11KV		5	6					7	4	
BETTESHANGER LOCAL 33/11KV	2	8					10			
CANTERBURY LOCAL		11					6	5		
CANTERBURY TOWN 33KV		14	8					22		
CHARTHAM 33/11KV	1	6	2				1	6		2
DEAL PRIMARY 33/11KV		9					2	7		
DOVER PRIMARY 33/11KV	24					24				
DYMCHURCH 33/11KV		5						5		
FAIRMEADOW 11 KV		18						18		
FOLKESTONE GRID 132 KV		1	1					1	1	
FOLKESTONE MOREHALL 132/11KV		14	2					14	2	
HARRIETSHAM 33/11KV		10					10			
HERNE BAY 33/11KV		13						11	2	
HYTHE MAIN	10					10				
KENARDINGTON 33/6.6KV		5					5			
LIGHTWEIGHT AGGREGATES 33/11KV		4						4		
LITTLE CHART 33/6.6KV		8					3	5		
MAIDSTONE GRID 132 KV		2					2			
MAIDSTONE GRID NORTH	2	14					16			
MAIDSTONE GRID SOUTH	12					12				
MANSTON 33/11KV	11						11			
MARGATE 33/11KV		5	5					6	4	
MEADS		3	8					3	8	
MONKTON GRID 11KV	9					9				
MONKTON GRID 132	1					1				
RAMSGATE 33/11KV			13					5	7	1
RICHBOROUGH 33/11KV		10					4	6		
ROMNEY WARREN 33KV		8						8		
SELLINDGE CONVERTER STATION		1					1			
SEVINGTON 33/11KV		10					10			
SHEPWAY 33/11KV	11					2	9			
SHIRLEY 33/11 KV	1	9	2			1		11		
SINGLETON 33/6.6KV	11						11			
SMEETH 33/11KV		3						2	1	
ST PETERS 33/11KV		1	11					3	8	1
STANFORD PRIMARY		4	4					4	1	3
STELRAD 33/11KV		1						1		
TENTERDEN 33KV		10						10		
THANET LOCAL 33/11KV	1	12					13			
WAREHORNE 33KV		4					1	3		
WATERSIDE 33/11 KV	13						13			
WESTGATE 33/11KV			12					11	1	
WHITSTABLE 33/11KV	10	2					12			
WINGHAM 33/11KV		10					5	5		

Table 7. 33kV Circuit breakers

Substation	2015					2024				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ALLINGTON GENERATION	2					2				
ASHFORD GRID 132 KV		4						4		
ASHFORD GRID 33 KV		14	1				5	10		
BETTESHANGER GRID 132 KV		2						2		
BETTESHANGER GRID 33KV		3	9					7	5	
CANTERBURY SOUTH 132 KV		3					3			
CANTERBURY SOUTH 33 KV		15					14	1		
DOVER PRIMARY 33/11KV	24					24				
FOLKESTONE GRID 33KV	11						11			
HERNE BAY GRID 33KV	9						9			
HERNE BAY WINDFARM	5						5			
MAIDSTONE 132/33KV	19						19			
MAIDSTONE GRID 132 KV		1					1			
PFIZERS 33KV	1	2					3			
RICHBOROUGH GRID 132 KV	2						2			
RICHBOROUGH GRID 33KV	4	7					11			
RICHBOROUGH ZONE		2					2			
SELLINDGE 132 KV	1						1			
SELLINDGE GRID LOCAL	4						4			
SHELFORD FARM	1						1			
TENTERDEN SW STN 33KV		2					2			
THANET GRID 132KV		4					4			
THANET GRID 33KV		16					16			
WHITSTABLE 33KV SWITCHING STATION	3					3				

Table 8. 132kV Circuit Breakers

Substation	2015					2024				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BETTESHANGER GRID 132 KV			1	2						3
CANTERBURY NORTH 132 KV		3					3			
CANTERBURY SOUTH 132 KV	4		3	3			4			6
EUROTUNNEL 132 KV		2						2		
FOLKESTONE GRID 132 KV		2					2			
MAIDSTONE GRID 132 KV		2					2			
MONKTON GRID 132	1						1			
RICHBOROUGH GRID 132 KV	2	1	5	4			3			9
RUCKINGE GRID 132 KV			1	2						3
SELLINDGE 132 KV		8					8			

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

Table 9. Primary Transformers

Substation	2015					2024				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ASHFORD CENTRAL 33/6.6KV		2					1	1		
ASHFORD EAST		2						2		
ASHFORD WEST 33/6.6KV		2						2		
BARMING 33/11KV		2					2			
BETTESHANGER LOCAL 33/11KV		1	1				1			1
CANTERBURY LOCAL	1	1					1		1	
CANTERBURY TOWN 33KV		2	1					2	1	
CHARTHAM 33/11KV		2					2			
DEAL PRIMARY 33/11KV				2						2
DOVER PRIMARY 33/11KV			2	2					2	2
DYMCHURCH 33/11KV			1						1	
HARRIETSHAM 33/11KV		2					1	1		
HERNE BAY 33/11KV	2		1				2		1	
HYTHE MAIN		1	1					1	1	
KENARDINGTON 33/6.6KV		1						1		
LIGHTWEIGHT AGGREGATES 33/11KV		1					1			
LITTLE CHART 33/6.6KV		2					1	1		
MANSTON 33/11KV		2					2			
MARGATE 33/11KV		2					2			
MEADS			2					2		
RAMSGATE 33/11KV			2					2		
RICHBOROUGH 33/11KV		2					2			
ROMNEY WARREN 33KV			2						2	
SELLINDGE CONVERTER STATION		1					1			
SEVINGTON 33/11KV		2					2			
SHEPWAY 33/11KV			1	1					1	1
SHIRLEY 33/11 KV		1			1			1		1
SINGLETON 33/6.6KV		2					1	1		
SMEETH 33/11KV		1						1		
ST PETERS 33/11KV			2					2		
STANFORD PRIMARY			2					2		
STELRAD 33/11KV			1						1	
TENTERDEN 33KV		2					2			
THANET LOCAL 33/11KV	1		1	1			1		1	1
WAREHORNE 33KV	1						1			
WATERSIDE 33/11 KV	1	1					1	1		
WESTGATE 33/11KV			2					2		
WHITSTABLE 33/11KV		2						2		
WINGHAM 33/11KV		2						2		

Table 10. Grid Transformers

Substation	2015					2024				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ASHFORD GRID 132 KV		1	1		1			1	1	1
BETTESHANGER GRID 132 KV		2						2		
CANTERBURY SOUTH 132 KV		2	1				2	1		
FOLKESTONE GRID 132 KV		2		1	1		1	1		2
HERNE BAY GRID 132/33KV	1	1					2			
MAIDSTONE GRID 132 KV	2	2					3	1		
MONKTON GRID 132	1						1			
RICHBOROUGH GRID 132 KV	2						2			
RUCKINGE GRID 132 KV		2						2		
SELLINDGE 132 KV		1					1			
THANET GRID 132KV		1	3				1		3	

