Eskom

TRANSMISSION

GENERATION CONNECTION CAPACITY ASSESSMENT OF THE 2022 TRANSMISSION NETWORK (GCCA – 2022 UPDATE)

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EXECUTIVE SUMMARY

The Generation Connection Capacity Assessment (GCCA) document was created in response to a call from government to connect renewable energy (RE) independent power producers (IPPs) to the national electricity grid as part of the implementation of the Integrated Resource Plan (IRP). The 2010 IRP allocated 17 800 MW of solar and wind generation capacity in line with the government's commitment to reduce emissions.

Two previous versions of the GCCA have been issued as follows:

- GCCA – 2012, 2012 release – Assessment of the 2012 network
- GCCA – 2022, 2015 release – Assessment of the 2022 network

These provided the expected available connection capacity at the busbars of the main transmission system (MTS) substations based on the completion of approved transmission projects in those respective years.

This document is the latest version of the GCCA is an update of the previous GCCA – 2022 named;

- GCCA – 2022 update, 2018 release – Assessment of the 2022 network.

The reason for the update is to re-evaluate the available generation capacity due to changes in the load and generation forecasts between the 2016 – 2025 transmission development plan (TDP) and the latest 2018 – 2027 TDP. There has also been a change in the customer load network (CLN) boundary demarcation and names. The substations within those CLNs have changed in some cases, this has altered the network configuration since the last GCCA. This GCCA is updated and structured in terms of the new CLN areas. Since the GCCA is based on the network in service in 2022, the changes in load and generation forecasts affect commissioning dates of projects and the potential generation connection capacity that could be available by 2022. This update will ensure that the next bid window and other IPP procurement programmes have an accurate indication of what capacities will be available in 2022, which is the expected date for the next round of REIPPPP.

The GCCA – 2022 UPDATE includes all the projects expected to be completed in 2022 as contained in the 2018 – 2027 TDP issued in December 2017. This is to provide developers and investors with an indication of the potential available generation connection capacity around the supply areas of transmission substations on the Eskom network in 2022. The status of the reinforcement projects at each transmission substation is indicated as either

approved or proposed, which must be taken into consideration when reviewing the capacity values of a specific transmission substation.

The capacity calculation at the secondary voltage of the transmission substation (referred to as LV) does not require compliance with the single contingency (N – 1) criterion for generation connection as in the previous GCCA. Thus, the full installed transformer MVA capacity at a transmission substation is available for providing generation connection capacity at the LV busbar. The area / CLN capacity assessment is based on the N – 1 criterion as it looks at the high voltage (HV) which is the primary side of transmission substations.

The generation connection capacity of the transmission supply areas that could be available by 2022, assuming that the TDP is fully implemented, is shown in Figure A1. The darker the shade of green, the more connection capacity is available and vice versa.

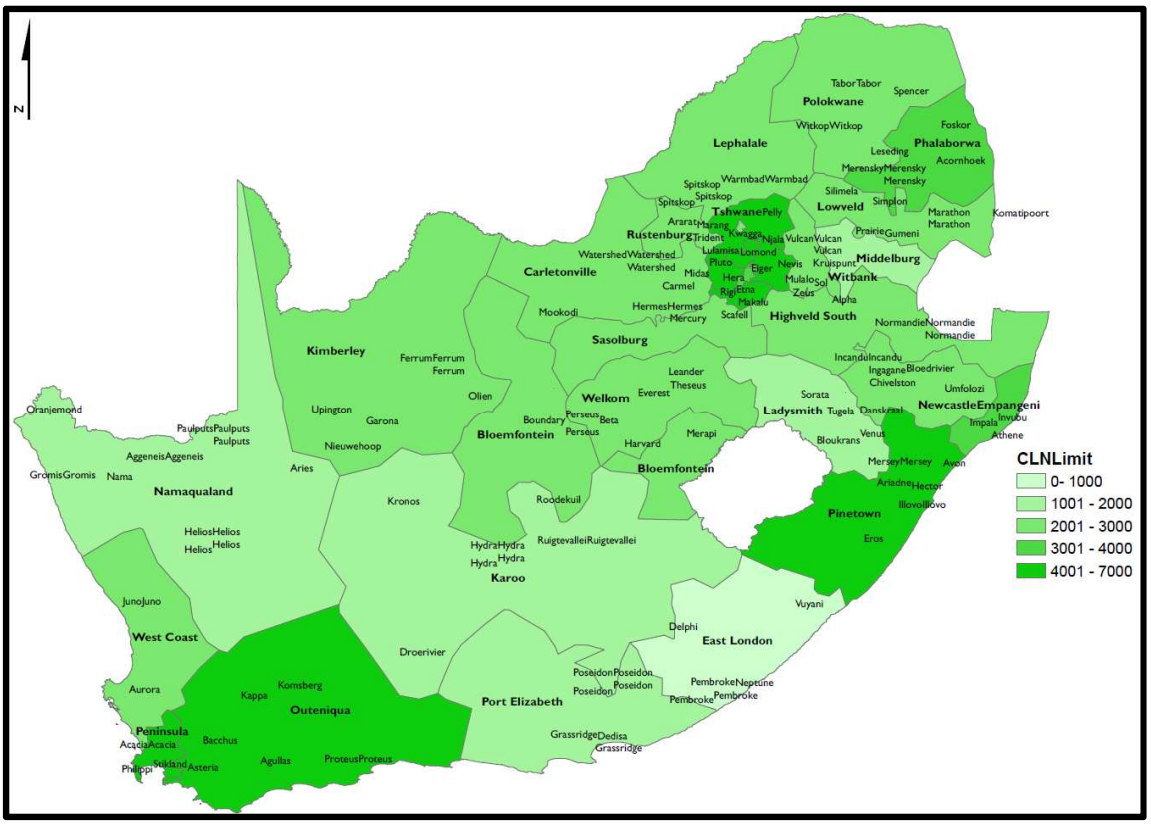

Figure A1: The GCCA-2022 transmission supply area generation connection capacities for light load

The main improvement in the GCCA – 2022 UPDATE is the introduction of the Power BI representation of the results. Power BI offers the capability to represent the connection capacity results data visually with maps showing the exact location of substations, their CLN

and all the available generation connection capacity by clicking on that area or substation. It also provides the town names so that IPPs can search for a town in which they wish to develop their plant and this would be shown in the map with the closest substation visible to enable the developer to choose the one closest and has adequate generation capacity for their plant.

The interactive PDF document which was first introduced in the previous GCCA has been kept and was updated in line with this document. The interactive PDF document contains rich layered information, which can be toggled on and off in a map depending on what the viewer is interested in. These layers include the existing and planned transmission network, the location of the successful IPP bidders for all the REIPPPP rounds, the transmission substation supply areas, and the transmission supply areas (CLN's). Also included are the GCCA – 2022 light and midday load connection capacity values at the substation, and CLN levels. There is also detailed information regarding the substation transformation capacity and voltage levels, which can be accessed in tabular form on the PDF map.

Eskom has identified potential transmission projects that could unlock additional connection capacity by 2022, which are not included in the TDP. These include projects at existing transmission substations and the establishment of new transmission substations with new transmission lines. These potential projects are grouped into four categories based on how long they could take to be completed.

SEA corridors which were discussed in the previous GCCA have now been promulgated by the government. The Department of Environmental Affairs (DEA) has now completed the SEA studies for these routes as part of the SIP 10 initiative of the government's National Development Plan. A new and simpler approval process to obtain the required environmental authorisation (EA) for transmission projects within these corridors has been approved in principle by Cabinet and is being developed as part of the SIP 10 initiative to reduce the response time for releasing and completing transmission infrastructure projects. Promulgated SEA corridors, planned substations and potential completion timelines are also indicated in the interactive maps.

The location of the potential transmission substation projects from the TDP and the transmission power corridor routes are shown in Figure A2.

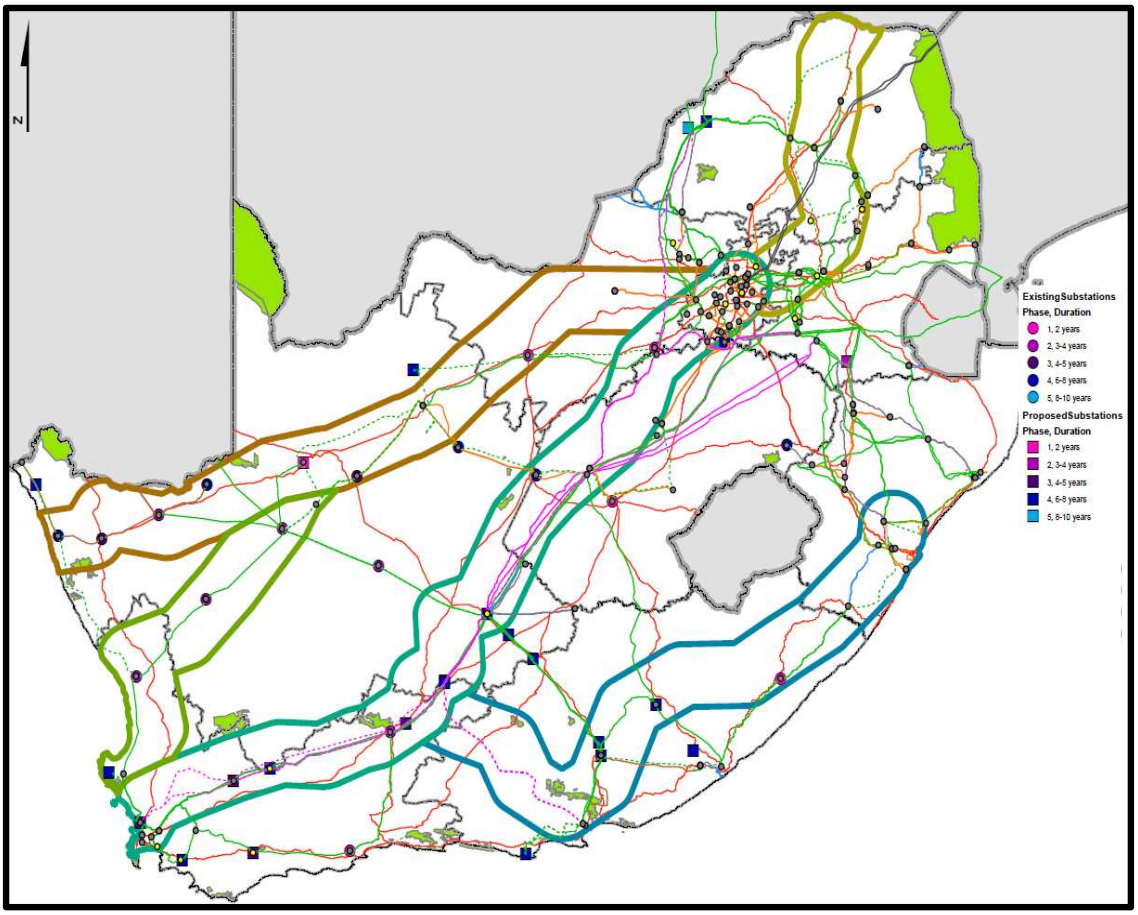

Figure A2: The potential Transmission substation projects and the five transmission power corridors (SEA promulgated)

LIST OF ABBREVIATIONS

CLN	Customer load network
CSP	Concentrating solar power
DEA	Department of Environmental Affairs (Government of South Africa)
DoE	Department of Energy (Government of South Africa)
GCCA	Grid Connection Capacity Assessment
HV busbar	High-voltage busbar of a substation (> 132 or 220 kV at transmission level)
IPP	Independent power producer
IRP	Integrated Resource Plan
LV busbar	Low-voltage busbar of a substation (≤ 132 or 220 kV at transmission level)
MTS	Main transmission system
MVAR	Megavolt-ampere-reactive (power)
MW	Megawatt (power)
N-0	System healthy condition of the network
N-1	Single contingency event on the network
NTC	National Transmission Company
PV	Photovoltaic
PV analysis	Power system voltage stability study
Power BI	Business intelligence software
RE	Renewable energy
TDP	Transmission Development Plan
TNSP	Transmission network service provider
SIP	Strategic Integrated Projects
SEA	Strategic Environment Assessment
REIPPPP	Renewable Energy Independent Power Producer Procurement Program
REBID	Renewable Energy Bidding

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I. DISTRIBUTION LIST

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II. REVISIONS

Date	Rev.	Remarks
April 2018	0	- First issue
May 2018	1	- Revised to split IPPs into PV and Wind. - Revised to consider the maximum IPP output potential for all connected IPPs at substations in calculating 2022 MV limit at the substation for light and midday load

1 INTRODUCTION

1.1. CONTEXT OF THE GENERATION CONNECTION CAPACITY DOCUMENT

Eskom is a vertically integrated company which is responsible for the bulk of electricity generation in South Africa. The main existing coal generators are situated in the Mpumalanga and Limpopo provinces. They supply electricity at high voltages to large customers and distributors as far south as Cape Town via the transmission network. The transmission license is held by the Eskom Transmission Division, the transmission network service provider (TNSP). The planning of expansion and upgrade of the transmission network is the sole responsibility of the Transmission Grid Planning department.

The purpose of the generation connection capacity assessment (GCCA) is to assess the generation capacity available in the transmission network based on both the proposed and approved projects which will be in service in 2022. It assesses the available capacity at the transmission substation medium voltage (MV) busbar, high voltage (HV) busbar as well as the transmission supply areas and grids. This document is an update of the previous GCCA 2022, the update was necessitated by changes in the load and generation forecasts as well as the progress of the proposed projects in previous TDP's.

1.2. STRUCTURE OF THE DOCUMENT

This document is structured as follows:

Chapter 2 provides the background to the study and the scope of the study,

Chapter 3 outlines the methodology employed in the study and how the results are presented and should be interpreted.

Chapter 4 describes the results and how they ought to be read and gives the different transmission connections to an MTS substation.

Chapter 5 highlights the changes from the previous GCCA – 2022 report, released in 2015 and shows changes in connection capacity.

Chapter 6 describes how additional grid connection capacity could be unlocked, including the development of major transmission power corridors.

Chapter 7 explains how to use the interactive spatial PDF map document that can be downloaded separately, entitled GCCA – 2022 Spatial Map.pdf.

Chapter 8 proposes improvement to be made and incorporated in the next revision of the GCCA document

2 BACKGROUND

Since the call from government to connect renewable energy (RE) independent power producers (IPPs) to the national electricity grid, the renewable energy independent power producer program (REIPPPP) has had four main bidding rounds where (REIPPs) have been approved to the total value of 6429 MW and are broken down in their different technologies in Table 2.1 below.

Table 2.1. REIPPPP Approved Projects Technology and Size

Technology	**Size (MW)**
Onshore wind	3449.57
Landfill gas	22.70
Biomass	41.50
Concentrated solar power (CSP)	600.00
Small hydro	19.00
Photovoltaic	2332.81
Total REIPPP	**6429.58**

The REIPPP program had a large interest among investors and the public. The need by the public and IPP developers to understand where network connection capacity is available gave rise to the conceptualization of the initial generation connection capacity assessment report. This would make it easier for IPP developers to identify potential sites close to substations with sufficient generation connection capacity.

The first GCCA document was released in 2012; it dealt with transmission generation capacity assessment for the 2012 transmission network. This was done to evaluate the first bid window of the REBID program and only focused on the Greater Cape Province where there was a high concentration of IPP applications at the time. This GCCA document focused on what could be connected on the transmission substation low voltage (LV) busbars of the transmission substations.

A second GCCA was released in 2012 focusing on available generation connection capacity of the 2016 transmission network. This also did not focus on the entire transmission network but included the available generation capacity on the high voltage (HV) side of the transmission substation (over and above the MV capacity), not limited by the substation transformers. The requirement of this document was to assess available generation connection capacity of the transmission grid while complying with the (N – 1) criterion.

The third GCCA was released in 2015; it focused on the generation capacity of the 2022 transmission network. This document assessed the entire transmission network. The report focused on available capacity in 2022. This was because of the approval to connect the first four windows of the REIPPPP which extended to 2020. The transmission network was assessed with the consideration of all approved new projects and proposed new projects up to 2022. This document came with significant improvements such as the interactive spatial PDF map where you could view the generation connection capacity from substation level to corridor level spatially.

It has been three years since the release of the GCCA – 2022 document, during this time there has been a change in the economic outlook of the country and the electricity load and generation forecast have since been revised.

This has affected the expected commissioning dates of some projects which were expected in 2022 in the previous GCCA. There has also been a change in the demarcation of the CLN boundaries and the associated substations within them. This has changed the network configuration in relation to the old CLN boundaries used in the previous GCCA. This has the impact of changing the available generation connection capacity per CLN due to the inclusion or exclusion of certain substations in the new CLN boundaries.

This document is an update of the 2015 version of the GCCA – 2022. The revision comes at an ideal time when there have been changes in the CLN demarcations which have resulted in significant changes in the network configuration between the previous GCCA and the current update. The benefit of updating the GCCA – 2022 is that it ensures that the latest generation connection capacity assessment of the network is available to stakeholders when the list of the new round of REIPPP is released, which is expected around 2022.

2.1. CHANGES IN PROJECTS

This chapter reports the changes in the network between the previous GCCA and the current update, such as deferred projects and new projects brought forward. Table 2.1.1 shows those projects that have changed dates in the form of province, CLN and their status.

Table 2.1.1. Project changes

PROVINCE	CLN	New Projects included	Deferred or Cancelled Projects
Eastern Cape	**Port Elizabeth**	_	- PE Sub 400/132kV substation
Gauteng	**Johannesburg South**	_	- Kyalami 400/132kV substation - North Rand 275/132kV transformation
KwaZulu-Natal	**Empangeni**	- Impala 275 kV - Athene 400 kV busbar	- Mbewu 1 x 2000MVA 765/400kV substation
KwaZulu-Natal	**Ladysmith**	- Sorata 275 kV busbar	_
KwaZulu-Natal	**Pinetown**	_	- St Faiths 400/132kV substation
Limpopo	**Polokwane**	_	- Njhelele 400/132kV substation
Limpopo	**Phalaborwa**	_	- Senakangwedi B 400/132 kV substation transformation
Northern Cape	**Karoo**	- Hydra 765 kV busbar, - Kronos 400 kV busbar, -Upington 400 kV busbars - Ruigtevallei 220/132kV substation, 1 x 250MVA transformer was bypassed under the Gariep strengthening project	- Gamma 765/400kV substation transformation
Northern Cape	**Kimberley**	- Liewensaar 275 kV busbar - Niewehoop 400kV busbar	_

PROVINCE	CLN	New Projects included	Deferred or Cancelled Projects
North West	**Carletonville**	_	- Watershed 1 x 250MVA 275/132kV transformer
North West	**Rustenburg**	- Dinaledi 400 kV busbar	- Bighorn 400/132kV substation - Marang B 400/132kV substation
Western Cape	**Southern Cape**	_	- Narina 400/132kV substation

2.2. NETWORK CORRECTIONS

Table 2.2.1 shows corrections that made in the base network information to reflect the latest information.

Table 2.2.1. Network corrections

CLN	New Projects included
Highveld North CLN	- Prairie 275/132kV substation transformation size corrected from 2 x 500MVA 275/132kV (previous GCCA – 2022) transformers to 2 x 240MVA - Rockdale132/88kV substation transformation size corrected from 2 x 90MVA 132/88kV to 1 x 80MVA and 3 x 30MVA 132/88kV transformers
Highveld South	- Sol B substation was excluded in the previous GCCA – 2022 document and has been included in this update
Lephalale	- Spitskop 400/132 kV transformation changed from 2 x 250 MVA in previous GCCA to 2 x 500 MVA.
Phalaborwa	- Senakangwedi 275/22kV substation has 3rd 180MVA transformers

2.3. INCLUSION OF PROPOSED TRANSMISSION PROJECTS

For GCCA – 2022 all projects which were proposed in the 2015 – 2024 TDP up to 2022 were included in the transmission network assessment. This practice has been continued in the current update. The current commissioning dates of projects up to 2022 are based on the dates in the 2018 – 2027 TDP. Some of the major corridor projects that are planned to be commissioned by 2022 are shown in Table 2.3.1 below;

Table 2.3.1. Projects in execution and planned to be completed by FY2022/2023

Province	Project name
Gauteng	Vaal Strengthening South Phase 1
	Simmerpan 88 kV Establishment
	Glockner-Etna 1st and 2nd 400 kV line (operated @ 275 kV)
	Waterberg fault level project : Midas, Apollo, Pluto substations
	Lepini Ext 275kV 2 x 150MVAr capacitors
	Benburg MTS install 3rd 250 MVA 275/132 kV Transformer
KZN	Ariadne – Venus 2nd 400kV line
	Ariadne – Eros 2nd 400kV line
	Mbewu 400kV switching substation
	Umfolozi Mbewu 765kV line
	Loop in/out Athene-Umfolozi & Umfolozi – Invubu 400kV Lines
Limpopo	Waterberg Fault Level Project: Witkop Substation
	Dwaalboom (Dwarsberg) 132kV switching station
	Medupi-Ngwedi (Mogwase) 1st 400kV line
	Medupi-Ngwedi (Mogwase) 1st 765kV line (Energised at 400kV)
Mpumalanga	Highveld South Reinforcement: Sasol 2 and 3 Series Reactors
	Waterberg Fault Level Project : Merensky Substation
	Highveld South Reinforcement Phase 1: Series Reactors
	Mpumalanga Underrated Equipment
	Kusile PS Integration
	Normandie MTS 2nd 400/132 KV Transformer
North West	Watershed Strengthening
	Medupi Phase 1: Fault Level Plan – Spitskop

Province	Project name
	Waterberg Fault Level Project: Hermes and Lomond substations
	Ngwedi 2nd 400/132 kV transformer
Free State	Waterberg Fault Level Project: Perseus Substation
	Harrismith Strengthening Phase 1 (Sorata 275/132 kV integration)
	Everest-Merapi 400 kV line (operated at 275 kV)
Northern Cape	Kronos-Cuprum 1st & 2nd 132kV feeder bays Kronos 400/132 kV Helios 400/132 kV
	Niewehoop – Upington 1st 400kV line and Upington substation
	Namaqualand strengthening (Juno-Gromis-Oranjemund line)
	Northern Cape Strengthening: Ferrum – Nieuwehoop 400kV line
	Groeipunt 220/132 kV substation
	Northern Cape Strengthening: Aries 400MVar SVC Reactor
Eastern Cape	Southern Grid TX Transformer Normalisation: Buffalo & Pembroke substations
	Grassridge-Dedisa 132 kV line
	PE Strengthening Phase 3: Poseidon; Delphi; Grassridge; Dedisa Shunt Capacitors
Western Cape	Muldersvlei 3rd 500 MVA 400/132 kV Transformer & 132 kV Series Reactors
	Ankerlig – Sterrekus 400kV lines
	Pinotage Substation (Firgrove Transmission Substation)
	Koeberg 400kV busbar reconfiguration (Risk Reduction)
	Komsberg 400/132 kV substation

2.4. OLD AND NEW CLNS WITH ASSOCIATED SUBSTATIONS

This section highlights the changes in the CLN demarcation with the renaming of certain CLN's and the changes in the allocation of zones (substations) to CLN's. Table 2.4.1 to Table 2.4.9 show the old CLNs and the zones (substations) allocated to them and the new CLNs with its associated zones. This GCCA document uses the new CLN demarcation.

