

LANGEBERG MUNICIPALITY



ELECTRICITY MASTERPLAN

Noree Area of Supply

P302015-ELE-MPL-006-B

SEPTEMBER 2022

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1 EXECUTIVE SUMMARY

An electricity master plan report is a long-term planning document that investigates the current infrastructure and status of the electrical network, which forms the basis for future planning and network upgrade recommendations. Information on the changes to existing 11 kV networks were obtained from Langeberg Municipality.

This report deals with the electrical infrastructure in the Noree supply area of Langeberg Municipality. The current notified maximum demand is 6MVA with recent maximum demand peaking at 5.38MVA. The load growth is forecasted at 2.38% per year based on historical average with some minor developments planned indicating that the NMD might be exceeded by 2024.

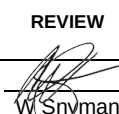
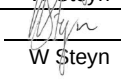
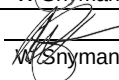
The impact of the load growth and new developments on the existing infrastructure was determined and recommendations were made on how to make sure that the electricity supply for the whole area remains reliable and of an acceptable quality.

Major proposed capital projects are the addition of a second 66/11kV transformer and associated works to provide spare and redundant capacity.

Service delivery, demand side management initiatives, assessment of asset condition and economic development and alternative sources of energy are also discussed.

The projects completed to date have been updated as applicable.

P302015-ELE-MPL-006-B

REV	DESCRIPTION	ORIG	REVIEW	iXengineers APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for approval	 W Steyn	 W Snyman	N/A	2022-06-27		
B	Issued for approval	 W Steyn	 W Snyman	N/A	2022-09-09		

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION.....	2
3	EXISTING INFRASTRUCTURE	2
3.1	BULK SUPPLY.....	3
3.2	11kV INFRASTRUCTURE.....	4
3.3	ASSET CONDITION ASSESSMENT	4
3.3.1	SUBSTATION	5
3.3.2	SWITCHGEAR	5
3.3.3	TRANSFORMERS	5
3.3.4	CONSUMER METERS	5
4	ASSESMENT OF EFFICIENCY LEVELS AND SERVICE DELIVERY	6
4.1	OPERATIONS.....	6
4.2	LEVELS OF SERVICE.....	7
4.3	DEMAND SIDE MANAGEMENT	8
5	ENERGY LOSSES.....	8
5.1	BACKGROUND OBJECTIVE METHODOLOGY.....	8
5.2	NOREE TECHNICAL LOSSES	9
6	ASSESSMENT OF ECONOMIC DEVELOPMENT	9
7	ALTERNATIVE SOURCES OF ENERGY	11
7.1	CURRENT SSEG INSTALLATIONS	11
7.2	SSEG IMPACT ON MUNICIPAL REVENUE.....	11
7.3	ALTERNATIVE ENERGY SUPPLY FOR MUNICIPAL BUILDINGS	12
7.4	ALTERNATIVE ENERGY SUPPLY OPTIONS FOR MUNICIPAL FEED IN POINTS.....	13
8	FUTURE DEVELOPMENTS / LOAD GROWTH FORECAST	15
8.1	HISTORIC LOAD GROWTH TREND	15
8.2	PROPOSED DEVELOPMENTS	17

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

9	LOAD FLOW ANALYSIS	19
9.1	METHODOLOGY	19
9.2	RESULTS OF LOAD FLOW ANALYSIS.....	19
9.2.1	CURRENT MAXIMUM DEMAND LOAD FLOW	20
9.2.1.1	PROSPECTIVE FAULT CURRENT STUDY	20
9.2.1.2	VOLTAGE LEVEL STUDY	20
9.2.1.3	CONDUCTOR THERMAL CAPACITY STUDY	21
9.2.2	5-YEAR MAXIMUM DEMAND LOAD FLOW	21
9.2.2.1	VOLTAGE LEVEL STUDY	22
9.2.2.2	CONDUCTOR THERMAL CAPACITY STUDY	22
9.2.3	10-YEAR MAXIMUM DEMAND LOAD FLOW	22
9.2.3.1	VOLTAGE LEVEL STUDY	23
9.2.3.2	CONDUCTOR THERMAL CAPACITY STUDY	23
10	RECOMMENDED CAPITAL UPGRADES.....	23
11	CONCLUSIONS	24
12	RECOMMENDATIONS.....	24
	APPENDIX 1 – NOREE 11KV ELECTRICAL DISTRIBUTION NETWORK LAYOUT	25
	APPENDIX 2 – NOREE 11KV SINGLE LINE DIAGRAM	26
	APPENDIX 3 – ASSET CONDITION ASSESSMENT	27
	APPENDIX 4 – NETWORK TECHNICAL LOSSES CALCULATION	28
	APPENDIX 5 – SSEG IMPACT ON MUNICIPAL REVENUE	29
	APPENDIX 6 – ALTERNATIVE ENERGY SUPPLY FEED IN POINT	30
	APPENDIX 7 – LOAD GROWTH FORECAST	31
	APPENDIX 8 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS	32
	APPENDIX 9 – PROSPECTIVE FAULT LEVEL STUDY.....	33
	APPENDIX 10 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY	

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 11 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY	35
APPENDIX 12 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS	36
APPENDIX 13 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY ...	37
APPENDIX 14 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY	38
APPENDIX 15 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS	39
APPENDIX 16 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY .	40
APPENDIX 17 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY	41
APPENDIX 18 – RECOMMENDED CAPITAL UPGRADES.....	42

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

LIST OF ABBREVIATIONS

ACSR	Aluminium Conductor Steel Reinforced
ADMD	After Diversity Maximum Demand
IDP	Integrated Development Plan
LED	Local Economic Development
LV	Low Voltage
kVA	kilovolt Ampere: Apparent Power
kW	kilowatt: Real Power
kWh	kilowatt hour
MFMA	Municipal finance management act
MV	Medium Voltage
MVA	Megavolt Ampere: Apparent Power
MW	Megawatt
NDP	National Development Plan
NMD	Notified Maximum Demand
NRS	National Rationalised Specifications
N/C	Normally Closed
N/O	Normally Open
PILC	Paper Insulated Lead Covered
PV	Photovoltaic
SALGA	South African Local Government Association
SANS	South African National Standards
SDBIP	Service Delivery Budget Implementation Plan
SDF	Spatial Development Framework
SS	Substation
SSEG	Small Scale Embedded Generation
SWH	Solar Water Heater
TID	Token Identifier
XLPE	Cross-linked Polyethylene

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

2 INTRODUCTION

iX Engineers (Pty) Ltd was appointed to compile a new master plan which includes updates to the previous master plan on the electricity infrastructure in the Langeberg Municipal area.

The contents of this report will cover the Noree area of supply. The other supply areas will be covered in separate reports.

This master plan report must be read in conjunction with the drawings and other information available in the Appendices.

3 EXISTING INFRASTRUCTURE

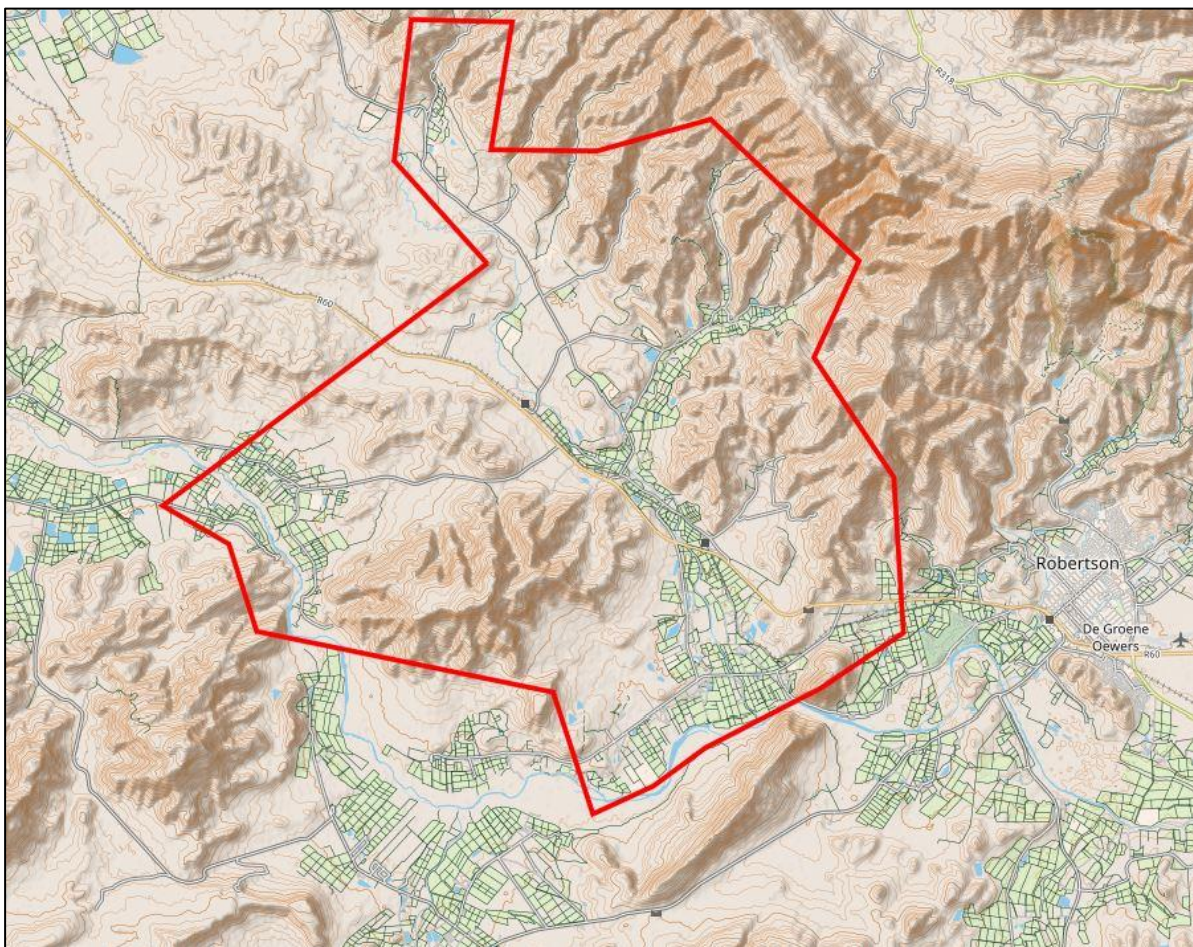


Figure 1: Noree Distribution Area

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3.1 BULK SUPPLY

Noree is currently supplied in bulk from the Eskom Klipdrif Substation 132 / 66kV substation via the Uitspan 66kV switching station to the Eskom Noree switching station, located adjacent to the municipal Noree 66/11kV substation. There is currently only one 10 MVA 66/11kV transformer installed at Noree Substation. Supply is taken at 66kV.

Noree area is on the Miniflex tariff.

Supply Voltage (kV)	Maximum Demand (MVA)	Notified Maximum Demand (MVA)
66	5.38*	6

*Maximum demand figure from February 2022.

Historical maximum demand and notified maximum figures for Noree are shown in the chart below:

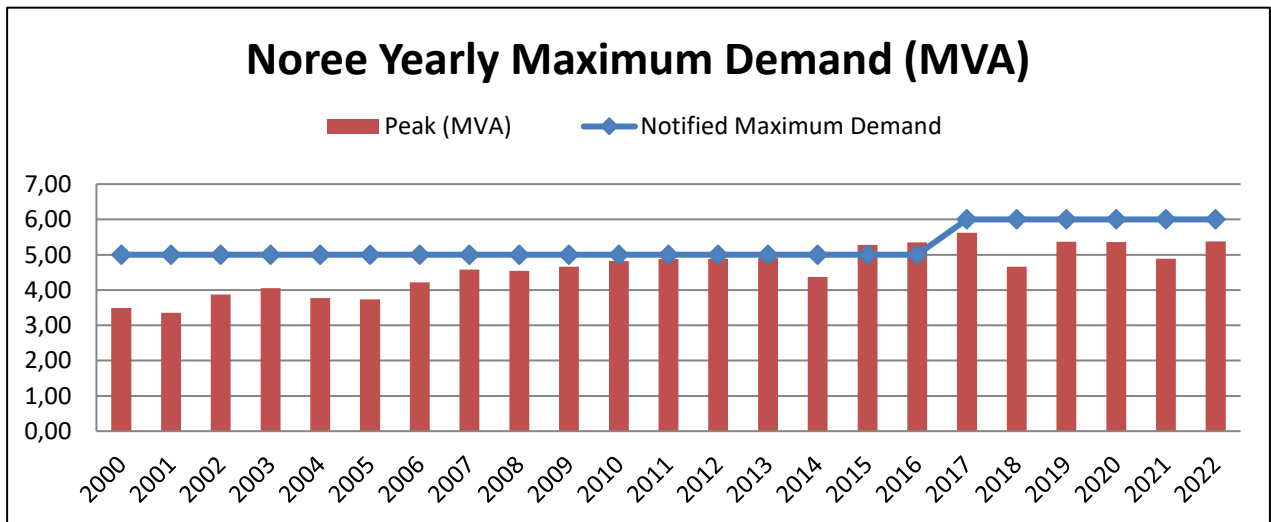


Figure 2: Noree Yearly Maximum Demand Figures

Noree has shown steady growth up until 2017, where after the demand levelled out and no significant increase has been seen since.

The current notified maximum demand (NMD) is 6 MVA.

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The monthly maximum demand figures are included below indicating that Noree area of supply reaches its peak during the month of February / March each year.

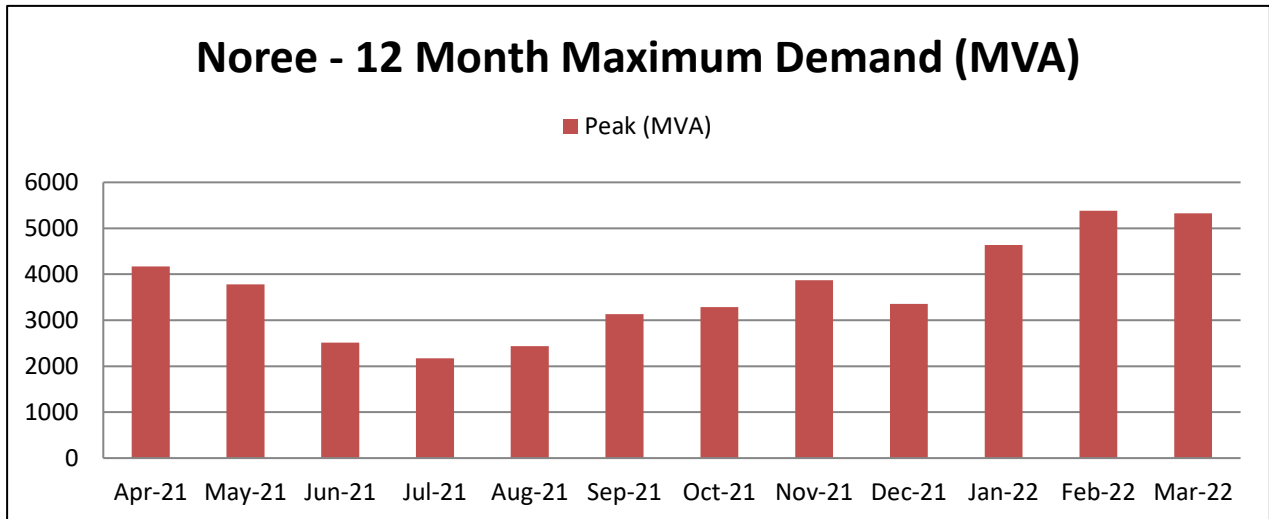


Figure 3: Noree Monthly Maximum Demand Figures

3.2 11kV INFRASTRUCTURE

There is one incomer that feeds the Noree 11kV main switching station with three outgoing feeders. The bus section in the switching station is operated normally closed.