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

3.3 Security of Supply and Load Index Analysis

Table 11. P2/6 Assessment table

Substation	Season	FC NOW (MVA)	DPCR5 Intervention FC ED1 Start (MVA)	RIIO-ED1 without intervention				RIIO-ED1 with intervention		P2/6 at End of ED1
				2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	FC ED1 end (MVA)	2022 (S) 22/23 (W)	
Ashford Central	W	22.9	22.9	16.9	17.3	LI1	LI1	22.9	LI1	C
Ashford East	S	17.3	34.5	14.7	15.1	LI1	LI1	34.5	LI1	C
Ashford Grid	W	123.8	123.8	65.1	69.6	LI1	LI1	123.8	LI1	D
Ashford West	W	6.5	6.5	3.8	4.2	LI1	LI1	6.5	LI1	B
Barming	W	22.8	22.8	17.3	18.5	LI1	LI2	22.8	LI2	C
Betteshanger Grid	W	78.0	78.0	46.9	49.4	LI1	LI1	78.0	LI1	C
Betteshanger Local	W	24.0	24.0	11.6	12.3	LI1	LI1	24.0	LI1	C
Canterbury Local	W	23.8	23.8	21.6	22.5	LI2	LI2	23.8	LI4	C
Canterbury South	W	160.8	160.8	80.6	83.6	LI1	LI1	238.9	LI1	D
Canterbury Town	S	34.5	34.5	34.7	35.6	LI4	LI5	51.7	LI1	C
Chartham	S	11.5	11.5	7.7	8.9	LI1	LI1	11.5	LI1	B
Deal	W	24.0	24.0	12.1	12.7	LI1	LI1	24.0	LI1	C
Dover T1/T2	W	14.0	14.0	16.2	16.8	LI5	LI5	23.9	LI1	C
Dover T3/T4	W	22.6	22.6	18.7	19.4	LI2	LI2	22.6	LI2	C
Dymchurch	S	3.5	3.5	3.2	3.4	LI2	LI3	3.5	LI4	B
Folkestone 132/33	W	78.0	78.0	49.1	52.1	LI1	LI1	78.0	LI1	C
Folkestone East	W	23.0	23.0	15.7	17.3	LI1	LI1	23.0	LI1	C
Folkestone Morehall	W	39.0	39.0	31.7	33.9	LI2	LI2	39.0	LI2	C
Harrietsham	W	16.0	16.0	11.7	12.0	LI1	LI1	16.0	LI1	B
Herne Bay	W	37.0	37.0	25.8	26.7	LI1	LI1	37.0	LI1	C
Herne Bay Grid	W	124.6	124.6	42.3	44.2	LI1	LI1	124.6	LI1	C
Hythe	W	24.0	24.0	12.6	13.4	LI1	LI1	24.0	LI1	C
Kenardington	W	4.5	4.5	2.8	3.3	LI1	LI1	4.5	LI1	B
Lightweight Aggregates	S	3.9	18.0	5.3	5.9	LI1	LI1	18.0	LI1	B
Little Chart	W	7.0	7.0	5.9	6.3	LI2	LI2	15.0	LI1	B
Manston	S	30.0	30.0	4.1	4.1	LI1	LI1	30.0	LI1	B
Margate	W	35.3	35.3	19.7	20.3	LI1	LI1	35.3	LI1	C
Ramsgate	W	22.9	22.9	21.0	21.7	LI2	LI2	24.3	LI2	C
Richborough Grid	S	90.0	90.0	15.3	15.9	LI1	LI1	90.0	LI1	C
Richborough Local	S	18.0	18.0	6.9	7.5	LI1	LI1	18.0	LI1	B
Romney Warren	W	11.9	11.9	13.0	13.6	LI5	LI5	11.9	LI1	C
Ruckinge Grid	W	58.5	58.5	27.9	29.4	LI1	LI1	58.5	LI1	C
Sellindge Grid	S	43.6	45.1	35.8	37.6	LI1	LI2	45.1	LI2	C
Sevington Total	W	30.4	54.6	17.8	18.1	LI1	LI1	54.6	LI1	C
Shepway	W	23.0	23.0	26.4	27.4	LI5	LI5	38.1	LI1	C
Singleton	W	21.4	21.4	17.2	18.0	LI2	LI2	21.4	LI2	C
Smeeth	W	4.6	4.6	3.5	4.4	LI1	LI3	15.0	LI1	B
St Peters	W	22.8	22.8	23.2	23.9	LI5	LI3	24.0	LI4	C
Stanford	W	15.0	14.9	8.7	9.5	LI1	LI1	14.9	LI1	B
Tenterden	W	13.0	13.0	10.2	11.1	LI1	LI2	15.0	LI1	B
Thanet Grid	W	117.0	117.0	105.4	109.0	LI2	LI2	117.0	LI2	D
Thanet Local	S	20.0	20.0	12.6	13.2	LI1	LI1	20.0	LI1	C
Warehorne	S	2.5	2.5	2.0	2.2	LI1	LI2	11.1	LI1	B
Waterside	S	30.0	30.0	20.1	20.7	LI1	LI1	30.0	LI1	C
Westgate	W	23.0	23.0	17.7	18.7	LI1	LI2	23.0	LI2	C
Whitstable	W	33.0	33.0	20.0	21.0	LI1	LI1	33.0	LI1	C
Wingham	W	14.0	14.0	10.1	10.5	LI1	LI1	14.0	LI1	B
Maidstone 132/33	W	91.4	127.7	83.8	86.8	LI1	LI1	127.7	LI1	D
Maidstone Grid North	S	30.0	30.0	16.2	16.7	LI1	LI1	30.0	LI1	C
Maidstone Grid South	W	38.1	38.1	18.5	19.1	LI1	LI1	38.1	LI1	C

Key: LI5 LI4 DSR

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3.4 Operational and technical constraints

Information where available or appropriate: Network reliability (fault history), Harmonics, Particular time constraints, Overstressed Switchgear (**Fault Level:** Making and breaking duty from DIgSILENT report) and Out of phase duty

3.5 National Grid

Richborough NEMO DC link 2011 -2017

National Grid has approached UKPN to aid in facilitating the connection of a new DC interconnection between the UK and Belgium with the connection point to the National Grid network at Richborough. The Richborough site was chosen as there is some land available following the closure of the Richborough coal-fired power station.

National Grid has identified that obtaining a 400 kV line corridor from Canterbury North GSP to Richborough presents a significant challenge and possible delays. Considering the construction date of 2019 National Grid have proposed to UKPN the accession of UKPN existing 132 kV double circuit corridor to be up-rated to 400 kV in return for a new SGT connection point at Richborough. Works for this project will have an effect on planned RDP works as discussed below.

Canterbury - Sellindge 132kV Circuits Reconductoring 2017 -2018

This project requires the replacement of conductors and fittings on 79 towers between Canterbury and Sellindge. Although this work will not impact the network capacity it is recommended that work coordination and impact to local population be considered when undertaking lines work in the immediate vicinity

3.6 Network Constraints

New connections for embedded generation are currently restricted due to anticipated high reverse power flows through SGT's at Canterbury North GSP and Ruckinge Grid GT2 under system normal including overloading of the PX and PF 132kV circuits under N-1 conditions.

4 RECOMMENDED STRATEGY

4.1 Proposed interventions

4.1.1 Asset Health

3116: PC 1-83 – Re-conductor 2021

The 132kV overhead line between PC Woodnesborough Junction and Etchinghill T is a double circuit line, consisting of 83 towers and is 25km long. The line was built in 1963 (77 towers) using Zebra phase conductors and Lynx earth-wire on C534 design towers. The line was extended in 1982 (6 towers) using L7(C) design.

A CORMON test carried out in 2005 between towers 2-4; 21-23; 56-57 and 74-76 did not indicate any signs of corrosion in the earth-wire and bottom phase-wires. Due to the age profile of the overhead line conductors on the PC OHL route, mostly over 45 years, it is proposed to carry out another CORMON test in 2014.

Foot patrols carried out in 2004 showed that insulators, phase and earth fittings, step bolts and tower steelwork were in acceptable condition. However;

- Tower foundation muffs require painting through-out
- The condition of the anti-climbing guards and signage was found to be condition 3 at towers 6 and 7

The SPN Infrastructure Development Plan has identified the PC route as a candidate for re-enforcing to meet the future requirements of the East Kent Development Strategy. This would require re-conductor both circuits (and down-leads) with UPAS conductor (300mm² AAAC) for operation at 75°C. If CORMON tests reveal the need for conductor replacement, re-conductor with Zebra for operation at 75°C is preferred.

The project plan is to:

- Complete painting of tower foundation muffs and replacement of anti-climbing guards and signage in poor condition in 2010.
- Complete replacement of all the phase and earth conductors in 2014/2015 (subject to the result of CORMON tests)
- Replace the fittings on all spans in tandem with the re-conductor (and in line with our asset replacement policy)

Due to the sufficient loss of capacity with the removal of a double circuit line it is proposed that the reinforcement of Morehall and Folkestone be completed before the onset of this project to allow transfers between.

The section of works southern connection point, tower 83 is proposed to connect to a new switching station at Etchinghill. It is proposed that the completion of the substation be coordinated with the completion of the line to allow completion of connection to the new substation at the completion of the lines work.

- Left conductor HI 4 2024 except towers Asset ID299860 o 299863
- Left fitting all HI 5 2024 except towers Asset ID 35, 36, 60-63 however a number of towers fitting become HI5 earlier
- Right conductor HI4 2024 except tower 60-63
- Right fitting 80% of towers HI4 2015 then all accept 60-63 HI5 2024
- Earth conductor HI 4 2024 except 60-63
- Earth fitting HI4 2015, HI5 by 2024 except 60-63
- Tower steel work HI5 2015
- Foundations no problem in current period

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

4011: Canterbury South 132/33kV GT2 Decommissioning 2019 - 20

Although the PLE do not indicate a requirement for the transformer to be reinforced during ED1 period the works associated with the National Grid as noted within section 2.5 may benefit from an early reinforcement. In support of this option the transformer and associated transformer CB 100910-CB-210, HI indicates that each would require assets replacement based on condition by 2024 and 2015 respectively.