Table 2.4.1. Gauteng Grid

Grid	New CLN	Substations	Old CLN
Gauteng	Tshwane	Kwagga	Pretoria
		Lomond	Pretoria
		Njala	Pretoria
		Pelly	Pretoria
		Verwoerdburg	Pretoria
	East Rand	Benburg	Nigel
		Brenner	Nigel
		Nevis	Nigel
		Pieterboth	Nigel
		Esselen	Johannesburg
	Johannesburg South	Croydon	Johannesburg
		Eiger	Johannesburg
		Jupiter	Johannesburg
		Fordsburg	Johannesburg
		Prospect	Johannesburg
	Johannesburg North	Craighall	Johannesburg
		Kyalami	Johannesburg
		Lepini	Johannesburg
		Lulamisa	Johannesburg
		Apollo	Johannesburg
		Minerva	Johannesburg

Table 2.4.2. Mpumalanga Grid

Grid	New CLN	Substations	Old CLN
Mpumalanga	Middelburg	Arnot	Highveld North
		Hendrina	Highveld North
		Komati	Highveld North
		Rockdale	Highveld North
		Duvha	Highveld North
		Rockdale B	Highveld North
	Highveld South	Alpha	Highveld South
		Sol	Highveld South
		Zeus	Highveld South
		Normandie	Newcastle
	Lowveld	Gumeni	Highveld North
		Komatipoort	Lowveld
		Marathon	Lowveld
		Senakangwedi	Lowveld
		Simplon	Lowveld
		Prairie	Highveld North
	Witbank	Kruispunt	Highveld North
		Vulcan	Highveld North

Table 2.4.3. Limpopo Grid

Grid	New CLN	Substations	Old CLN
Limpopo	Polokwane	Njhelele	Polokwane
		Spencer	Polokwane
		Tabor	Polokwane
		Witkop	Polokwane
		Silimela	Lowveld
	Lephalale	Spitskop	Waterberg
		Borutho	Polokwane
		Warmbad	Waterberg
	Phalaborwa	Acornhoek	Lowveld
		Foskor	Lowveld
		Merensky	Lowveld
		Leseding	Polokwane
		Tubatse	Polokwane

Table 2.4.4. North West Grid

Grid	New CLN	Substations	Old CLN
North West	Rustenburg	Ararat	Rustenburg
		Bighorn	Rustenburg
		Marang	Rustenburg
		Ngwedi	Rustenburg
		Trident	Rustenburg
		Dinaledi	Rustenburg
	Carletonville	Carmel	Carletonville
		Hermes	Carletonville
		Midas	Carletonville
		Pluto	Carletonville
		Watershed	Carletonville

Table 2.4.5. Western Cape Grid

Grid	New CLN	Substations	Old CLN
Western Cape	West Coast	Aurora	West Coast
		Juno	West Coast
	Penninsula	Sterrekus	Penninsula
		Acacia	Penninsula
		Erica	Penninsula
		Muldervlei	Penninsula
		Philippi	Penninsula
		Pinotage	Penninsula
		Stikland	Penninsula
	Outeniqua	Agulhas	Southern Cape
		Bacchus	Southern Cape
		Droerivier	Southern Cape
		Kappa	Southern Cape
		Komsberg	Southern Cape
		Proteus	Southern Cape
		Narina	Southern Cape
		Gourikwa	Penninsula
		Asteria	Penninsula

Table 2.4.6. Free State Grid

Grid	New CLN	Substations	Old CLN
Free State	Bloemfontein	Beta	Bloemfontein
		Harvard	Bloemfontein
		Perseus	Bloemfontein
		Merapi	Bloemfontein
		Serumula	Bloemfontein
		Boundary	Kimberley
	Sasolburg	Makalu	Vaal Triangle
		Makalu B	Vaal Triangle
		Mercury	Carletonville
	Welkom	Everest	Welkom
		Leander	Welkom
		Theseus	Welkom
		Sorata	Ladysmith

Table 2.4.7. Eastern Cape Grid

Grid	New CLN	Substations	Old CLN
Eastern Cape	East London	Delphi	East London
		Neptune	East London
		Pembroke	East London
		Vuyani	East London
		Buffalo	East London
	Port Elizabeth	Dedisa	Port Elizabeth
		Grassridge	Port Elizabeth
		Iziko	Port Elizabeth
		Poseidon	Port Elizabeth
		Thyspunt	Port Elizabeth

Table 2.4.8. Northern Cape Grid

Grid	New CLN	Substations	Old CLN
Nothern Cape	Karoo	Gamma	Karoo
		Hydra	Karoo
		Kronos	Karoo
		Roodekuil	Karoo
		Ruigtevallei	Karoo
	Namaqualand	Aggeneis	Namaqualand
		Aries	Namaqualand
		Gromis	Namaqualand
		Helios	West Coast
		Nama	Namaqualand
		Oranjemond	Namaqualand
		Paulputs	Namaqualand
		Groeipunt	Namaqualand
	Kimberley	Ferrum	Kimberley
		Garona	Kimberley
		Hotazel	Kimberley
		Olien	Kimberley
		Nieuwehoop	Namaqualand
		Lewensaar	Namaqualand
		Upington	Namaqualand

Table 2.4.9. KwaZulu-Natal Grid

Grid	New CLN	Substations	Old CLN
KwaZulu-Natal	Empangeni	Athene	Empangeni
		Impala	Empangeni
		Invubu	Empangeni
		Mbewu	Empangeni
		Iphiva	Empangeni
	Ladysmith	Bloukrans	Ladysmith
		Danskraal	Ladysmith
		Tugela	Ladysmith
		Venus	Ladysmith
	Newcastle	Bloedrivier	Newcastle
		Chivelston	Newcastle
		Incandu	Newcastle
		Ingagane	Newcastle
		Umfolozi	Newcastle
		Pegasus	Newcastle
	Pinetown	Ariadne	Pinetown
		Avon	Pinetown
		Eros	Pinetown
		Georgedale	Empangeni
		Hector	Pinetown
		Illovo	Pinetown
		Mersey	Pinetown
		St Faiths	Pinetown
		Insundu	Pinetown

Figure 2.4.1 and Figure 2.4.2 show the CLN's before (GCCA 2022) and after (GCCA 2022 Update) the reconfiguration respectively, it can be observed through the colours that some of the CLN's have changed completely.

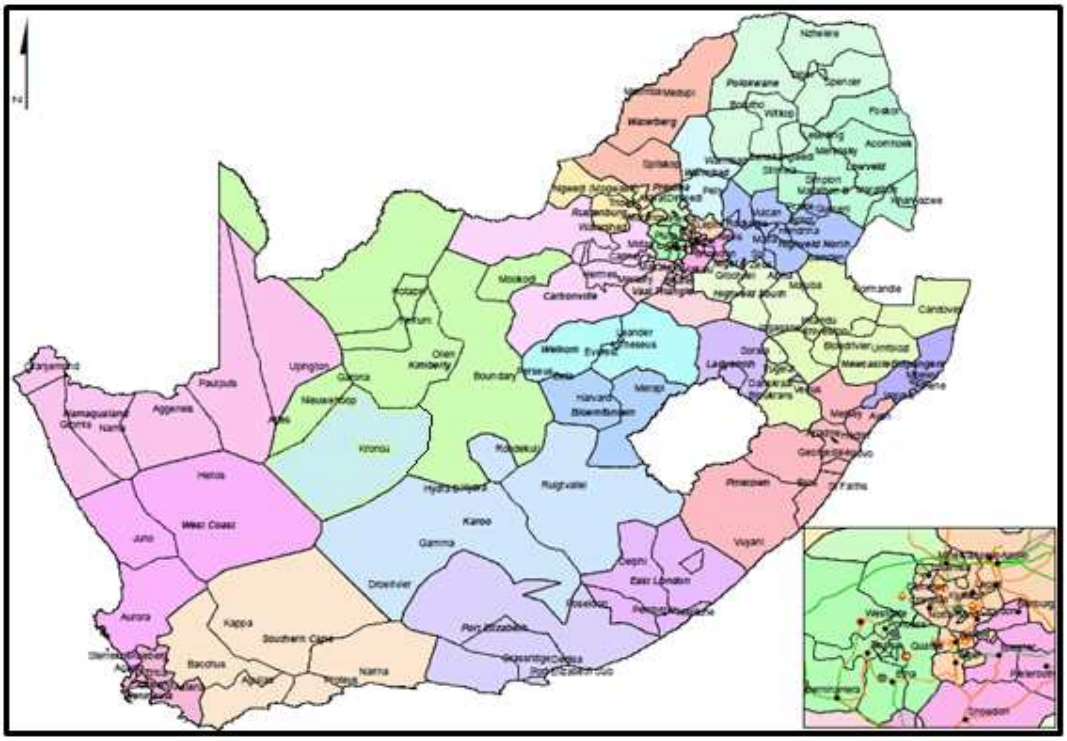

Figure 2.4.1. Map of South Africa showing the old CLN demarcation and substation within them

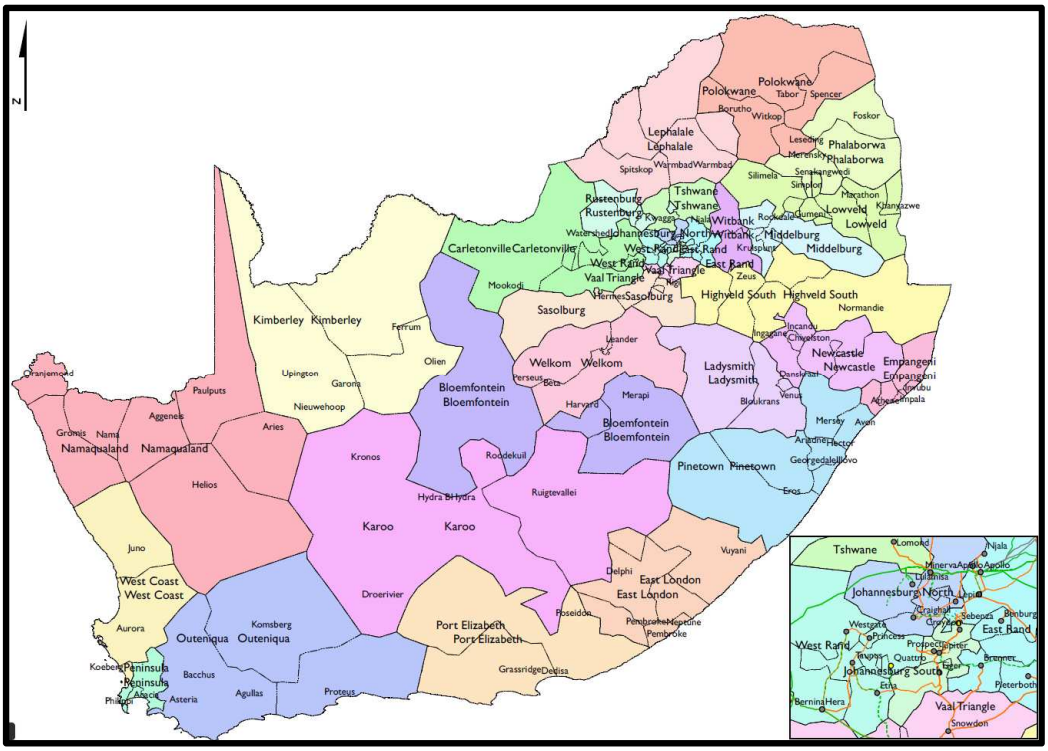

Figure 2.4.2. Map of South Africa showing the new CLN demarcation and substation within them

As an example one distinct change in the CLN demarcation is the Kimberley CLN. In Figure 2.4.1 Kimberley is highlighted in green and Bloemfontein is within its supply area. In Figure 2.4.2 on the other hand, Bloemfontein is a CLN on its own.

3 METHODOLOGY AND INTERPRETATION

This chapter explains how the available generation connection capacity is calculated and how the results can be interpreted.

3.1. DEFINITION OF A TRANSMISSION CONNECTION

This section gives an illustration of the different ways an IPP may be connected onto the transmission network.

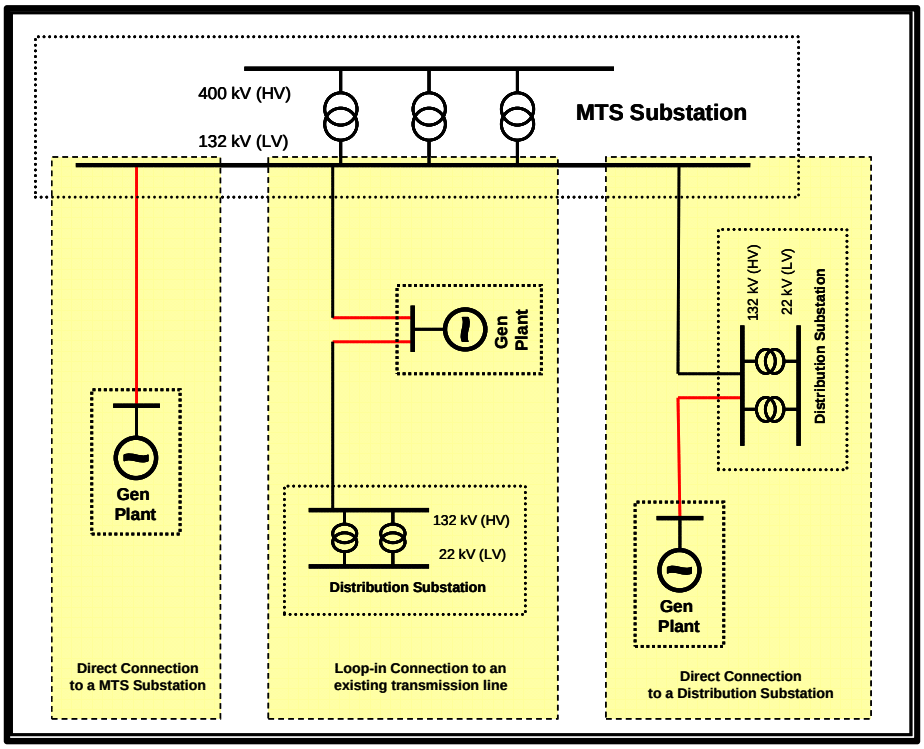

Figure 3.1. Generation plant connection to the LV busbar options

The generator can either be connected directly onto the transmission substation busbar, it can connect by looping in and out of a transmission line supplying a distribution substation or it can connect directly on a distribution substation which is connected to the transmission network as shown in Figure 3.1 from left to right.

3.2. METHODOLOGY OF CALCULATION

The calculation of the generation connection capacity in this document is based on the expected transmission infrastructure to be in service in the year 2022 as prescribed by the 2018 – 2027 TDP. The previous GCCA released in 2015 considered the network expected to be in service in 2022 in line with the 2015 – 2024 TDP. Some of the infrastructure that was identified in the 2015 release of the GCCA might have been deferred in this update as the commissioning dates of projects from the 2015 – 2024 TDP were revised in the 2018 – 2027 TDP.

3.2.1. CALCULATION OF THE CONNECTION CAPACITY

In this section the different levels where capacity assessment is done are introduced, the section also explains the criteria applied and the method of calculation. It describes how substations with multiple voltage levels and the supply area or CLN are assessed.

Level 1: LV level (Transformation assessment)

The LV busbar includes all voltage levels of 66 kV, 88 kV, 132 kV and 220 kV in some instances on the transmission network. Voltage levels below these such as 11 kV, 22 kV and 33 kV are not considered in this assessment as they only form part of the distribution network.

The capacity calculation at the LV busbar of the substation does not require the N – 1 reliability criterion, refer to Figure 3.2 below. This means that a generator may be connected to the network through only one transformer and during a fault in that transformer the generator would be disconnected from the network without a backup connection, and that would be acceptable as per South African Grid Code Clause 7.6.5, which states:

For power stations of less than 1000MW,

"With all connecting lines in service, it shall be possible to transmit the total output of the power station to the system for any system load condition. If the local area depends on the power station for voltage support, the connection shall be made with a minimum of two lines."

While for power stations of more than 1000MW:

"With one connecting line out of service (N-1), it shall be possible to transmit the total output of the power station to the system for any system load condition."

From the clause stated above it is evident that the South African Grid Code only prescribes the single contingency criteria compliance to power stations more than 1000MW,since IPPs generate power they have been treated as power stations in this document. IPPs are generally less than 1000MW and so they don't have to comply to the this criteria, unless the area depends on the generators for voltage control.

In instances where the transmission substation has multiple transformers, the full transformation capacity, e.g. 1000 MVA as shown in Figure 3.2, will be available to provide generation connection capacity and not limited to a single transformer size. The power is first consumed by the load before being exported to the network. The red arrows represent the power flow from the generator through the transmission substation throughout the document.

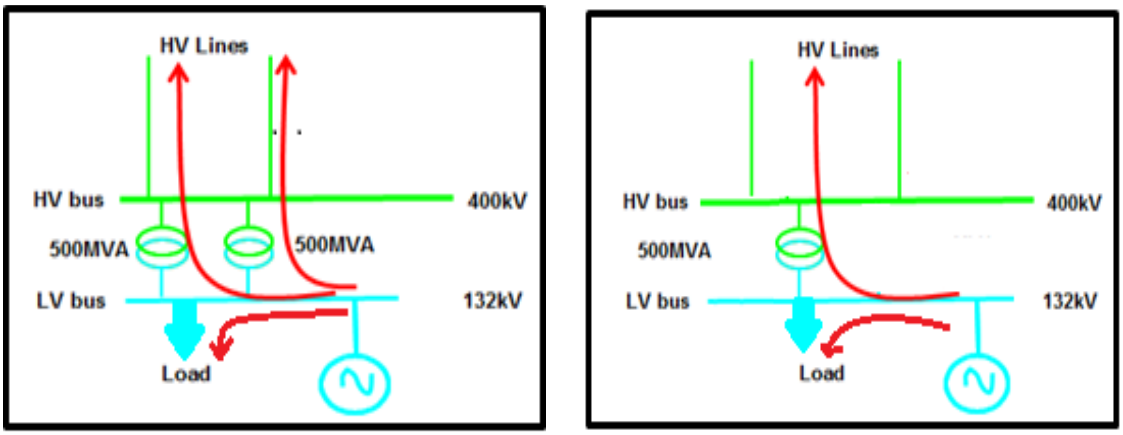

Figure 3.2. Transmission substation showing a simple generator on the LV busbar

In cases where the substation has multiple voltages levels, the LV capacity is calculated for each voltage level such as in the case in Figure 3.3. The generation could be connected on the 88kV busbar in which case the generation connection capacity will be limited by 2 x 315MVA 132/88kV transformers. In the case where the generation is connected on the 132 kV busbar, the generation connection capacity would be limited by 2 x 500 MVA 400/132 kV transformers. In such cases the generation connection capacity at 88 kV, 132 kV would be given for the purpose of this assessment.

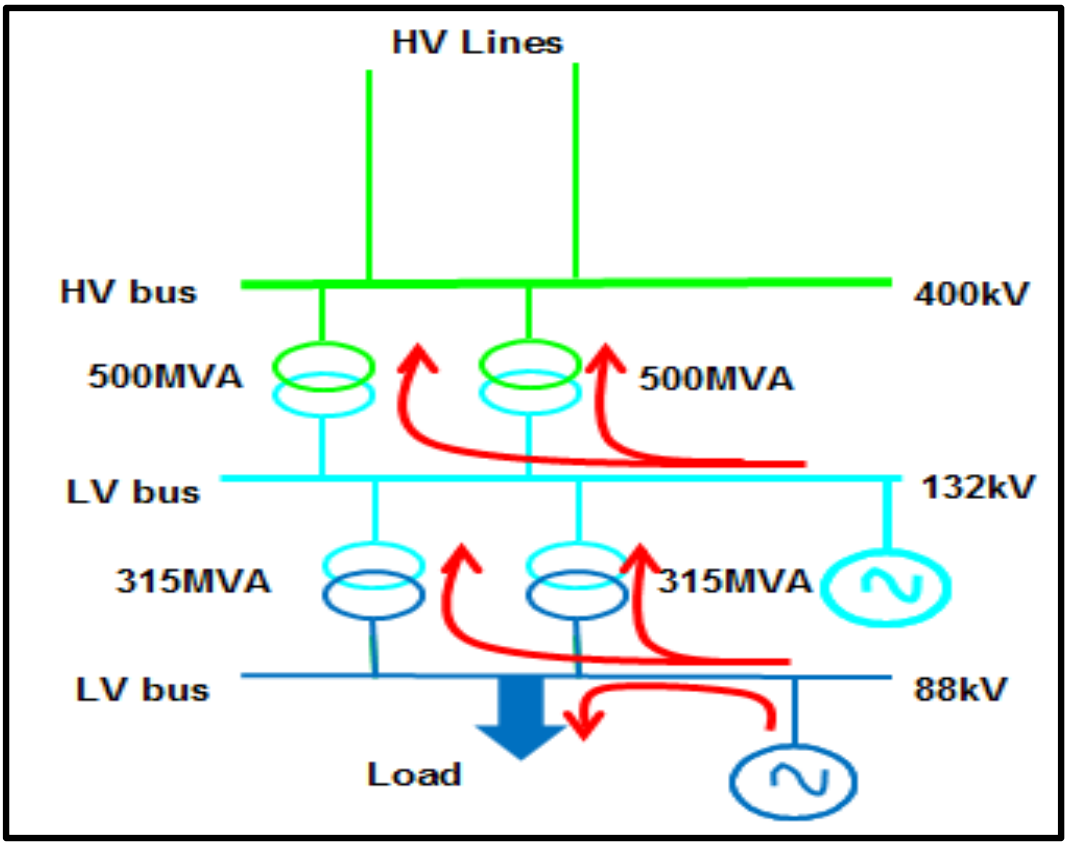

Figure 3.3. Transmission substation showing multiple voltage levels and possible LV connections

Level 2: HV level (Incoming feeders assessment)

HV level refers to all busbars and lines at voltages 220 kV, 275, and 400 kV. In some cases where the secondary or lowest voltage level of the substation is 220 kV then this would referred to as LV level.

The generation connection capacity calculation for the HV level is based on connecting the generator on the HV busbar of the substation and increasing the generation output until the HV lines feeding the substation reach their limit. The maximum HV generation connection capacity takes into account the single contingency (N – 1) criterion and the generation value is documented for that substation as the HV limit.

With reference to Figure 3.4, this means that the generation capacity is calculated with HV L1 switched off while HV L2 is in service and again with HV L2 switched off whole HV L1 is in service. The lowest value between the two is used as the generation connection capacity for the HV level.

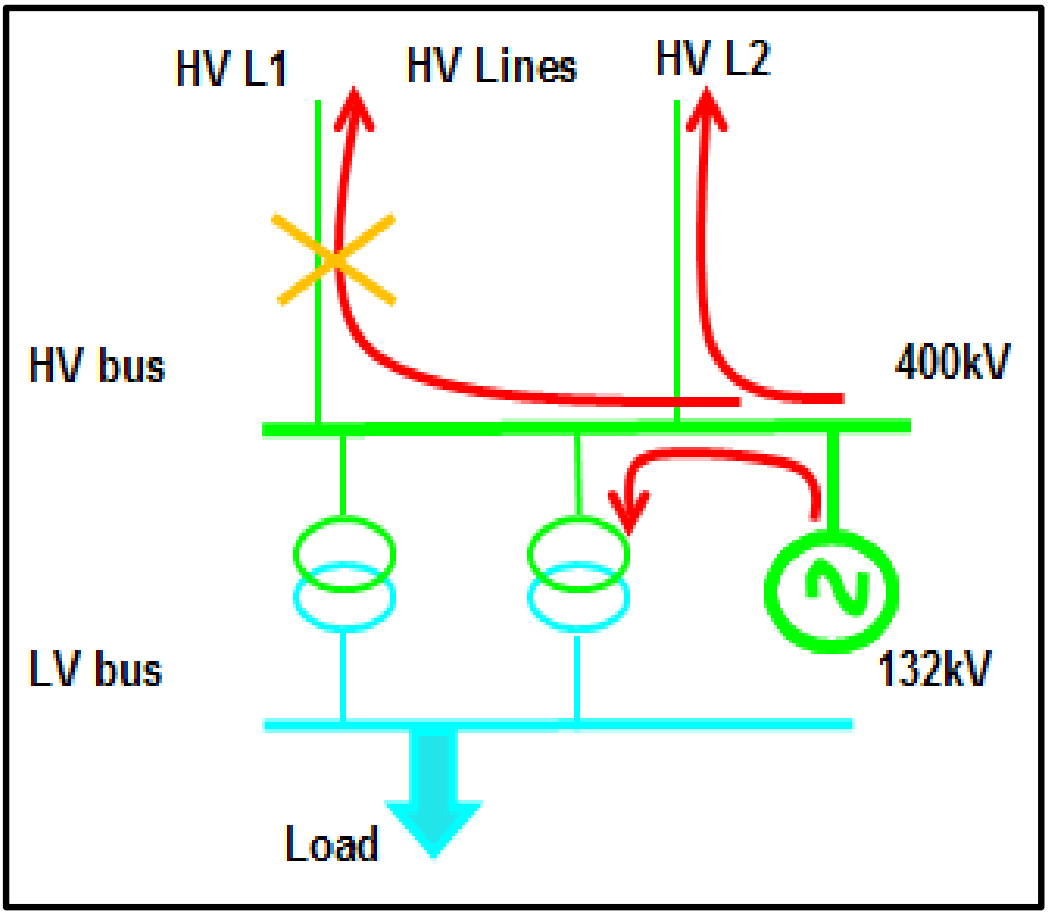

Figure 3.4. Transmission substation showing single contingency (N – 1) HV L1 out of service

The diagram above shows the generator connected on the HV busbar and HV L1 switched off for one of the single contingency. The second one is to switch HV L2 of and getting the results.

Level 3: Area corridor capacity assessment

The area level capacity assessment considers the CLN as units of assessment, the generators are placed at the HV busbar of each substation within the CLN and these are increased while conducting N – 1 assessments, the increase at each busbar is proportional to that bus maximum in Level 2. PV analysis is conducted and the lowest export capacity is chosen among all the contingencies. N – 1 reliability criterion is used to assess the area level capacity as illustrated in Figure 3.4 in section 3 of this document. G1, G2, G3 and G4 are increased until the required planning limits are breached for each contingency in the HV lines.