The area consists overhead lines of the ACSR type with pole mounted transformers and sections of the overhead line are interconnected to create the possibility of ring feeders should a fault on one of the feeders occur.

The 11kV electrical distribution network layout for Noree is included in Appendix 1 and single line diagram in Appendix 2.

3.3 ASSET CONDITION ASSESSMENT

The information of existing assets was obtained from the municipal asset register.

The asset condition assessments for the various equipment are included in Appendix 3

The expected useful life for the different asset types are indicated below as published in the Municipal Finance Management Act Guidelines.

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Asset Type	Expected Useful Life (Years)
MV Transformer	45
MV Cables and Lines	45
MV Substation and Switchgear	45
LV Network	50
Consumer Meters	15

Table 1: MFMA – Local Government Capital Asset Management Guideline

3.3.1 SUBSTATION

The Noree substation was constructed in 1998 and all equipment is still within the expected useful life and only due for replacement in 2043.

3.3.2 SWITCHGEAR

The 11kV switchgear installation date is not indicated on the asset register. It is assumed to be the same as the substation equipment.

3.3.3 TRANSFORMERS

The transformers for the Noree area are not indicated separately on the asset register and is included in the Robertson area of supply report assessment.

3.3.4 CONSUMER METERS

Langeberg Municipality is on a continued meter replacement programme. In the financial year 2020/21, 385 meters were replaced with prepaid meters for the entire Langeberg municipal area.

All STS prepayment meters will be affected by the Token Identifier (TID) rollover happening on 24 November 2024. Any tokens generated after this date will be rejected by the meter as being old tokens. The current TID base date that is used to generate tokens is 1993.

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To overcome this issue, all STS prepayment meters will require a key change token to be entered into the meter and be accepted by the meter. After the key change has been accepted, the new tokens will be calculated from a 2014 base date and will have a lifespan up to 2045.

4 ASSESMENT OF EFFICIENCY LEVELS AND SERVICE DELIVERY

4.1 OPERATIONS

The effectiveness of operations was assessed in accordance with the requirements of the Integrated Development Plan (IDP). Basic service delivery objectives were set at restoring 95% of municipal interruptions within 4 hours and 98% within 24 hours after complaints have been received according to NRS 047 Electricity Supply – Quality of Service and Reporting Guidelines. From the below chart it is evident that both objectives have been surpassed.

For Noree supply area figures were not indicated separately and thus included in the Robertson area of supply report.

The IDP also sets out an objective to provide quotations for new electricity connections (within 10 days) where existing network is being used, and within 30 days where extensions must be done.

The chart below indicates the response time success percentages per category. Deviations are indicated as 4% which is within the recommended target percentage success rate (at least 90% as stated in NRS 047) for providing quotations timeously.

The figures are for the whole of the Langeberg Municipal area.

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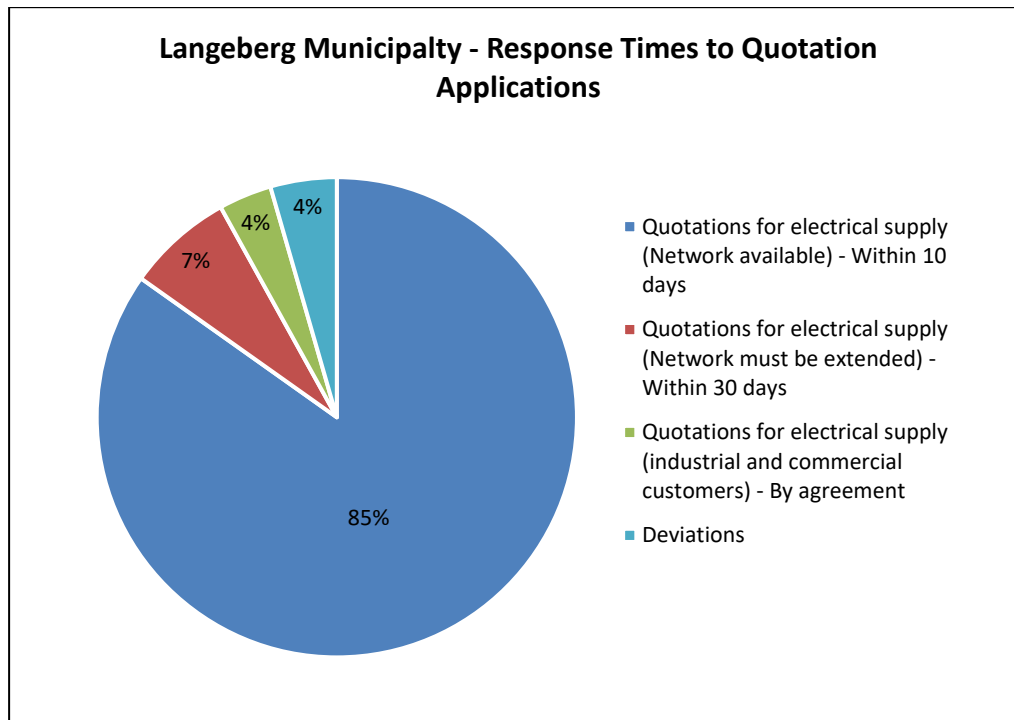


Figure 4: Quotation Application Response Times (Jun 20 – Jul 21)

4.2 LEVELS OF SERVICE

The possibility to restrict residential consumers by lowering the 60A rating of circuit breakers was also considered in this report.

According to the SDBIP figures, there are 17,804 (30 June 2021) formal residential properties connected to the municipal network which are billed.

To replace these circuit breakers will require substantial resources from the municipality to implement. If implemented, the lowered rating could cause nuisance tripping due to established consumer load profiles.

An option that could be considered is to implement the setting of meters, where applicable, to a certain amperage to trip and reset after a certain period and evaluate the response from consumers.

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4.3 DEMAND SIDE MANAGEMENT

The following are forms of demand side management initiatives that can be implemented / expanded on to further reduce the demand of the municipality:

- Set limits on meters,
- Installation of high efficiency motors,
- Installation of variable speed drives, where feasible to reduce,
- Installation of power factor correction equipment where low power factor measurements are experienced to reduce reactive energy supply from municipal network,
- Solar water heater installations / retrofit,
- SSEG installations with backup battery systems to reduce the reliance on the municipal network during peak periods,

5 ENERGY LOSSES

5.1 BACKGROUND OBJECTIVE METHODOLOGY

The transfer of electricity from generation to the end-users involves losses in energy volumes (electrical or technical losses) that reduce the amount of electricity volumes available for sale to end-customers. In addition, other energy losses may also occur due to non-metered usage related to electricity theft (non-technical).

Energy loss is an intrinsic risk in the electricity business and utilities globally have the challenge to address this issue.

Technical losses include resistive losses of the primary feeders, the distribution transformer losses (resistive losses in windings and the core losses), resistive losses in the secondary network, resistive losses in service cables and losses in and due to kWh meter accuracy. Losses are inherent to the distribution of electricity and cannot be eliminated.

The calculation of technical losses can be done using various approaches with different degrees of accuracy. Technical losses in distribution systems are directly related to consumers' load curves, which vary due to seasonality and / or changes in load over the year. For the management of technical losses, a balance between absolute calculation accuracy and the effort must prevail. Acceptable approaches to calculate

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technical losses of an electricity distribution network can be divided into two groups. These are the full accuracy methods and methods of representative load profiles.

5.2 NOREE TECHNICAL LOSSES

An investigation was done to determine the level of technical losses in the Noree networks. The total losses were calculated by using the representative load profiles as the sum of all loads and no load losses. The table below summarises the contribution of each element in the network to the total technical loss, refer to Appendix 4 for the technical losses calculation.:

Network Element	% loss contribution
Transformers No Load Losses	1.58
Transformers Partial Load Losses	1.56
MV Network Losses	1.48
LV Network Losses	2.22
Total losses	6.84

The estimated technical loss factor for Noree is therefore 1.0684. The Noree network can be classified as a mixed load between urban (residential and small holdings) and rural. Using this classification and comparing the above calculated load factor to the NRS 080 table 1(a) and 1(b) guideline indicates the calculated value is within the guideline values.

6 ASSESSMENT OF ECONOMIC DEVELOPMENT

The Local Economic Development Strategy must form an integral part of the assessment, latest version available is dated May 2018.

The LED strategy is aligned with the national and provincial planning framework.

The following are requirements set out in the National Development Plan (NDP) relating to electricity needs and supported by the LED strategy of Langeberg Municipality:

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Objective (NDP)	Action proposed	Langeberg Municipality Status	Objective achieved / Action required
Economic Infrastructure	90% of people with access to the electricity grid by 2030	LED strategy confirmed that 94% of households used electricity as energy source for lighting. (2017)	Objective Achieved, continuously monitor new developments and provide electricity supply as required.
	Move to less carbon-intensive electricity production (renewable energy), including solar water heating	Refer to section on Alternative Sources of Energy in the masterplan for description. SSEG grid connection allowed.	Continuous development, Langeberg Municipality to be included in future SWH programmes.
	Establish a national, regional and municipal fibre-optic network to provide the base for broad band access and attract private investment	N/A	Fibre-optic ducts could be installed, at relatively low cost, with new or replacement of existing cables on strategic routes to reduce double excavations.
Environmental Sustainability and Resilience	Municipal regulations to stimulate renewable energy	Guidelines currently in place for SSEG connection to grid	Objective achieved
	All new buildings to meet the energy-efficiency criteria set out in South African National Standard 204	Energy efficiency conditions included in Langeberg Municipality: Land Use Planning By Law Clause 66 (2) (h)	Land use Planning Bylaw dated 2015 includes "energy efficiency" as a condition of approval. Reference to SANS 204 "Energy efficiency in buildings" to be included.
Inclusive Rural Economy	Improved infrastructure and service delivery to activate rural economies	Installation of networks as required.	Continuous implementation.
Social Protection	Design and implement mechanisms to assist the unemployed to access the labour market	Contract Participation Goals (CPG) and Extended Public Works Programme (EPWP) requirements to be included in tender conditions	Continuous implementation and reporting in projects.

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

7 ALTERNATIVE SOURCES OF ENERGY

7.1 CURRENT SSEG INSTALLATIONS

There are currently 49 SSEG installations exporting into the Langeberg Municipal network. Below is a trend indicating the growth of SSEG installations.

Noree area of supply SSEG installations are not indicated separately and is included in the total for Robertson area, if any. The total installed capacity of SSEG's in Langeberg Municipal area is 1,863.28kW.

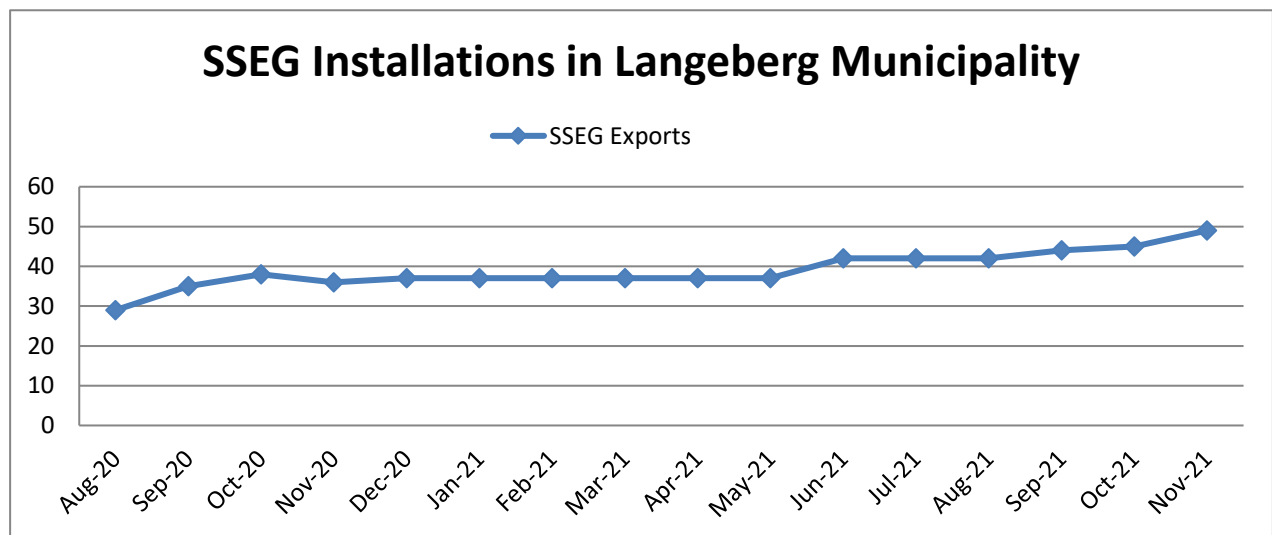


Figure 5: SSEG Installations

7.2 SSEG IMPACT ON MUNICIPAL REVENUE

A business case study on the impact of SSEG installations on municipal revenue was done and included in Appendix 5. Residential, Small Business, Medium Business and Large Business installations were considered.

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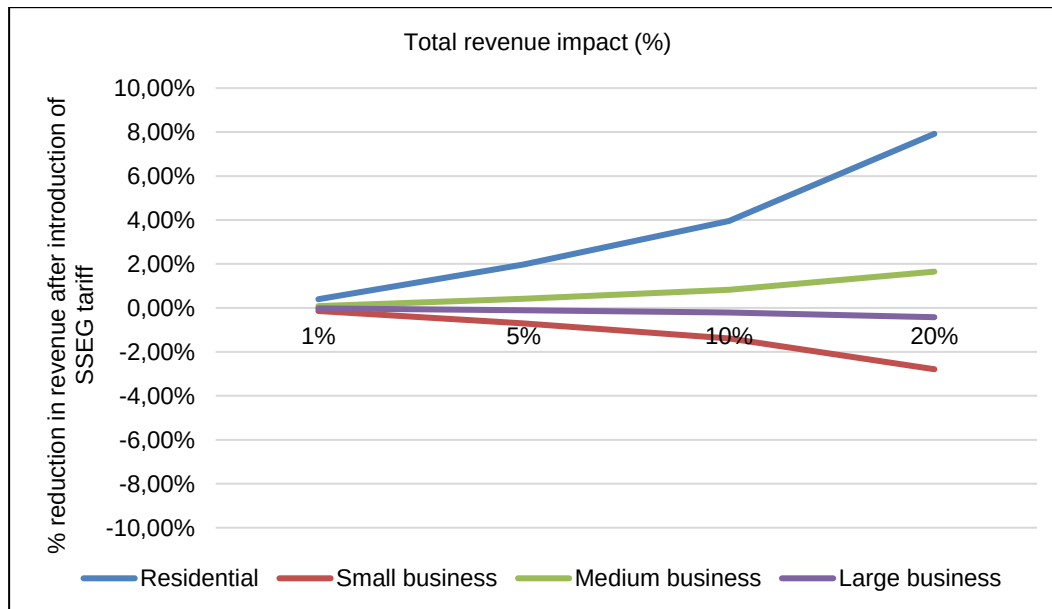


Figure 6: Revenue Impact of SSEG Installations

7.3 ALTERNATIVE ENERGY SUPPLY FOR MUNICIPAL BUILDINGS

An high level investigation into the possibility of supplying municipal buildings with alternative energy supply was undertaken. The Robertson municipal offices in Kerk Street was taken as an example study area for a solar PV system installation and report included in the Robertson area of supply masterplan report.