By replacing the transformer during the 2019 - 2020 UKPN will be able to utilise the transfer capability of line transformer during the construction phase of the new 400kV line reducing the associated risk the UKPN network.

To maximise the economic benefits it is recommended that CBs, 1009910-CB-405 and 1009910-CB-505 replacement be included as part of the works based on asset condition. CBs 1009910-CB-105, 1009910-CB-205 will also need to be replaced if Line PX is not transferred to national grid or the bays are reused for connection of the SGT.

The current cyclic ratings for both GT1 and GT3 is 120MVA however GT3 is limited by its cable connection to 114MVA and GT2 is 39MVA therefore the site has a firm capacity of 153MVA.

GT2 is a 30 MVA unit and has an obsolete tap-changer and is suffering from high moisture and acidity levels. GT2 has been condition assessed and classified as having a health index of 120. Therefore, it is proposed to decommission GT2. It is also proposed to decommission 2*30 MVA reactors currently operated in series with GT2. The load forecasts show that the two 90MVA (GT1 and GT3) provide sufficient firm capacity. However, it is recommended to use a 90 MVA as a replacement transformer as it has a dedicated circuit from Canterbury South 132kV Grid.

- HI index shows HI3 2015 and HI5 2024
- 2 reactors on the circuit most likely to provide additional reactance to limit load flows through 30MVA Tx.
- Canterbury south requires 6 breakers to be replaced due to HI5 2024
- This project to be coordinated with project 7807

4112: PG Canterbury North-Sittingbourne 132kV OHL Refurbishment, 1-3 All 2016 - 17

Subject to CORMON test results, the refurbishment of the 132kV OHL is required. The OHL is approximately 1km long.

4117: Refurbishment line PU Canterbury North to Etchinghill 2017 -18

Conductor replacement is not required during the 2015 -2016 period, however tower replacement is required beyond 2015. It is therefore recommended that the scope of this project be extended to include the a full replacement of all line assets including tower steel work which becomes HI4 by 2015, towers foundations which become HI4 by 2023 and conductor and earth wire which becomes HI3 by 2024. It is also recommended that this work be moved forward to cater for the tower condition.

- PU Canterbury North-Etchinghill 132kV OHL refurbishment; 9-28, 57-88 circuit 1 and earth
- PU Canterbury North-Etchinghill 132kV OHL refurbishment 9-28, 57-88 circuit 1 and earth. Subject to the results of CORMON tests.

4118: Line PV Sellindge to Folkestone 132kV refurbishment 2017-18

Refurbishment works will be required due to asset condition. These works are recommended to be extended to the include the towers steel work which becomes HI4 by 2015, foundations become HI4 by 2015, right conductors, asset ID308416 to 308424 which become HI4 by 2015, left asset ID308416 to 308424 conductors and fitting and earth wire becomes HI4 by 2012 and right conductors assess ID308416 to 308424 become HI4 by 2015.

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

This project will be harmonised with coordination with project 3057 Etchinghill 132kV switching station development.

4139: Stelrad 33/11KV - Replace T4 2018-19

This is a single 5MVA transformer site. HI shows HI2 in 2015 and becomes HI3 by 2024 thus cannot justify asset replacement based on condition. PLE of not exceed sites firm capacity therefore replacement/reinforcement cannot be justified on load bases. Hence the strategy is rejected

Stelrad Primary: T4 was manufactured in 1952. It will be replaced at the end of its nominal life based on age-related deterioration and its overall condition.

6365: Canterbury South 132kV: Install Voltage Compensator 2015-18

National Grid are proposing to impose a maximum 90MVAR export limit for Canterbury North 2x240MVA transformer GSP to resolve high overnight super grid voltage profiles. The technical issues are currently being evaluated in the context of super-grid target voltage levels and the impact of distribution network connected generation. The expected outcome is to install a +/-30MVAR compensator to the Canterbury South 132kV busbars.

7809: Betteshanger Grid 33kV - Refurbishment of 33kV Switchgear 2017-18

The condition assessment of the 1956/1963 Reyrolle L42T Oil Switchgear installed at Betteshanger Grid 33kV has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Refurbishment. Completion of the project will see 5 circuit breakers refurbished.

7813: Herne Bay 33/11kV - Replace 11kV Switchgear 2020-21

The condition assessment of the 1991 GEC VMX Vacuum Switchgear installed at Herne Bay 33/11kV has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Replacement. Completion of the project will see 13 circuit breakers replaced with 13 new circuit breakers.

7828: Margate 33/11kV - Retrofit 11kV Switchgear 2017-18

The condition assessment of the 1973 Reyrolle LMT Oil Switchgear installed at Margate 33/11kV has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Refurbishment. Completion of the project will see 10 circuit breakers replaced with 10 new circuit breakers

7841: Ramsgate 33/11kV - Replace 11kV Switchgear 2015-16

The condition assessment of the 1949 - 62 Reyrolle C gear Oil Switchgear installed at Ramsgate 33/11kV has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Replacement. Completion of the project will see 13 circuit breakers replaced with 13 new circuit breakers.

7882: Deal Primary 33/11kV - Refurbish Primary Transformer (T1, T2) 2014-15

The condition assessment of the 1965/66 Fuller Primary Transformers with Fuller HS tap changers installed at has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level

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that is not commensurate with UK Power Networks strategy. Therefore this project recommends its refurbishment. Completion of the project will see 1 Grid Transformer refurbished.

7883: Dover Primary 33/11kV - Refurbish Primary Transformer (T3, T4) 2021-22

The condition assessment of the 1967 AEI Primary Transformers with Fuller HS tap changer has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its refurbishment. Completion of the project will see 2 Primary Transformers replaced with 2 new Primary Transformers.

- This project should be coordinated with project 3192 Dover 33/11kV T1 and T2 transformer replacement 2015-18 (see below).

7889: Herne Bay 33/11kV - Replace Primary Transformer (T1)

The condition assessment of the 1959 Hackbridge Primary Transformer with Hackbridge 33XCO tap changer installed at has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its replacement. Completion of the project will see 4 Primary Transformers replaced with 4 new Primary Transformers

7893: Hythe Main - Refurbish Primary Transformer (T1)

The condition assessment of the 1966 Fuller Electric Primary Transformer with Fuller F tap changer installed has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its refurbishment. Completion of the project will see 1 Grid Transformer refurbished.

7911: Thanet Grid 132kV - Refurbish Grid Transformer (GT1A, GT1B & GT2B)

It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its refurbishment. Completion of the project will see 3 Grid transformers refurbishment

7919: Ashford East - Retrofit 11kV Switchgear

The condition assessment of the 1968 South Wales Switchgear C4X Oil Switchgear installed at Ashford East has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Refurbishment. Completion of the project will see 11 circuit breakers replaced with 11 new circuit breakers

7923: Chartham - Retrofit 11kV Switchgear

The condition assessment of the 1971 Brush VSI oil switchgear installed at CHARTHAM has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. Therefore this project recommends its Refurbishment. Completion of the project will see 8 circuit breakers replaced with 8 new circuit breakers.

7930: Folkestone East - Retrofit 11kV Switchgear

The condition assessment of the 1975 Reyrolle LMT oil switchgear installed at FOLKESTONE EAST has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. Therefore this project recommends its Refurbishment. Completion of the project will see 5 circuit breakers replaced with 5 new circuit breakers.

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- This project would benefit from coordination with project 3172.

7960: Thanet Grid to St Peters 33kV 132kV Tower Line (TGR) - 132kV Tower Line replacement

The condition assessment of the THANET GRID TO ST PETERS 33KV 132KV Tower Line (TGR) has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 1 km of 132kV Tower Line replaced

- This project would benefit from coordination with projects 7847 and 3307

7964: Canterbury North to Canterbury South 132kV Tower Line (PGA) - 132kV Tower Line refurbishment

The condition assessment of the CANTERBURY NORTH TO CANTERBURY SOUTH 132kV Tower Line (PGA) has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the refurbishment. Completion of the project will see 4 towers of 132kV Tower Line replaced

7976: Richborough to Betteshanger 132kV Tower Line PHA - 132kV Tower Line replacement

The condition assessment of the RICHBOROUGH TO BETTSHANGER 132kV Tower Line PHA has shown that the probability of failure due to forecast degradation is likely to increase network risk to a level that is not commensurate with UK Power Networks strategy. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 12 km of 132kV Tower Line replaced

This project supersedes project 3115 PC1 – PHA39A – re-conductor 2019 – 2021

8168: Canterbury South 33kV – Wingham 33kV Pole replacement

The condition assessment of the Canterbury South 33kV – Wingham 33kV Pole has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 29 km of 33KV POLE replaced

8170: Sellindge Grid Local – Stanford & Tees 33kV pole replacement

The condition assessment of the Sellindge Grid Local – Stanford & Tees 33kV pole has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 5 km of 33KV Pole replaced

8171: Folkestone 33kV – Shorncliffe/Hythe No1 33kV Pole replacement

The condition assessment of the Folkestone 33kV – Shorncliffe/Hythe No1 33kV Pole has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 6 km of 33KV POLE replaced

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8175: Ashford Grid 33kV – Smeeth 33kV Pole replacement

The condition assessment of the Ashford Grid 33kV – Smeeth 33kV Pole has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends the replacement. Completion of the project will see 6 km of 33KV POLE replaced.