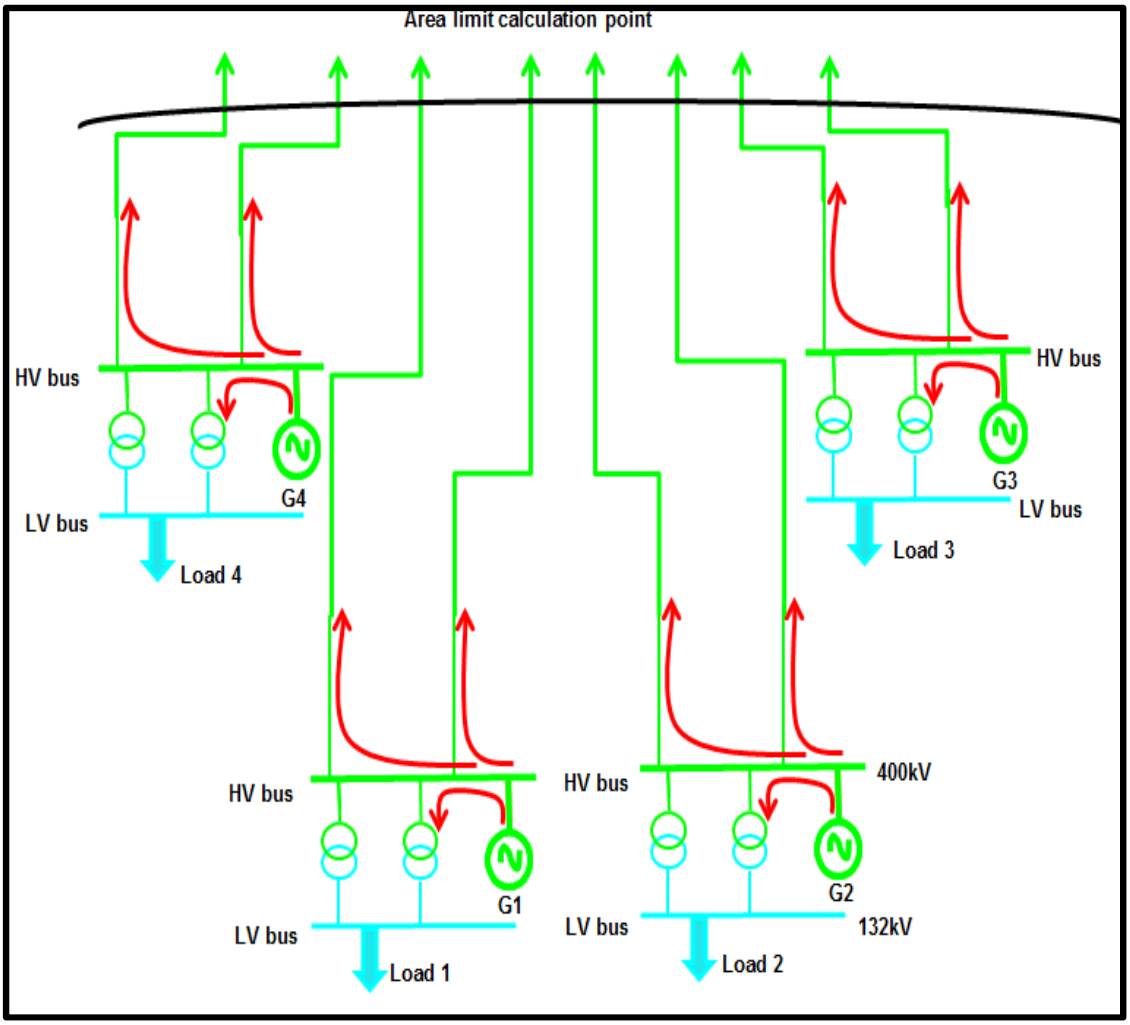

Figure 3.5. Area or Regional network showing the area limit calculation point (area interface)

The results from the study is recorded to show the substation LV generation capacity limit, the substation HV limit and the area / CLN generation limit. This is done to provide the stakeholders with detailed information of what capacity is available at different voltage levels of the substation and in different CLNs and through to the corridors. This would provide sufficient insight to potential investors and customers to make a decision as to which part of the network they would prefer to connect their generators. The regional assessment considers the grid as a unit of analysis and generation in the Northern Cape, Western Cape and Eastern Capes grids is increased until limits are breached under various N – 1 contingencies. This determines the maximum generation in the grids concerned.

3.2.2. INTERPRETATION OF THE CONNECTION CAPACITY VALUE

Based on the connection capacity of a specific transmission substation, a developer should be able to make a high-level assessment of what is likely required to connect its generation project to each point on the Eskom transmission network.

This would be done by first identifying in which transmission substation supply area the generation project would be located and relating it to the approximate distance to that transmission substation or the nearest distribution substation within that supply area. The maps indicating the supply areas and the list of transmission substation names within each supply area are provided in this as well as on the interactive spatial PDF map.

Then, using the proposed total MW output of the generation plant, the connection requirements and timing assessment can be done as follows:

Project MW output less than MTS connection capacity

The generation project should be able to connect to the transmission network without any additional upstream transformation reinforcement required. The customer can connect either via the distribution network or connecting directly to the LV or HV busbar of the transmission substation.

Project MW output same as MTS connection capacity

If the generation project MW output is the same as the transmission substation connection capacity, then the project may be able to be connected without any additional upstream reinforcement requirements.

Project MW output greater than MTS connection capacity

The generation project will not be able to connect without some form of additional upstream transmission reinforcement. The reinforcement is likely to place a time constraint for connecting the generation plant project, depending on the nature and size of the transmission reinforcement work required.

It should be noted that the generation connection values that are provided in this report have taken the load and generation connected at each substation in 2022 into account, refer to Figure 3.1 to Figure 3.5 for the methodology.

4 GENERATION CONNECTION CAPACITY ASSESSMENT RESULTS

4.1. SUPPLY AREA CONNECTION CAPACITY RESULTS

To recap, in the current CLN configuration, the transmission grid is divided into 30 supply areas commonly referred to as CLNs and are used to conduct the load forecast for the country. CLN areas have a certain number of transmission substations within them that supply the area. The supply areas are not bound by provincial boundaries as they are related to the networks from which they are supplied. Figure 4.1 below show these supply areas.

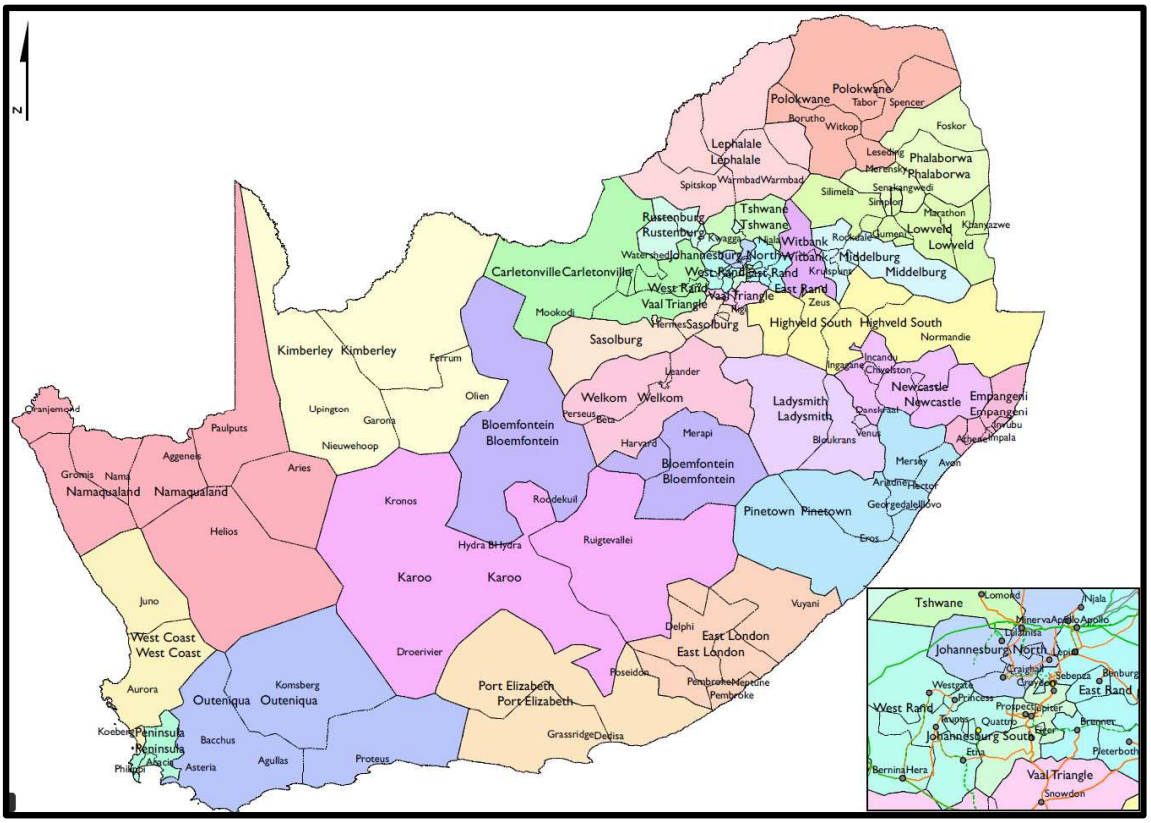

Figure 4.1. Transmission CLNs with new transmission supply areas shaded

Two network operating scenarios were assessed in this report which is the light load condition and the midday load condition. The generation capacity results obtained for both light load and midday load condition are shown in Figure 4.2 and Figure 4.3 below.

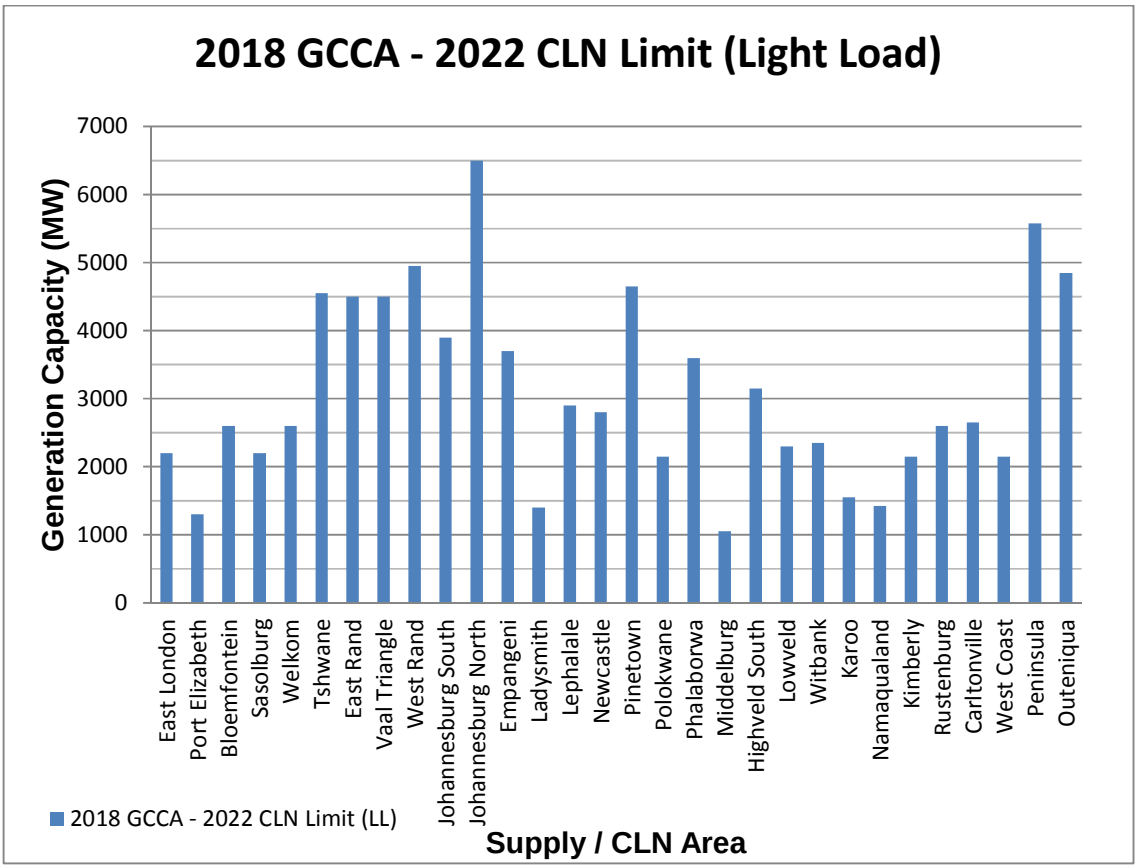

Figure 4.2. 2018 GCCA – 2022 update CLN generation capacity limit results for light load

Figure 4.2 shows the generation connection capacity for the light load scenario of the current GCCA update. At light load the study casefile is adjusted to represent the light load patterns and generation pattern for all generators including the renewables in the country.

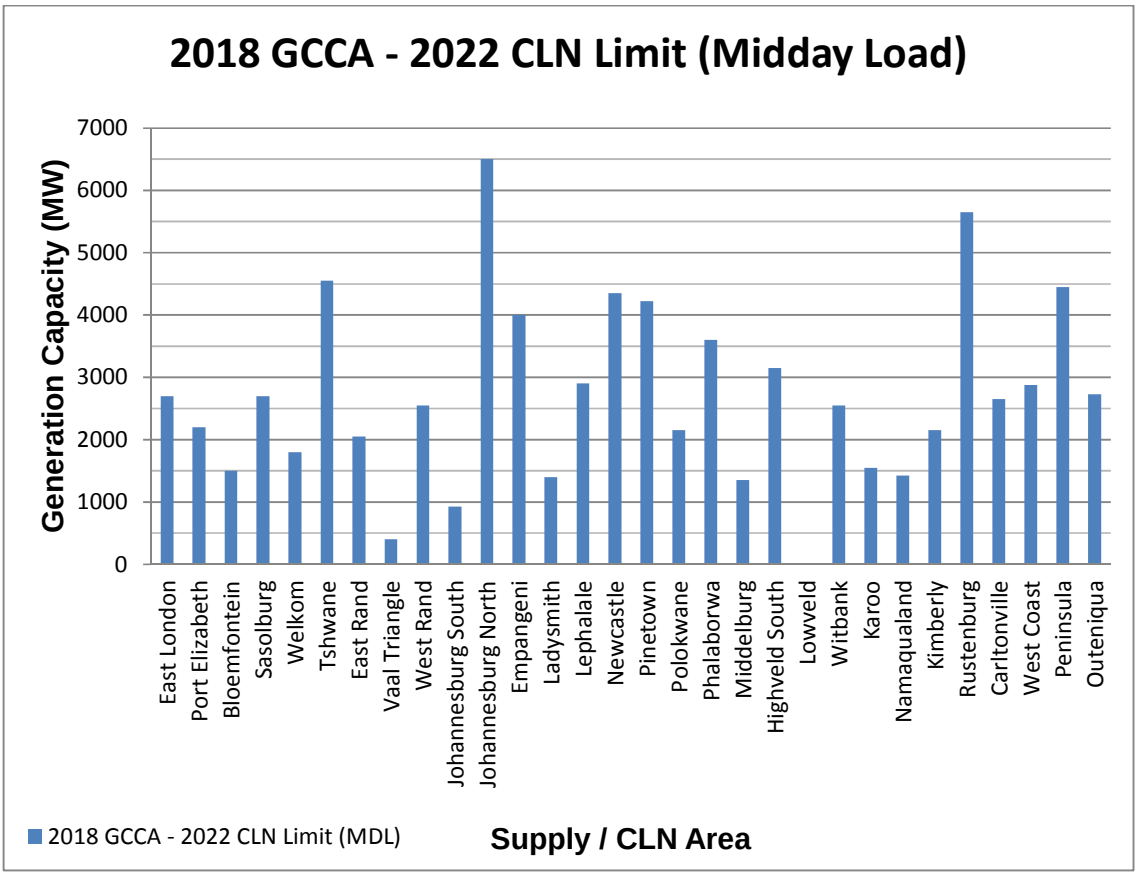

Figure 4.3. 2018 GCCA – 2022 update CLN generation capacity limit results for midday load

Figure 4.3 shows the generation connection capacity for the midday load scenario of the current GCCA update. At midday load the study casefile is adjusted to represent the midday load patterns and generation pattern for all generators including the renewables in the country. For example the midday the photovoltaic (PV) plants are at 100% and wind is around 20% and hence the study is set accordingly.

4.2. HV AND SUBSTATION LEVEL CONNECTION CAPACITY RESULTS

The previous section presented the results for the CLN or area level and is referred to as level 3 in the methodology section. The project also involved the generation capacity assessments of level 1 (Substation LV Level) and level 2 (Substation HV Level) as shown in *Figure 4.4* and *Figure 4.5* respectively.

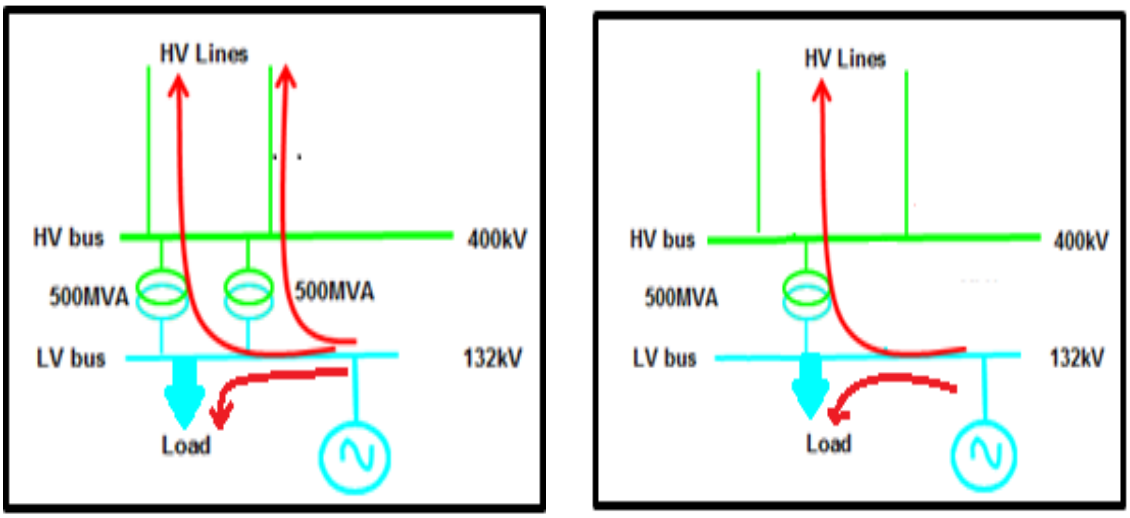

Figure 4.4. Transmission substation showing a simple generator on the LV busbar

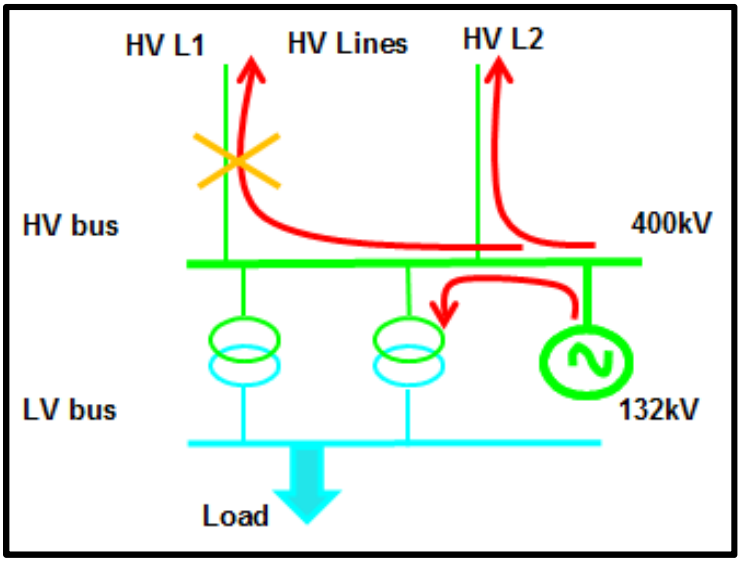

Figure 4.5. Transmission substation showing single contingency (N – 1) HV L1 out of service

The results for level 1 and level 2 are included in Appendix A and Appendix B for the light load and midday load scenarios.

5 CHANGES IN CONNECTION CAPACITY

The methodology used to calculate the generation connection capacity limits at the transmission substations on the LV and HV busbar, the CLN / area is the same as in the previous GCCA – 2022 with the exception of the contingencies which now include the HV lines interfacing the areas. The difference between the GCCA 2022 and the GCCA 2022 UPDATE is the re-zoning of the CLNs as discussed in section 2.3. Another significant difference is that in the previous GCCA the HV level did not assess the capacity limit of the HV lines feeding the substations in cases where the limit was due to other sections of the network and not the substation HV lines, e.g. voltage violation at another substation in the study area. Some CLNs have changed names, for instance, Pretoria is now Tshwane but has the same zones/substations as before. There are, however CLNs that have changed entirely, in these substations have been added or removed, and consequently these CLN's are totally different from the CLNs in the previous GCCA 2022.

The changes in the CLN zones have the effect of changing the interfaces (HV lines) entering a CLN. In cases where additional substations have been added to a CLN which was previously not there, additional lines supplying those added substations contribute to the interface flows increasing the transfer capabilities into or out of that CLN. On the contrary, if a substation has been removed from a CLN and linked to another CLN, those HV lines that were previously part of the old CLN interface now removed in the new CLN, will reduce the available generation connection capacity to that CLN.

In essence, the network configurations used in the previous GCCA and those used in this update are different and hence the results are also different making it difficult to compare them.

Figure 5.1 and Figure 5.2 shows the spatial view of the generation connection capacity assessment results from the previous GCCA and those of the current GCCA update.

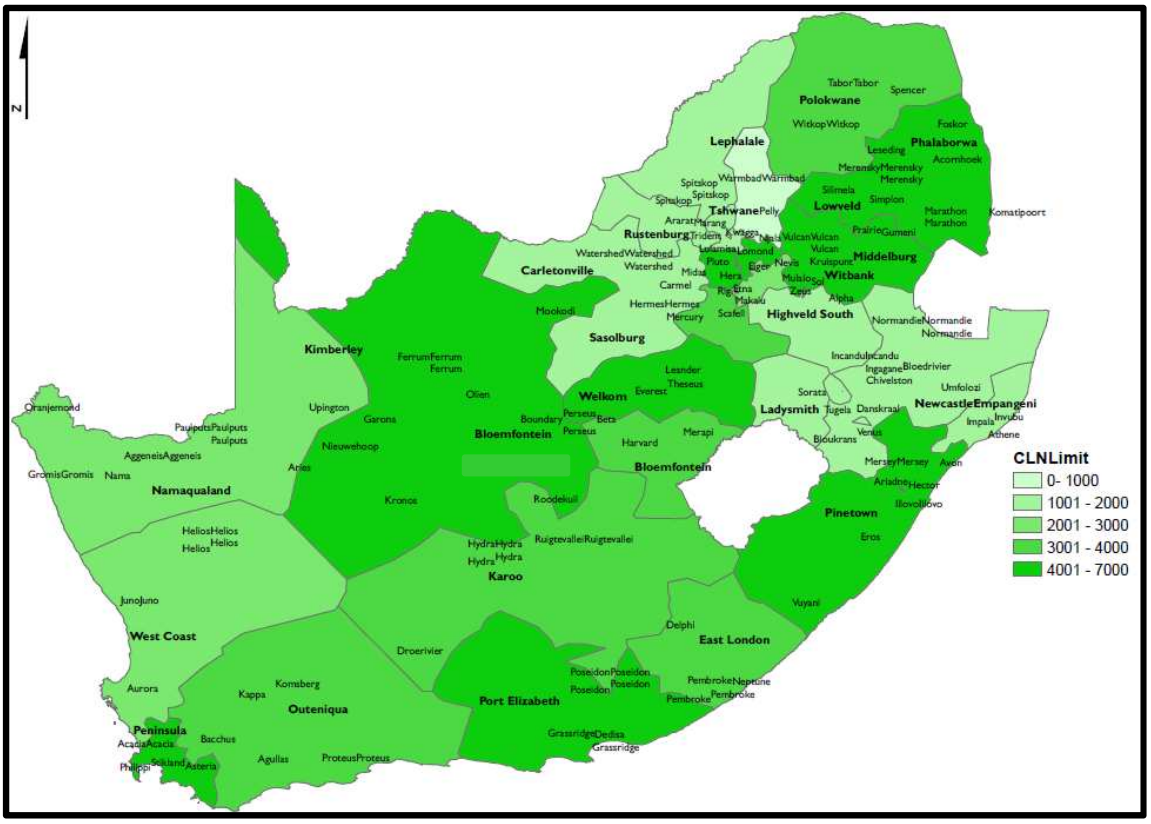

Figure 5.1. Spatial view of the generation connection capacity assessment of the previous GCCA

The generation connection capacity results shown in Figure 5.1 are based on the old CLN areas since those were the official demarcations when the GCCA was prepared in 2015. Those have since changed and in the current GCCA update, the new areas have been adopted and the results in Figure 5.2 are based on the new CLN areas.