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7.4 ALTERNATIVE ENERGY SUPPLY OPTIONS FOR MUNICIPAL FEED IN POINTS

A high-level investigation into the possibility of implementing a 2MWp (DC) solar PV plant at the Noree Main substation has been undertaken. The area directly adjacent of the substation was used as a hypothetical area that could be utilised for the plant. An area of approximate 1.9 Ha would be required and the estimated annual production would be around 3.5GWh, refer to Appendix 6 for the simulation report.

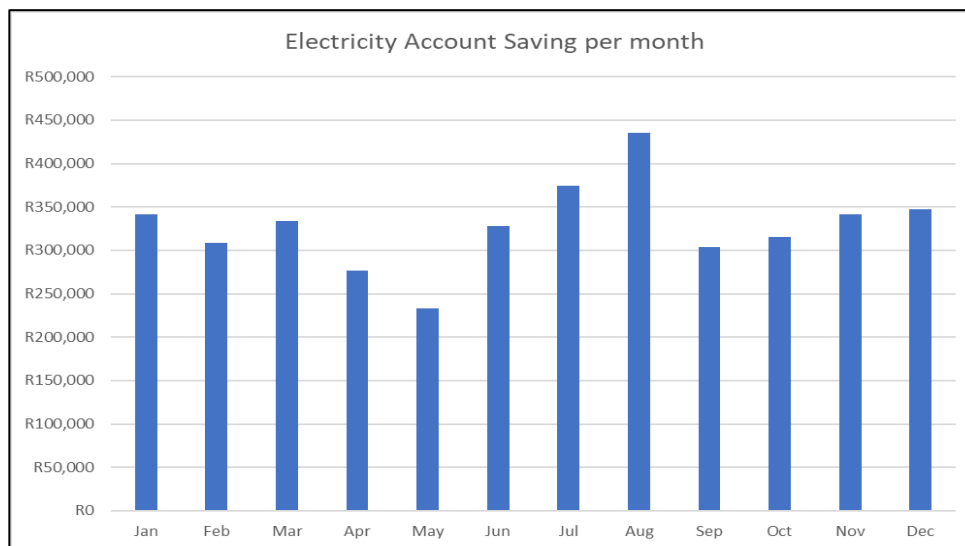
Below is a high-level cost estimate of both the capital and operation costs:

Capital Costs	
Solar PV Plant	Total
- Solar PV	24,000,000
-Perimeter Fence (electrified)	2,216,349
- CCTV	1,000,000
- Sundries	500,000
- Contingencies	2,771,635
Sub-total 1:	30,487,984
Grid Connection	
- Cable works	375,000
- Substation works	1,000,000
- Contingencies	137,500
Sub-total 2:	1,512,500
Professional Fees and Costs	
- Professional Fees	2,880,044
- Professional Costs	288,004
Sub-total 3:	3,168,048
Total (Sub-total 1+2+3)	35,168,532
Operational Costs per Annum	700,000

By applying the hourly production figures for a typical year to the applicable Eskom tariff (MiniFlex 2022) and assuming no energy will be exported to the Eskom grid, the estimated monthly electricity account savings for the first year would be R3.94million. The chart below indicates the estimated saving per month:

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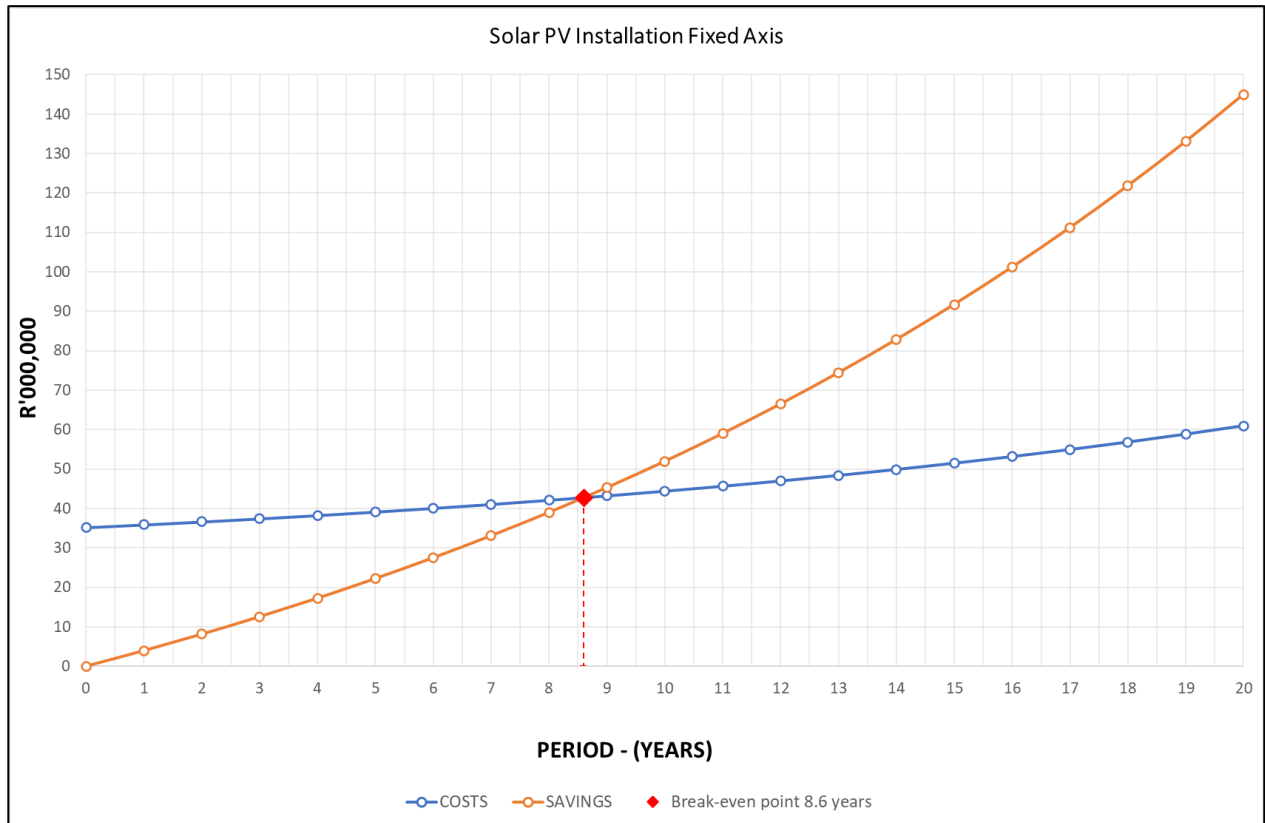


From the above a simple payback has been calculated without accounting for the costs of capital or the time cost of money. An annually compounded inflation rate of 6% has been assumed for both the O&M costs as well as tariff increases. The calculation indicates a break-even point of 8.597 years:

Solar PV - Fixed Axis					
PERIOD	Costs (R 'million)		Savings (R 'million)		NET Cashflow (R 'million)
	OPEX	Cum total	Annual	Cum total	
0		35.17		0	35.169
1	0.700	35.87	3.942	3.942	31.927
2	0.742	36.61	4.178	8.120	28.491
3	0.787	37.40	4.429	12.548	24.849
4	0.834	38.23	4.694	17.243	20.988
5	0.884	39.11	4.976	22.219	16.895
6	0.937	40.05	5.275	27.494	12.557
7	0.993	41.04	5.591	33.085	7.959
8	1.053	42.10	5.927	39.012	3.085
9	1.116	43.21	6.282	45.294	-2.082
10	1.183	44.40	6.659	51.953	-7.558
11	1.254	45.65	7.059	59.012	-13.363
12	1.329	46.98	7.482	66.494	-19.517
13	1.409	48.39	7.931	74.426	-26.040
14	1.493	49.88	8.407	82.833	-32.954
15	1.583	51.46	8.912	91.744	-40.283
16	1.678	53.14	9.446	101.191	-48.051
17	1.778	54.92	10.013	111.204	-56.286
18	1.885	56.80	10.614	121.817	-65.015
19	1.998	58.80	11.251	133.068	-74.267
20	2.118	60.92	11.926	144.994	-84.075

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8 FUTURE DEVELOPMENTS / LOAD GROWTH FORECAST

8.1 HISTORIC LOAD GROWTH TREND

Historic maximum demand figures for the Noree network:

- Year 2000 : 3.49MVA
- Year 2005 : 3.74MVA
- Year 2010 : 4.82MVA
- Year 2015 : 5.28MVA
- Year 2020 : 5.36MVA

The historic maximum demand figures are based on the statistical metering data obtained from the Eskom Bulk Supply Point, as received from Langeberg Municipality.

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Analysis of this data reveals a historical growth of 2.38% year on year average.

Using the historical figures, a graph was compiled to forecast future growth and included below:

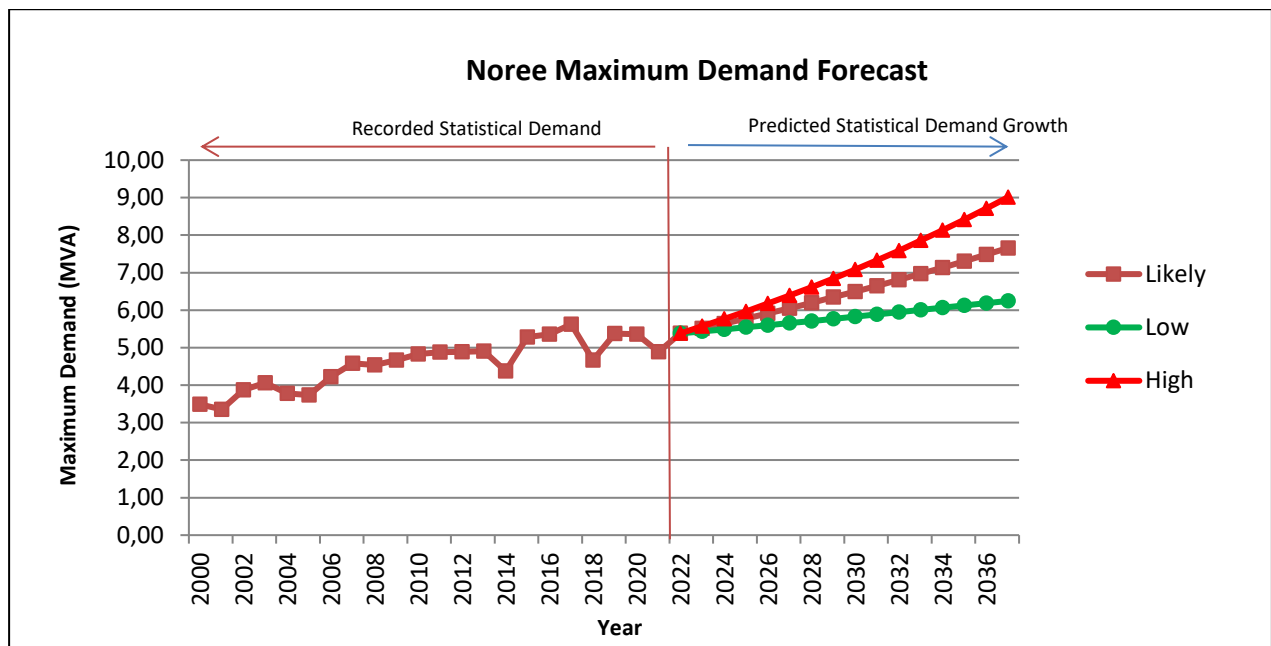


Figure 7: Noree Maximum Demand Forecast based on historic growth

Predicted maximum demand figures for low, likely and high demand predictions are as follows:

Growth Prediction	Current	2027	2032
Low (1.0%)	5.38 MVA	5.65 MVA	5.94 MVA
Likely (2.38%)		6.05 MVA	6.81 MVA
High (3.5%)		6.39 MVA	7.59 MVA

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8.2 PROPOSED DEVELOPMENTS

A detailed forecast of the proposed developments is included in Appendix 7 and is a combination of information received from correspondence with large power users and current electricity supply applications received for Noree area.

A summary of the forecast is included on the next page.

Only loads of significant size are demonstrated separately, the remaining form part of the “Other Load Growth”. Due to the recent growth trend of the area, a 2.38% growth factor was included.

Applying the above load growth forecasting, it is forecasted that the current NMD of 6 MVA will be reached by 2024.

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

Summary of Load Growth Forecast:

Layout / Reference Number	Possible Developments	Area (Ha)	Number of erven	Total Load	Growth	Coinc. Factor	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
	Developments as per detailed Appendix																
	Other Current Loads			7,686	2.38%	0.7	7,686	7,869	8,056	8,248	8,444	8,645	8,851	9,061	9,277	9,498	9,724
	Total undiversified						7,686	8,219	8,706	9,198	9,694	10,495	10,701	10,911	11,127	11,348	12,074
	Total diversified (kVA)						5,380	5,753	6,094	6,438	6,786	7,346	7,490	7,638	7,789	7,943	8,452
	Total diversified (MVA)						5.38	5.75	6.09	6.44	6.79	7.35	7.49	7.64	7.79	7.94	8.45
	Notified Maximum Demand						6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

LANGEBERG MUNICIPALITY**ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY**

9 LOAD FLOW ANALYSIS

9.1 METHODOLOGY

The simulation software used to perform the load flow analysis is ReticMaster® Electrical Network Software for Distribution Systems.

The existing information was obtained from single line diagrams as well as technical input from the Langeberg Municipality for the following areas:

- Noree

The load flow simulations were performed on the network to provide insight into the Noree MV Network as it currently appears, and how it will perform with the addition of the known 5 and 10 year loads as well as the 2.38% per annum increase for average load growth.

The following load flow simulations were performed:

- Simulation 1: Current Maximum Demand;
- Simulation 2: 5 Year Maximum Demand;
- Simulation 3: 10 Year Maximum Demand;
- Simulation 4: Various Contingencies.

9.2 RESULTS OF LOAD FLOW ANALYSIS

The Noree network represents a diversified maximum demand of 5.38 MVA (measured in February 2022).

The Noree Network has a total installed capacity of 11.12MVA. Therefore, the Noree network appears relatively lightly loaded, with a demand factor of approximately 0.48 ($5.38 / 11.120$).

The total connected load per individual transformer was entered into the simulation software and a scaling factor was introduced to all loads to bring the maximum demand on the network in line with load growth

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

predictions to evaluate the effects on the network. This scenario was then simulated as the current status of the network and forms the basis for the future forecasting.

A coincidental factor of 0.7 was used as all the loads do not peak simultaneously.

The 5- and 10-year simulations were then prepared using scaling factors to coincide with the growth predictions and any known 5- and 10-year loads were added separately.