8661: Betteshanger grid – 132kV switchgear replacement

The condition assessment of the 1963 GEC OFA11 Bulk Oil Switchgear installed at Betteshanger Grid has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its Replacement. Completion of the project will see 3 circuit breakers replaced with 3 new circuit breakers

8966: Little Chart 33/6.6kV Transformer Reinforcement 2015

Little Chart 33/6.6kV substation PLE is forecast to exceed the sites firm capacity during 2015 due to transformer cyclic rating limitation. The site is currently supplied by 2 times 5MVA transformers to cater for the increased demand it is recommended that these be uprated to 12MVA and thus provide sufficient capacity for the increase in PLEs. HI shows that T1 requires immediate asset replacement due to condition with a current HI5 rating. For this reason it is proposed that the upgrade take place at the earliest convenience. In addition it is recommended that a provisional contingency be included in the scope to allow for the up rating of the switchgear if the requirement is determined upon completion of a survey. ITC cooling has been considered for these transformers however due to the asset condition of T1, ITC cooling could only be supplied by a single transformer thus the advantage is not considered advantageous.

The incoming circuit has a capacity of 24MVA. After the replacement of the transformers the sites new firm capacity will be 12MVA sufficient to meet the forecasted PLE's.

4.1.2 Reinforcement

3057: Etchinghill 132kV Switching Station 2022-2024

This project involves developing Etchinghill junction into a 132kV double busbar switching station to enhance load transfer flexibility. This project will allow switching flexibility across seven circuits (Folkestone x 2, Sellindge x2, Richborough x 2 and Canterbury North x 1).

3214: Canterbury North 132kV - switching station 2019-22

This project makes provision for the establishment of a new 132kV double busbar substation at the Canterbury North NGT connection point. In addition to the circuits currently switched at Canterbury North, the new switchboard will also accommodate all the 132 kV feeders supplied from Canterbury South.

3719 - Romney Warren 33/11kV Transformer and Switch Gear Reinforcement 2019

This project involves replacing T1 and T2 with 12/24MVA transformers and the replacement of the existing 11kV switchgear.

8081: Canterbury Town 33kV/11kV – ITC 2015-18

This project involves installing 1 x 24 MVA transformer, replacing 1.2 km of underground cable, replacement of 22 panels of 11kV switchboard and installation of 1 panels of 33kV switchboard.

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

8085: Ramsgate 33kV/11kV – ITC 2016-19

This project involves replacing 2 x 16/20 MVA transformers with 2 x 40 MVA transformers in order to increase firm capacity to 40MVA. The 1949 - 62 Reyrolle C gear Oil 11kV Switchgear is due to be replaced on condition under project 7841. The existing 33kV circuits will be banked while the new 40 MVA circuit will supply the uprated transformer. This is an optimised project.

8087: Shepway 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA Units 2014-16

This project involves replacing the existing 11.5/23MVA transformers with two new 20/40MVA units, uprating the existing 11kV transformer circuit breakers to 2000A units, and adding two new panels to the switchboard in order to increase firm capacity to 40MVA. .

8089/7847: St Peters 33/11kV - Replace 11kV Switchgear & transformer Reinforcement 2020-23

This project involves replacing T1 and T2 with new 40MVA units, switchgear replacement and circuit reinforcement in order to increase firm capacity to 40MVA.

8146: Tenterden 33kV/6.6kV Reinforcement - Replace T2 with 7.5/15 MVA Unit & Re-Conductor 12 km of 33kV OHL Conductor on Wood Pole 2016-19

This project involves replacing the existing 10MVA (T2) transformer with a 15MVA transformer and uprating the capacity of the 12km 33kV OHL feeder circuit.

8147/8967: Warehorne 33kV/11kV Reinforcement-Replace the 11kV Switchboard 2015-18

This project involves installing an additional 15 MVA transformer and replacing the 6 panel switchboard to enable it to be extended by 1 incomer and a 1 bus section to enable the ITC.

8245: Smeeth 33kV/11kV – ITC 2017-20

This project involves replacing the existing single 5MVA transformer with 2x7.5/15MVA rated units and installation of a 33kV switching station

8629: Shepway 33kV Reinforcement - Install 3rd 3km x 33kV UGC Circuit From Maidstone Grid 2014-17

This project involves uprating the existing 33kV circuits to 2x40MVA in order to match the proposed increase in existing transformer capacity from 2x11.5/23MVA to 2x20/40MVA under project 1.37.07.8629.

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

4.2 Costs and phasing

Table 12. NLRE ED1 NAMP

SR _ Table J - S&R - Baseline_Final_RIIO_ED1 Re-Submission_19th Feb_2014_15:15 (£)												
Cat	GWPID	Description	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
A	1.02.03	3116 PC - Woodnesborough Jnct - Etchinghill T- Potential Reinforcement	0	0	0	0	0	0	680,186	1,734,439	0	0
A	1.51.01	3309 Folkestone Grid (Morehall) 132/11kV - Replace GT1A & GT2A	1,347,107	896,080	0	0	0	0	0	0	0	0
A	1.51.03	3829 Kenardington - Replace T1 33/6.6 kV Tx	200,251	0	0	0	0	0	0	0	0	0
A	1.51.01	4011 Canterbury South GT2	0	0	0	0	0	0	467,622	1,012,338	0	0
A	1.02.03	4111 PMA Canterbury North-Canterbury South 132kV OHL Refurbishment, 1-3 All	0	17,689	70,754	53,066	0	0	0	0	0	0
A	1.02.03	4112 PG - Wormshill T - Sittingbourne - Conductor Replacement	0	0	0	113,364	289,073	0	0	0	0	0
A	1.02.03	4117 PU - Canterbury North-Etchinghill - Conductor Replacement	0	0	0	0	170,047	433,610	0	0	0	0
A	1.02.03	4118 PV - Sellindge - Folkstone - Conductor Replacement	0	0	0	0	85,023	216,805	0	0	0	0
A	1.51.03	4134 Northiam 33kV - Replace T1 and T2	0	0	0	0	0	0	0	228,195	730,224	142,088
A	1.51.03	4139 Stelrad 33/11kV - Replace T4	0	0	0	0	0	249,721	324,790	0	0	0
A	1.02.05	5539 100MW20 - Dover/Folkstone Grid - Foundation Refurbishment	720,876	0	0	0	0	0	0	0	0	0
A	1.55.02	5828 Ruckinge 132kV Grid - Refurbish 3 x 132kV Circuit Breakers	61,875	0	0	0	0	0	0	0	0	0
A	1.48.06	7807 Canterbury South - Replace 132kV Switchgear	0	0	0	0	0	993,049	3,900,180	3,900,180	0	0
A	1.48.02	7809 Betteshanger Grid 33kV - Refurb 33kV Switchgear	0	0	0	0	101,538	169,231	0	0	0	0
A	1.50.01	7813 Herne Bay 33/11kV - Replace 11kV Switchgear	0	0	0	0	0	0	0	248,861	627,250	0
A	1.50.01	7828 Margate 33/11kV - Retrofit 11kV Switchgear	0	0	0	0	74,062	76,861	0	0	0	0
A	1.50.01	7841 Ramsgate 33/11kV - Replace 11kV Switchgear	0	0	247,960	624,526	0	0	0	0	0	0
A	1.50.01	7847 St Peters 33/11kV - Replace 11kV Switchgear	0	0	243,450	610,879	0	0	0	0	0	0
A	1.51.11	7882 Deal Primary 33/11kV - Refurbish Primary Transformer (T1, T2)	0	113,672	187,958	0	0	0	0	0	0	0
A	1.51.11	7883 Dover Primary 33/11kV - Refurbish Primary Transformer (T3, T4)	0	0	0	0	0	0	0	0	94,540	207,090
A	1.51.03	7889 Herne Bay 33/11kV - Replace Primary Transformer (T1)	0	0	0	0	0	0	0	0	0	82,574
A	1.51.11	7893 Hythe Main - Refurbish Primary Transformer (T1)	0	0	0	0	0	0	75,969	74,846	0	0
A	1.51.11	7904 Shepway 33/11kV - Refurbish Primary Transformer (T1, T2)	0	0	0	113,672	187,958	0	0	0	0	0
A	1.51.11	7911 Thanet Grid 132kV - Refurbish Grid Transformer (GT1A, GT1B & GT2B)	0	0	0	0	0	0	351,210	101,850	0	0
A	1.51.03	7912 Thanet Local 33/11kV - Replace Primary Transformer (T1, T2)	0	0	0	0	0	78,056	1,072,886	0	0	0
A	1.50.01	7919 Ashford East - Retrofit 11kV Switchgear	0	0	0	78,211	88,608	0	0	0	0	0
A	1.50.01	7923 Chartham - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	29,783	89,349	0
A	1.50.01	7930 Folkestone East - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	0	0	0
A	1.02.03	7960 TGR - Thanet Grid - St Peters - Conductor Replacement	0	0	0	0	20,280	30,612	0	0	0	0
A	1.02.03	7964 Canterbury North to Canterbury South 132kV Tower Line (PGA) - 132kV Tower Line Refurbishment	0	15,758	29,832	0	0	0	0	0	0	0
A	1.02.03	7976 PHA - Richborough - Bettshanger - Conductor Replacement	0	0	0	0	0	190,941	419,762	0	0	0
A	1.51.01	8003 Herne Bay Grid - Replace Grid Transformer (GT1)	310,103	0	0	0	0	0	0	0	0	0
A	1.09.01	8168 100911008 - 33kV Canterbury South/Wingham - OHLReplacement	0	0	0	0	0	0	0	283,679	704,076	0
A	1.09.01	8170 100916201 - 33kV Sellindge Grid local/Stanford&Tees - OHLReplacement	0	0	0	0	0	0	79,316	90,987	0	0
A	1.09.01	8171 100912003 - 33kV Folkestone/ShorcliffeHythe No1 - OHLReplacement	0	0	0	0	0	72,098	132,265	0	0	0
A	1.09.01	8175 100910211 - 33kV Ashford Grid/Smeeth - OHLReplacement	0	0	87,831	116,532	0	0	0	0	0	0
A	1.48.01	8661 Betteshanger Grid 132kV Switchgear Replacement	0	0	189,638	569,147	0	0	0	0	0	0
A	1.51.03	8966 Little Chart 33kV/6.6kV - Replace T2 with 7.5/15 MVA unit for condition and T1 for load (optimised)	0	0	0	0	0	0	38,361	192,055	307,888	385,359
A	1.50.01	8967 Warehorne 33kV/11kV - Replace the 11kV Switchboard (Optimised)	0	0	140,928	259,750	259,750	378,571	0	0	0	0