There are notable differences between the old CLN demarcations to the new CLNs as can be noted in looking at Figure 5.1 in comparison to Figure 5.2. The details of which substations form which CLN can be found in Table 2.4.1 to Table 2.4.9.

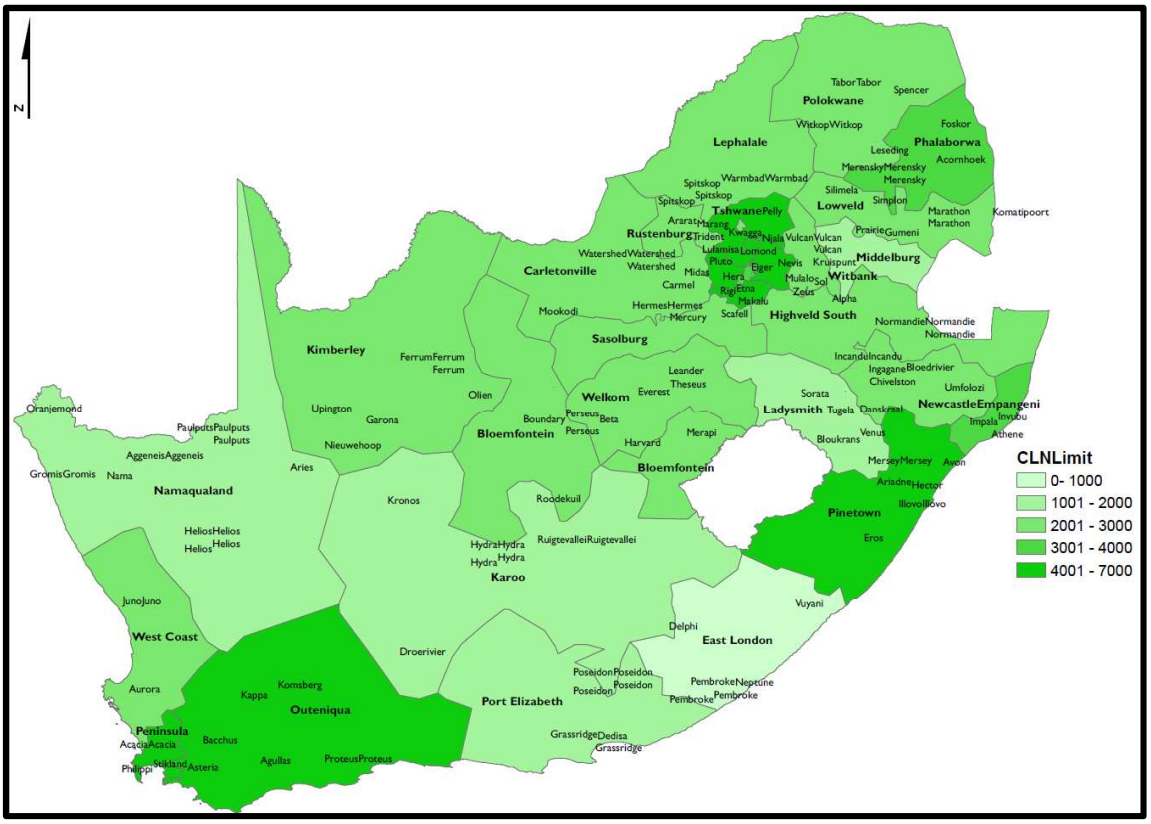

Figure 5.2. Spatial view of the generation connection capacity assessment of the GCCA 2022 update

The maps in Figure 5.1 and Figure 5.2 show the available generation capacity spatially and are represented by the colour green. The intensity of the green indicates the magnitude of available generation connection capacity in that CLN. A higher intensity indicates a high amount of available generation connection capacity while the lighter the green the less the available generation connection capacity. The white area in Figure 5.1 and Figure 5.2 Lesotho and does not form part of this.

It is evident from the two maps above that there has been a change in the available generation connection capacity from the previous GCCA – 2022. Figure 5.2 shows more evenly distributed generation capacity availability with the exception of the Outeniqua, Pinetown and Tshwane. Areas such as the Karoo, Kimberley, Bloemfontein, Welkom and East London have significantly reduced the available generation connection capacity. Areas which have shown increases in their available generation capacity are Tshwane and Lephalale.

Figure 5.3 below shows the differences in the 2015 GCCA and the 2018 update. It shows the low load scenario area level results. The CLNs with the double bars on the graph

indicate the CLNs that have maintained and are plotted together to show differences in their values.

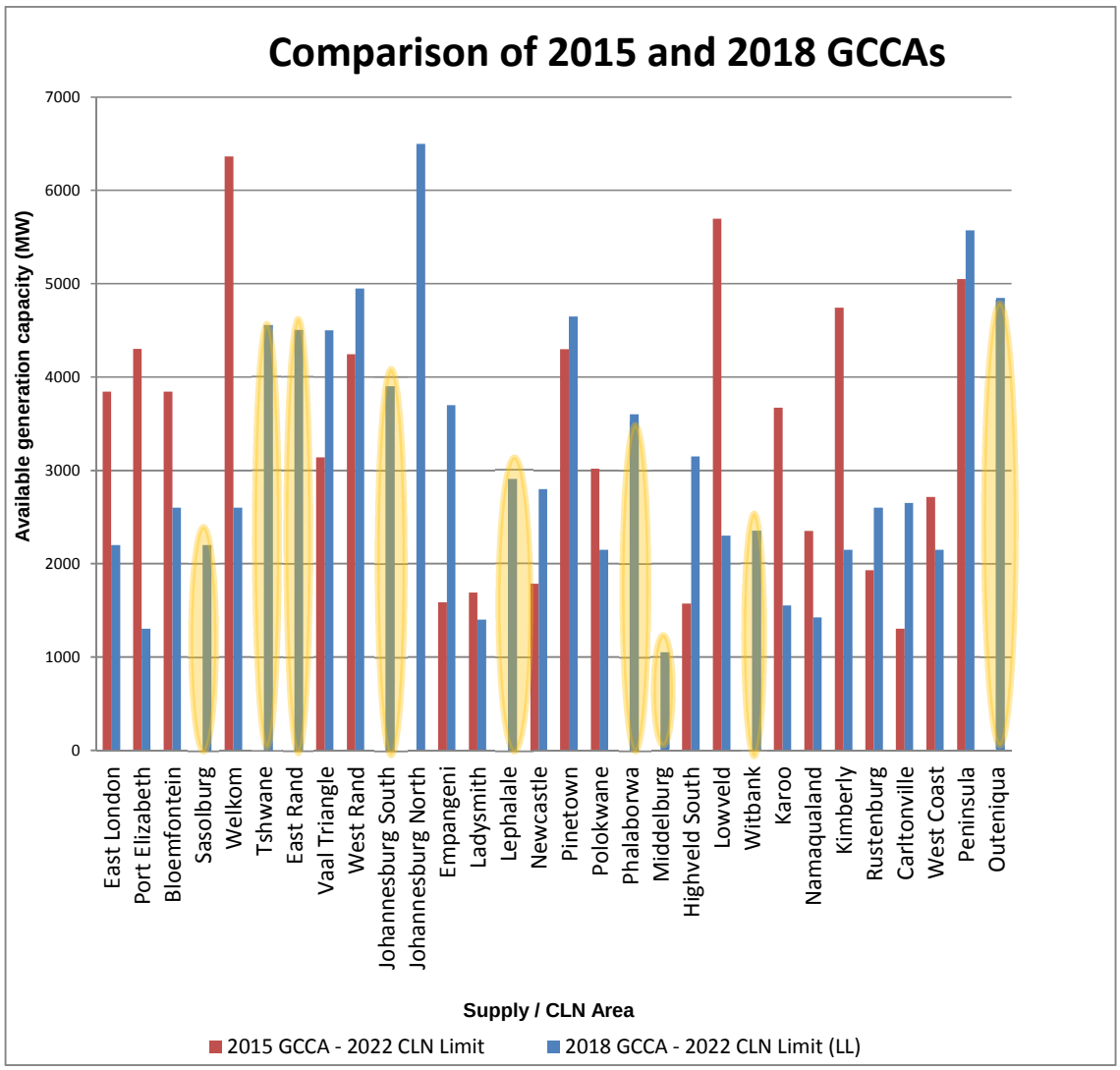

Figure 5.3. Comparison between the 2015 and 2018 Light Load GCCA results

The bars highlighted in orange have no comparable partner from the previous GCCA generation capacity results as CLN names have either changed or new CLNs have been introduced. These are: Sasol, Tshwane, East Rand, Johannesburg South, Johannesburg North, Lephalale, Phalaborwa, Middelburg, Witbank and Outeniqua and have no associated red bar.

In order to attempt to compare the results, the old CLNs that were as closely configured to the new CLNs were matched with those CLNs without counterparts in Figure 5.3 above. The results with all new CLNs matched with the old CLNs are shown in Figure 5.4 and Figure

5.5. Figure 5.4 below shows the generation capacity variances between the 2015 GCCA results and those from the current update for the light load scenario.

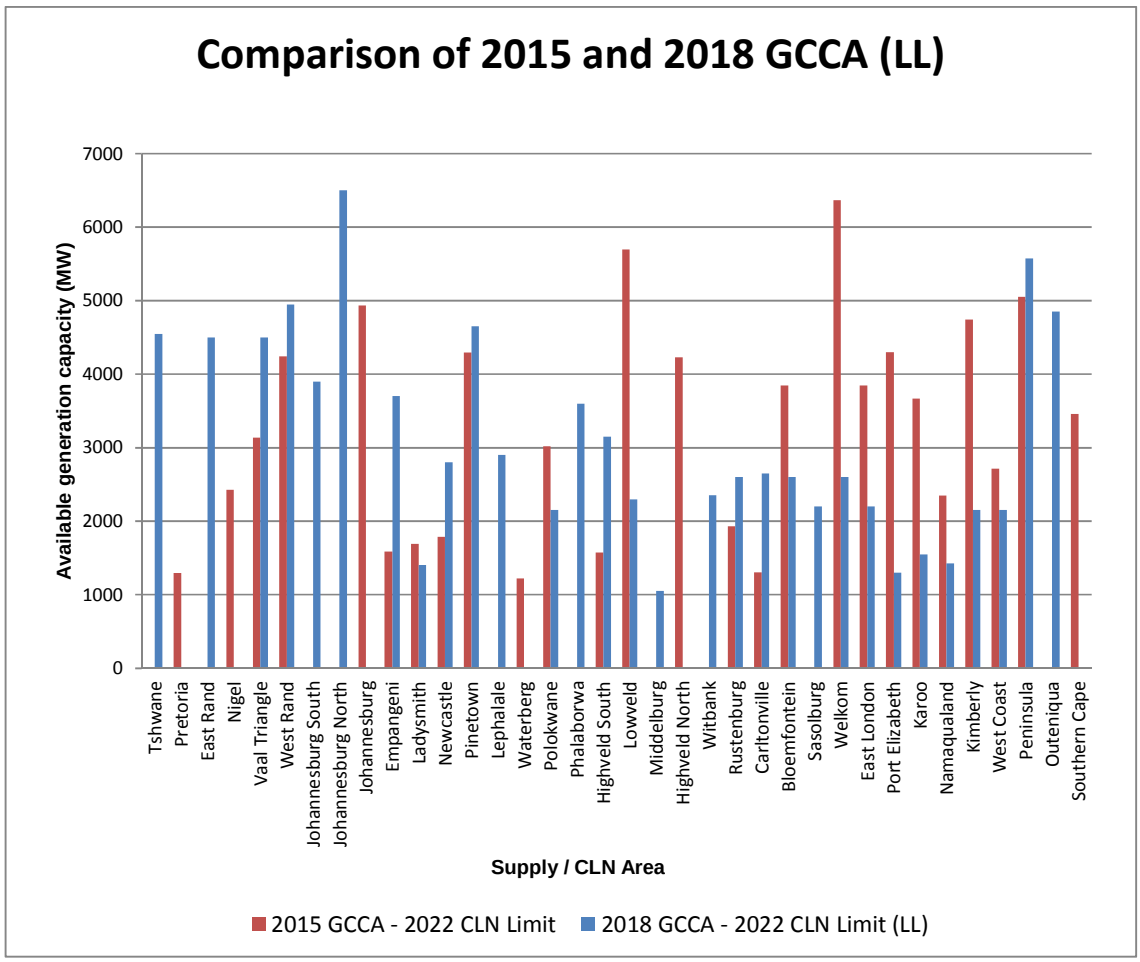

Figure 5.4. CLN light load limit comparison between current GCCA update and the 2015 version

On average the light load graph in Figure 5.4 shows a slight increase in the available generation capacity throughout the country. It can be seen that, Witbank, Namaqualand, Kimberley, Karoo, Phalaborwa, East London, Port Elizabeth and Bloemfontein have a significant reductions in the available generation connection capacity. The light load scenario is the most onerous condition since the network is lightly loaded and the extra generation from the IPPs has to be evacuated through the network to areas with less generation. In instances where the network is heavily loaded the generation is first consumed by the load before flowing upstream through the network giving a higher value of available generation connection capacity than the light load.

Figure 5.5 shows the results for the midday load scenarios represented in the same format as the light load case above.

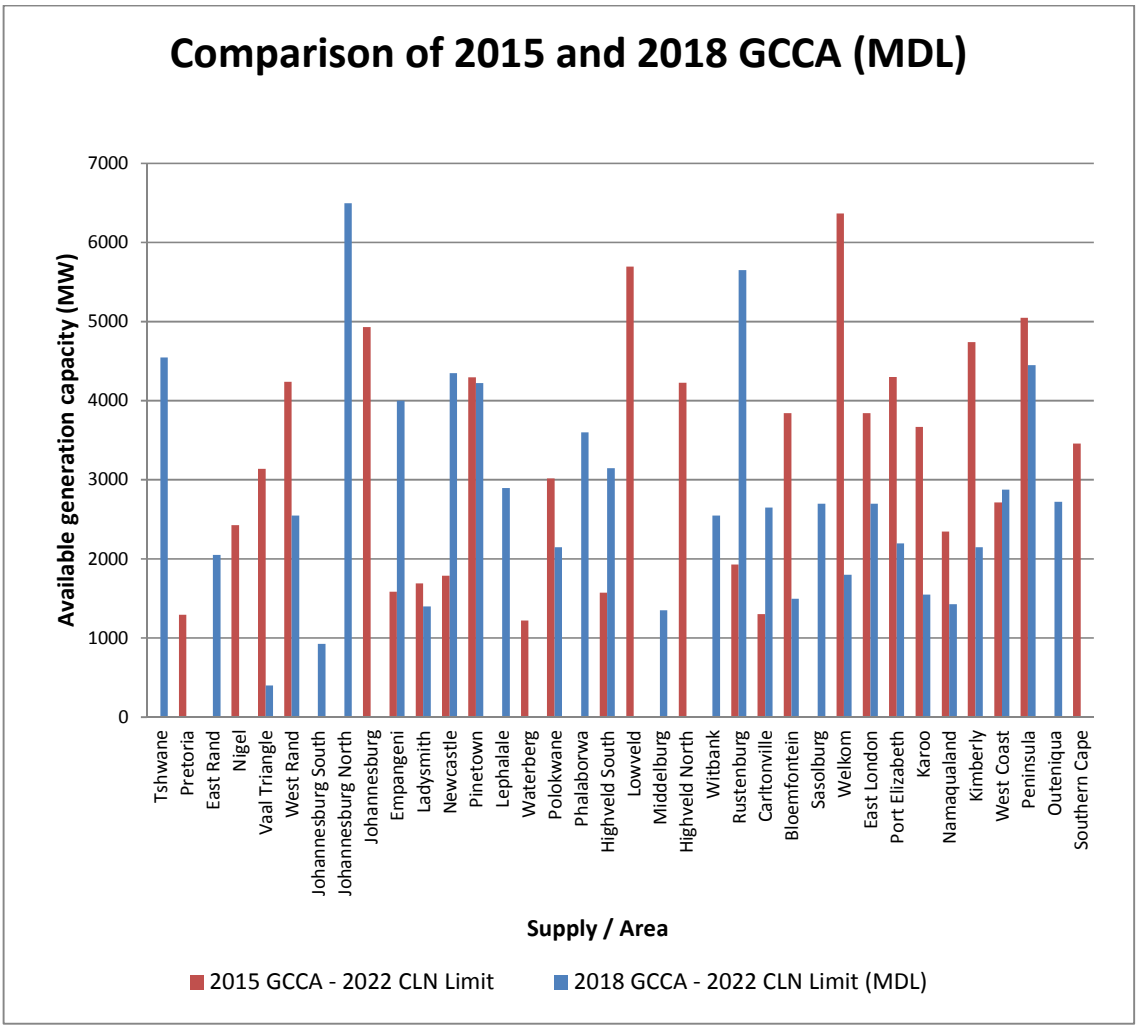

Figure 5.5. CLN midday load limit comparison between current GCCA update and the 2015 version

In the case of the midday load the variance shows differences in the available generation connection capacity with a more distributed share across the country with the exception of a few spikes in the Welkom, Port Elizabeth, Lowveld, Bloemfontein and Kimberley areas. The detailed results used to generate these graphs may be found in Appendix C.

There has been a change in the network configuration between the previous GCCA and the current update, where some CLNs like Kimberley were significantly reduced when the CLNs were re-demarcated. This causes a difference in the CLN capacity values due to the network differences. The differences in the results can also be attributed to the different methodologies used between the previous GCCA and the current update. In the previous GCCA, the generation in the study area was increased and the areas outside of the study areas were monitored for thermal loading and voltage violations. The contingencies that

were considered previously were only those of branches in the study area and excluded the branches interfacing the study area.

The methodology used in the GCCA update was to monitor busbars in the study area (CLN) and the interfacing busbars while increasing generation in the area. It also considered the branches interfacing the study area when conducting contingencies. The main focus was on the study area so as to avoid violations happening further away from the study area limiting the connection capacity inside the study area as this is not a true result.

5.1. POWER BI

The main improvement in the GCCA – 2022 UPDATE is the introduction of the Power BI representation of the results. Power BI offers the capability to represent the connection capacity results data visually with maps showing the exact location of substations, their CLN and all the available generation connection capacity by clicking on that area or substation. It also provides the town names so that IPPs can search for a town in which they wish to develop their plant and this would be shown in the map with the closest substation visible to enable the developer to choose the one closest and has adequate generation capacity for their plant.

Power BI is a web based platform which can be accessed from any smart device, making it easier to access anywhere. It has the capability of providing information such as the shortest distance from where the developer selected as plant location to the closest transmission substation. It provides information about the substation transformation at all voltage levels and exact coordinates of their location making it a useful tool for desktop planning and decision making.

6 UNLOCKING OF ADDITIONAL GRID CONNECTION CAPACITY

This chapter presents the possibilities and options for the creation of additional grid connection capacity beyond what has been calculated for this report. The objective of including this information is to indicate to IPP developers what possibilities exist outside of the TDP list of projects.

The Transmission substation tables regarding installed transformer capacity and generation connection capacity contained in Appendix A are all based on only the transmission projects proposed in the TDP for the period 2018 to 2027. Eskom and the DoE discussed the possibility of the creation of additional grid access for new RE and other IPP plants for future IPP procurement programs. Other initiatives between Eskom and the DEA have also been undertaken to develop a more flexible and faster process of acquiring the necessary authorizations for transmission infrastructure projects to enable the more rapid creation of new grid access capacity.

6.1. ADDITIONAL TRANSMISSION INFRASTRUCTURE PROJECTS

Eskom Grid Planning has identified a number of potential transmission projects, which could unlock additional connection capacity by 2022, that are not included in the TDP, as their requirement has not yet been confirmed or agreed to. These projects include works at existing Transmission substations as well as the establishment of new Transmission substations with new transmission lines.

These potential projects can be grouped into four phases based on how long they would take to be completed, assuming that funding were made available, allowing time for the necessary approvals and scope of work involved.

The phases are as follows;

Table 6.1. Potential transmission projects

Phase	Duration (years)	Description
1	2	Limited work at existing Transmission substations
2	3 – 4	Limited work at existing Transmission substation with limited transmission line work
3	4 – 5	Existing or new Transmission substation project that requires more transmission line work with full EIA study
4	6 – 8	Existing or new Transmission substation project that requires backbone transmission line work with longer lead times

The list of these potential transmission projects is provided in a table in Appendix F. The table groups the projects into their respective phases in Transmission substation alphabetical order and provides the following information:

- How much new connection capacity could be added in MW
- A brief description of the network strengthening scope of work
- The province
- Expected duration of project development to completion if funded

The location of these potential transmission projects is shown on the map in Figure 6.1 with the different phases highlighted in different colours. The circle symbols indicate projects at existing Transmission substations, while the square symbols indicate projects at new Transmission substation sites, planned or proposed. This information is also included on the accompanying interactive spatial PDF map.

6.2. SEA STUDY OF TRANSMISSION POWER CORRIDORS

To understand the future transmission grid needs, Eskom Grid Planning completed a long-term strategic study, entitled the “2040 Transmission Network Study, which can be accessed by pressing control and clicking on SAE Study under references”. This study identified five major transmission power corridors that would need to be developed, regardless of which future generation scenario unfolded. Securing these power corridors for transmission development would provide a flexible and robust network that could respond to meet the needs of future IRP and IPP requirements.

One of the challenges to providing new grid access in time is the uncertainty in obtaining all the necessary authorizations before construction of transmission projects can start. New IPP generation plant can be completed long before new transmission infrastructure can be put in place based on the current planning and approval processes. There is a large discontinuity between when IPP and transmission projects can be started and completed, posing severe risk to future IPP procurement programs.

Discussions were held with the DEA regarding this issue, and it was agreed that a new and much simpler approval process to obtain the required environmental authorization (EA) from the DEA for transmission and distribution lines and substations had to be created. The DEA undertook to use the five transmission power corridors as a basis for a strategic environmental assessment (SEA) study of these corridors as part of the Strategic Integrated Projects (SIP) program introduced by the 2012 National Infrastructure Development Plan, namely SIP 10. The objective of this SIP is to enable the transmission and distribution infrastructure to serve the needs of the country.

In parallel, as part of SIP 10, the DEA, with its appointed consultant, the CSIR, is developing a new authorization process that will include all the necessary environmental studies and license approvals required to obtain a final EA being put in place for projects within these corridors. The EIA study results and EAs granted for specific transmission lines are proposed to be valid for extended periods to allow for strategic acquisition of servitudes long before actually required. This, in turn, will enable the preparation and design work for transmission projects, especially lines, to commence early and be in place for final approval for release when required by the REIPPP and other IPP programs, providing grid access within the same time frames as the IPP projects.

The power corridors for the SEA studies will be 100 km wide for most of their length to allow for flexibility of final transmission line route options. The corridor routes have taken into

account the SIP 10 (“green energy in support of the South African economy) project to identify suitable corridors and zones that would be “high-potential areas for wind and solar PV energy”. The eight “RE focus zones” that have been identified are either crossed by, or close to, the five power corridor routes.

The public participation process has already finalized the power corridor boundaries, and the required environmental studies are under way. It is anticipated that all the necessary work will be completed to present the final proposal of corridor routes and the new EA process to government by the end of 2015.

The five transmission power corridor routes are indicated on the map in Figure 6.1 as well as on the accompanying interactive spatial PDF map. The five corridor routes are colour-coded and labelled. The “international corridor” is primarily for unlocking grid access to IPPs and the supply of new load demand in this area, despite the name, and the potential for future interconnections via Zimbabwe.