The following reports were then prepared for each scenario, where applicable and discussed:

- Prospective fault current study,
- Voltage level study (The NRS 034-1 stipulate that a voltage drop in the order of up to 3% to be acceptable in MV distributor cables),
- Conductor thermal capacity study.

9.2.1 CURRENT MAXIMUM DEMAND LOAD FLOW

Simulation 1 was based on the normal network configuration and operating conditions. The N/O and N/C points reflect the actual network status. There is one 10MVA 66/11kV transformer which supplies the Noree MV network.

The simulation was performed applying a scaling factor of 0.68 to all the loads, which returned a maximum demand of 5.43 MVA compared to the actual maximum demand of 5.38 MVA. A difference of 50kVA, which is an acceptable difference.

Refer to Appendix 8 for the current maximum demand load flow analysis.

9.2.1.1 PROSPECTIVE FAULT CURRENT STUDY

The prospective short circuit fault current study was performed, and results included in Appendix 9. The study was only performed once as adding additional loads to the system will not affect the values. The equipment ratings exceed the prospective fault current values and no issues were identified.

9.2.1.2 VOLTAGE LEVEL STUDY

Refer to Appendix 10. The GOREE feeder slightly exceeds the voltage limits, the highest percentage voltage drop is indicated below:

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

Feeder	Load	Percentage
GOREE (From Main Switching Station)	BUS 0071	3.13%

The other feeders are all within limits.

9.2.1.3 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 11. All feeders are well within their thermal capacity limits, percentage loading indicated below:

Main Switching Station Feeders	Thermal Loading
VINK RIVIER (BUS_0045)	36.3%
GOREE (BUS_0142)	45.2%
EILANDIA (BUS_0137)	12.1%

9.2.2 5-YEAR MAXIMUM DEMAND LOAD FLOW

Simulation 2 was performed applying a scaling factor of 0.76 to all the loads, which returned a maximum demand of 6.07 MVA compared to the predicted maximum demand of 6.05 MVA. This was done prior to the adding of any known future loads

The following loads were added:

Description – 5 Year	kVA
Rooiberg	$500 \times 0.7 = 350\text{kVA}$
Middelburg	$800 \times 0.7 = 560\text{kVA}$
Rooilandia Farm	$500 \times 0.7 = 350\text{kVA}$
Total	$1,800 \times 0.7 = 1,260\text{kVA}$

Refer to Appendix 12 for the 5-year maximum demand load flow analysis.

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

9.2.2.1 VOLTAGE LEVEL STUDY

Refer to Appendix 13. All three feeders exceed the voltage limits, the highest percentage voltage drop is indicated below:

Feeder	Load	Percentage
GOREE (From Main Switching Station)	BUS_0071	7.13%
VINK RIVIER (From Main Switching Station)	BUS_0099	4.02%
EILANDIA (From Main Switching Station)	BUS_0127	3.15%

9.2.2.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 14. All feeders are well within their thermal capacity limits, percentage loading indicated below:

Main Switching Station Feeders	Thermal Loading
VINK RIVIER (BUS_0045)	60.4%
GOREE (BUS_0142)	50.3%
EILANDIA (BUS_0137)	13.6%

The remainder of the feeders operate within their thermal limits.

9.2.3 10-YEAR MAXIMUM DEMAND LOAD FLOW

Simulation 3 was performed applying a scaling factor of 0.85 to all the loads, which returned a maximum demand of 6.81 MVA compared to the predicted maximum demand of 6.81 MVA. This was done prior to the adding of any known future loads

The following loads were added, where existing 5 year loads were already present, these were adjusted to total indicated below:

Description – 10 Year	kVA
Rooiberg	$1000 \times 0.7 = 700\text{kVA}$

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

Refer to Appendix 15 for the 10-year maximum demand load flow analysis.

9.2.3.1 VOLTAGE LEVEL STUDY

Refer to Appendix 16.

All three feeders exceed the voltage limits, the highest percentage voltage drop is indicated below:

Feeder	Load	Percentage
GOREE (From Main Switching Station)	BUS_0071	7.73%
VINK RIVIER (From Main Switching Station)	BUS_0099	4.52%
EILANDIA (From Main Switching Station)	BUS_0127	3.54%

9.2.3.2 CONDUCTOR THERMAL CAPACITY STUDY

Refer to Appendix 17. All feeders are within their thermal capacity limits.

Main Switching Station Feeders	Thermal Loading
VINK RIVIER (BUS_0045)	70.9%
GOREE (BUS_0142)	56.6%
EILANDIA (BUS_0137)	15.3 %

The remainder of the feeders operate within their thermal limits.

10 RECOMMENDED CAPITAL UPGRADES

Refer to Appendix 18 for list of recommended upgrades.

The capital projects are included as per the municipal plan for upgrading of the networks.

Masterplan recommendations were also included and indicated separately.

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

11 CONCLUSIONS

The following conclusions can be made for the Noree area of supply:

- The current maximum demand of 5,38MVA is within the notified maximum demand of 6MVA,
- The Noree network is relatively lightly loaded, with a demand factor of 0.48. Total installed capacity of 11.120MVA,
- Noree substation only has one transformer feeding the network,
- The current network operates within voltage and conductor thermal limits. The GOREE feeder slightly exceeds the voltage limit,
- The feeders are within their thermal capacity limit for the 5- and 10-year forecast,
- The voltage drop exceeds the limits for the 5- and 10-year forecast. Voltage regulators are installed on the network not factored into the simulation.

12 RECOMMENDATIONS

The following recommendations are made:

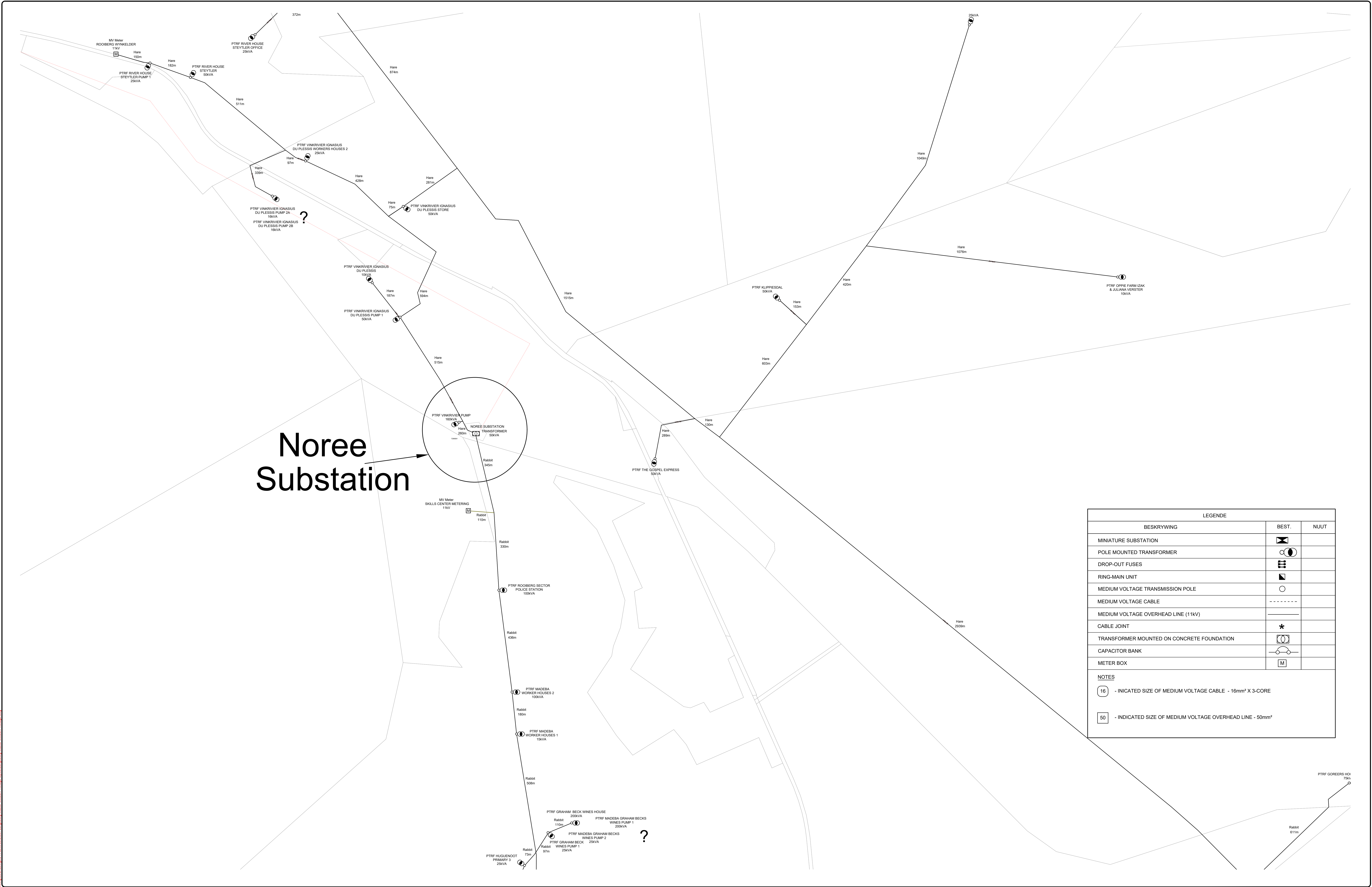
- Upgrading and replacement of network infrastructure as per the recommended capital project upgrades and masterplan recommendations,
- Regular updating of asset register,
- Information shortcomings were identified on existing layouts and schematics. Field studies to be conducted and all drawings to be updated,
- All infrastructure to be recorded on a GIS (geographic information system) and be updated regularly as projects are completed to keep an up to date database,
- An in-depth field study to determine the installation date of the different equipment types in the network to provide an accurate database of expected useful life remaining and phased replacement plan,
- Replacement of equipment that have exceeded their expected useful life as per asset condition assessment,
- Meter logging of municipal buildings electricity supply for implementation into study report for alternative energy supply e.g solar PV system,
- Installation of maximum demand meters on feeders in main switching station.

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 1 – NOREE 11KV ELECTRICAL DISTRIBUTION NETWORK LAYOUT

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LEGENDE

BESKRYWING	BEST.	NUUT
MINIATURE SUBSTATION		
POLE MOUNTED TRANSFORMER		
DROP-OUT FUSES		
RING-MAIN UNIT		
MEDIUM VOLTAGE TRANSMISSION POLE		
MEDIUM VOLTAGE CABLE		
MEDIUM VOLTAGE OVERHEAD LINE (11kV)		
CABLE JOINT		
TRANSFORMER MOUNTED ON CONCRETE FOUNDATION		
CAPACITOR BANK		
METER BOX		

NOTES

16

- INDICATED SIZE OF MEDIUM VOLTAGE CABLE - 16mm² X 3-CORE

50

- INDICATED SIZE OF MEDIUM VOLTAGE OVERHEAD LINE - 50mm²

NOTES

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REVISION SCHEDULE

No	DATE	DESCRIPTION	DRW	CHK
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CONSULTING ENGINEER

20050166

JUNE 2022

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DATE

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CHECKED

WS

WS

WMS

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CLIENT

LANGEBERG

MUNISIPALITEIT MUNICIPALITY MASIPALA

PO BOX 52 | ROBERTSON - 6705
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PROJECT

NOREE
ELECTRICAL DISTRIBUTION
NETWORK

DRAWING DESCRIPTION

EXISTING 11kV
MEDIUM VOLTAGE
LAYOUT

SCALE FOR REDUCED PLAN

DATE

SCALE

ORIGINAL SIZE

JUNE 2022

1:5000

A0

DRAWING NUMBER

REV

P302015-E-NOR-01

0

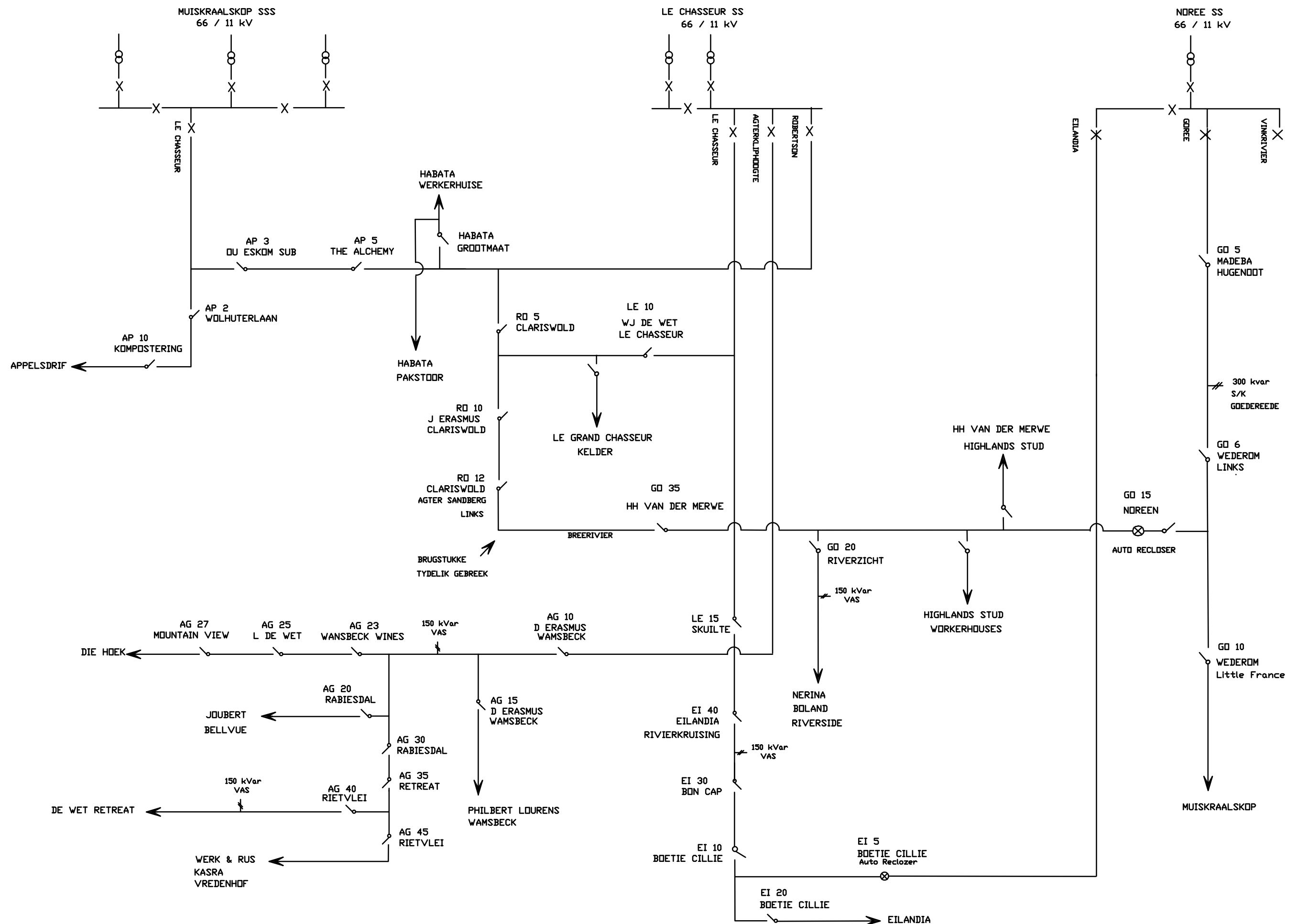
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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 2 – NOREE 11KV SINGLE LINE DIAGRAM