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

Table 13. LRE ED1 NAMP Table

SR_Table J - S&R - Baseline_Final_RIIIO_ED1 Re-Submission_19th Feb_2014_15:15 (£)												
Cat	GWPID	Description	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
R	1.36.01	3057 Etchinghill 132kV Switching Station	0	0	0	0	0	0	0	0	120,563	1,699,939
R	1.11.12	3090 Lightweight Aggregates - Relocation (New Snowdown 33/11kV Primary)	855,463	1,173,895	0	0	0	0	0	0	0	0
R	1.35.01	3187 Ashford - Sellindge - 33kV Reinforcement	815,328	0	0	0	0	0	0	0	0	0
R	1.36.01	3214 Canterbury North 132kV - Switching Station	0	0	0	0	0	0	301,666	2,350,203	4,865,990	1,591,121
T	3.33.01	3222 Sevington 33/11kV Substation - Install 3rd 33/11kV Transformer	453,750	247,500	0	0	0	0	0	0	0	0
R	1.33.14	3270 Project Hop, Manston, Thanet - Refunds to the EKSDC	0	0	409,553	409,553	409,553	409,553	409,553	409,553	409,553	409,553
R	1.34.02	3271 Wingham 33/11kV 11kV Load Transfer	178,038	267,056	0	0	0	0	0	0	0	0
T	3.33.07	3276 Ashford Centre Development - New 33/11kV Substation	0	0	0	0	394,204	1,576,817	1,182,613	0	0	0
T	3.33.07	3277 Ashford Development Chilmington Green, New Primary Substation	0	0	563,623	2,254,493	1,690,870	0	0	0	0	0
R	1.33.01	3719 Romney Warren 33/11kV Reinforcement - Replace T1/T2 with 12/24 MVA Units & Replace 8 Panel GEC VMX SWB (Optimised)	23,807	344,254	966,873	444,978	0	0	0	0	0	0
R	1.34.01	5761 Herne Bay 33/11kV-Install Auto Close Scheme for 11kV T1 Breaker	50,056	0	0	0	0	0	0	0	0	0
Q	1.40.05	6365 Canterbury South 132kV: Install Voltage Compensator	0	0	13,265	508,893	484,690	0	0	0	0	0
R	1.33.01	8081 Canterbury Town 33kV/11kV - Install 4th 12/24 MVA Transformer, Install 1.2 km of 33kV UGC Circuit From Canterbury South & Replace 22 Panel 11kV SWB	0	0	483,431	628,568	628,569	773,703	0	0	0	0
R	1.33.01	8085 Ramsgate 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA Units	0	0	0	23,617	302,174	646,733	102,904	0	0	0
R	1.37.07	8086 Ramsgate 33kV Group Reinforcement - Install 4 km of 33kV UGC	0	0	0	0	0	0	0	0	0	0
R	1.33.01	8089 St Peters 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 Transformers	0	0	0	0	0	0	0	46,035	299,140	644,140
R	1.33.01	8137 Ashford Central 33kV/6.6kV Reinforcement - 3rd 12/24 MVA Transformer & 1 km of 33kV UGC Circuit From Ashford	0	0	0	0	0	0	0	0	0	0
R	1.33.01	8138 Dymchurch 33kV/11kV Reinforcement - Replace T1 with 7.5MVA & add T2, Install 8km of 33kV UGC Circuit	0	0	0	0	0	0	0	0	0	0
R	1.33.01	8139 Kenardington 33kV/6.6kV - ITC	0	0	0	0	0	0	0	0	0	0
R	1.33.01	8146 Tenterden 33kV/6.6kV Reinforcement - Replace T2 with 7.5/15 MVA Unit & Re-Conductor 12 km of 33kV OHL Conductor on Wood Pole	0	0	0	39,892	236,885	468,835	660,892	0	0	0
R	1.33.01	8147 Warehorne 33kV/11kV - Install T2 as 7.5/15 MVA, add 2x 11kV panels & install 0.5km of 33kV ugc	0	0	42,197	213,900	349,234	442,371	0	0	0	0
R	1.33.01	8087 Shepway 33kV/11kV Reinforcement - Replace T1/T2 with 20/40 MVA Units	331,257	544,208	237,362	0	0	0	0	0	0	0
R	1.33.01	8245 Smeeth 33kV/11kV - Replace T1/Add T2 as 7.5/15 MVA Units	0	0	0	0	38,091	207,638	373,464	501,200	0	0
R	1.37.07	8629 Shepway 33kV Reinforcement - Install 3rd 3km x 33kV UGC Circuit From Maidstone Grid	0	22,553	248,080	750,556	417,469	0	0	0	0	0

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

4.3 HI / LI Improvement

Table 14. – LI Table (With Intervention)