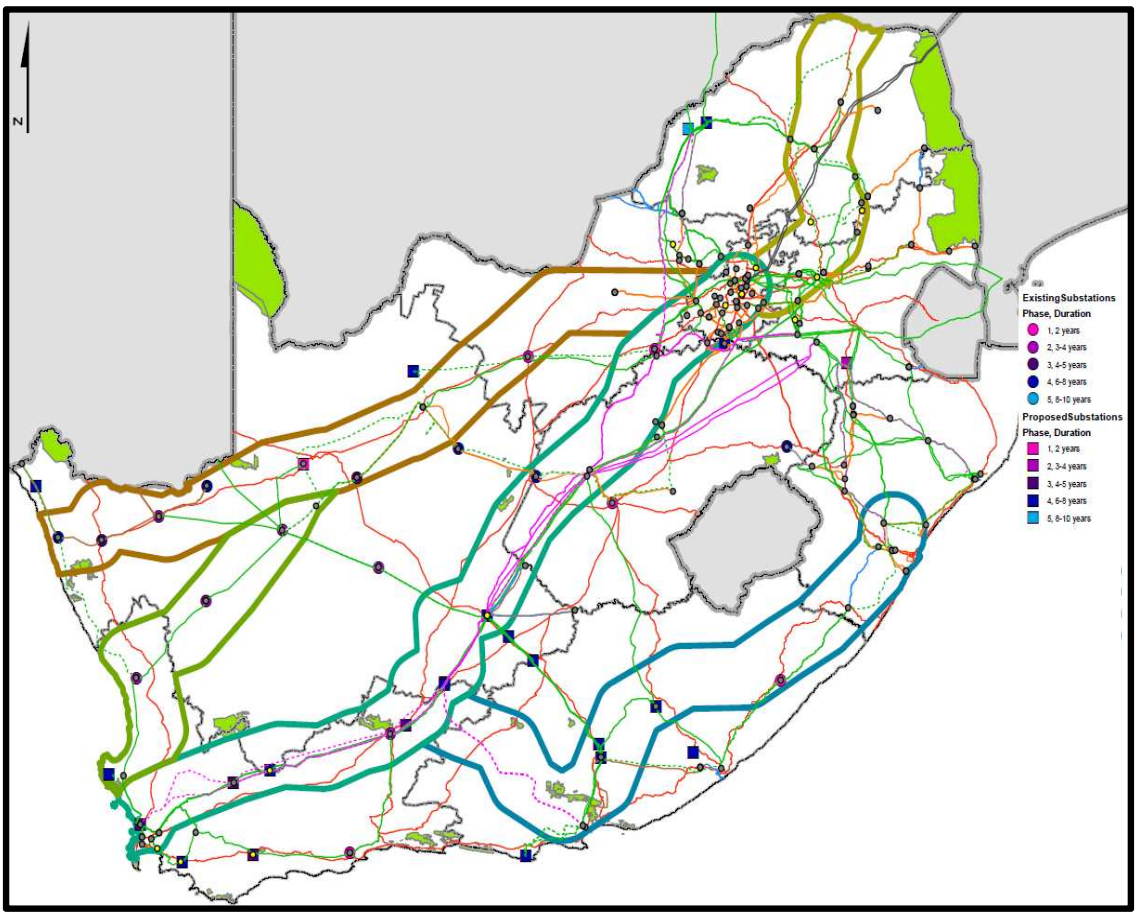

Figure 6.1. The potential Transmission substation projects and the five transmission power corridors

7 THE INTERACTIVE SPATIAL PDF MAP

An interactive spatial map in PDF format was created to accompany this GCCA – 2022 document, which was the biggest improvement introduced in the previous GCCA, which can be accessed by pressing control and clicking on Interactive Spatial PDF Map under references. This map has been kept in the current GCCA update and updated with the latest information. This interactive PDF map contains a number of different levels of information, which can be toggled on and off on the map, to be displayed spatially. These levels include the existing transmission network, the planned transmission projects, the location of the successful IPP bidders for all the REIPPP rounds, the Transmission substation supply areas, and the transmission supply areas, among others.

The list of available levels of information is shown in Figure 7.1. On the left side of the PDF map, the “two squares” button must be clicked to open up the available levels. In order to activate or disable a level on the map, the cursor must be placed on the “eye” button and clicked. When opened, the PDF map has all the levels activated. The PDF map contains an insert map of the greater Gauteng area to provide better clarity in the congested network diagram.

Table 7.1. Map representation of transmission network information

On the map, the Transmission network information is indicated as follows:	
Existing Transmission substation	Black circle
Existing Transmission substation with upgrade	Black circle with red outline
New Transmission substation	Yellow circle with red outline
Transmission line voltages	765 kV Purple, 400 kV green, 275 kV Orange and 220 kV Red Rather use the official voltage colours.
Existing transmission lines	Solid lines
New transmission lines	Dashed lines
Phasing of potential Transmission upgrade projects	Phase 1 pink, Phase 2 maroon, Phase 3 dark purple, Phase 4 dark blue, Phase 5 light blue Any other colours acceptable, different from official acceptable voltage colours
Potential upgrade at existing Transmission substation	Circle in colour of phase
Potential upgrade at new Transmission substation	Square in colour of phase
Transmission power corridors	Colour-coded by name

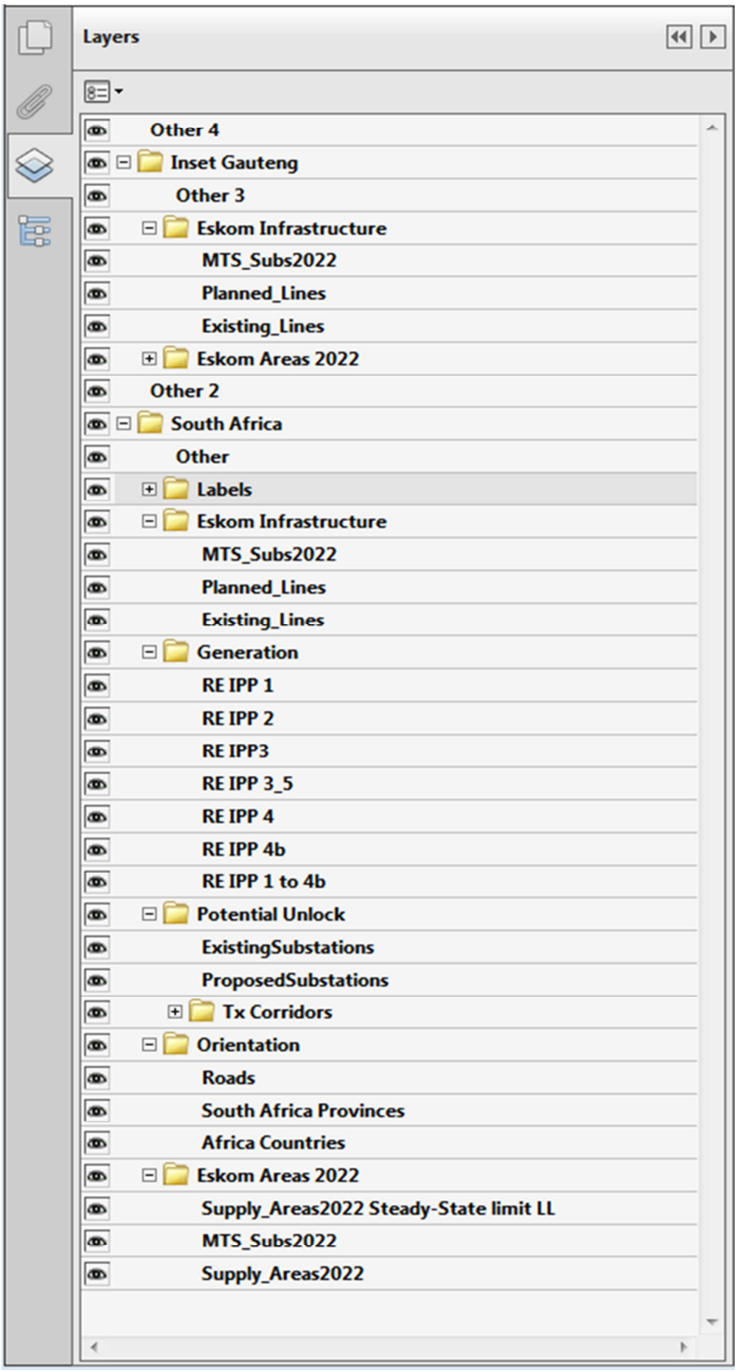

Figure 7.1. The available levels of spatial information on the PDF map

Included in the PDF map document are the GCCA-2022 connection capacity values and other relevant information in tabular form, which can be accessed under the model tree function. This is activated by clicking on the button that looks like the letter “E”.

The level of the information available is shown in Figure 7.2. The required level must be selected, and a drop-down list of names in alphabetical order will appear. Clicking on a

name, for example, Transmission substation or transmission line, will display the available information in tabular form in the window below the list. In the case of a Transmission substation, a red circle will highlight the selected substation on the map.

This interactive PDF map can be interrogated spatially as desired by potential developers and investors to address their own particular issues regarding their specific IPP projects under consideration.

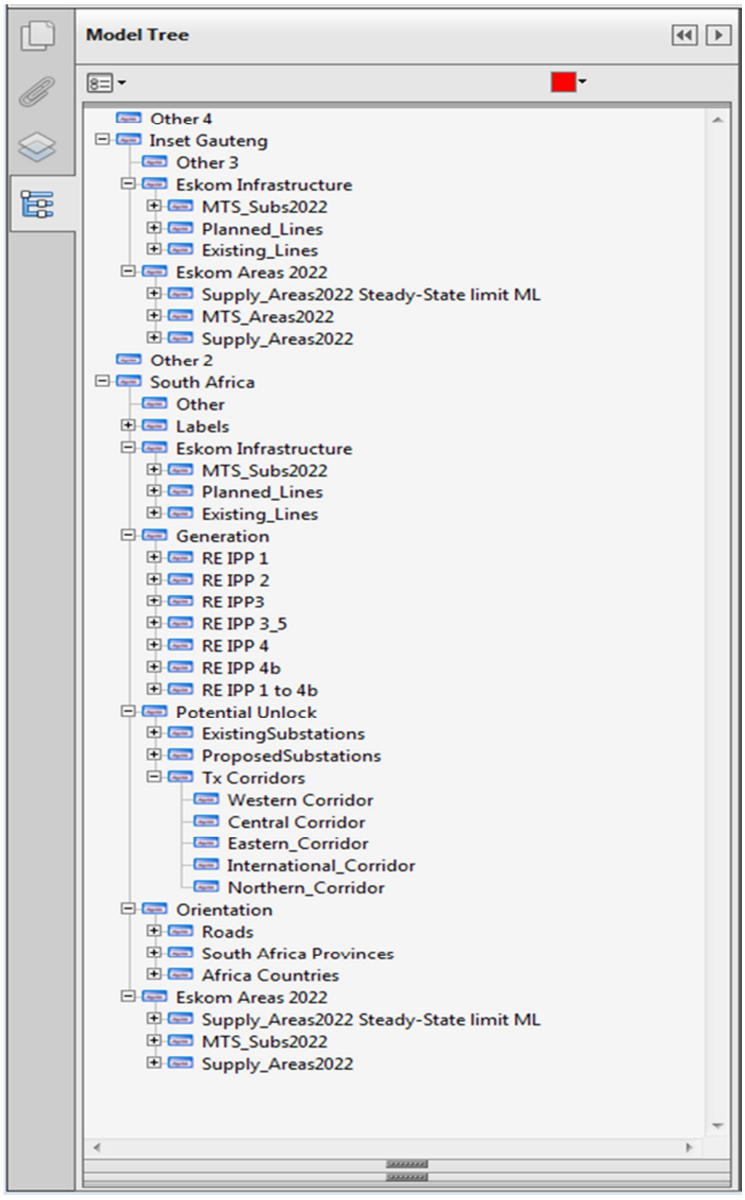

Figure 7.2. The available levels of tabular information in the PDF map document

8 IMPROVEMENTS FOR THE NEXT GCCA

In this GCCA the available generation connection capacity was assessed up to the CLN level. In the next update the regional level will be assessed and this will be level 4 as explained below.

Level 4: Regional corridor assessment

The regional level capacity assessment considers the different transmission network as units of analysis, in this first iteration of regional capacity assessment, the Northern, Eastern and Western Cape grids were considered. Single contingency (N – 1) criterion was used for determining transmission limits, generation in the busbars of these grids were increased until thermal or voltage limits were breached.

Figure 8.1 below shows the Northern Cape grid and its associated CLNs.

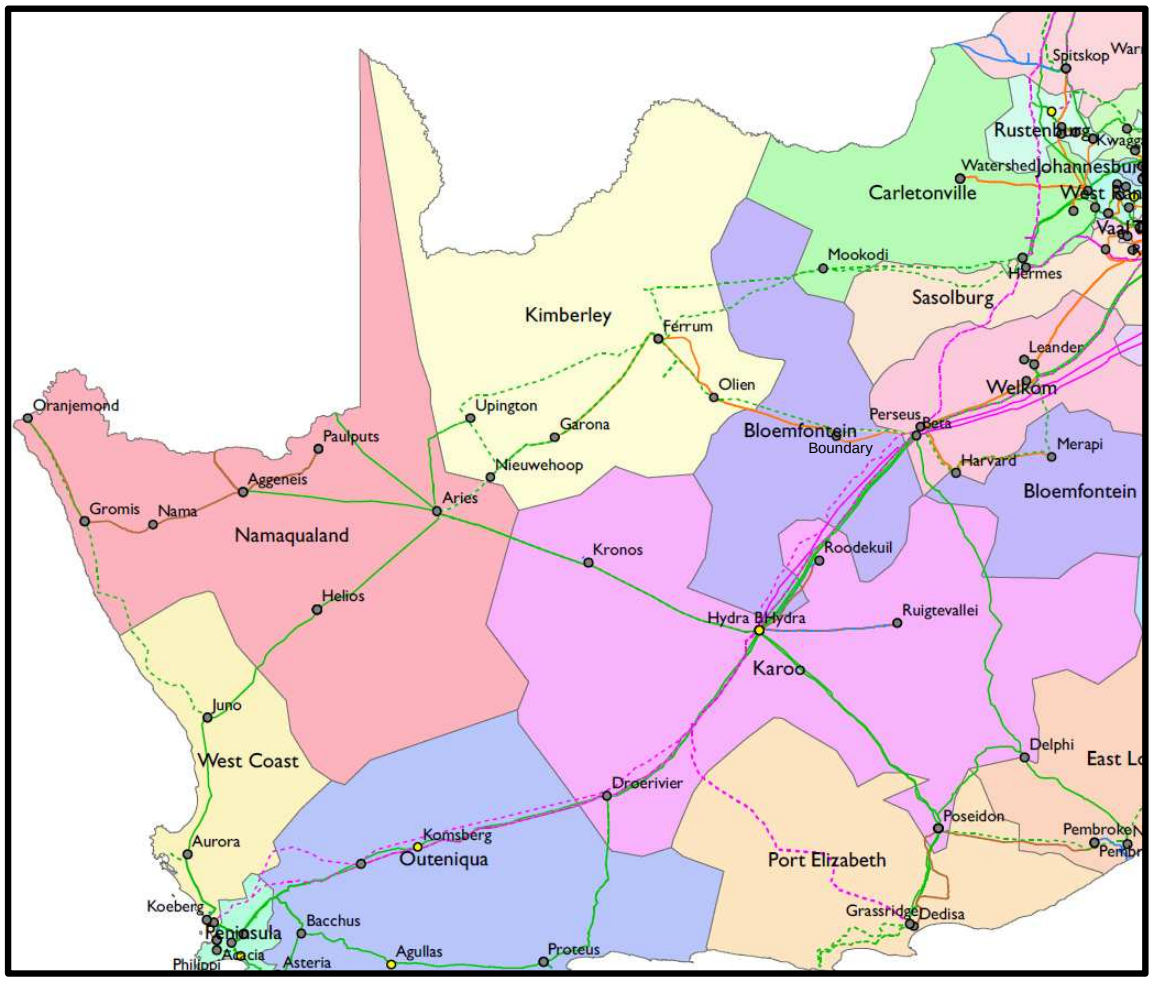

Figure 8.1. Northern Grid showing transmission lines supplying the area

The Northern Cape grid comprises of the Namaqua, Kimberley, Bloemfontein and the Karoo CLNs and the main lines supplying this grid are;

- 2 x 275 kV lines from Boundary to Olien substation
- 2 x 275 kV lines from Perseus to Boundary substation
- 1 x 400 kV line from Juno to Helios substation
- 1 x 400 kV line from Juno to Gromis substation
- 2 x 400 kV lines from Poseidon to Hydra substation
- 1 x 400 kV line from Delphi to Beta substation
- 3 x 400 kV lines from hydra to Droerivier substation (or even Victoria Series Cap station). Droêrivier belongs to WCOU / Western Cape Province.

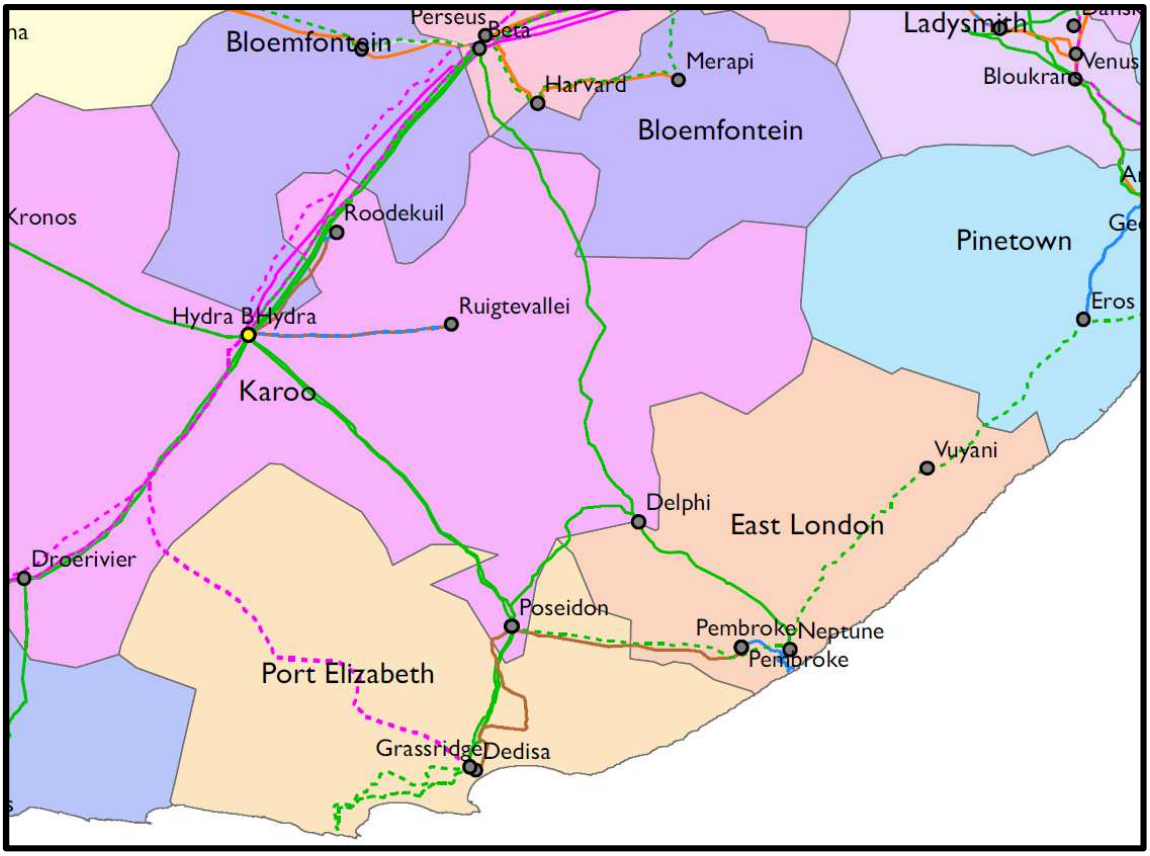

Figure 8.2. Eastern Grid showing transmission lines supplying the area

The eastern grid comprises of the Port Elizabeth, and the East London CLNs and the main lines supplying this grid are;

- 2 x 400 kV lines from Hydra to Poseidon substation
- 1 x 400 kV line from Beta to Delphi substation
- 1 x 400 kV line from Eros to Vuyani substation

Figure 8.3 below shows the Western Cape grid and its associated CLNs.

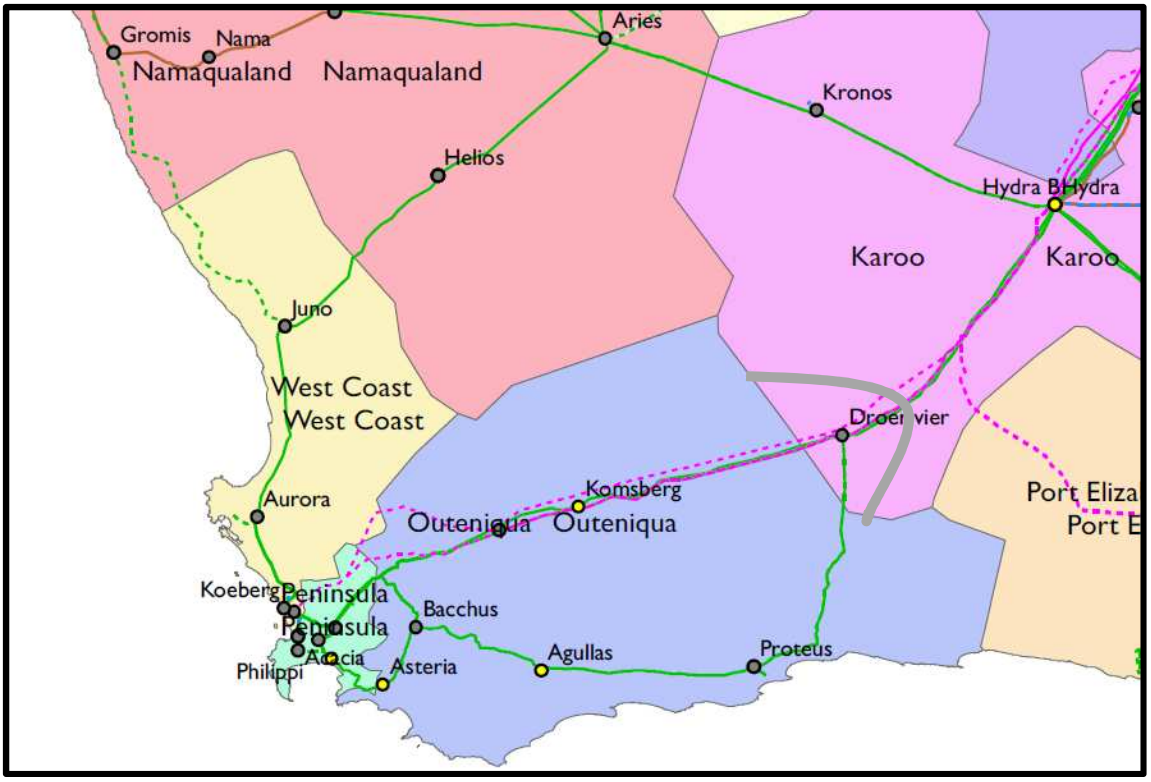

Figure 8.3. Western Grid showing transmission lines supplying the area

The western grid comprises of the West Coast and the Outeniqua CLNs and the main lines supplying this grid are;

- 1 x 400 kV line from Helios to Juno substation
- 1 x 400 kV line from Gromis to Juno substation
- 3 x 400 kV lines from Droerivier to Victoria or Hydra substation

REFERENCES

1. Transmission Development Plan
2. South African Grid Code
3. SAE Study
4. Interactive Spatial PDF Map

APPENDIX A: GENERATION CAPACITY ASSESSMENT RESULTS PER CLN FOR LIGHT LOAD

The Transmission substation tables in Appendix A provide the following information:

Supply Area	The name of the supply area
Province	The name of the province in which the MTS substation is located e.g. Droêrivier is located in Western Cape.
Substation	The name of the MTS substation
Transformer Voltages	The transformer voltage levels in the MTS substation
2015 No. of Trfrs	The number of transformers of a specific voltage level and size in the MTS substation at the end of the year 2015
2015 Trfr Size (MVA)	The MVA unit size of transformers of a specific voltage level in the MTS substation at the end of the year 2015
2015 Installed Transformer MVA	The total installed transformer MVA of a specific voltage level and size in the MTS substation at the end of the year 2015
Year of Trfr Upgrade	Year when new transformers are expected to be installed in the MTS substation
Upgrade Status	The project status of the upgrade, either approved with funding or proposed as in the TDP for 2015 to 2024
2017 No. of Trfrs	The number of transformers of a specific voltage level and size in the MTS substation at the end of the year 2017
2017 Trfr Size (MVA)	The MVA unit size of transformers of a specific voltage level in the MTS substation at the end of the year 2017
2017 Installed Transformer MVA	The total installed transformer MVA of a specific voltage level and size in the MTS substation at the end of the year 2017
Year of Trfr Upgrade	Year when new transformers are expected to be installed in the MTS substation
Upgrade Status	The project status of the upgrade, either approved with funding or proposed as in the TDP for 2018 to 2027
2022 No. of Trfrs	The number of transformers of a specific voltage level and size in the MTS substation at the end of the year 2022