DIAGRAM 1: AGTERKLIPHOOFT, CLARISWOLD, LE CHASSEUR & EILANDIA



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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 3 – ASSET CONDITION ASSESSMENT

Noree Substation Asset Condition

Area (Suburb)	Asset Location	Name	Installation Date	Replacement Date	Replacement Cost
Robertson	Noree SS	66/11kV Trfr 1 - 10MVA	1998	2043	5,000,000.00
Robertson	Noree SS	Aux Trfr 1	1998	2043	125,000.00
Robertson	Noree SS	66kV Line Isolator	1998	2043	125,000.00
Robertson	Noree SS	BTU	1998	2043	100,000.00
Robertson	Noree SS	66kV Trfr 1 C/B	1998	2043	344,000.00
Robertson	Noree SS	66kV CTs	1998	2043	222,000.00
					5,916,000.00

Noree 11kV Switchgear Asset Condition

Area (Suburb)	Asset Location	Name	Function	Installation Date	Replacement Date	Replacement Cost
Robertson	SS Noree	VINKRIVIER 11kV FDR	FEEDER			400,000.00
Robertson	SS Noree	EILANDIA 11kV OH LINE	FEEDER			650,000.00
Robertson	SS Noree	BUS SECTION	FEEDER			650,000.00
Robertson	SS Noree	Goree 11kV Feeder	FEEDER			400,000.00
Robertson	SS Noree	INCOMER NO.1	INCOMER			650,000.00
						2,750,000.00

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 4 – NETWORK TECHNICAL LOSSES CALCULATION

 LANGEBERG MUNISIPALITEIT MUNICIPALITY MASIPALA	 iXengineers Infrastructure Excellence	Langeberg Municipality - Energy Losses	
ELECTRICAL ENERGY LOSSES CALCULATION - NOREE		Langeberg	PAGE 2
		iX P302015	REV. 0

Calculation of network losses in support of NRS 080 Reporting

CALCULATION SHEET NOTES Langeberg Municipality - Energy Losses NETWORK ANALYSIS AND ENERGY LOSSES Energy losses calculation

Notes:

Energy losses comprises:

- 1 System losses due to I^2R losses in distribution networks as calculated by loadflow analysis
- 2 No load losses of inductive element's magnetic circuits.
- 3 Load losses of transformers proportional to loading
- 4 Partial discharge losses - not considered due to destructive nature and maintenance requirements
- 5 Dielectric losses - Not considered
- 6 Similar network LV distribution losses used, no information available on LV Network

Calculation base:

- 1 Network I^2R losses derived from network load-flow analysis
- 2 Network I^2R losses adjusted for averaged load
- 3 Monthly maximum demand and energy statistics required

Definitions

- 1 Demand - Apparent power drawn from supply network
- 2 Load (Connected, etc) - The total connected load on the system.
- 3 Load Factor (LF) - The average power in the typical monthly period divided by the peak apparent power
- 4 Demand factor (DF) - The maximum demand divided by the connected load (indicative of reserve capacity)

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ELECTRICAL ENERGY LOSSES CALCULATION - NOREE

Langeberg

PAGE

3

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Date

6/17/2022

MV Network losses					Billing/log data					
Simu- ratio	Network peak power:		P kW		5112	Month	Demand kVA	Energy kWh	Load factor	Demand Factor
	Network losses from load flow:		P _{loss} kW		75.60	Apr	4171	1766403	0.58	0.37
Network Average power			kVA		2103	May	3782	1282521	0.46	0.33
Total electrical losses			kW	kWh/month	% loss	Jun	2513	1140600	0.62	0.22
Transformer No load Losses			33.2	24236	1.58%	Jul	2174	1084863	0.68	0.19
Transformer Partial Load losses			32.9	24017	1.56%	Aug	2432	1119855	0.63	0.21
HV & MV Network system losses pm			31.1	22724	1.48%	Sep	3134	1220116	0.53	0.27
LV Network losses calculated pm				34087	2.22%	Oct	3286	1301418	0.54	0.29
Total losses				105064	6.84%	Nov	3869	1540613	0.55	0.34
Technical Loss Factor tlf :					1.068	Dec	3357	1434441	0.58	0.29
						Jan	4639	2038187	0.60	0.41
Installed Transformer and reactor losses						Feb	5381	2136037	0.54	0.47
Qty	kVA	Losses/unit kW		Total loss kW		Mar	5323	2360099	0.61	0.47
		No load	Load	No load	FL loss	Avg demand	3672	1535429	0.58	0.32
15	16	0.095	0.41	1.425	6.15	Avg power	2103			
17	25	0.12	0.57	2.04	9.69					
34	50	0.18	1	6.12	34					
35	100	0.3	1.7	10.5	59.5					
8	160	0.44	2.4	3.52	19.2					
4	200	0.52	2.7	2.08	10.8					
0	250	0.62	3.2	0	0					
5	315	0.72	3.8	3.6	19					
1	400	0.91	5.4	0.91	5.4					
1	500	1.1	5.4	1.1	5.4					
0	630	1.3	6.4	0	0					
0	800	1.6	8	0	0					
1	1000	1.9	9.5	1.9	9.5					
0	1600	2.75	13.5	0	0					
0	2000	3.25	16	0	0					
121				33.195	178.64					
Total installed capacity kVA		11420								

Notes:

- 1) Transformer quantities from single line diagram
- 2) Billing/Logs Eskom period Apr 2021 to Mar 2022.

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 5 – SSEG IMPACT ON MUNICIPAL REVENUE

This report was generated on	5/25/2022
For	Langeberg Municipality

Developed by

G:ENESIS
UNLOCKING VALUE

8 SALGA
SOUTH AFRICAN LOCAL
GOVERNMENT ASSOCIATION
Inspiring service delivery

**german
cooperation**
DEUTSCHE ZUSAMMENARBEIT

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for Sustainable Development

Table 1: SSEG tariffs chosen by the municipality

		Summer				Winter			
		Residential	Small business	Medium business	Large business	Residential	Small business	Medium business	Large business
Tariff type	TOU or flat tariff structure	Flat	Flat	TOU	TOU	Same as summer			
	Monthly or annual clearing of balances	Monthly clearing	Monthly clearing	Monthly clearing	Monthly clearing				
	Payment of credit balances to customers	No payments	No payments	No payments	No payments				
	Escalation of export tariff	Changes over time	Changes over time	Changes over time	Changes over time				
TOU tariffs	Import tariff								
	Fixed charge (R/m)			2,368	2,368			2,368	2,368
	Monthly demand charge (R/kVA)			276	254			276	254
	Peak (c/KWh)			94	93			94	93
	Standard (c/KWh)			94	93			94	93
	Off-peak (c/KWh)			94	93			94	93
	Export tariff								
	Peak (c/KWh)			68	68			68	68
	Standard (c/KWh)			68	68			68	68
Off-peak (c/KWh)			68	68			68	68	
Flat tariffs	Import tariff								
	Fixed charge (R/m)	1,538	1,538			1,538	1,538		
	Monthly demand charge (R/kVA)	-	-			-	-		
	Variable charge (c/KWh)	190	190			190	190		
	Export tariff								
	Variable charge (c/KWh)	68	68			68	68		

Table 2: Total revenue impact * (%)

% of customers on the relevant tariff that install rooftop PV	Residential	Small business	Medium business	Large business	Total
1%	0.40%	-0.14%	0.08%	-0.02%	0.25%
5%	1.98%	-0.70%	0.41%	-0.11%	1.23%
10%	3.96%	-1.40%	0.83%	-0.21%	2.46%
20%	7.92%	-2.79%	1.65%	-0.42%	4.91%

Notes: * Total revenue impact = (Reduction in municipal revenue + Value of Solar)/Municipal revenue prior to introduction of Solar PV SSEG tariffs

Chart 1: Total revenue impact (%)

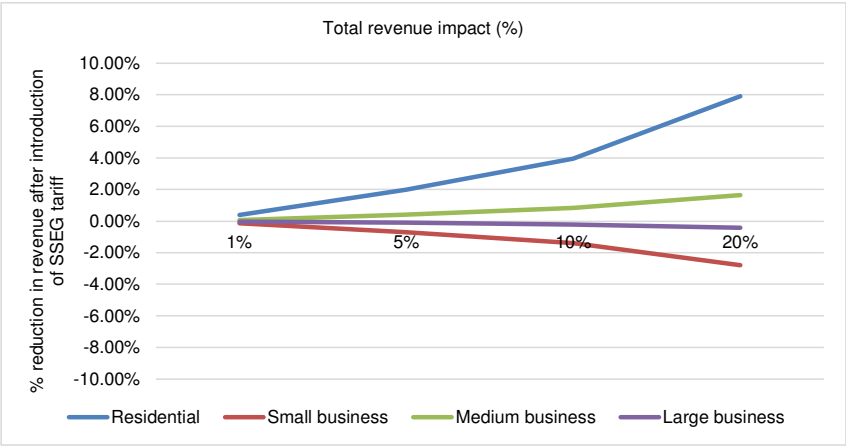


Table 3: Reduction in revenue, Value of Solar and Total effect (Rm)

	Residential	Small business	Medium business	Large business	Total
1% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	1.1	-0.2	-0.2	-0.1	0.6
Value of Solar (Rm) (B)	0.6	0.1	0.3	0.1	1.0
Total effect (Rm) (A + B)	1.8	-0.1	0.0	0.0	1.7
5% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	5.6	-1.2	-1.0	-0.3	3.1
Value of Solar (Rm) (B)	3.2	0.5	1.3	0.3	5.2
Total effect (Rm) (A + B)	8.8	-0.7	0.2	-0.1	8.3
10% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	11.3	-2.3	-2.1	-0.7	6.2
Value of Solar (Rm) (B)	6.3	0.9	2.6	0.5	10.4
Total effect (Rm) (A + B)	17.6	-1.4	0.5	-0.1	16.5
20% of customers install rooftop PV					
Reduction in revenue (Rm) (A)	22.5	-4.6	-4.2	-1.4	12.3
Value of Solar (Rm) (B)	12.7	1.8	5.1	1.1	20.7
Total effect (Rm) (A + B)	35.2	-2.8	0.9	-0.3	33.0

Table 4: Business case for the Solar PV customer for the chosen SSEG tariffs

	Residential	Small business	Medium business	Large business	Key for PBP and IRR results:	Key for NPV results:
Net present value (Rands)	-263,700	648,328	409,308	4,101,820	Unfavourable	Negative
Pay-back period (PBP) (Years)	>26	3	11	6	Average	Positive
Internal rate of return	0%	36%	10%	19%	Very good	
LCOE (Rands)	0.94	1.04	0.97	0.89		
Monthly bill for one Solar PV customer (Rands)	R 2,608	R 11,891	R 8,485	R 259,127		

Table 5: Average electricity consumption per annum, average solar self-consumption rate per annum and peak demand per season

	Residential	Small business	Medium business	Large business
Avg elect cons/annum (KWh/a)	10,853	87,831	92,013	2,415,350
Avg solar self-cons rate/annum*	71%	100%	43%	100%
Summer peak demand (kW)	2.21	12.19	12.78	346.05
Winter peak demand (kW)	3.36	17.13	17.95	503.08

Notes: * Avg solar self-cons rate/annum = Rooftop PV electricity consumed on-site/Total rooftop PV electricity produced

Chart 2: Energy balances

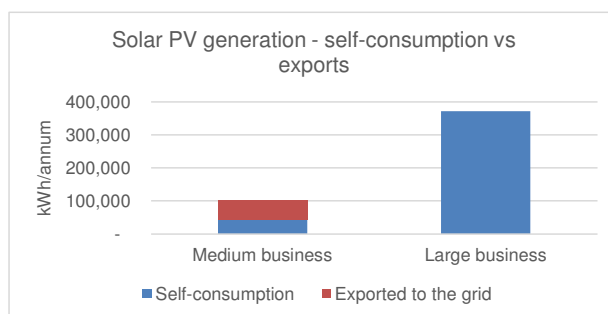
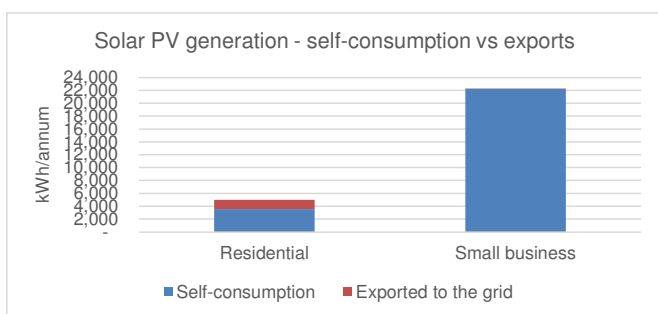


Table 6: Revenue Available for Network Costs and Average Bulk Energy Costs

		Residential	Small business	Medium business	Large business
Revenue per customer available for Network Costs (ZAR/month)	non-SSEG	R 1,280	R 9,688	R 7,482	R 132,456
	SSEG*	R 2,028	R 7,545	R 5,219	R 126,505
Average Bulk Purchase Costs (c/kWh)	non-SSEG	88.51	78.15	78.15	77.28
	SSEG	93.56	79.53	77.14	77.86

*Includes value of solar exports

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 6 – ALTERNATIVE ENERGY SUPPLY FEED IN POINT

Noree 2MWp Langeberg Masterplan, Robertson, South Africa

Report

Project Name	Langeberg Masterplan
Project Address	Robertson, South Africa
Prepared By	Wiets Snyman info@ixengineers.co.za



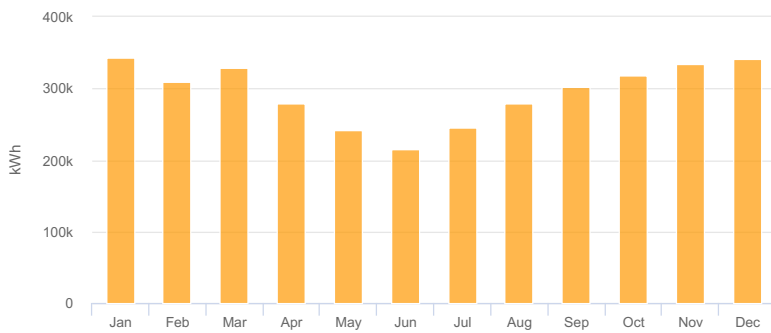
System Metrics

Design	Noree 2MWp
Module DC Nameplate	2.00 MW
Inverter AC Nameplate	1.61 MW Load Ratio: 1.24
Annual Production	3,540 GWh
Performance Ratio	81.0%
kWh/kWp	1,767.4
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	4e8ad109b5-7184273f86-abd41a2ac5-1253cc88f6