Canterbury/Sellindge			
Substation	Voltage kV	2023 Load Index	
		Without Investment	With Investment
Ashford Central	33/6.6	1.00	1.00
Ashford East	33/11	1.00	1.00
Ashford Grid	132/33	1.00	1.00
Ashford West	33/6.6	1.00	1.00
Barming	33/11	2.00	2.00
Betteshanger Grid	132/33	1.00	1.00
Betteshanger Local	33/11	1.00	1.00
Canterbury Local	33/11	2.00	4.00
Canterbury South	132/33	1.00	1.00
Canterbury Town	33/11	5.00	1.00
Chartham	33/11	1.00	1.00
Deal	33/11	1.00	1.00
Dover T1/T2	33/11	5.00	1.00
Dover T3/T4	33/11	2.00	2.00
Dymchurch	33/11	3.00	4.00
Folkestone 132/33	132/33	1.00	1.00
Folkestone East	33/11	1.00	1.00
Folkestone Morehall	132/11	2.00	2.00
Harrietsham	33/11	1.00	1.00
Herne Bay	33/11	1.00	1.00
Herne Bay Grid	132/33	1.00	1.00
Hythe	33/11	1.00	1.00
Kenardington	33/6.6	1.00	1.00
Lightweight Aggregates	33/11		
Little Chart	33/6.6	2.00	1.00
Maidstone Total	132/11		
Manston	33/11	1.00	1.00
Margate	33/11	1.00	1.00
Ramsgate	33/11	2.00	2.00
Richborough Grid	132/33	1.00	1.00
Richborough Local	33/11	1.00	1.00
Romney Warren	33/11	5.00	5.00
Ruckinge Grid	132/33	1.00	1.00
Sellindge Grid	132/33	2.00	2.00
Sevington Total	33/11	1.00	1.00
Shepway	33/11	5.00	1.00
Singleton	33/6.6	2.00	2.00
Smeeth	33/11	3.00	1.00
St Peters	33/11	3.00	4.00
Stanford	33/11	1.00	1.00
Tenterden	33/6.6	2.00	1.00
Thanet Grid	132/33	2.00	2.00
Thanet Local	33/11	1.00	1.00
Walton	33/11	1.00	1.00
Warehorne	33/11	2.00	1.00
Waterside	33/11	1.00	1.00
Westgate	33/11	2.00	2.00
Whitstable	33/11	1.00	1.00
Wingham	33/11	1.00	1.00
Maidstone 132/33	132/33	1.00	1.00
Maidstone Grid North	132/11	1.00	1.00
Maidstone Grid South	132/11	1.00	1.00
Chilmington Green	33/11		
Snowdown	33/11	1.00	1.00
Ashford Local	33/11		

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

Table 15. HI's for 6.6kV and 11kV Circuit breakers (With Intervention)

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
ASHFORD CENTRAL 33/6.6KV	1	13				1	13			
ASHFORD EAST		4	7				11			
ASHFORD WEST 33/6.6KV		7					7			
BARMING 33/11KV		5	6				11			
BETTESHANGER LOCAL 33/11KV	2	8					10			
CANTERBURY LOCAL		11					6	5		
CANTERBURY TOWN 33KV		14	8					22		
CHARTHAM 33/11KV	1	6	2				9			
DEAL PRIMARY 33/11KV		9					2	7		
DOVER PRIMARY 33/11KV		13	10	1				19	4	1
DYMCHURCH 33/11KV		5						5		
FAIRMEADOW 11 KV		18						18		
FOLKESTONE EAST 11 KV		11	1				12			
FOLKESTONE GRID 132 KV		1	1					1	1	
FOLKESTONE MOREHALL 132/11KV		14	2					14	2	
HARRIETSHAM 33/11KV		10					10			
HERNE BAY 33/11KV		13				13				
HYTHE MAIN	10					10				
KENARDINGTON 33/6.6KV		5					5			
LIGHTWEIGHT AGGREGATES 33/11KV		4						4		
LITTLE CHART 33/6.6KV		8					3	5		
MAIDSTONE GRID 132 KV		2					2			
MAIDSTONE GRID NORTH	2	14					16			
MAIDSTONE GRID SOUTH	12					12				
MANSTON 33/11KV	11						11			
MARGATE 33/11KV		5	5				10			
MEADS		3	8					3	8	
MONKTON GRID 11KV	9					9				
MONKTON GRID 132	1					1				
RAMSGATE 33/11KV			13			13				
RICHBOROUGH 33/11KV		10					4	6		
ROMNEY WARREN 33KV		8						8		
SELLINDGE CONVERTER STATION		1					1			
SEVINGTON 33/11KV		10					10			
SHEPWAY 33/11KV	11					2	9			
SHIRLEY 33/11 KV	1	9	2			1		11		
SINGLETON 33/6.6KV	11						11			
SMEETH 33/11KV		3						2	1	
ST PETERS 33/11KV		1	11			12				
STANFORD PRIMARY		4	4					4	1	3
STELRAD 33/11KV		1						1		
TENTERDEN 33KV		10						10		
THANET LOCAL 33/11KV	1	12					13			
WAREHORNE 33KV		4				4				
WATERSIDE 33/11 KV	13						13			
WESTGATE 33/11KV			12					11	1	
WHITSTABLE 33/11KV	10	2					12			
WINGHAM 33/11KV		10					5	5		

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

Table 16. 33kV Circuit breakers

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
ALLINGTON GENERATION	2					2				
ASHFORD GRID 132 KV		4						4		
ASHFORD GRID 33 KV		14	1				5	10		
BETTESHANGER GRID 132 KV		2						2		
BETTESHANGER GRID 33KV		3	9				12			
CANTERBURY SOUTH 132 KV		3					3			
CANTERBURY SOUTH 33 KV		15					14	1		
DOVER PRIMARY 33/11KV	24					24				
FOLKESTONE GRID 33KV	11						11			
HERNE BAY GRID 33KV	9						9			
HERNE BAY WINDFARM	5						5			
MAIDSTONE 132/33KV	19						19			
MAIDSTONE GRID 132 KV		1					1			
PFIZERS 33KV	1	2					3			
RICHBOROUGH GRID 132 KV	2						2			
RICHBOROUGH GRID 33KV	4	7					11			
RICHBOROUGH ZONE		2					2			
SELLINDGE 132 KV	1						1			
SELLINDGE GRID LOCAL	4						4			
SHELFORD FARM	1						1			
TENTERDEN SW STN 33KV		2					2			
THANET GRID 132KV		4					4			
THANET GRID 33KV		16					16			
WHITSTABLE 33KV SWITCHING STA	3					3				

Table 17. 132kV Circuit Breakers

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
BETTESHANGER GRID 132 KV			1	2		3				
CANTERBURY NORTH 132 KV		3				3				
CANTERBURY SOUTH 132 KV	4		3	3		10				
EUROTUNNEL 132 KV		2						2		
FOLKESTONE GRID 132 KV		2					2			
MAIDSTONE GRID 132 KV		2					2			
MONKTON GRID 132	1						1			
RICHBOROUGH GRID 132 KV	2	1	5	4			3			9
RUCKINGE GRID 132 KV			1	2			3			
SELLINDGE 132 KV		8					8			

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

Table 18. 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
ASHFORD CENTRAL 33/6.6KV		2				1	1	1		
ASHFORD EAST		2						2		
ASHFORD WEST 33/6.6KV		2						2		
BARMING 33/11KV		2					2			
BETTESHANGER LOCAL 33/11KV		1	1				1			1
CANTERBURY LOCAL	1	1					2			
CANTERBURY TOWN 33KV		2	1			1		2	1	
CHARTHAM 33/11KV		2					2			
DEAL PRIMARY 33/11KV				2			2			
DOVER PRIMARY 33/11KV			2	2		2	2			
DYMCHURCH 33/11KV			1			2				
HARRIETSHAM 33/11KV		2					1	1		
HERNE BAY 33/11KV	2		1			1	2			
HYTHE MAIN		1	1				1	1		
KENARDINGTON 33/6.6KV		1				2				
LIGHTWEIGHT AGGREGATES 33/11KV		1					1			
LITTLE CHART 33/6.6KV		2				2				
MANSTON 33/11KV		2					2			
MARGATE 33/11KV		2					2			
MEADS			2					2		
RAMSGATE 33/11KV			2			2				
RICHBOROUGH 33/11KV		2					2			
ROMNEY WARREN 33KV			2			2				
SELLINDGE CONVERTER STATION		1					1			
SEVINGTON 33/11KV		2					2			
SHEPWAY 33/11KV			1	1		2				
SINGLETON 33/6.6KV		2					1	1		
SMEETH 33/11KV		1				2				
ST PETERS 33/11KV			2			2				
STANFORD PRIMARY			2					2		
STELRAD 33/11KV			1			1				
TENTERDEN 33KV		2				1	1			
THANET LOCAL 33/11KV	1		1	1		2	1			
WAREHORNE 33KV	1					1				
WATERSIDE 33/11 KV	1	1					1	1		
WESTGATE 33/11KV			2					2		
WHITSTABLE 33/11KV		2						2		
WINGHAM 33/11KV		2						2		

Canterbury / Sellindge

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

Table 19. 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
ASHFORD GRID 132 KV		1	1		1			1	1	1
BETTESHANGER GRID 132 KV		2						2		
CANTERBURY SOUTH 132 KV		2	1			1	2			
FOLKESTONE GRID 132 KV		2		1	1	2	1	1		
HERNE BAY GRID 132/33KV	1	1				1	1			
MAIDSTONE GRID 132 KV	2	2				2	2			
MONKTON GRID 132	1						1			
RICHBOROUGH GRID 132 KV	2						2			
RUCKINGE GRID 132 KV		2						2		
SELLINDGE 132 KV		1				1	1			
THANET GRID 132KV		1	3				4			

5 ALTERNATIVE STRATEGIES CONSIDERED

4133: Ashford West 33/6.6kV Replace T1 and T2 2014/15 and 2015/16

Ashford West asset condition HI shows that the condition of these assets does not warrant their replacement during ED1 period. It is therefore recommended that the project be deferred to ED2 period after re-evaluation of the assets. PLE indicated that these transformers will not drift “Out of Firm” within ED1 period and thus will not require reinforcement.