2022 Trfr Size (MVA)	The MVA unit size of transformers of a specific voltage level in the MTS substation at the end of the year 2022
2022 Installed Transformer MVA	The total installed transformer MVA of a specific voltage level and size in the MTS substation at the end of the year 2022
2022 LV Busbar Connection Capacity (MW)	The available generation connection capacity at the LV busbar (132 kV or 88 kV or 66 kV) at the MTS at the end of the year 2022
2022 HV Busbar Connection Capacity (MW)	The generation connection capacity limit at the HV busbar (220 kV or 400 kV) at the MTS at the end of the year 2022
2022 Supply Area HV Busbar Steady-state Limit (MW)	The overall generation connection capacity limit of all the MTS substations within the supply area at the end of the year 2022

A1. EAST LONDON

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
East London	Pembroke	132/66	2	90	180	-	-	2	90	180	13	0	-	-	1	160	160	0	0	170	2550	2550	
East London	Delphi	400/132	2	120	240	2020	Proposed	2	120	240	32	97	2020	Proposed	3	120	360	0	97	288	1950	1950	
East London	Neptune	400/132	2	500	1000	-	-	2	500	1000	24	0	-	-	2	500	1000	0	0	980	1600	1600	
East London	Pembroke	220/66	0	0	0	2022	Proposed	0	0	0	0	0	2022	Approved	0	9	0	0	0	0	0	0	550
East London	Pembroke	220/132	2	250	500	-	-	2	250	500	0	53	2022	Proposed	0	0	0	0	53	0	0	0	
East London	Pembroke	400/132	0	0	0	2022	Proposed	0	0	0	13	0	2022	Approved	1	500	500	0	0	503	200	200	
East London	Vuyani	400/132	2	250	500	-	-	2	250	500	61	0	-	-	2	250	500	0	0	551	1500	1500	

A2. PORT ELIZABETH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Port Elizabeth	Dedisa	400/132	3	500	1500	2022	Proposed	2	500	1000	85	0	2022	Proposed	3	500	1500	0	0	980	1300	2015	
Port Elizabeth	Grassridge	220/132	2	360	720	-	-	2	360	720	0	26	-	-	2	360	720	0	26	679	1300	2650	
Port Elizabeth	Grassridge	400/132	4	500	2000	-	-	4	500	2000	167	616	-	-	4	500	2000	0	616	980	750	15	
Port Elizabeth	Poseidon	220/66	1 1	40 80	120	-	-	1 1	40 80	120	0	0	-	-	1 1	40 80	120	0	0	118	1000	1000	1300
Port Elizabeth	Poseidon	220/132	2	125	250	-	-	2	125	250	0	158	-	-	2	125	250	0	158	87	1000	1000	
Port Elizabeth	Poseidon	400/132	0	0	0	2016	-	0	0	0	24	481	-	-	1	500	500	0	481	33	1300	1300	
Port Elizabeth	Poseidon	400/220	2	500	1000	-	-	2	500	1000	0	0	-	-	2	500	1000	0	0	980	1000	1000	

A3. BLOEMFONTEIN

Supply Area	Substation	Transformer Voltages	No. of Trfrs 2015	Trfr Size (MVA) 2015	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs 2017	Trfr Size (MVA2017)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs 2022	Trfr Size (MVA)2022	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Bloemfontein	Boundary	275/132	2	250	500	-	-	2	250	500	83	0	-	-	2	250	500	228	0	573	1150	1150	
Bloemfontein	Harvard	275/132	2	500	1000	-	-	2	500	1000	88	0	-	-	2	500	1000	64	0	980	1050	1050	2600
Bloemfontein	Merapi	275/132	1	250	250	2016	-	2	250	500	42	0	-	-	2	250	500	0	0	532	800	800	

A4. SASOLBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Sasolburg	Mercury	400/132	2	500	1000	-	-	2	500	1000	40	0	-	-	2	500	1000	68	0	980	2250	2250	
Sasolburg	Makalu	275/88	4	160	640	-	-	4	160	640	117	0	-	-	4	160	640	0	0	744	2550	2550	2200
Sasolburg	Scafell	275/132	2	135	270	-	-	2	135	270	19	0	-	-	2	135	270	0	0	284	900	900	

A5. WELKOM

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Welkom	Everest	275/132	2	500	1000	-	-	2	500	1000	20	0	-	-	2	500	1000	0	0	980	1400	1400	2600
Welkom	Leander	400/132	2	500	1000	-	-	2	500	1000	134	0	-	-	2	500	1000	0	0	980	1650	1650	
Welkom	Sorata	275/132	0	0	0	2021	Proposed	0	0	0	28	0	2020	Proposed	1	250	250	0	0	273	0	0	
Welkom	Theseus	400/132	2	500	1000	-	-	2	500	1000	172	0	-	-	2	500	1000	0	0	980	1675	1675	

A6. TSHWANE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Tshwane	Lomond	275/88	2	315	630	-	-	2	315	630	75	0	-	-	2	315	630	0	0	692	900	1470	
Tshwane	Pelly	275/132	2	250	500	-	-	2	250	500	58	0	-	-	2	250	500	0	0	548	1050	1050	
Tshwane	Thuso (Verwoedburg)	400/132	2	250	500	2021	Proposed	2	250	500	51	0	2025	Proposed	2	250	500	0	0	541	750	750	4550
Tshwane	Wildebees	400/132	-	-	-	2021	Proposed	-	-	-	33	0	2021		2	315	630	0	0	650	1450	1450	
Tshwane	Njala	275/132	-	-	-	-	-	4	250	1000	129	0	-	-	4	250	1000	0	0	980	1550	1550	

A7. EAST RAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
East Rand	Benburg	275/132	3	250	750	-	-	3	250	750	96	0	-	-	3	250	750	0	0	831	950	950	
East Rand	Brenner	275/88	3	315	945	-	-	3	315	945	126	0	-	-	3	315	945	0	0	980	3050	3050	
East Rand	Esselen	132/88	1	160	160	-	-	1	160	160	0	0	-	-	1	160	160	0	0	157	157	157	
East Rand	Esselen	275/132	1 2	250 180	500 360	-	-	1 2	250 180	500 360	69	0	-	-	1 2	250 180	610	0	0	667	3100	3100	4500
East Rand	Esselen	275/88	2	315	630	-	-	2	315	630	0	0	-	-	2	315	630	0	0	617	3100	3100	
East Rand	Nevis	275/132	2	500	1000	-	-	2	500	1000	132	0	-	-	2	500	1000	0	0	980	3100	3100	
East Rand	Pieterboth	275/132	2	315	630	-	-	2	315	630	85	0	-	-	2	315	630	0	0	702	1650	1650	

A8. VAAL TRIANGLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Vaal Triangle	Glockner	275/88	2	315	630	-	-	2	315	630	56	0	2017		3	315	945	0	0	980	750	750	
Vaal Triangle	Kookfontein	275/132	2	250	500	-	-	2	250	500	35	0	-	-	2	250	500	0	0	525	850	2200	
Vaal Triangle	Olympus	275/88	3	315	945	-	-	3	315	945	134	0	-	-	3	315	945	0	0	980	1750	2300	4500
Vaal Triangle	Rigi	275/88	3	160	480	-	-	3	160	480	68	0	-	-	3	160	480	0	0	538	3200	3650	
Vaal Triangle	Snowdon	275/88	2	315	630	-	-	2	315	630	56	0	2017		3	315	945	0	0	980	750	750	

A9. WEST RAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
West Rand	Bernina	275/132	4	240	960	-	-	4	240	960	127	0	-	-	4	240	960	0	0	980	2100	2100	
West Rand	Etna	275/88	2	315	630	-	-	2	315	630	71	0	-	-	2	315	630	0	0	688	2650	2800	
West Rand	Hera	275/88	3	315	945	-	-	3	315	945	106	0	-	-	3	315	945	0	0	980	1100	1100	
West Rand	Princess	275/132	0	0	0	2021	Proposed	0	0	0	65	0	2021	Proposed	2	500	1000	0	0	980	2150	2150	4950
West Rand	Quattro	275/132	3	500	1500	-	-	3	500	1500	185	0	-	-	3	500	1500	0	0	980	2800	2800	
West Rand	Taunus	275/132	2	500	1000			2	500	1000	233	0	-	-	2	500	1000	0	0	980	1200	1200	
West Rand	Westgate	275/132	4	240	960	-	-	4	240	960	127	0	-	-	4	240	960	0	0	980	2100	2100	

A10. JOHANESBURG SOUTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Johannesburg South	Croydon	275/132	3	250	750	-	-	3	250	750	17	0	-	-	3	250	750	0	0	752	1050	1050	3900
Johannesburg South	Eiger	275/88	3	315	945	-	-	3	315	945	30	0	-	-	3	315	945	0	0	956	2800	2800	
Johannesburg South	Jupiter	275/88	3	180	540	-	-	3	180	540	120	0	-	-	3	180	540	0	0	649	1400	2150	
Johannesburg South	Prospect	275/88	-	-	-	-	-	4	250	1000	134	0	-	-	4	250	1000	0	0	980	1150	1150	

A11. JOHANESBURG NORTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Johannesburg North	Craighall	275/88	3	315	945	-	-	3	315	945	112	0	-	-	3	315	945	0	0	980	1750	1750	
Johannesburg North	Lepini	275/88	4	315	1260	-	-	4	315	1260	162	0	-	-	4	315	1260	0	0	980	1700	1700	6500
Johannesburg North	Lulamisa	400/88	3	315	945	-	-	3	315	945	224	0	-	-	3	315	945	0	0	980	2300	2300	

A12. EMPANGENI

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Empangeni	Athene	400/132	4	500	2000	-	-	4	500	2000	689	0	-	-	4	500	2000	0	0	980	3800	3800	4000
Empangeni	Impala	275/132	4	250	1000	-	-	4	250	1000	131	0	-	-	4	250	1000	0	0	980	1250	1250	

A13. LADYSMITH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Ladysmith	Bloukrans	275/132	2	250	500	-	-	2	250	500	52	0	-	-	2	250	500	0	0	542	450	450	
Ladysmith	Danskraal	275/132	2	125	250	-	-	2	125	250	25	0	-	-	2	125	250	0	0	270	550	550	1400
Ladysmith	Tugela	275/132	2	180	360	-	-	2	180	360	12	0	-	-	2	180	360	0	0	365	700	700	

A14. NEWCASTLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Newcastle	Bloedrivier	275/88	2	160	320	-	-	2	160	320	24	0	-	-	2	160	320	0	0	338	750	750	
Newcastle	Incandu	400/132	0 2	500 315	630	2017	-	1 2	500 315	1130	133	0	-	-	1 2	500 315	1130	0	0	980	1800	1900	2800
Newcastle	Ingagane	275/88	2	160	320	-	-	2	160	320	29	0	-	-	2	160	320	0	0	343	1250	1250	
Newcastle	Umfolozi	400/88	2	160	320	-	-	2	160	320	38	0	-	-	2	160	320	0	0	352	4450	4450	

A15. PINETOWN

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Pinetown	Ariadne	400/132	2	500	1000	-	-	2	500	1000	114	0	-	-	2	500	1000	0	0	980	2900	2900	
Pinetown	Avon	275/132	2	250	500	2017	-	3	250	750	0	0	2017	-	3	250	750	0	0	735	1500	1500	
Pinetown	Eros	400/132	2	500	1000	-	-	2	500	1000	98	0	-	-	2	500	1000	0	0	980	2675	2675	
Pinetown	Georgedale	132/88	2	45	90	-	-	2	45	90	32	0	-	-	2	45	90	0	0	120	112	112	
Pinetown	Georgedale	275/132	2 1	150 250	550	-	-	2 1	150 250	550	32	0			1 1	150 250	400	0	0	424	1500	1500	4650
Pinetown	Illovo	132/88	1	80	80	-	-	1	80	80	0	0	-	-	1	80	80	0	0	78	80	80	
Pinetown	Illovo	275/132	2	250	500	-	-	2	250	500	0	0	-	-	2	250	500	0	0	490	1900	1900	
Pinetown	Mersey	275/132	2	250	500	-	-	2	250	500	61	0	-	-	2	250	500	0	0	551	3200	3200	
Pinetown	Mersey	400/275	3	800	2400	-	-	3	800	2400	0	0	-	-	3	800	2400	0	0	980	5100	5500	

A16. POLOKWANE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Polokwane	Leseding	400/132	2	500	1000	-	-	2	500	1000	215	0	-	-	2	500	1000	0	0	980	2150	2150	2150
Polokwane	Spencer	275/132	2	250	500	-	-	2	250	500	70	0	-	-	2	250	500	0	0	560	950	950	
Polokwane	Tabor	275/132	2	250	500	-	-	2	250	500	96	0	-	-	2	250	500	0	0	586	800	800	
Polokwane	Tabor	400/132	1	500	500	-	-	1	500	500	96	0	-	-	1	500	500	28	0	586	500	500	
Polokwane	Witkop	400/275	2	400	800	-	-	2	400	800	0	0	-	-	2	400	800	0	0	784	1450	1450	
Polokwane	Witkop	400/132	3	500	1500	-	-	3	500	1500	170	0	-	-	3	500	1500	30	0	980	1350	1350	

A17. LEPHALALE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Lephalale	Spitskop	275/88	2	315	630	-	-	2	315	630	92	0	-	-	2	315	630	0	0	709	2150	2150	
Lephalale	Spitskop	400/132	2	500	1000	2016	-	2	500	1000	128	0	-	-	3	500	1500	0	0	980	4050	5375	
Lephalale	Spitskop	400/275	2	800	1600	-	-	2	800	1600	0	0	-	-	2	800	1600	0	0	980	4050	5375	2900
Lephalale	Warmbad	275/132	2	125	250	-	-	2	125	250	1	0	-	-	2	125	250	0	0	246	750	750	
Lephalale	Warmbad	132/66	2	40	80	-	-	2	40	80	5	0	-	-	2	40	80	0	0	83	83	83	
Lephalale	Borutho	400/132	2	500	1000	2022	Proposed	2	500	1000	120	0	2022	Proposed	2	500	1000	0	0	980	3600	3600	

A18. PHALABORWA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Phalaborwa	Acornhoek	275/132	2	75	150	2017	-	2	125	250	35	0	-	-	2	125	250	0	0	280	1000	1000	
Phalaborwa	Foskor	275/132	2	250	500	2017	-	3	250	750	133	0	-	-	3	250	750	0	0	868	900	900	
Phalaborwa	Merensky	275/132	2	250	500	-	-	2	250	500	55	0	-	-	2	250	500	0	0	545	2450	2550	
Phalaborwa	Merensky	400/132	1	500	500	-	-	1	500	500	0	0	-	-	1	500	500	0	0	490	3150	3150	3600
Phalaborwa	Merensky	400/275	2	400	800	-	-	3	400	1200	0	0	-	-	3	400	1200	0	0	980	3150	3150	
Phalaborwa	Senakangwedi	275/22	2	180	360	-	-	2	180	360	41	0	-	-	2	180	360	0	0	394	1450	1450	
Phalaborwa	Silimela	400/132	2	500	1000	2019	Proposed	2	500	1000	39	0	2019	Approved	2	500	1000	0	0	980	2150	2150	

A19. MIDDELBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Middelburg	Rockdale	132/88	2	90	180	-	-	1 3	80 30	170	16	0	-	-	1 3	80 30	170	0	0	183	183	183	1050
Middelburg	Rockdale	275/132	2	500	1000	-	-	2	500	1000	0	0	-	-	2	500	1000	0	0	980	500	500	
Middelburg	Emkhiweni (Rockdale B)	400/132	2	500	1000	2022	Proposed	0	0	0	175	0	2022	Proposed	2	500	1000	0	0	980	1500	1500	

A20. HIGHVELD SOUTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Highveld South	SolB4	400/132	4	500	2000	-	-	4	500	2000	687	0	-	-	4	500	2000	0	0	980	2200	2200	3150
Highveld South	Normandie	132/88	1	160	160	-	-	1	160	160	0	0	-	-	1	160	160	0	0	157	1650	1650	
Highveld South	Normandie	400/88	2	160	320	-	-	2	160	320	15	0	-	-	2	160	320	0	0	329	2300	2300	
Highveld South	Normandie	400/132	2	250	500	-	-	2	250	500	38	0	-	-	2	250	500	0	0	528	2300	2300	

A21. LOWVELD

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Lowveld	Gumeni	400/132	0	0	0	2017	-	2	500	1000	25	0	-	-	2	500	1000	0	0	980	2300	2300	
Lowveld	Khanyazwe	275/132	1	250	250	-	-	1	250	250	10	0	-	-	1	250	250	0	0	255	800	800	
Lowveld	Komatipoort	275/132	2	125	250	-	-	2	125	250	37	0	-	-	2	125	250	0	0	282	750	750	
Lowveld	Marathon	132/66	2	30	60	-	-	2	40	80	25	0	-	-	2	40	80	0	0	103	103	103	2300
Lowveld	Marathon	275/132	2	500	1000	-	-	2	500	1000	88	0	-	-	2	500	1000	0	0	980	1850	1850	
Lowveld	Prairie	275/132	2	500	1000	-	-	2	240	480	9	0	-		2	240	480	0	0	479	1550	1550	
Lowveld	Simplon	275/132	2	250	500	-	-	2	250	500	40	0	-	-	2	250	500	0	0	530	1000	1000	

A22. WITBANK

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Witbank	Vulcan	400/132	2 1	300 250	850	2022	Proposed	2 1	300 250	850	125	0	2022	Proposed	2 2	500 250	1500	0	0	980	4400	4400	2350
Witbank	Kruispunt	275/132	4	250	1000	-	-	4	250	1000	137	0	-	-	4	250	1000	0	0	980	1150	1150	

A23. KAROO

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Karoo	Hydra	400/220	2	315	630	-	-	2	315	630	0	0	-	-	2	315	630	0	0	617	700	700	1550
Karoo	Hydra	400/132	2	500	1000	2018	-	2	240	480	45	387			2 1	240 500	980	317	387	618	700	700	
Karoo	Hydra B	400/132	0	0	0	2021	Proposed	0	0	0	0	0	2021	Proposed	1	500	500	0	0	490	1700	1700	
Karoo	Kronos	400/132	0	0	0	2016	-	1	250	250	0	238	2019	Proposed	2	250	500	225	238	252	1700	1700	
Karoo	Roodekuil	220/132	1	125	125	-	-	1	125	125	11	0	-	-	1	125	125	0	0	134	575	575	
Karoo	Ruigtevallei	132/66	2	20	40	-	-	2	20	40	25	0	2020	Approved	3	20	60	0	0	84	84	84	
Karoo	Ruigtevallei	220/132	2	250	500	-	-	2	250	500	25	0	-	-	1	250	250	70	0	270	270	270	

A24. NAMAQUALAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Namaqualand	Aggeneis	220/66	2	40	80	-	-	2	40	80	23	0	-	-	2	40	80	0	0	101	600	950	
Namaqualand	Aggeneis	400/220	2	315	630	-	-	2	315	630	23	137	-	-	2	315	630	0	137	504	550	550	
Namaqualand	Aries	400/22	1	40	40	-	-	1	45	45	0	0	-	-	1	45	45	0	0	44	1425	1425	
Namaqualand	Gromis	220/66	2	40	80	-	-	2	40	80	1	0	-	-	2	40	80	0	0	79	400	400	
Namaqualand	Gromis	400/220	0	0	0	2020	Proposed	0	0	0	1	0	2020	Proposed	1	315	315	0	0	310	700	700	
Namaqualand	Nama	220/66	2	80	160	-	-	2	80	160	5	0	-	-	2	80	160	0	0	162	175	350	
Namaqualand	Oranjemond	220/66	2	80	160	-	-	2	80	160	8	0	-	-	2	80	160	0	0	165	700	700	1425
Namaqualand	Paulputs	132/22	1	10	10	-	-	1	10	10	3	0	-	-	1	10	10	0	0	13	13	13	
Namaqualand	Paulputs	220/132	1	125	125	2019	Proposed	1 1	125 250	375	3	0	-	-	1 1	125 250	375	85	0	371	425	450	
Namaqualand	Helios	22/66	-	-	-	-	-	1	10	10	0	0			1	10	10	0	0	10	10	10	
Namaqualand	Helios	132/66	-	-	-	-	-	0	0	0	0	0	2019	Approved	1	20	20	0	0	20	20	20	
Namaqualand	Helios	400/22	1	40	40	-	-	1	45	45	13	0	-	-	1	45	45	0	0	57	700	950	
Namaqualand	Helios	400/132	1	500	500	2017	-	3	500	1500	0	276	-	-	3	500	1500	75	276	980	700	950	

A25. KIMBERLY

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Kimberly	Upington	400/132	1	500	500	2022	Proposed	0	0	0	0	0	2020	Proposed	2	500	1000	234	0	980	900	1600	
Kimberly	Ferrum	132/66	3	80	240	-	-	3	80	240	24	0	-	-	3	80	240	0	0	259	259	259	
Kimberly	Ferrum	275/132	2	250	500	-	-	2	250	500	0	0	-	-	2	250	500	224	0	490	1450	1450	
Kimberly	Ferrum	400/132	2	500	1000	-	-	2	500	1000	15	0	-	-	2	500	1000	0	0	980	1775	1775	2150
Kimberly	Garona	275/132	1	125	125	-	-	1	125	125	5	0	-	-	1	125	125	0	0	128	1250	1250	
Kimberly	Nieuwehoop	400/132	0	0	0	2016	-	1	500	500	0	0	-	-	1	500	500	0	0	490	1000	1000	
Kimberly	Olien	275/132	2	150	300	-	-	2	150	300	53	0	-	-	2	150	300	139	0	347	1350	1350	

A26. RUSTENBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Rustenburg	Ararat	275/88	3	315	945	-	-	3	315	945	95	0	-	-	3	315	945	0	0	980	850	850	
Rustenburg	Bighorn	275/88	3	315	945	-	-	3	315	945	210	0	-	-	3	315	945	0	0	980	2300	2600	
Rustenburg	Bighorn	400/275	2	800	1600	-	-	2	800	1600	0	0	-	-	2	800	1600	0	0	980	4200	4200	
Rustenburg	Dinaledi	400/132	2	500	1000	2016	-	2	500	1000	142	0	-	-	3	500	1500	0	0	980	4050	4050	2600
Rustenburg	Marang	400/88	4	315	1260	-	-	4	315	1260	88	0	-	-	4	315	1260	0	0	980	2700	2700	
Rustenburg	Ngwedi (Mogwase)	400/132	0	0	0	2016	-	1	500	500	87	0	2020	-	2	500	1000	0	0	980	3300	3300	
Rustenburg	Trident	275/88	2	315	630	-	-	2	315	630	153	0	-	-	2	315	630	0	0	770	1550	1650	

A27. CARLETONVILLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs 2015	Trfr Size (MVA) 2015	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs 2017	Trfr Size (MVA2017)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs 2022	Trfr Size (MVA)2022	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Carletonville	Carmel	275/132	2	500	1000	-	-	2	500	1000	60	0	-	-	2	500	1000	0	0	980	1000	1000	2650
Carletonville	Hermes	132/88	3	180	540	-	-	3	180	540	0	0	-	-	3	180	540	0	0	529	529	529	
Carletonville	Hermes	400/132	3	500	1500	-	-	3	500	1500	67	0	-	-	3	500	1500	0	0	980	2400	2400	
Carletonville	Midas	400/132	2	500	1000	-	-	2	500	1000	162	0	-	-	2	500	1000	0	0	980	2550	2550	
Carletonville	Mookodi	400/132	2	500	1000	-	-	2	500	1000	90	0	-	-	2	500	1000	75	0	980	1525	1525	
Carletonville	Watershed	275/132	0	0	0	2016	Deferred	0	0	0	82	0	2021	Approved	1	250	250	75	0	327	850	850	
Carletonville	Watershed	132/88	2	180	360	-	-	2	180	360	14	0	-	-	2	180	360	0	0	367	367	367	
Carletonville	Watershed	275/88	2	315	630	-	-	2	315	630	0	0	-	-	2	315	630	0	0	617	0	0	

A28. WEST COAST

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
West Coast	Aurora	400/132	4	250	1000	2021	-	4	250	1000	0	161	2021	Proposed	2	500	1000	89	161	819	1650	1650	
West Coast	Juno	132/66	2	40	80	2020	Proposed	2	40	80	2	0	-	-	2	80	160	0	0	159	159	159	2150
West Coast	Juno	400/132	2	120	240	2020	Proposed	2	120	240	1	0	-	-	2	500	1000	0	0	980	2100	3400	