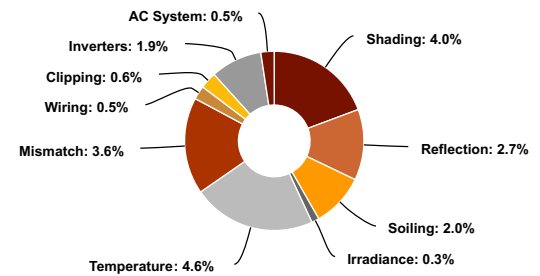
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m ²)	Annual Global Horizontal Irradiance	1,902.8	
	POA Irradiance	2,181.1	14.6%
	Shaded Irradiance	2,093.7	-4.0%
	Irradiance after Reflection	2,038.0	-2.7%
	Irradiance after Soiling	1,997.3	-2.0%
	Total Collector Irradiance	1,997.1	0.0%
Energy (kWh)	Nameplate	4,002,778.1	
	Output at Irradiance Levels	3,991,487.6	-0.3%
	Output at Cell Temperature Derate	3,807,210.1	-4.6%
	Output After Mismatch	3,669,225.6	-3.6%
	Optimal DC Output	3,650,458.5	-0.5%
	Constrained DC Output	3,627,600.6	-0.6%
	Inverter Output	3,557,662.7	-1.9%
	Energy to Grid	3,539,874.3	-0.5%
Temperature Metrics			
	Avg. Operating Ambient Temp		20.3 °C
	Avg. Operating Cell Temp		30.3 °C
Simulation Metrics			
	Operating Hours	4607	
	Solved Hours	4607	

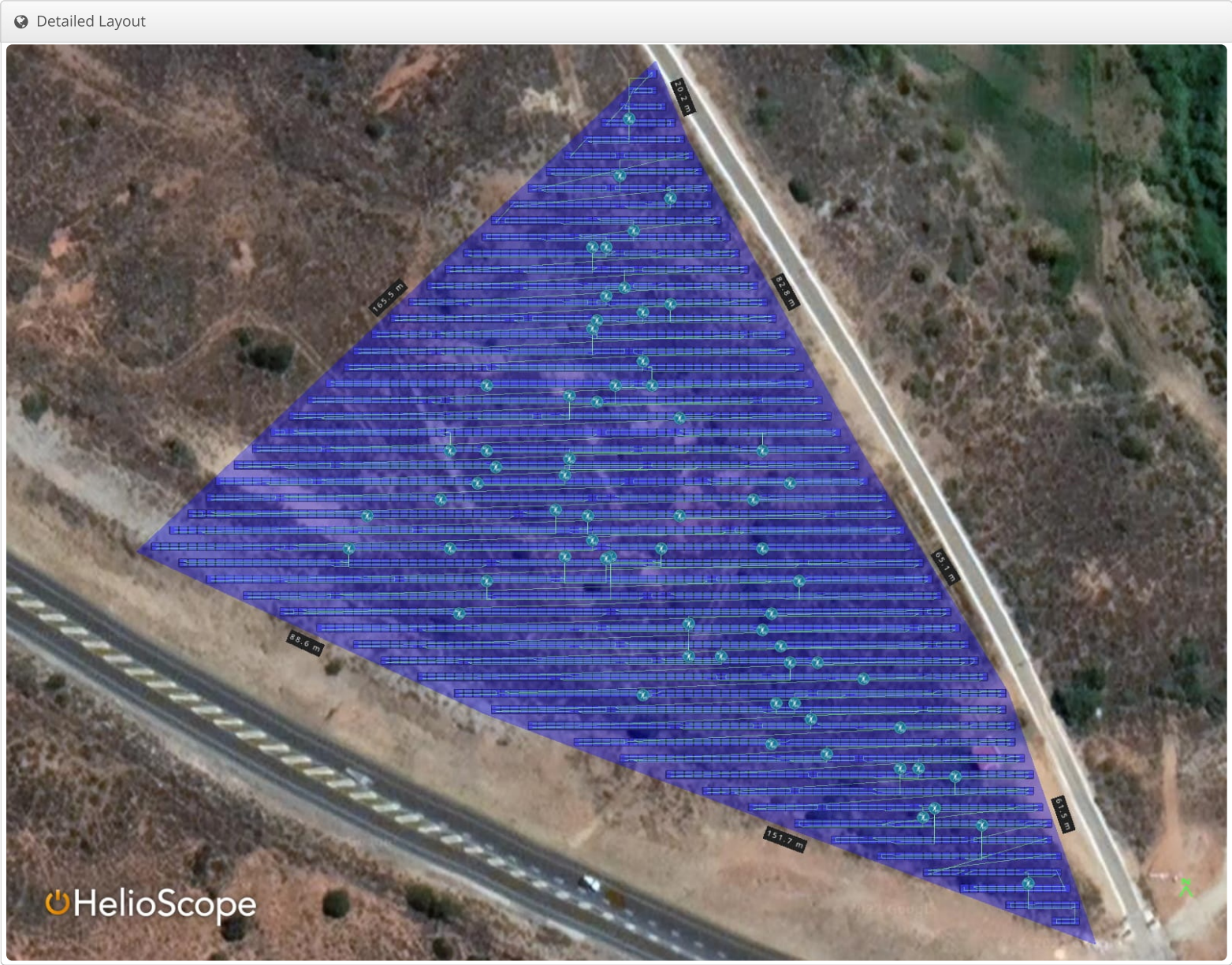
Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By						Characterization				
	CS3W-440MB-AG (Canadian Solar)	HelioScope						Spec Sheet Characterization, PAN				
Component Characterizations	Device	Uploaded By						Characterization				
	Sunny Tripower 24000TL-US (SMA)	HelioScope						Modified CEC				

Components		
Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	67 (1.61 MW)
Strings	10 AWG (Copper)	272 (14,438.5 m)
Module	Canadian Solar, CS3W-440MB-AG (440W)	4,552 (2.00 MW)

Wiring Zones			
Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	4-19	Along Racking

Field Segments									
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	32°	0°	2.0 m	2x1	2,276	4,552	2.00 MW



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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 7 – LOAD GROWTH FORECAST

[illegible]

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 8 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 9 – PROSPECTIVE FAULT LEVEL STUDY

Noree Prospective Fault Level Study

SUBSTATION/TRANSFORMER	3 ϕ Fault (kA)	ϕ -G Fault (kA)
TRFR	5.2	0.33
N165	5.2	0.33
BUS_0142	4.92	0.32
BUS_0045	4.91	0.32
BUS_0046	4.39	0.32
BUS_0047	4.21	0.32
BUS_0048	3.87	0.31
BUS_0051	3.61	0.31
BUS_0049	3.56	0.31
BUS_0050	3.08	0.3
ROOIBERG	3.08	0.3
BUS_0052	3.07	0.3
BUS_0054	2.98	0.3
BUS_0053	2.89	0.3
BUS_0055	2.8	0.29
BUS_0100	2.71	0.29
BUS_0056	2.68	0.29
BUS_0101	2.59	0.29
BUS_0102	2.38	0.28
BUS_0057	2.35	0.28
BUS_0058	2.28	0.28
BUS_0103	2.24	0.28
BUS_0059	2.12	0.28
BUS_0072	2.07	0.28
BUS_0073	2.03	0.27
BUS_0105	1.97	0.27
BUS_0104	1.96	0.27
BUS_0075	1.93	0.27
BUS_0074	1.92	0.27
BUS_0060	1.87	0.27
BUS_0106	1.84	0.27
BUS_0076	1.82	0.27
BUS_0077	1.77	0.27
BUS_0109	1.74	0.26
BUS_0107	1.73	0.26
BUS_0078	1.72	0.27
BUS_0146	1.71	0.26
N157	1.71	0.26
BUS_0079	1.63	0.26
BUS_0080	1.58	0.26
BUS_0081	1.5	0.26
BUS_0082	1.45	0.26
BUS_0083	1.44	0.26

BUS_0061	1.38	0.26
BUS_0084	1.38	0.26
BUS_0086	1.36	0.26
BUS_0085	1.32	0.25
BUS_0087	1.3	0.25
BUS_0089	1.29	0.25
BUS_0088	1.28	0.25
BUS_0090	1.28	0.25
BUS_0091	1.23	0.25
BUS_0092	1.21	0.25
BUS_0093	1.21	0.25
BUS_0094	1.18	0.25
BUS_0062	1.16	0.25
BUS_0095	1.09	0.24
BUS_0137	1.09	0.22
BUS_0063	1.07	0.24
BUS_0096	1.04	0.24
BUS_0138	1.04	0.22
BUS_0136	1.02	0.22
BUS_0097	1.01	0.24
BUS_0139	1.01	0.22
BUS_0135	1.01	0.22
BUS_0098	1	0.24
BUS_0145	1	0.22
BUS_0099	0.99	0.24
BUS_0134	0.99	0.22
BUS_0140	0.98	0.21
BUS_0133	0.95	0.21
BUS_0064	0.93	0.24
BUS_0141	0.93	0.21
BUS_0131	0.92	0.21
BUS_0130	0.91	0.21
BUS_0065	0.9	0.23
BUS_0129	0.9	0.21
BUS_0128	0.89	0.2
BUS_0127	0.87	0.2
BUS_0066	0.85	0.23
BUS_0067	0.84	0.23
LEC_LOAD	0.84	0.2
BUS_0068	0.82	0.23
BUS_0069	0.78	0.23
BUS_0070	0.76	0.22
BUS_0071	0.72	0.22

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 10 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Noree Current Voltage Level Study

Node Name	Min Voltage	Difference
TRFR	100.84%	
N165	100.84%	
BUS_0045	100.66%	0.18%
BUS_0046	100.30%	0.54%
BUS_0047	100.30%	0.54%
BUS_0142	100.25%	0.59%
ESKOM_S_S	100.00%	0.84%
BUS_0048	99.89%	0.95%
BUS_0143	99.88%	0.96%
BUS_0049	99.84%	1.00%
BUS_0050	99.74%	1.10%
ROOIBERG	99.74%	1.10%
BUS_0144	99.73%	1.11%
BUS_0051	99.69%	1.15%
BUS_0052	99.45%	1.39%
BUS_0053	99.45%	1.39%
BUS_0054	99.40%	1.44%
BUS_0002	99.31%	1.53%
BUS_0055	99.29%	1.55%
BUS_0100	99.24%	1.60%
BUS_0101	99.24%	1.60%
BUS_0102	99.23%	1.61%
BUS_0103	99.23%	1.61%
BUS_0104	99.23%	1.61%
BUS_0105	99.23%	1.61%
BUS_0056	99.22%	1.62%
BUS_0057	98.99%	1.85%
BUS_0003	98.99%	1.85%
BUS_0058	98.93%	1.91%
BUS_0004	98.83%	2.01%
BUS_0059	98.80%	2.04%
BUS_0072	98.74%	2.10%
BUS_0073	98.70%	2.14%
BUS_0074	98.69%	2.15%
BUS_0005	98.66%	2.18%
BUS_0006	98.65%	2.19%
BUS_0007	98.64%	2.20%
BUS_0060	98.61%	2.23%
BUS_0075	98.60%	2.24%
BUS_0076	98.51%	2.33%
BUS_0106	98.48%	2.36%
BUS_0077	98.47%	2.37%
BUS_0107	98.47%	2.37%

BUS_0078	98.42%	2.42%
BUS_0079	98.35%	2.49%
BUS_0109	98.35%	2.49%
BUS_0080	98.31%	2.53%
BUS_0137	98.31%	2.53%
BUS_0146	98.30%	2.54%
BUS_0008	98.30%	2.54%
BUS_0044	98.30%	2.54%
RMU_5	98.30%	2.54%
SWITCH	98.30%	2.54%
N157	98.30%	2.54%
BUS_0147	98.29%	2.55%
BUS_0148	98.28%	2.56%
BUS_0149	98.28%	2.56%
BUS_0032	98.27%	2.57%
BUS_0138	98.27%	2.57%
AUTORECLOSER	98.26%	2.58%
BUS_0111	98.26%	2.58%
BUS_0139	98.26%	2.58%
BUS_0140	98.26%	2.58%
BUS_0141	98.26%	2.58%
BUS_0145	98.26%	2.58%
BUS_0081	98.25%	2.59%
BUS_0033	98.25%	2.59%
BUS_0112	98.25%	2.59%
BUS_0113	98.25%	2.59%
BUS_0126	98.24%	2.60%
BUS_0061	98.23%	2.61%
BUS_0034	98.23%	2.61%
BUS_0114	98.23%	2.61%
BUS_0115	98.23%	2.61%
BUS_0124	98.23%	2.61%
BUS_0082	98.22%	2.62%
BUS_0125	98.22%	2.62%
BUS_0083	98.21%	2.63%
BUS_0037	98.21%	2.63%
BUS_0062	98.20%	2.64%
BUS_0035	98.20%	2.64%
BUS_0136	98.20%	2.64%
BUS_0038	98.19%	2.65%
BUS_0039	98.19%	2.65%
BUS_0041	98.19%	2.65%
BUS_0116	98.19%	2.65%
BUS_0135	98.19%	2.65%
BUS_0036	98.17%	2.67%
BUS_0040	98.17%	2.67%
BUS_0042	98.17%	2.67%

BUS_0084	98.16%	2.68%
BUS_0134	98.16%	2.68%
BUS_0085	98.15%	2.69%
BUS_0086	98.15%	2.69%
BUS_0087	98.14%	2.70%
BUS_0088	98.13%	2.71%
BUS_0089	98.13%	2.71%
BUS_0090	98.13%	2.71%
BUS_0091	98.13%	2.71%
BUS_0092	98.13%	2.71%
BUS_0117	98.12%	2.72%
BUS_0009	98.11%	2.73%
BUS_0133	98.11%	2.73%
BUS_0093	98.09%	2.75%
BUS_0131	98.08%	2.76%
BUS_0094	98.07%	2.77%
BUS_0130	98.07%	2.77%
BUS_0129	98.07%	2.77%
BUS_0095	98.06%	2.78%
BUS_0128	98.06%	2.78%
BUS_0127	98.06%	2.78%
LEC_LOAD	98.06%	2.78%
BUS_0096	98.05%	2.79%
BUS_0097	98.05%	2.79%
BUS_0098	98.05%	2.79%
BUS_0099	98.05%	2.79%
BUS_0118	98.02%	2.82%
BUS_0119	98.01%	2.83%
BUS_0120	98.01%	2.83%
BUS_0121	97.97%	2.87%
BUS_0122	97.94%	2.90%
BUS_0063	97.92%	2.92%
BUS_0010	97.92%	2.92%
BUS_0011	97.92%	2.92%
BUS_0012	97.91%	2.93%
BUS_0013	97.90%	2.94%
BUS_0123	97.85%	2.99%
BUS_0014	97.84%	3.00%
BUS_0064	97.73%	3.11%
BUS_0065	97.69%	3.15%
BUS_0015	97.67%	3.17%
BUS_0066	97.62%	3.22%
BUS_0067	97.61%	3.23%
BUS_0068	97.60%	3.24%
BUS_0016	97.58%	3.26%
BUS_0017	97.57%	3.27%
BUS_0069	97.56%	3.28%

BUS_0070	97.55%	3.29%
BUS_0071	97.53%	3.31%
BUS_0018	97.51%	3.33%
BUS_0019	97.51%	3.33%
BUS_0020	97.40%	3.44%
BUS_0021	97.39%	3.45%
BUS_0022	97.37%	3.47%
BUS_0023	97.27%	3.57%
BUS_0024	97.24%	3.60%
BUS_0025	97.20%	3.64%
BUS_0026	97.12%	3.72%
BUS_0028	97.12%	3.72%
BUS_0027	97.10%	3.74%
BUS_0029	97.09%	3.75%
BUS_0030	97.07%	3.77%
BUS_0031	97.06%	3.78%