- HI index shows HI2 in 2015 and HI3 in 2024
- PLE is not exceeded

8090: Thanet Grid Transformer Reinforcement and Line PY replacement

Rejected Option 1: Expansion of Thanet to a Full 132/33kV Substation.

This option would require the expansion of Thanet Substation to a full 132/33KV substation configuration including reinforcement of 3 of the existing transformers from 45MVA to 90MVA, the additional of a bus section and line bays for the connecting line PY, feeders. The new configuration would increase the capacity of Thanet substation to 160MVA however the firm capacity would still be limited to that of line PY at 130MVA. The assets replacement work of line PY would still require undertaking due to their condition and could be used to increase the capacity to allow the full utilisation of the 160MVA.

This strategy has been reject on the basis that the increased capacity cannot be justified and hence the additional expense.

7904: Shepway T1 and T2 Refurbishment

This project has now been incorporated into project 8087 as described above.

3115: PC1 – PHA39A – re-conductor 2019 – 2021

This project has now been superseded by project 7976.

Line PC1 – PHA39A is a short line 132kV double circuit which runs from Woodnesborough junction to Betteshanger substation. HI index indicates that all line equipment will need to be replaced by 2015 except the left conductor therefore it is recommended that this project be expanded to include replacement or refurbishment of the towers, conductors, earth wire and all fittings.

Foundations HI indicate that they will still be serviceable at the end of the period however the additional cost relevant to their proposed risk would indicate that these should be replaced in conjunction with the towers. It is therefore recommended that a detailed condition assessment is undertaken to determine whether they should be included in the works. Where it is determined that these should be replaced, new towers can be constructed adjacent to the existing towers reducing the outage period, or else temporary towers can be utilised, thus negating any Wayleave issues with new routes.

HI have determined that the left fittings and earth conductor will need to be replaced in 2012 during the existing DPR5 period however it is recommended that mitigation measures be implemented to defer the works to 2015. This should include a condition assessment report to determine any high risk insulators and their replacement using live line techniques as appropriate, with 6 monthly inspections.

The double circuit forms the only 132kV connection to Betteshanger substation therefore the extended outages required for the tower replacement will have a significant impact. Betteshanger has 6 x 33kV connections which can facilitate load transfer. To maximise the available transfer capacity it is proposed that the works will be done during summer early in the RDP period preferably 2015 when forecast loads are at their lowest. Any work that can be implemented with the line live should be undertaken to further reduce outage times.

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

- Left conductor HI 4 2024
- Left fitting HI 5 2012
- Right conductor HI4 2015
- Right fitting HI4 2015
- Earth conductor HI 4 2012
- Earth fitting HI4 2015
- Tower steel work HI5 2015
- Foundations no problem in current period.

8137: Ashford Central 33kV/6.6kV – ITC

This project can be deferred as firm capacity is not exceeded during ED1 period.

The predicted load at Ashford Central 33kV/6.6kV is projected to exceed firm capacity during ED2 period. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to increase transformer circuit capacity by installing one 24MVA transformer, installation of 0.2 km of 33kV underground cable, addition of 1x6.6 kV series reactor and the addition of 2 x 6.6kV panels. Completion of this project will see the transformer feeder circuit uprated by the addition of 1 x 12/24MVA 33kV/6.6kV transformers and a new 0.2 km of 33kV underground cable circuit.

8138: Dymchurch 33kV/11kV – ITC

This project can be deferred as firm capacity is not exceeded during ED1 period.

The predicted load at Dymchurch 33kV/11kV is projected to exceed firm capacity during ED2 period. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to increase transformer circuit capacity by installing 2 x 7.5 MVA transformer/s, installing 7.5 km of 33kV underground cable and addition of 2 panels of 11kV switchboard. Completion of this project will see the firm capacity increases by the addition of 2 x 33/11kV transformers, addition of a section of 33kV underground cable and addition of 2 panel/s of 11kV switchboard

7817/7902: Romney Warren – Refurbish T1 and T2 and Replace 11kV switchboard

The above projects have been replaced by an optimised project number 3719, which involves replacement of T1 and T2 and including the 11kV switchboard in order to match the new transformer capacity.

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

6 References

References	Description
Reference 1	SPN Planning Load Estimates 2011 – 2023 (27 th February 2014)
Reference 2	SPN 132kV System Diagram East
Reference 3	SPN 132kV System Diagram West
Reference 4	SPN LTDS Network Schematics
Reference 5	NAMP SPN Table J Less Ind 19 th February 2014
Reference 6	ED1 Update September 2012 v10.3.1

6.1 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	Single Line Diagram – Recommended Strategy

6.2 Document History

Version	Date of Issue	Author	Details
1.1	March 2013	URS	Initial Draft
1.2	June 2013	I. Utah	ED1 Alignment
2	February 2014	I. Utah	ED1 Re-submission

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
Itayi Utah	Infrastructure Planner		
Tendai Matiringe	IDP Coordinator (EPN/LPN/SPN)		
Chris Winch	Planning Manager (North / South)		

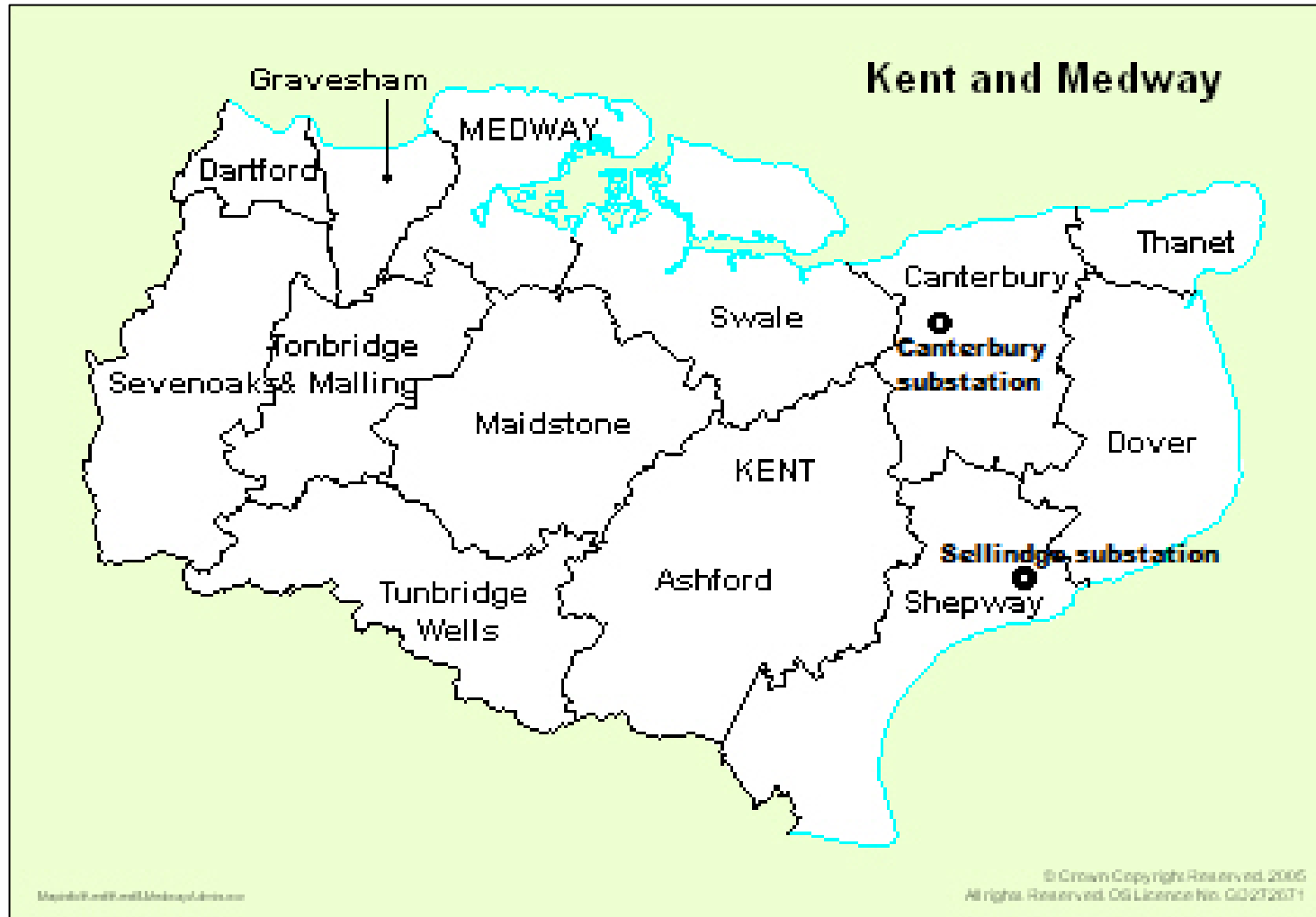
Approval by:

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

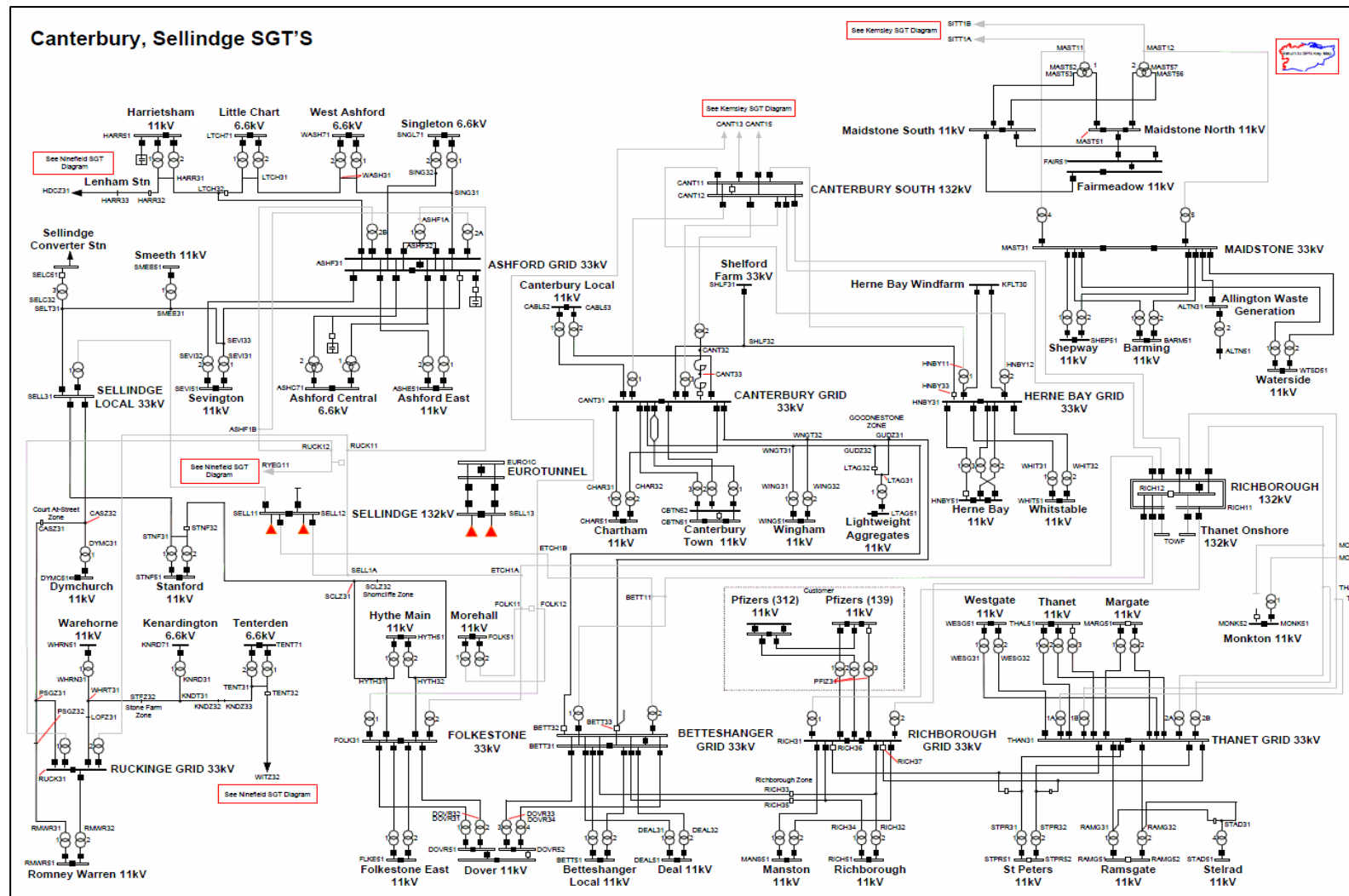
Regional Development Plan

Area Covered

APPENDIX A: GEOGRAPHICAL DIAGRAM

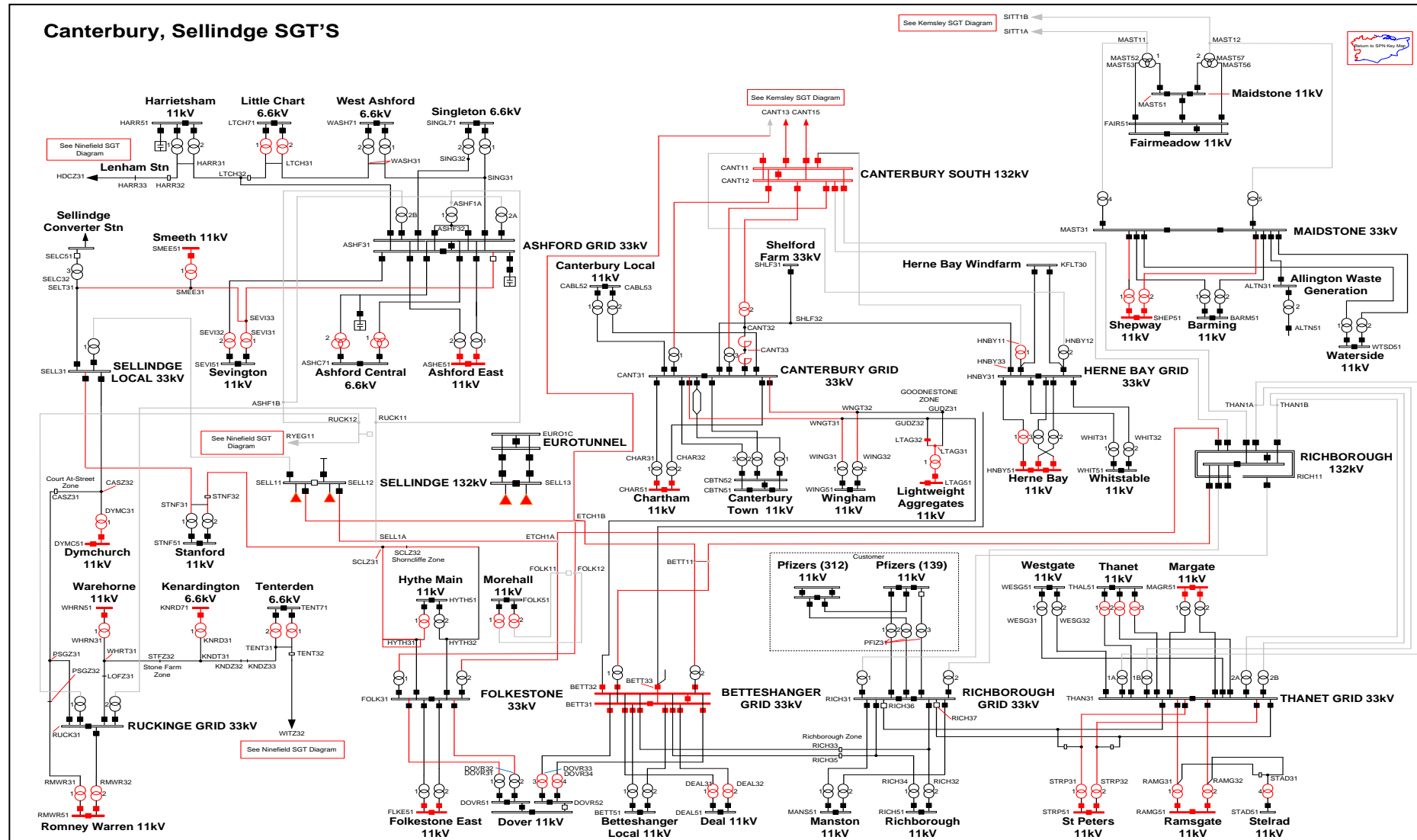


APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK



Area Covered

APPENDIX C: SINGLE LINE DIAGRAM – RECOMMENDED STRATEGY



Regional Development Plan

Area Covered

APPENDIX D: GEO-PHYSICAL NETWORK DIAGRAM