A29. PENINSULA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Peninsula	Acacia	132/66	2	120	240	-	-	2	120	240	0	0	-	-	2	120	240	0	0	235	235	235	
Peninsula	Acacia	400/132	3	500	1500	-	-	3	500	1500	210	0	-	-	3	500	1500	0	0	980	3700	3700	
Peninsula	Muldersvlei	132/66	2	80	160	-	-	2	80	160	0	0	-	-	2	80	160	0	0	157	4750	4750	
Peninsula	Muldersvlei	400/132	3	500	1500	-	-	3	500	1500	170	138	-	-	3	500	1500	0	138	980	4750	4750	5575
Peninsula	Philippi	400/132	2	500	1000	-	-	2	500	1000	215	0	-	-	2	500	1000	0	0	980	1950	1950	
Peninsula	Pinotage	400/132	0	0	0	2017	-	0	0	0	108	0	2018	Approved	2	500	1000	0	0	980	1500	1500	
Peninsula	Stikland	400/132	3	500	1500	-	-	3	500	1500	210	0	-	-	3	500	1500	0	0	980	3100	3100	

A30. OUTENIQUA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Outeniqua	Asteria	400/132	0	0	0	2021	Proposed	0	0	0	51	0	2022	Approved	2	500	1000	0	0	980	1650	1650	
Outeniqua	Bacchus	400/132	2	500	1000	-	-	2	500	1000	58	58	-	-	2	500	1000	36	58	980	3300	3300	
Outeniqua	Droerivier	400/132	2	120	240	-	-	2	120	240	19	0	-	-	2	120	240	0	0	254	4875	4875	
Outeniqua	Proteus	132/66	2	80	160	-	-	2	80	160	45	0	-	-	2	80	160	0	0	202	160	160	4700
Outeniqua	Proteus	400/132	2	500	1000	-	-	2	500	1000	105	0	-	-	2	500	1000	0	0	980	1200	1200	
Outeniqua	Komsberg	400/132	-	-	-	-	-	-	-	-	0	419	2020	Approved	1	500	500	0	419	71	1300	1300	

APPENDIX B: GENERATION CAPACITY ASSESSMENT RESULTS PER CLN FOR MIDDAY LOAD

B1. EAST LONDON

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
East London	Pembroke	132/66	2	90	180	-	-	2	90	180	28	0	-	-	2	160	320	0	0	342	2350	2350	1050
East London	Delphi	400/132	2	120	240	2020	Proposed	2	120	240	141	97	2020	Proposed	3	120	360	0	97	397	925	925	
East London	Neptune	400/132	2	500	1000	-	-	2	500	1000	82	0	-	-	2	500	1000	0	0	980	1500	1600	
East London	Pembroke	220/66	0	0	0	2022	Proposed	0	0	0	28	0	2022	Approved	1	160	160	0	0	185	125	125	
East London	Pembroke	220/132	2	250	500	-	-	2	250	500	28	53	2022	Proposed	2	250	500	0	53	465	125	125	
East London	Pembroke	400/132	0	0	0	2022	Proposed	0	0	0	28	0	2022	Approved	1	500	500	0	0	518	250	250	
East London	Vuyani	400/132	2	250	500	-	-	2	250	500	149	0	-	-	2	250	500	0	0	639	1600	1600	

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B2. PORT ELIZABETH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Port Elizabeth	Dedisa	400/132	3	500	1500	2022	Proposed	2	500	1000	280	0	2022	Proposed	3	500	1500	0	0	980	2200	2200	2200
Port Elizabeth	Grassridge	220/132	2	360	720	-	-	2	360	720	403	26	-	-	2	360	720	0	26	980	2200	2200	
Port Elizabeth	Grassridge	400/132	4	500	2000	-	-	4	500	2000	403	616	-	-	4	500	2000	0	616	980	1800	1800	
Port Elizabeth	Poseidon	220/66	1 1	40 80	120	-	-	1 1	40 80	120	64	0	-	-	1 1	40 80	120	0	0	182	2200	2200	
Port Elizabeth	Poseidon	220/132	2	125	250	-	-	2	125	250	64	158	-	-	2	125	250	0	158	151	2200	2200	
Port Elizabeth	Poseidon	400/132	0	0	0	2016	-	0	0	0	64	481	-	-	1	500	500	0	481	73	2200	2200	
Port Elizabeth	Poseidon	400/220	2	500	1000	-	-	2	500	1000	64	0	-	-	2	500	1000	0	0	980	2200	2200	

B3. BLOEMFONTEIN

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Bloemfontein	Boundary	275/132	2	250	500	-	-	2	250	500	83	228	-	-	2	250	500	228	0	345	1500	1500	1500
Bloemfontein	Harvard	275/132	2	500	1000	-	-	2	500	1000	276	64	-	-	2	500	1000	64	0	980	1350	1350	
Bloemfontein	Merapi	275/132	1	250	250	2016	-	2	250	500	128	0	-	-	2	250	500	0	0	618	900	900	

B4. SASOLBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Sasolburg	Mercury	400/132	2	500	1000	-	-	2	500	1000	65	68	-	-	2	500	1000	68	0	977	2300	2300	2700
Sasolburg	Makalu	275/88	4	160	640	-	-	4	160	640	188	0	-	-	4	160	640	0	0	815	2350	2350	
Sasolburg	Scafell	275/132	2	135	270	-	-	2	135	270	38	0	-	-	2	135	270	0	0	303	1100	1100	

B5. WELKOM

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Welkom	Everest	275/132	2	500	1000	-	-	2	500	1000	34	0	-	-	2	500	1000	0	0	980	2800	2800	
Welkom	Leander	400/132	2	500	1000	-	-	2	500	1000	288	0	-	-	2	500	1000	0	0	980	2700	2600	1800
Welkom	Sorata	275/132	0	0	0	2021	Proposed	0	0	0	156	0	2020	Proposed	1	250	250	0	0	401	401	401	
Welkom	Theseus	400/132	2	500	1000	-	-	2	500	1000	397	0	-	-	2	500	1000	0	0	980	2700	2500	

B6. TSHWANE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Tshwane	Lomond	275/88	2	315	630	-	-	2	315	630	75	0	-	-	2	315	630	0	0	692	900	1470	4550
Tshwane	Pelly	275/132	2	250	500	-	-	2	250	500	213	0	-	-	2	250	500	0	0	703	1050	1050	
Tshwane	Thuso (Verwoedburg)	400/132	2	250	500	2021	Proposed	2	250	500	127	0	2025	Proposed	2	250	500	0	0	617	750	750	
Tshwane	Wildebees	400/132	-	-	-	2021	Proposed	-	-	-	181	0	2021		2	315	630	0	0	798	1450	1450	
Tshwane	Njala	275/132	-	-	-	-	-	4	250	1000	497	0	-	-	4	250	1000	0	0	980	1550	1550	

B7. EAST RAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
East Rand	Benburg	275/132	3	250	750	-	-	3	250	750	308	0	-	-	3	250	750	0	0	980	1150	1150	2050
East Rand	Brenner	275/88	3	315	945	-	-	3	315	945	505	0	-	-	3	315	945	0	0	980	2950	2025	
East Rand	Esselen	132/88	1	160	160	-	-	1	160	160	146	0	-	-	1	160	160	0	0	303	303	303	
East Rand	Esselen	275/132	1 2	250 180	610	-	-	1 2	250 180	610	291	0	-	-	1 2	250 180	610	0	0	889	2050	2050	
East Rand	Esselen	275/88	2	315	630	-	-	2	315	630	73	0	-	-	2	315	630	0	0	690	2950	2050	
East Rand	Nevis	275/132	2	500	1000	-	-	2	500	1000	254	0	-	-	2	500	1000	0	0	980	2950	2050	
East Rand	Pieterboth	275/132	2	315	630	-	-	2	315	630	209	0	-	-	2	315	630	0	0	826	1800	1750	
East Rand	Benburg	275/132	3	250	750	-	-	3	250	750	308	0	-	-	3	250	750	0	0	980	1150	1150	

B8. VAAL TRIANGLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Vaal Triangle	Kookfontein	275/88	2	315	630	-	-	2	315	630	158	0	2017		3	315	945	0	0	980	800	800	
Vaal Triangle	Olympus	275/132	2	250	500	-	-	2	250	500	58	0	-	-	2	250	500	0	0	548	850	750	
Vaal Triangle	Rigi	275/88	3	315	945	-	-	3	315	945	0	0	-	-	3	315	945	0	0	926	500	50	400
Vaal Triangle	Snowdon	275/88	3	160	480	-	-	3	160	480	191	0	-	-	3	160	480	0	0	661	450	450	
Vaal Triangle	Kookfontein	275/88	2	315	630	-	-	2	315	630	158	0	2017		3	315	945	0	0	980	800	800	

B9. WESTRAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
West Rand	Bernina	275/132	4	240	960	-	-	4	240	960	0	0	-	-	4	240	960	0	0	941	1950	1950	
West Rand	Etna	275/88	2	315	630	-	-	2	315	630	395	0	-	-	2	315	630	0	0	980	3000	2550	
West Rand	Princess	275/88	3	315	945	-	-	3	315	945	0	0	-	-	3	315	945	0	0	926	950	950	
West Rand	Quattro	275/132	0	0	0	2021	Proposed	0	0	0	380	0	2021	Proposed	2	500	1000	0	0	980	2600	2600	4550
West Rand	Taunus	275/132	3	500	1500	-	-	3	500	1500	534	0	-	-	3	500	1500	0	0	980	2500	2500	
West Rand	Westgate	275/132	2	500	1000	-	-	2	500	1000	659	0	-	-	2	500	1000	0	0	980	1650	1650	

B10. JOHANESBURG SOUTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Johannesburg South	Croydon	275/132	3	250	750	-	-	3	250	750	136	0	-	-	3	250	750	0	0	871	1150	750	925
Johannesburg South	Eiger	275/88	3	315	945	-	-	3	315	945	93	0	-	-	3	315	945	0	0	980	2100	925	
Johannesburg South	Jupiter	275/88	3	180	540	-	-	3	180	540	353	0	-	-	3	180	540	0	0	882	600	600	
Johannesburg South	Prospect	275/88				-	-	4	250	1000	527	0	-	-	4	250	1000	0	0	980	1850	925	

B11. JOHANESBURG NORTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Johannesburg North	Craighall	275/88	3	315	945	-	-	3	315	945	255	0	-	-	3	315	945	0	0	980	1750	1750	6500
Johannesburg North	Lepini	275/88	4	315	1260	-	-	4	315	1260	535	0	-	-	4	315	1260	0	0	980	1700	1700	
Johannesburg North	Lulamisa	400/88	3	315	945	-	-	3	315	945	592	0	-	-	3	315	945	0	0	980	2300	2300	

B12. EMPANGENI

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Empangeni	Athene	400/132	4	500	2000	-	-	4	500	2000	1404	0	-	-	4	500	2000	0	0	980	3950	3950	4000
Empangeni	Impala	275/132	4	250	1000	-	-	4	250	1000	305	0	-	-	4	250	1000	0	0	980	1450	1450	

B13. LADYSMITH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Ladysmith	Bloukrans	275/132	2	250	500	-	-	2	250	500	140	0	-	-	2	250	500	0	0	630	800	800	1400
Ladysmith	Danskraal	275/132	2	125	250	-	-	2	125	250	75	0	-	-	2	125	250	0	0	320	650	650	
Ladysmith	Tugela	275/132	2	180	360	-	-	2	180	360	50	0	-	-	2	180	360	0	0	403	950	950	

B14. NEWCASTLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Newcastle	Bloedrivier	275/88	2	160	320	-	-	2	160	320	77	0	-	-	2	160	320	0	0	391	850	850	4350
Newcastle	Incandu	400/132	2	315	630		-	2 1	315 500	1130	296	0	-	-	2 1	315 500	1130	0	0	980	1800	1800	
Newcastle	Ingagane	275/88	2	160	320	-	-	2	160	320	64	0	-	-	2	160	320	0	0	378	1700	1700	
Newcastle	Umfolozi	400/88	2	160	320	-	-	2	160	320	144	0	-	-	2	160	320	0	0	458	4675	4675	

B15. PINETOWN

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Pinetown	Ariadne	400/132	2	500	1000	-	-	2	500	1000	278	0	-	-	2	500	1000	0	0	980	3250	3250	
Pinetown	Avon	275/132	2	250	500	2017	-	3	250	750	0	0	2017	-	3	250	750	0	0	735	1850	1850	
Pinetown	Eros	400/132	2	500	1000	-	-	2	500	1000	222	0	-	-	2	500	1000	0	0	980	2950	2950	
Pinetown	Georgedale	132/88	2	45	90	-	-	2	45	90	0	0	-	-	2	45	90	0	0	88	112	112	
Pinetown	Georgedale	275/132	2 1	150 250	550	-	-	2 1	150 250	550	0	0			1 1	150 250	400	0	0	392	1200	1200	4225
Pinetown	Illovo	132/88	1	80	80	-	-	1	80	80	0	0	-	-	1	80	80	0	0	78	80	80	
Pinetown	Illovo	275/132	2	250	500	-	-	2	250	500	140	0	-	-	2	250	500	0	0	630	2300	2300	
Pinetown	Mersey	275/132	2	250	500	-	-	2	250	500	193	0	-	-	2	250	500	0	0	683	3425	3425	
Pinetown	Mersey	400/275	3	800	2400	-	-	3	800	2400	0	0	-	-	3	800	2400	0	0	980	3462	3462	

B16. POLOKWANE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Polokwane	Leseding	400/132	2	500	1000	-	-	2	500	1000	458	0	-	-	2	500	1000	0	0	980	2150	2150	
Polokwane	Spencer	275/132	2	250	500	-	-	2	250	500	201	0	-	-	2	250	500	0	0	691	1050	350	
Polokwane	Tabor	275/132	2	250	500	-	-	2	250	500	108	0	-	-	2	250	500	0	0	598	900	350	2150
Polokwane	Tabor	400/132	1	500	500	-	-	1	500	500	108	28	-	-	1	500	500	28	0	570	500	350	
Polokwane	Witkop	400/275	2	400	800	-	-	2	400	800	463	0	-	-	2	400	800	0	0	980	900	350	
Polokwane	Witkop	400/132	3	500	1500	-	-	3	500	1500	463	30	-	-	3	500	1500	30	0	980	1050	375	

B17. LEPHALALE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Lephalale	Spitskop	275/88	2	315	630	-	-	2	315	630	273	0	-	-	2	315	630	0	0	890	2150	650	
Lephalale	Spitskop	400/132	2	500	1000	2016	-	2	500	1000	273	0	-	-	3	500	1500	0	0	980	2200	650	
Lephalale	Spitskop	400/275	2	800	1600	-	-	2	800	1600	273	0	-	-	2	800	1600	0	0	980	2200	650	
Lephalale	Warmbad	275/132	2	125	250	-	-	2	125	250	9	0	-	-	2	125	250	0	0	254	750	750	2850
Lephalale	Warmbad	132/66	2	40	80	-	-	2	40	80	9	0	-	-	2	40	80	0	0	87	87	87	
Lephalale	Borutho	400/132	2	500	1000	2022	Proposed	2	500	1000	361	0	2022	Proposed	2	500	1000	0	0	980	2250	600	

B18. PHALABORWA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Phalaborwa	Acornhoek	275/132	2	75	150	2017	-	2	125	250	100	0	-	-	2	125	250	0	0	345	2250	1950	3600
Phalaborwa	Foskor	275/132	2	250	500	2017	-	3	250	750	338	0	-	-	3	250	750	0	0	980	900	900	
Phalaborwa	Merensky	275/132	2	250	500	-	-	2	250	500	160	0	-	-	2	250	500	0	0	650	2550	2550	
Phalaborwa	Merensky	400/132	1	500	500	-	-	1	500	500	160	0	-	-	1	500	500	0	0	650	3900	3900	
Phalaborwa	Merensky	400/275	2	400	800	-	-	3	400	1200	160	0	-	-	3	400	1200	0	0	980	3900	3900	
Phalaborwa	Senakangwedi	275/33	2	180	360	-	-	2	180	360	185	0	-	-	2	180	360	0	0	538	1400	1400	
Phalaborwa	Silimela	400/132	2	500	1000	2019	Proposed	2	500	1000	33	0	2019	Approved	2	500	1000	0	0	980	2400	2400	
Phalaborwa	Acornhoek	275/132	2	75	150	2017	-	2	125	250	100	0	-	-	2	125	250	0	0	345	2250	1950	
Phalaborwa	Foskor	275/132	2	250	500	2017	-	3	250	750	338	0	-	-	3	250	750	0	0	980	900	900	

B19. MIDDELBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Middelburg	Rockdale	132/88	2	90	180	-	-	1	80	80	38	0	-	-	1	80	80	0	0	116	116	116	1350
Middelburg	Rockdale	132/88	-	-	-	-	-	3	30	90	38	0	-	-	3	30	90	0	0	126	126	126	
Middelburg	Rockdale	275/132	2	500	1000	-	-	2	500	1000	38	0	-	-	2	500	1000	0	0	980	500	500	
Middelburg	Emkhiweni (Rockdale B)	400/132	2	500	1000	2022	Proposed	0	0	0	203	0	2022	Proposed	2	500	1000	0	0	980	3200	3200	
Middelburg	Rockdale	132/88	2	90	180	-	-	1	80	80	38	0	-	-	1	80	80	0	0	116	116	116	

B20. HIGHVELD SOUTH

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Highveld South	SolB4	400/132	4	500	2000	-	-	4	500	2000	1177	0	-	-	4	500	2000	0	0	980	2200	2200	5350
Highveld South	Normandie	132/88	1	160	160	-	-	1	160	160	46	0	-	-	1	160	160	0	0	203	2425	2425	
Highveld South	Normandie	400/88	2	160	320	-	-	2	160	320	46	0	-	-	2	160	320	0	0	360	0	0	
Highveld South	Normandie	400/132	2	250	500	-	-	2	250	500	46	0	-	-	2	250	500	0	0	536	0	0	

B21. LOWVELD

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Lowveld	Gumeni	400/132	0	0	0	2017	-	2	500	1000	57	0	-	-	2	500	1000	0	0	980	0	0	5350
Lowveld	Khanyazwe	275/132	1	250	250	-	-	1	250	250	120	0	-	-	1	250	250	0	0	365	0	0	
Lowveld	Komatipoort	275/132	2	125	250	-	-	2	125	250	86	0	-	-	2	125	250	0	0	331	0	0	
Lowveld	Marathon	132/66	2	30	60	-	-	2	40	80	232	0	-	-	2	40	80	0	0	310	0	0	
Lowveld	Marathon	275/132	2	500	1000	-	-	2	500	1000	232	0	-	-	2	500	1000	0	0	980	0	0	
Lowveld	Prairie	275/132	2	500	1000	-	-	2	240	480	33	0	-		2	240	480	0	0	503	0	0	
Lowveld	Simplon	275/132	2	250	500	-	-	2	250	500	118	0	-	-	2	250	500	0	0	608	0	0	

B22. WITBANK

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Witbank	Vulcan	400/132	2	300	600	2022	Proposed	2	300	600	216	0	2022	Proposed	2 2	500 250	1500	0	0	980	4075	4075	2550
Witbank	Kruispunt	275/132	4	250	1000	-	-	4	250	1000	325	0	-	-	4	250	1000	0	0	980	1250	1250	

B23. KAROO

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Karoo	Hydra	400/220	2	315	630	-	-	2	315	630	0	0	-	-	2	315	630	0	0	617	700	700	1550
Karoo	Hydra	400/132	2	500	1000	-	-	2	240	480	45	705	2018	Approved	2 1	240 500	480 980	317	387	309	700	700	
Karoo	Hydra B	400/132	0	0	0	2021	Proposed	0	0	0	0	0	2021	Proposed	1	500	500	0	0	490	1700	1700	
Karoo	Kronos	400/132	0	0	0	2016	-	1	250	250	0	463	2019	Proposed	2	250	500	225	238	27	1700	1700	
Karoo	Roodekuil	220/132	1	125	125	-	-	1	125	125	95	0	-	-	1	125	125	0	0	218	575	575	
Karoo	Ruigtevallei	132/66	2	20	40	-	-	2	20	40	0	0	2020	Approved	3	20	60	0	0	59	59	59	
Karoo	Ruigtevallei	220/132	2	250	500	-	-	2	250	500	73	70	-	-	1	250	250	70	0	248	248	248	

B24. NAMAQUALAND

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Namaqualand	Aggeneis	220/66	2	40	80	-	-	2	40	80	54	0	-	-	2	40	80	0	0	132	600	950	
Namaqualand	Aggeneis	400/220	2	315	630	-	-	2	315	630	0	137	-	-	2	315	630	0	137	481	550	550	
Namaqualand	Aries	400/22	1	40	40	-	-	1	45	45	0	0	-	-	1	45	45	0	0	44	1425	1425	
Namaqualand	Gromis	220/66	2	40	80	-	-	2	40	80	1	0	-	-	2	40	80	0	0	79	400	400	
Namaqualand	Gromis	400/220	0	0	0	2020	Proposed	0	0	0	1	0	2020	Proposed	1	315	315	0	0	310	700	700	
Namaqualand	Nama	220/66	2	80	160	-	-	2	80	160	5	0	-	-	2	80	160	0	0	162	175	350	
Namaqualand	Oranjemond	220/66	2	80	160	-	-	2	80	160	5	0	-	-	2	80	160	0	0	162	700	700	1425
Namaqualand	Paulputs	132/33	1	10	10	-	-	1	10	10	3	0	-	-	1	10	10	0	0	13	13	13	
Namaqualand	Paulputs	220/132	1	125	125	2019	Proposed	1 1	125 250	375	3	285	-	-	1 1	125 250	375	285	0	86	425	450	
Namaqualand	Helios	22/66	-	-	-	-	-	1	10	10	0	0	-	-	1	10	10	0	0	10	10	10	
Namaqualand	Helios	132/66	-	-	-	-	-	0	0	0	0	0	2019	Approved	1	20	20	0	0	20	20	20	
Namaqualand	Helios	400/22	1	40	40	-	-	1	45	45	15	0	-	-	1	45	45	0	0	59	700	950	
Namaqualand	Helios	400/132	2	500	1000	2017	-	3	500	1500	0	351	-	-	3	500	1500	75	276	980	700	950	

B25. KIMBERLY

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit LL (MW)	HV Limit LL (MW)	2022 HV Area Limit LL (MW)	2022 CLN Limit LL (MW)
Kimberly	Upington	400/132	1	500	500	2022	Proposed	0	0	0	0	384	2020	Proposed	2	500	1000	384	0	596	900	1600	
Kimberly	Ferrum	132/66	3	80	240	-	-	3	80	240	24	0	-	-	3	80	240	0	0	259	259	259	
Kimberly	Ferrum	275/132	2	250	500	-	-	2	250	500	0	224	-	-	2	250	500	224	0	266	1450	1450	
Kimberly	Ferrum	400/132	2	500	1000	-	-	2	500	1000	15	100	-	-	2	500	1000	100	0	895	1775	1775	2150
Kimberly	Garona	275/132	1	125	125	-	-	1	125	125	11	50	-	-	1	125	125	50	0	84	1250	1250	
Kimberly	Nieuwehoop	400/132	0	0	0	2016	-	1	500	500	0	0	-	-	1	500	500	0	0	490	1000	1000	
Kimberly	Olien	275/132	2	150	300	-	-	2	150	300	8	239	-	-	2	150	300	239	0	63	1350	1350	

B26. RUSTENBURG

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Rustenburg	Ararat	275/88	3	315	945	-	-	3	315	945	95	0	-	-	3	315	945	0	0	980	900	900	
Rustenburg	Bighorn	275/88	3	315	945	-	-	3	315	945	210	0	-	-	3	315	945	0	0	980	2600	2200	
Rustenburg	Bighorn	400/275	2	800	1600	-	-	2	800	1600	0	0	-	-	2	800	1600	0	0	980	4200	4200	
Rustenburg	Dinaledi	400/132	2	500	1000	2016	-	2	500	1000	142	0	-	-	3	500	1500	0	0	980	3950	3950	5650
Rustenburg	Marang	400/88	4	315	1260	-	-	4	315	1260	25	0	-	-	4	315	1260	0	0	980	2650	2650	
Rustenburg	Ngwedi (Mogwase)	400/132	0	0	0	2016	-	1	500	500	87	0	2020	-	2	500	1000	0	0	980	3225	3225	
Rustenburg	Trident	275/88	2	315	630	-	-	2	315	630	153	0	-	-	2	315	630	0	0	770	2500	1550	