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 11 – CURRENT MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Noree Current Feeder Loading

Feeder to	Feeder % Loading
BUS_0142	43.30%
BUS_0143	41.84%
BUS_0144	40.81%
BUS_0002	40.66%
BUS_0045	38.47%
BUS_0046	37.38%
BUS_0048	36.97%
BUS_0003	33.73%
BUS_0004	33.48%
BUS_0005	32.45%
BUS_0008	30.15%
BUS_0051	29.41%
BUS_0009	19.22%
BUS_0010	18.27%
BUS_0052	16.66%
BUS_0014	16.19%
BUS_0054	16.14%
BUS_0055	15.96%
BUS_0015	15.66%
BUS_0056	15.61%
BUS_0057	15.26%
BUS_0058	15.09%
BUS_0059	14.74%
BUS_0016	13.53%
BUS_0100	12.97%
BUS_0032	12.51%
BUS_0106	12.12%
BUS_0137	12.07%
BUS_0109	11.65%
BUS_0146	11.59%
BUS_0072	11.44%
BUS_0033	11.29%
BUS_0073	10.39%
BUS_0075	9.07%
BUS_0037	8.63%
BUS_0076	8.54%
BUS_0077	8.28%
AUTORECLOSER	8.00%
BUS_0044	8.00%
BUS_0039	7.85%
BUS_0049	7.65%
BUS_0041	7.60%
BUS_0020	7.50%

BUS_0050	7.48%
BUS_0060	7.24%
BUS_0078	7.22%
BUS_0079	7.12%
BUS_0136	6.77%
BUS_0022	6.70%
BUS_0080	6.59%
BUS_0061	6.44%
BUS_0023	6.16%
BUS_0111	6.15%
BUS_0135	6.06%
BUS_0024	5.89%
BUS_0025	5.89%
BUS_0117	5.85%
N165	5.66%
BUS_0081	5.53%
BUS_0018	5.50%
BUS_0082	5.36%
BUS_0083	5.36%
BUS_0134	5.36%
BUS_0118	5.32%
BUS_0063	5.28%
BUS_0084	5.25%
BUS_0113	5.10%
BUS_0064	5.01%
BUS_0126	4.64%
BUS_0120	4.52%
BUS_0065	4.48%
BUS_0133	4.36%
BUS_0121	4.25%
BUS_0034	4.24%
BUS_0086	4.19%
BUS_0035	3.98%
BUS_0066	3.95%
BUS_0124	3.87%
BUS_0115	3.81%
BUS_0067	3.73%
BUS_0122	3.72%
BUS_0026	3.65%
BUS_0138	3.53%
BUS_0027	3.48%
BUS_0123	3.19%
RMU_5	3.16%
BUS_0116	2.79%
BUS_0029	2.68%
BUS_0068	2.67%
BUS_0131	2.59%

BUS_0093	2.39%
BUS_0130	2.24%
BUS_0069	2.13%
BUS_0036	2.12%
BUS_0038	2.12%
BUS_0042	2.12%
BUS_0011	1.91%
BUS_0094	1.86%
BUS_0030	1.61%
BUS_0012	1.59%
BUS_0040	1.59%
BUS_0006	1.58%
BUS_0129	1.53%
BUS_0128	1.53%
BUS_0147	1.41%
BUS_0070	1.33%
BUS_0114	1.32%
BUS_0087	1.27%
BUS_0127	1.17%
BUS_0085	1.06%
BUS_0007	1.06%
BUS_0013	1.06%
BUS_0112	1.06%
BUS_0101	0.94%
BUS_0139	0.88%
BUS_0145	0.88%
BUS_0148	0.88%
BUS_0071	0.80%
BUS_0095	0.80%
BUS_0021	0.80%
BUS_0119	0.80%
BUS_0074	0.79%
BUS_0125	0.79%
BUS_0089	0.74%
BUS_0062	0.64%
BUS_0096	0.64%
BUS_0102	0.59%
BUS_0031	0.54%
BUS_0088	0.53%
BUS_0097	0.53%
BUS_0107	0.53%
BUS_0017	0.53%
BUS_0140	0.53%
ROOIBERG	0.50%
BUS_0090	0.48%
BUS_0149	0.35%
BUS_0098	0.27%

BUS_0099	0.27%
BUS_0103	0.25%
BUS_0091	0.21%
BUS_0053	0.17%
BUS_0105	0.17%
BUS_0019	0.16%
BUS_0028	0.16%
BUS_0092	0.11%
BUS_0047	0.07%
BUS_0104	0.07%

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 12 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 13 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Noree 5 Year Voltage Level Study

Node Name	Min Voltage	Difference
N163	100.57%	
BUS_0045	100.30%	0.27%
ESKOM_S_S	100.00%	0.57%
BUS_0142	99.86%	0.71%
BUS_0046	99.78%	0.79%
BUS_0047	99.78%	0.79%
BUS_0143	99.42%	1.15%
BUS_0144	99.24%	1.33%
BUS_0048	99.20%	1.37%
BUS_0049	99.10%	1.47%
BUS_0050	98.92%	1.65%
BUS_0051	98.92%	1.65%
ROOIBERG	98.92%	1.65%
ADDITIONAL	98.92%	1.65%
BUS_0002	98.74%	1.83%
BUS_0052	98.52%	2.05%
BUS_0053	98.52%	2.05%
BUS_0100	98.46%	2.11%
BUS_0101	98.46%	2.11%
BUS_0102	98.45%	2.12%
BUS_0103	98.45%	2.12%
BUS_0104	98.45%	2.12%
BUS_0105	98.44%	2.13%
BUS_0054	98.43%	2.14%
BUS_0003	98.36%	2.21%
BUS_0055	98.26%	2.31%
BUS_0004	98.15%	2.42%
BUS_0056	98.13%	2.44%
BUS_0005	97.96%	2.61%
BUS_0006	97.95%	2.62%
BUS_0007	97.93%	2.64%
BUS_0057	97.74%	2.83%
BUS_0137	97.71%	2.86%
BUS_0106	97.68%	2.89%
BUS_0107	97.68%	2.89%
BUS_0138	97.66%	2.91%
BUS_0139	97.66%	2.91%
BUS_0140	97.65%	2.92%
BUS_0141	97.65%	2.92%
BUS_0145	97.65%	2.92%
BUS_0058	97.64%	2.93%
BUS_0136	97.59%	2.98%
BUS_0135	97.57%	3.00%

BUS_0109	97.55%	3.02%
ROOILANDIA	97.55%	3.02%
BUS_0134	97.54%	3.03%
BUS_0146	97.52%	3.05%
BUS_0008	97.52%	3.05%
BUS_0044	97.52%	3.05%
RMU_5	97.52%	3.05%
SWITCH	97.52%	3.05%
BUS_0147	97.51%	3.06%
BUS_0148	97.50%	3.07%
BUS_0149	97.50%	3.07%
BUS_0133	97.48%	3.09%
BUS_0032	97.47%	3.10%
BUS_0111	97.47%	3.10%
BUS_0112	97.46%	3.11%
BUS_0113	97.46%	3.11%
BUS_0126	97.46%	3.11%
BUS_0131	97.45%	3.12%
BUS_0033	97.44%	3.13%
BUS_0114	97.44%	3.13%
BUS_0115	97.44%	3.13%
BUS_0124	97.44%	3.13%
BUS_0130	97.44%	3.13%
BUS_0129	97.44%	3.13%
BUS_0125	97.43%	3.14%
BUS_0128	97.43%	3.14%
BUS_0034	97.42%	3.15%
BUS_0127	97.42%	3.15%
LEC_LOAD	97.42%	3.15%
BUS_0059	97.40%	3.17%
BUS_0116	97.40%	3.17%
BUS_0035	97.38%	3.19%
BUS_0037	97.37%	3.20%
BUS_0036	97.35%	3.22%
BUS_0072	97.34%	3.23%
BUS_0038	97.34%	3.23%
BUS_0039	97.33%	3.24%
BUS_0117	97.32%	3.25%
BUS_0009	97.30%	3.27%
BUS_0040	97.30%	3.27%
BUS_0073	97.29%	3.28%
BUS_0074	97.28%	3.29%
BUS_0041	97.27%	3.30%
BUS_0042	97.25%	3.32%
BUS_0118	97.20%	3.37%
BUS_0119	97.19%	3.38%
BUS_0120	97.19%	3.38%

BUS_0075	97.18%	3.39%
BUS_0121	97.15%	3.42%
BUS_0122	97.11%	3.46%
BUS_0010	97.09%	3.48%
BUS_0011	97.08%	3.49%
BUS_0076	97.07%	3.50%
BUS_0012	97.07%	3.50%
BUS_0013	97.06%	3.51%
BUS_0077	97.02%	3.55%
BUS_0123	97.02%	3.55%
BUS_0014	97.00%	3.57%
BUS_0078	96.98%	3.59%
BUS_0079	96.89%	3.68%
BUS_0060	96.86%	3.71%
BUS_0080	96.84%	3.73%
BUS_0015	96.80%	3.77%
BUS_0081	96.78%	3.79%
BUS_0082	96.74%	3.83%
BUS_0083	96.73%	3.84%
BUS_0016	96.70%	3.87%
BUS_0017	96.69%	3.88%
BUS_0084	96.68%	3.89%
BUS_0085	96.67%	3.90%
BUS_0086	96.66%	3.91%
BUS_0087	96.65%	3.92%
BUS_0088	96.65%	3.92%
BUS_0089	96.65%	3.92%
BUS_0090	96.65%	3.92%
BUS_0091	96.65%	3.92%
BUS_0092	96.65%	3.92%
BUS_0018	96.63%	3.94%
BUS_0019	96.62%	3.95%
BUS_0093	96.59%	3.98%
BUS_0094	96.58%	3.99%
BUS_0095	96.57%	4.00%
BUS_0096	96.56%	4.01%
BUS_0097	96.55%	4.02%
BUS_0098	96.55%	4.02%
BUS_0099	96.55%	4.02%
BUS_0020	96.50%	4.07%
BUS_0021	96.48%	4.09%
BUS_0022	96.46%	4.11%
BUS_0023	96.35%	4.22%
BUS_0024	96.31%	4.26%
BUS_0025	96.27%	4.30%
BUS_0026	96.18%	4.39%
BUS_0028	96.18%	4.39%

BUS_0027	96.16%	4.41%
BUS_0029	96.15%	4.42%
BUS_0030	96.13%	4.44%
BUS_0031	96.11%	4.46%
BUS_0061	95.63%	4.94%
BUS_0062	95.60%	4.97%
BUS_0063	94.52%	6.05%
BUS_0064	93.80%	6.77%
BUS_0065	93.62%	6.95%
MIDDELBURG	93.62%	6.95%
BUS_0066	93.55%	7.02%
BUS_0067	93.53%	7.04%
BUS_0068	93.51%	7.06%
BUS_0069	93.47%	7.10%
BUS_0070	93.46%	7.11%
BUS_0071	93.44%	7.13%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 14 – 5-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Noree 5 Year Feeder Loading

Feeder to	Feeder % Loading
BUS_0045	60.40%
BUS_0046	59.16%
BUS_0048	58.70%
BUS_0142	50.34%
BUS_0143	49.18%
BUS_0144	48.01%
BUS_0002	47.83%
BUS_0051	44.93%
BUS_0003	39.88%
BUS_0004	39.58%
BUS_0005	38.40%
BUS_0008	35.73%
BUS_0052	27.73%
BUS_0054	27.14%
BUS_0055	26.94%
BUS_0056	26.55%
BUS_0057	26.15%
BUS_0058	25.96%
BUS_0059	25.56%
BUS_0009	21.68%
BUS_0060	21.47%
BUS_0010	20.61%
BUS_0061	20.57%
BUS_0063	19.23%
BUS_0064	18.93%
BUS_0065	18.31%
BUS_0014	18.27%
BUS_0015	17.67%
BUS_0100	16.81%
BUS_0106	15.75%
BUS_0016	15.26%
BUS_0109	15.16%
BUS_0032	14.04%
BUS_0049	13.77%
BUS_0050	13.58%
BUS_0137	13.57%
BUS_0072	12.98%
BUS_0033	12.25%
BUS_0073	11.79%
BUS_0075	10.29%
BUS_0146	9.85%
BUS_0076	9.69%
BUS_0077	9.39%
BUS_0020	8.46%
BUS_0078	8.19%
BUS_0079	8.07%

N163	7.74%
BUS_0136	7.61%
BUS_0022	7.56%
BUS_0080	7.47%
BUS_0037	7.47%
BUS_0023	6.95%
BUS_0111	6.86%
BUS_0135	6.82%
BUS_0024	6.65%
BUS_0025	6.65%
BUS_0117	6.59%
BUS_0081	6.27%
BUS_0018	6.20%
BUS_0082	6.08%
BUS_0083	6.08%
BUS_0134	6.02%
BUS_0118	5.99%
BUS_0084	5.96%
BUS_0113	5.68%
BUS_0126	5.26%
BUS_0120	5.09%
BUS_0039	5.08%
BUS_0133	4.90%
BUS_0121	4.80%
BUS_0034	4.78%
BUS_0086	4.76%
BUS_0066	4.60%
BUS_0035	4.48%
BUS_0124	4.38%
BUS_0067	4.36%
BUS_0115	4.21%
BUS_0122	4.20%
BUS_0026	4.11%
BUS_0138	3.97%
BUS_0027	3.93%
BUS_0123	3.60%
RMU_5	3.58%
BUS_0041	3.29%
BUS_0068	3.11%
BUS_0116	3.06%
BUS_0029	3.03%
BUS_0131	2.91%
BUS_0093	2.71%
BUS_0130	2.52%
BUS_0069	2.49%
BUS_0036	2.39%
BUS_0038	2.39%
BUS_0042	2.39%
BUS_0011	2.16%
BUS_0094	2.11%

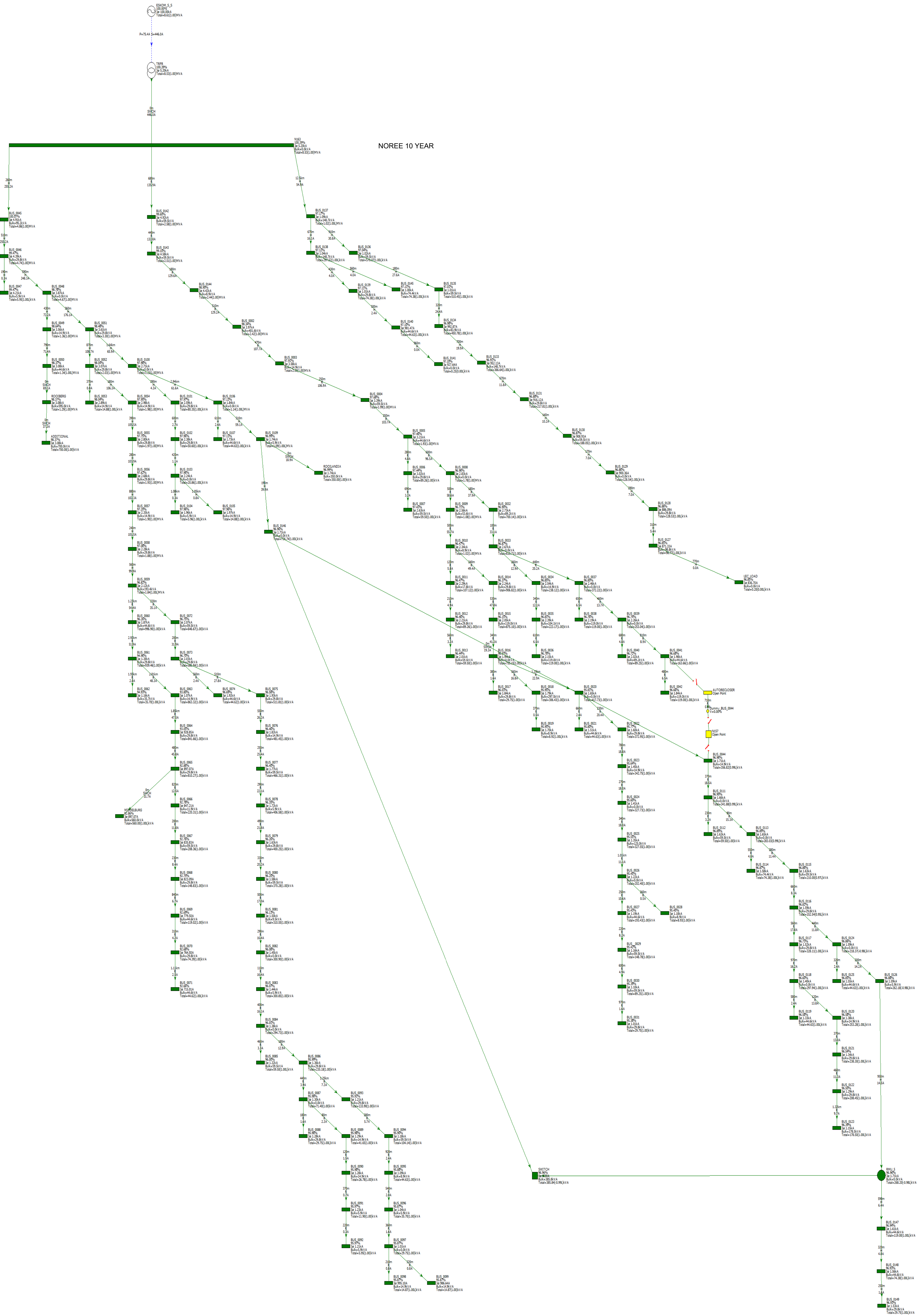
BUS_0030	1.82%
BUS_0012	1.80%
BUS_0040	1.79%
BUS_0006	1.78%
BUS_0129	1.72%
BUS_0128	1.72%
BUS_0147	1.59%
BUS_0070	1.56%
BUS_0114	1.49%
BUS_0087	1.44%
BUS_0127	1.32%
BUS_0085	1.20%
BUS_0013	1.20%
BUS_0007	1.19%
BUS_0112	1.19%
BUS_0101	1.06%
BUS_0139	0.99%
BUS_0145	0.99%
BUS_0148	0.99%
ROOIBERG	0.94%
BUS_0071	0.93%
BUS_0074	0.90%
BUS_0095	0.90%
BUS_0021	0.90%
BUS_0119	0.90%
BUS_0125	0.90%
BUS_0089	0.84%
BUS_0062	0.73%
BUS_0096	0.72%
BUS_0102	0.67%
MIDDELBURG	0.63%
BUS_0031	0.61%
BUS_0088	0.60%
BUS_0097	0.60%
BUS_0107	0.60%
BUS_0017	0.60%
BUS_0140	0.60%
BUS_0090	0.54%
BUS_0149	0.40%
ROOILANDIA	0.38%
ADDITIONAL	0.37%
BUS_0044	0.34%
BUS_0098	0.30%
BUS_0099	0.30%
BUS_0103	0.28%
BUS_0091	0.24%
BUS_0053	0.20%
BUS_0105	0.20%
BUS_0019	0.18%
BUS_0028	0.18%

BUS_0092	0.12%
BUS_0047	0.08%
BUS_0104	0.08%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 15 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS



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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 16 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – VOLTAGE LEVEL STUDY

Noree 10 Year Voltage Level Study

Node Name	Min Voltage	Difference
N163	100.39%	
BUS_0045	100.07%	0.32%
BUS_0142	99.60%	0.79%
BUS_0046	99.47%	0.92%
BUS_0047	99.47%	0.92%
BUS_0143	99.10%	1.29%
BUS_0144	98.90%	1.49%
BUS_0048	98.78%	1.61%
BUS_0049	98.64%	1.75%
BUS_0051	98.48%	1.91%
BUS_0050	98.37%	2.02%
ROOIBERG	98.37%	2.02%
ADDITIONAL	98.37%	2.02%
BUS_0002	98.34%	2.05%
BUS_0052	98.04%	2.35%
BUS_0053	98.04%	2.35%
BUS_0100	97.98%	2.41%
BUS_0101	97.97%	2.42%
BUS_0102	97.96%	2.43%
BUS_0103	97.96%	2.43%
BUS_0104	97.96%	2.43%
BUS_0105	97.96%	2.43%
BUS_0054	97.95%	2.44%
BUS_0003	97.91%	2.48%
BUS_0055	97.75%	2.64%
BUS_0004	97.68%	2.71%
BUS_0056	97.62%	2.77%
BUS_0005	97.46%	2.93%
BUS_0006	97.44%	2.95%
BUS_0007	97.43%	2.96%
BUS_0057	97.20%	3.19%
BUS_0137	97.17%	3.22%
BUS_0106	97.13%	3.26%
BUS_0107	97.13%	3.26%
BUS_0138	97.12%	3.27%
BUS_0139	97.11%	3.28%
BUS_0145	97.11%	3.28%
BUS_0140	97.10%	3.29%
BUS_0141	97.10%	3.29%
BUS_0058	97.08%	3.31%
BUS_0136	97.04%	3.35%
BUS_0135	97.01%	3.38%
BUS_0109	96.99%	3.40%
ROOILANDIA	96.99%	3.40%
BUS_0134	96.98%	3.41%
BUS_0146	96.96%	3.43%

BUS_0008	96.96%	3.43%
BUS_0044	96.96%	3.43%
RMU_5	96.96%	3.43%
SWITCH	96.96%	3.43%
BUS_0147	96.94%	3.45%
BUS_0148	96.93%	3.46%
BUS_0149	96.93%	3.46%
BUS_0133	96.91%	3.48%
BUS_0032	96.90%	3.49%
BUS_0111	96.90%	3.49%
BUS_0112	96.89%	3.50%
BUS_0113	96.89%	3.50%
BUS_0126	96.88%	3.51%
BUS_0131	96.88%	3.51%
BUS_0033	96.87%	3.52%
BUS_0114	96.87%	3.52%
BUS_0130	96.87%	3.52%
BUS_0115	96.86%	3.53%
BUS_0124	96.86%	3.53%
BUS_0129	96.86%	3.53%
BUS_0128	96.86%	3.53%
BUS_0034	96.85%	3.54%
BUS_0125	96.85%	3.54%
BUS_0127	96.85%	3.54%
LEC_LOAD	96.85%	3.54%
BUS_0059	96.82%	3.57%
BUS_0116	96.82%	3.57%
BUS_0035	96.81%	3.58%
BUS_0037	96.80%	3.59%
BUS_0036	96.78%	3.61%
BUS_0038	96.76%	3.63%
BUS_0072	96.75%	3.64%
BUS_0039	96.74%	3.65%
BUS_0117	96.73%	3.66%
BUS_0040	96.72%	3.67%
BUS_0009	96.71%	3.68%
BUS_0073	96.70%	3.69%
BUS_0074	96.69%	3.70%
BUS_0041	96.68%	3.71%
BUS_0042	96.66%	3.73%
BUS_0118	96.60%	3.79%
BUS_0075	96.58%	3.81%
BUS_0119	96.58%	3.81%
BUS_0120	96.58%	3.81%
BUS_0121	96.54%	3.85%
BUS_0122	96.50%	3.89%
BUS_0010	96.47%	3.92%
BUS_0011	96.47%	3.92%
BUS_0076	96.46%	3.93%
BUS_0012	96.46%	3.93%

BUS_0013	96.44%	3.95%
BUS_0077	96.40%	3.99%
BUS_0123	96.39%	4.00%
BUS_0014	96.37%	4.02%
BUS_0078	96.35%	4.04%
BUS_0060	96.26%	4.13%
BUS_0079	96.26%	4.13%
BUS_0080	96.20%	4.19%
BUS_0015	96.15%	4.24%
BUS_0081	96.13%	4.26%
BUS_0082	96.08%	4.31%
BUS_0083	96.07%	4.32%
BUS_0016	96.03%	4.36%
BUS_0017	96.03%	4.36%
BUS_0084	96.01%	4.38%
BUS_0085	96.00%	4.39%
BUS_0086	95.99%	4.40%
BUS_0087	95.98%	4.41%
BUS_0088	95.98%	4.41%
BUS_0089	95.98%	4.41%
BUS_0090	95.98%	4.41%
BUS_0091	95.97%	4.42%
BUS_0092	95.97%	4.42%
BUS_0018	95.95%	4.44%
BUS_0019	95.95%	4.44%
BUS_0093	95.92%	4.47%
BUS_0094	95.90%	4.49%
BUS_0095	95.88%	4.51%
BUS_0096	95.87%	4.52%
BUS_0097	95.87%	4.52%
BUS_0098	95.87%	4.52%
BUS_0099	95.87%	4.52%
BUS_0020	95.81%	4.58%
BUS_0021	95.80%	4.59%
BUS_0022	95.77%	4.62%
BUS_0023	95.64%	4.75%
BUS_0024	95.60%	4.79%
BUS_0025	95.55%	4.84%
BUS_0026	95.45%	4.94%
BUS_0028	95.45%	4.94%
BUS_0027	95.43%	4.96%
BUS_0029	95.42%	4.97%
BUS_0030	95.39%	5.00%
BUS_0031	95.38%	5.01%
BUS_0061	94.96%	5.43%
BUS_0062	94.93%	5.46%
BUS_0063	93.80%	6.59%
BUS_0064	93.05%	7.34%
BUS_0065	92.86%	7.53%
MIDDELBURG	92.86%	7.53%

BUS_0066	92.78%	7.61%
BUS_0067	92.76%	7.63%
BUS_0068	92.74%	7.65%
BUS_0069	92.69%	7.70%
BUS_0070	92.68%	7.71%
BUS_0071	92.66%	7.73%

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ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 17 – 10-YEAR MAXIMUM DEMAND LOAD FLOW ANALYSIS – CONDUCTOR THERMAL CAPACITY STUDY

Noree 10 Year Feeder Loading

Feeder to	Feeder % Loading
BUS_0045	70.88%
BUS_0046	69.49%
BUS_0048	68.97%
BUS_0142	56.64%
BUS_0143	55.33%
BUS_0144	54.02%
BUS_0002	53.82%
BUS_0051	48.92%
BUS_0003	44.89%
BUS_0004	44.56%
BUS_0005	43.23%
BUS_0008	40.22%
BUS_0052	30.20%
BUS_0054	29.54%
BUS_0055	29.31%
BUS_0056	28.87%
BUS_0057	28.43%
BUS_0058	28.20%
BUS_0059	27.76%
BUS_0009	24.42%
BUS_0010	23.21%
BUS_0060	22.65%
BUS_0061	21.64%
BUS_0014	20.58%
BUS_0063	20.13%
BUS_0049	20.05%
BUS_0015	19.90%
BUS_0050	19.83%
BUS_0064	19.78%
BUS_0065	19.08%
BUS_0100	18.29%
BUS_0016	17.20%
BUS_0106	17.10%
BUS_0109	16.43%
BUS_0032	15.80%
BUS_0137	15.26%
BUS_0072	14.62%
BUS_0033	13.79%
BUS_0073	13.27%
BUS_0075	11.59%
BUS_0146	11.08%
BUS_0076	10.92%
BUS_0077	10.58%
BUS_0020	9.54%
BUS_0078	9.23%
BUS_0079	9.09%

N163	8.92%
BUS_0136	8.57%
BUS_0022	8.52%
BUS_0080	8.42%
BUS_0037	8.41%
BUS_0023	7.84%
BUS_0111	7.71%
BUS_0135	7.67%
BUS_0024	7.50%
BUS_0025	7.50%
BUS_0117	7.42%
BUS_0081	7.07%
BUS_0018	6.98%
BUS_0082	6.85%
BUS_0083	6.85%
BUS_0134	6.78%
BUS_0118	6.75%
BUS_0084	6.71%
BUS_0113	6.39%
BUS_0126	5.92%
BUS_0120	5.73%
BUS_0039	5.72%
BUS_0133	5.52%
BUS_0121	5.40%
BUS_0034	5.38%
BUS_0086	5.36%
BUS_0066	5.19%
BUS_0035	5.04%
BUS_0124	4.93%
BUS_0067	4.91%
BUS_0115	4.74%
BUS_0122	4.72%
BUS_0026	4.64%
BUS_0138	4.47%
BUS_0027	4.43%
BUS_0123	4.05%
RMU_5	4.03%
BUS_0041	3.70%
BUS_0068	3.51%
BUS_0116	3.44%
BUS_0029	3.41%
BUS_0131	3.28%
BUS_0093	3.05%
BUS_0130	2.83%
BUS_0069	2.81%
BUS_0036	2.69%
BUS_0038	2.69%
BUS_0042	2.69%
BUS_0011	2.43%
BUS_0094	2.37%

BUS_0030	2.05%
BUS_0012	2.02%
BUS_0040	2.02%
BUS_0006	2.00%
BUS_0129	1.93%
BUS_0128	1.93%
BUS_0147	1.79%
BUS_0070	1.76%
BUS_0114	1.68%
BUS_0087	1.63%
BUS_0127	1.49%
ROOIBERG	1.38%
BUS_0085	1.36%
BUS_0013	1.35%
BUS_0007	1.34%
BUS_0112	1.34%
BUS_0101	1.20%
BUS_0139	1.12%
BUS_0145	1.12%
BUS_0148	1.12%
BUS_0071	1.05%
BUS_0095	1.02%
BUS_0021	1.02%
BUS_0074	1.01%
BUS_0119	1.01%
BUS_0125	1.01%
BUS_0089	0.95%
BUS_0062	0.82%
BUS_0096	0.81%
BUS_0102	0.75%
ADDITIONAL	0.75%
BUS_0088	0.68%
BUS_0097	0.68%
BUS_0017	0.68%
BUS_0031	0.68%
BUS_0107	0.67%
BUS_0140	0.67%
MIDDELBURG	0.63%
BUS_0090	0.61%
BUS_0149	0.45%
BUS_0044	0.39%
ROOILANDIA	0.38%
BUS_0098	0.34%
BUS_0099	0.34%
BUS_0103	0.31%
BUS_0091	0.27%
BUS_0053	0.22%
BUS_0105	0.22%
BUS_0019	0.20%
BUS_0028	0.20%

BUS_0092	0.14%
BUS_0047	0.09%
BUS_0104	0.09%

LANGEBERG MUNICIPALITY

ELECTRICITY MASTERPLAN - ASHTON AREA OF SUPPLY

APPENDIX 18 – RECOMMENDED CAPITAL UPGRADES

Langeberg Municipality Electrical Engineering Services Infrastructure: Capital Projects - Noree

[illegible]