B27. CARLETONVILLE

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Carltonville	Carmel	275/132	2	500	1000	-	-	2	500	1000	124	0	-	-	2	500	1000	0	0	980	1100	1100	
Carltonville	Hermes	132/88	3	180	540	-	-	3	180	540	0	0	-	-	3	180	540	0	0	529	529	529	
Carltonville	Hermes	400/132	3	500	1500	-	-	3	500	1500	67	0	-	-	3	500	1500	0	0	980	2400	2400	
Carltonville	Midas	400/132	2	500	1000	-	-	2	500	1000	292	0	-	-	2	500	1000	0	0	980	2500	2500	
Carltonville	Mookodi	400/132	2	500	1000	-	-	2	500	1000	90	75	-	-	2	500	1000	75	0	980	1450	1450	2650
Carltonville	Watershed	275/132	0	0	0	2016	Deferred	0	0	0	82	75	2021	Approved	1	250	250	75	0	252	800	800	
Carltonville	Watershed	132/88	2	180	360	-	-	2	180	360	14	0	-	-	2	180	360	0	0	367	367	367	
Carltonville	Watershed	275/88	2	315	630	-	-	2	315	630	0	0	-	-	2	315	630	0	0	617	0	0	
Carltonville	Carmel	275/132	2	500	1000	-	-	2	500	1000	124	0	-	-	2	500	1000	0	0	980	1100	1100	

B28. WEST COAST

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
West Coast	Aurora	400/132	4	250	1000	2021	-	4	250	1000	75	250	2021	Proposed	2	500	1000	89	161	805	1575	1575	
West Coast	Juno	132/66	2	40	80	2020	Proposed	2	40	80	2	0	-	-	2	80	160	0	0	159	159	159	2875
West Coast	Juno	400/132	2	120	240	2020	Proposed	2	120	240	2	109	-	-	2	500	1000	9	100	873	1575	1575	

B29. PENINSULA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Peninsula	Acacia	132/66	2	120	240	-	-	2	120	240	0	0	-	-	2	120	240	0	0	235	235	235	4450
Peninsula	Acacia	400/132	3	500	1500	-	-	3	500	1500	210	0	-	-	3	500	1500	0	0	980	3700	3700	
Peninsula	Muldersvlei	132/66	2	80	160	-	-	2	80	160	20	0	-	-	2	80	160	0	0	177	2375	2375	
Peninsula	Muldersvlei	400/132	3	500	1500	-	-	3	500	1500	20	138	-	-	3	500	1500	0	138	980	2375	2375	
Peninsula	Philippi	400/132	2	500	1000	-	-	2	500	1000	215	0	-	-	2	500	1000	0	0	980	1450	1450	
Peninsula	Pinotage	400/132	0	0	0	-	-	0	0	0	108	0	2018	Approved	2	500	1000	0	0	980	1500	1500	
Peninsula	Stikland	400/132	3	500	1500	-	-	3	500	1500	210	0	-	-	3	500	1500	0	0	980	3100	3100	
Peninsula	Acacia	132/66	2	120	240	-	-	2	120	240	0	0	-	-	2	120	240	0	0	235	235	235	

B30. OUTENIQUA

Supply Area	Substation	Transformer Voltages	No. of Trfrs	Trfr Size (MVA)	2015 Installed Transformer (MVA)	Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2017 Installed Transformer (MVA)	Light load	Gx at light load	Revised Year of Trfr Upgrade	Upgrade Status	No. of Trfrs	Trfr Size (MVA)	2022 Installed Transformer (MVA)	Solar REIPPP Gen Allocated (MW)	Wind REIPPP Gen Allocated (MW)	2022 MV Limit MDL (MW)	HV Limit MDL (MW)	2022 HV Area Limit MDL (MW)	2022 CLN Limit MDL (MW)
Outeniqua	Asteria	400/132	0	0	0	2021	Proposed	0	0	0	51	0	2022	Approved	2	500	1000	0	0	980	1650	1650	2725
Outeniqua	Bacchus	400/132	2	500	1000	-	-	2	500	1000	58	94	-	-	2	500	1000	36	58	944	2400	2400	
Outeniqua	Droerivier	400/132	2	120	240	-	-	2	120	240	19	0	-	-	2	120	240	0	0	254	3125	3125	
Outeniqua	Proteus	132/66	2	80	160	-	-	2	80	160	45	0	-	-	2	80	160	0	0	202	160	160	
Outeniqua	Proteus	400/132	2	500	1000	-	-	2	500	1000	105	0	-	-	2	500	1000	0	0	980	1750	1750	
Outeniqua	Komsberg	400/132	-	-	-	-	-	-	-	-	0	419	2020	Approved	1	500	500	0	419	71	2000	2000	

APPENDIX C: 2015 GCCA – 2022 AND 2018 GCCA – 2022 RESULTS FOR LIGHT AND MIDDAY LOAD

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
East London_Pembroke_132/66 kV	490	0	3844	326	2550	2550	2200	-163	2550	-1644	327	2350	2350	2700	-33	100	100	-43	-33	-100	-100	-33
East London_Delphi_400/132 kV	258	1228	3844	336	1950	1950	550	79	722	-3294	336	925	925	1050	30	59	59	-86	30	25	76	30
East London_Neptune_400/132 kV	980	852	3844	1004	1600	1600	550	24	748	-3294	1004	1500	1600	1050	2	88	88	-86	2	-76	61	2
East London_Pembroke_220/66 kV	0	0	3844	169.8	200	200	550	170	200	-3294	170	125	125	1050	100	100	100	-86	100	-100	97	100
East London_Pembroke_220/132 kV	0	0	3844	496	200	200	550	496	200	-3294	496	125	125	1050	100	100	100	-86	100	-100	97	100
East London_Pembroke_400/132 kV	928	780	3844	463	200	200	550	-464	-580	-3294	463	250	250	1050	-50	-74	-74	-86	-50	68	93	-50
East London_Vuyani_400/132 kV	490	984	3844	551	1500	1500	550	61	516	-3294	551	1600	1600	1050	12	52	52	-86	12	-63	58	12
Port Elizabeth_Dedisa_400/132 kV	980	524	4300	1555	1300	2015	1300	575	776	-3000	1555	2200	2200	2200	59	148	285	-70	59	-320	49	59
Port Elizabeth_Grassridge_220/132 kV	680	420	4300	872.6	1300	2650	1300	193	880	-3000	873	2200	2200	2200	28	210	531	-70	28	-424	49	28
Port Elizabeth_Grassridge_400/132 kV	980	1362	4300	1806	750	15	1300	826	-612	-3000	1806	1800	1800	2200	84	-45	-99	-70	84	-32	58	84

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Port Elizabeth_Poseidon_220 /66 kV	39	764	4300	63	1000	1000	1300	24	236	-3000	63	2200	2200	2200	61	31	31	-70	61	-188	49	61
Port Elizabeth_Poseidon_220 /66 kV	39	764	4300	102	1000	1000	1300	63	236	-3000	102	2200	2200	1300	161	31	31	-70	160	-188	49	160
Port Elizabeth_Poseidon_220 /132 kV	90	764	4300	269	1000	1000	1300	179	236	-3000	269	2200	2200	1300	200	31	31	-70	200	-188	49	200
Port Elizabeth_Poseidon_400 /132 kV	19	1260	4300	194	1300	1300	1300	176	40	-3000	194	2200	2200	2200	950	3	3	-70	949	-75	49	949
Port Elizabeth_Poseidon_400 /220 kV	980	1260	4300	1004	1000	1000	1300	24	-260	-3000	1004	2200	2200	2200	2	-21	-21	-70	2	-75	49	2
Bloemfontein_Beta_765/ 400 kV	0	2142	3845	3920	2600	2750	2600	3920	458	-1245	3920	1475	1475	1500	100	21	28	-32	100	31	62	100
Bloemfontein_Boundary_ 275/132 kV	266	1422	4744	490	1150	1150	2600	224	-272	-2144	490	1500	1500	1500	84	-19	-19	-45	84	-5	68	84
Bloemfontein_Harvard_2 75/132 kV	917	670	3845	1068	1050	1050	2600	151	380	-1245	1068	1350	1350	1500	16	57	57	-32	16	-101	65	16
Bloemfontein_Merapi_27 5/132 kV	490	912	3845	532	800	800	2600	42	-112	-1245	532	900	900	1500	9	-12	-12	-32	9	1	77	9
Bloemfontein_Perseus_4 00/275 kV	0	2263	3845	784	1850	1850	2600	784	-413	-1245	784	1750	1475	1500	100	-18	-18	-32	100	23	54	100
Bloemfontein_Perseus_4 00/275 kV	0	2263	3845	784	1850	1850	2600	784	-413	-1245	784	1750	1475	1500	100	-18	-18	-32	100	23	54	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Sasolburg_Mercury_400/132 kV	913	284	1302	1022	2250	2250	2200	109	1966	898	1022	2300	2300	2700	12	692	692	69	12	-710	-77	12
Sasolburg_Makalu_275/88 kV	627	326	3139	744	2550	2550	2200	117	2224	-939	744	2350	2350	2700	19	682	682	-30	19	-621	25	19
Sasolburg_Scafell_275/132 kV	264	303	3139	265	900	900	2200	0	597	-939	265	1100	1100	2700	0	197	197	-30	0	-263	65	0
Welkom_Everest_275/132 kV	980	1055	6365	980	1400	1400	2600	0	345	-3765	980	2800	2800	1800	0	33	33	-59	0	-165	56	0
Welkom Leander 400/132 kV	980	2106	6365	980	1650	1650	2600	0	-456	-3765	980	2700	2600	1800	0	-22	-22	-59	0	-28	58	0
Welkom_Sorata_275/132 kV	245	380	1691	273	0	0	2600	28	-380	909	273	273	273	1800	11	-100	-100	54	11	28	84	11
Welkom_Theseus_400/132 kV	980	3204	6365	1152	1675	1675	2600	172	-1529	-3765	1152	2700	2500	1800	18	-48	-48	-59	18	16	58	18
Tshwane_Lomond_275/88 kV	568	228	1295	692	900	1470	4550	124	672	3255	692	900	1470	4550	22	295	545	251	22	-295	31	22
Tshwane_Pelly_275/132 kV	490	474	860	548	1050	1050	4550	58	576	3690	548	1050	1050	4550	12	122	122	429	12	-122	-22	12
Tshwane_Thuso (Verwoedburg)_400/132 kV	0	500	1295	541	750	750	4550	541	250	3255	541	750	750	4550	100	50	50	251	100	-50	42	100
Tshwane_Wildebees_400/132 kV	0	0	0	650	1450	1450	4550	650	1450	4550	650	1450	1450	4550	100	100	100	100	100	-100	-100	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Tshwane Njala 275/132 kV	0	0	0	1109	1550	1550	4550	1109	1550	4550	1109	1550	1550	4550	100	100	100	100	100	-100	-100	100
Tshwane_Kwagga_275/132 kV	0	0	0	1487	1850	1850	4550	1487	1850	4550	1487	1850	1850	4550	100	100	100	100	100	-100	-100	875
East Rand_Benburg_275/132 kV	735	252	2425	831	950	950	4500	96	698	2075	831	1150	1150	2050	13	277	277	86	13	-356	53	13
East Rand_Brenner_275/88 kV	926	677	2425	1052	3050	3050	4500	126	2373	2075	1052	2950	2025	2050	14	351	351	86	14	-336	-22	14
East Rand_Esselen_132/88 kV	0	0	4932	225.8	225.8	225.8	4500	226	225.8	-432	226	226	226	2050	100	100	100	-9	100	-100	95	100
East Rand_Esselen_275/132 kV	352	545	4932	382	3100	3100	4500	29	2555	-432	382	2050	2050	2050	8	469	469	-9	8	-276	58	8
East Rand_Esselen_275/132 kV	352	545	4932	490	3100	3100	4500	137	2555	-432	490	2050	2050	2050	39%	469	469	-9	39	-276	58	39
East Rand_Esselen_275/88 kV	529	496	4932	686	3100	3100	4500	157	2604	-432	686	2950	2050	2050	30	525	525	-9	30	-495	40	30
East Rand_Nevis_275/132 kV	980	485	2425	1112	3100	3100	4500	132	2615	2075	1112	2950	2050	2050	13	539	539	86	13	-508	-22	13
East Rand_Pieterboth_275/132 kV	617	334	2425	617	1650	1650	4500	0	1316	2075	617	1800	1750	2050	0	394	394	86	0	-439	26	0
Vaal Triangle_Glockner_400/275 kV	0	1024	3139	2352	3100	3100	4500	2352	2076	1361	2352	2800	2800	400	100	203	203	43	100	-173	11	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Vaal Triangle Kookfontein 275/88 kV	926	240	3139	926	750	750	4500	0	510	1361	926	800	800	400	0	213	213	43	0	-233	75	0
Vaal Triangle Olympus 275/132 kV	490	559	3139	525	850	2200	4500	35	291	1361	525	850	750	400	7	52	294	43	7	-52	73	7
Vaal Triangle_Rigi_275/88 kV	926	337	3139	1060	1750	2300	4500	134	1413	1361	1060	500	50	400	14	419	582	43	14	-48	84	14
Vaal Triangle_Snowdon_275/88 kV	470	677	2425	538	3200	3650	4500	68	2523	2075	538	450	450	400	14	373	439	86	14	34	81	14
West Rand_Bernina_275/132 kV	940	699	4242	1067	2100	2100	4950	127	1401	708	1068	1950	1950	2550	13	200	200	17	14	-179	54	14
West Rand_Etna_275/88 kV	616	746	4242	688	2650	2800	4950	72	1904	708	688	3000	2550	4550	12	255	275	17	12	-302	29	12
West Rand_Hera_400/275 kV	0	508	4242	1635	2900	2900	4950	1635	2392	708	1635	3600	3600	4550	100	471	471	17	100	-609	15	100
West Rand_Princess_275/88 kV	926	183	4242	1032	1100	1100	4950	106	917	708	1032	950	950	4550	11	501	501	17	11	-419	78	11
West Rand_Quattro_275/132 kV	980	550	4242	1045	2150	2150	4950	65	1600	708	1045	2600	2600	4550	7	291	291	17	7	-373	39	7
West Rand_Taunus_275/132 kV	980	555	4242	1470	2800	2800	4950	490	2245	708	1470	2500	2500	4550	50	405	405	17	50	-350	41	50
West Rand_Westgate_275/132 kV	980	221	4242	980	1200	1200	4950	0	979	708	980	1650	1650	4550	0	443	443	17	0	-647	61	0

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Johannesburg South Croydon 275/132 kV	735	187	4932	752	1050	1050	3900	17	863	-1032	752	1150	750	925	2	461	461	-21	2	-515	77	2
Johannesburg South_Eiger_275/88 kV	926	440	4932	956	2800	2800	3900	30	2360	-1032	956	2100	925	925	3	536	536	-21	3	-377	57	3
Johannesburg South_Jupiter_275/88 kV	529	496	4932	649	1400	2150	3900	120	904	-1032	649	600	600	925	23	182	333	-21	23	-21	88	23
Johannesburg South_Sebenza_275/88 kV	0	0	0	654	1150	1400	3900	654	1150	3900	654	1950	925	925	100	100	100	100	100	-100	-100	100
Johannesburg South Prospect 275/88 kV	0	0	0	1114	1150	1150	3900	1114	1150	3900	1114	1850	925	925	100	100	100	100	100	-100	-100	100
Johannesburg North_Apollo_400/275 kV	0	1353	1295	-416	4400	4400	6500	-416	3047	5205	-416	4400	4400	6500	100	225	225	402	100	-225	-240	100
Johannesburg North_Apollo_400/275 kV	0	1353	1295	760	4400	4400	6500	760	3047	5205	760	4400	4400	6500	100	225	225	402	100	-225	-240	100
Johannesburg North_Craighall_275/88 kV	926	418	4932	926	1750	1750	6500	0	1332	1568	926	1750	1750	6500	0	319	319	32	0	-319%	65	0
Johannesburg North_Lepini_275/88 kV	980	531	4932	1397	1700	1700	6500	417	1169	1568	1397	1700	1700	6500	43	220	220	32	43	-220	66	43
Johannesburg North_Lulamisa_400/88 kV	926	475	4932	1150	2300	2300	6500	224	1825	1568	1150	2300	2300	6500	24	384	384	32	24	-384	53	24
Johannesburg North_Minerva_400/275 kV	0	1227	1295	3136	5625	5625	6500	3136	4398	5205	3136	5625	5625	6500	100	358	358	402	100	-358	-334	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Johannesburg North Minerva 400/275 kV	0	1227	1295	3136	5170	5170	6500	3136	3943	5205	3136	5170	5170	6500	100	321	321	402	100	-321	-299	100
Empangeni_Athene_400/132 kV	980	517	1585	2649	3800	3800	3700	1669	3283	2115	2649	3950	3950	4000	170	635	635	133	170	-664	-149	170
Empangeni_Impala_275/132 kV	963	528	1585	1111	1250	1250	3700	147	722	2115	1111	1450	1450	4000	15	137	137	133	15	-175	9	15
Empangeni_Invubu_400/275 kV	0	540	1585	2352	3000	3000	3700	2352	2460	2115	2352	3300	3300	4000	100	456	456	133	100	-511	-108	100
Ladysmith Bloukrans 275/132 kV	490	530	1691	490	450	450	1400	0	-80	-291	490	800	800	1400	0	-15	-15	-17	0	-51	53	0
Ladysmith_Danskraal_275/132 kV	245	344	1691	270	550	550	1400	25	206	-291	270	650	650	1400	10	60	60	-17	10	-89	62	10
Ladysmith_Tugela_275/132 kV	343	437	1691	364	700	700	1400	21	263	-291	365	950	950	1400	6	60	60	-17	6	-117	44	6
Ladysmith_Venus_400/275 kV	980	0	1691	1568	5650	5650	1400	588	5650	-291	1568	4150	4150	1400	60	100	100	-17	60	-100	-145	60
Lephalale_Spitskop_275/88 kV	617	195	1220	709	2150	2150	2900	92	1955	1680	314	850	850	4350	15	91	1003	138	-49	-336	30	-49
Lephalale_Spitskop_400/132 kV	980	472	1220	1598	4050	5375	2900	618	3578	1680	784	2050	2050	4350	63	758	1039	138	-20	-334	-68	-20
Lephalale_Spitskop_400/275 kV	0	0	1220	1568	4050	5375	2900	1568	4050	1680	623	1800	1800	4350	100	100	100	138	100	-100	-48	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Lephalale_Warmbad_275/132 kV	245	386	860	250	750	750	2900	5	364	2040	750	1800	1800	4350	2	94	94	237	206	-366	-109	206
Lephalale_Warmbad_132/66 kV	78	0	860	83	83.4	83.4	2900	5	83.4	2040	314	1700	1700	4350	6	100	100	237	301	-100	-98	301
Lephalale_Borutho_400/132 kV	980	348	3018	1100	3600	3600	2900	120	3252	-118	352	4675	4675	2800	12	934	934	-4	-64	-124	-55	-64
Newcastle_Bloedrivier_275/88 kV	314	155	1787	314	750	750	2800	0	595	1013	980	3250	3250	4225	0	384	384	57	213	-1997	-82	213
Newcastle Chivelston 400/275 kV	0	238	1787	784	2700	2700	2800	784	2462	1013	735	1850	1850	4225	100	1034	1034	57	100	-677	-4	100
Newcastle_Incandu_400/132 kV	617	207	1787	623	1800	1900	2800	6	1593	1013	1078	2950	2950	4225	1	770	818	57	75	-1325	-65	75
Newcastle_Incandu_400/132 kV	617	207	1787	750	1800	1900	2800	133	1593	1013	112	112	112	4225	22	770	818	57	-82	46	94	-82
Newcastle_Ingagane_275/88 kV	314	192	1787	314	1250	1250	2800	0	1058	1013	171	1200	1200	4225	0	551	551	57	-45	-525	33	-45
Newcastle_Umfolozi_400/88 kV	314	291	1787	352	4450	4450	2800	38	4159	1013	269	1200	1200	4225	12	1429	1429	57	-14	-312	33	-14
Pinetown_Ariadne_400/132 kV	980	279	4296	980	2900	2900	4650	0	2621	354	2352	4200	4200	4225	0	939	939	8	140	-1405	2	140

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Pinetown_Avon_275/132 kV	735	522	4296	735	1500	1500	4650	0	978	354	78	80	80	4225	0	187	187	8	-89	85	98	-89
Pinetown_Eros_400/132 kV	980	688	4296	1078	2675	2675	4650	98	1987	354	490	2300	2300	4225	10	289	289	8	-50	-234	46	-50
Pinetown_Georgedale_132/88 kV	0	0	0	112	112	112	4650	112	112	4650	532	3425	3425	4225	100	100	100	100	100	-100	-100	100
Pinetown_Georgedale_275/132 kV	735	445	4296	171	1500	1500	4650	-564	1055	354	2394	3462	3462	4225	-77	237	237	8	226	-678	19	226
Pinetown_Georgedale_275/132 kV	735	445	4296	269	1500	1500	4650	-466	1055	354	1195	2150	2150	2150	-63	237	237	8	63	-383	50	63
Pinetown_Hector_400/275 kV	0	663	4296	2352	3150	3150	4650	2352	2487	354	560	1050	350	2150	100	375	375	8	100	-58	76	100
Pinetown_Illovo_132/88 kV	78.4	484	4296	78.4	80	80	4650	0	-404	354	586	900	350	2150	0	-83	-83	8	647	-86	79	647
Pinetown_Illovo_275/132 kV	490	484	4296	490	1900	1900	4650	0	1416	354	586	500	350	2150	0	293	293	8	20	-3	88	20
Pinetown_Mersey_275/132 kV	490	535	4296	532	3200	3200	4650	42	2665	354	954	900	350	2150	9	498	498	8	95	-68	79%	95
Pinetown_Mersey_400/275 kV	0	1071	4296	2394	5100	5500	4650	2394	4029	354	1640	1050	375	2150	100	376	414	8	100	2	76	100
Polokwane_Leseding_400/132 kV	980	785	3018	1195	2150	2150	2150	215	1365	-868	709	2150	650	2900	22	174	174	-29	-28	-174	29	-28

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Polokwane Spencer 275/132 kV	490	306	3018	560	950	950	2150	70	644	-868	1598	2200	650	2850	14	210	210	-29	226	-619	27	226
Polokwane_Tabor_275/132 kV	462	286	3018	586	800	800	2150	123	514	-868	1568	2200	650	2850	27	180	180	-29	239	-669	27	239
Polokwane_Tabor_400/132 kV	490	296	3018	586	500	500	2150	96	204	-868	250	750	750	2850	20	69	69	-29	-49	-153	75	-49
Polokwane_Witkop_400/275 kV	0	602	3018	954	1450	1450	2150	954	848	-868	83	83	83.4	2850	100	141	141	-29	100	86	97	100
Polokwane Witkop 400/132 kV	980	602	3018	1640	1350	1350	2150	660	748	-868	1100	2250	600	2850	67	124	124	-29	12	-274	25	12
Phalaborwa_Senakangwedi B_400/132 kV	980	720	5698	1021	1300	1300	3600	41	580	-2098	1021	1250	1250	3600	4	81	81	-37	4	-74	78	4
Phalaborwa_Senakangwedi B_400/275 kV	0	0	5698	825	850	850	3600	825	850	-2098	825	800	800	3600	100	100	100	-37	100	-100	86	100
Phalaborwa_Acornhoek_275/132 kV	245	472	5698	245	1000	1000	3600	0	528	-2098	245	2250	1950	3600	0	112	112	-37	0	-377	61	0
Phalaborwa_Foskor_275/132 kV	735	373	5698	868	900	900	3600	133	527	-2098	868	900	900	3600	18	141	141	-37	18	-141	84	18
Phalaborwa_Merensky_275/132 kV	490	882	5698	532	2450	2550	3600	42	1568	-2098	532	2550	2550	3600	9	178	189	-37	9	-189	55	9
Phalaborwa_Merensky_400/132 kV	490	0	5698	532	3150	3150	3600	42	3150	-2098	532	3900	3900	3600	9	100	100	-37	9	-100	32	9

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Phalaborwa_Merensky_400/275 kV	0	251	5698	1218	3150	3150	3600	1218	2899	-2098	1218	3900	3900	3600	100	1155	1155	-37	100	-1454	32	100
Phalaborwa_Senakangwedi_275/33	352	143	5698	393.8	1450	1450	3600	41	1307	-2098	394	1400	1400	3600	12	914	914	-37	12	-879	75	12
Phalaborwa_Silimela_400/132	980	680	5698	1019	2150	2150	3600	39	1470	-2098	1019	2400	2400	3600	4	216	216	-37	4	-253	58	4
Middelburg_Rockdale_132/88	0	0	4228	94.4	94.4	94.4	1050	94	94.4	-3178	94	94	94	1350	100	100	100	-75	100	-100	98	100
Middelburg Rockdale 132/88	0	0	4228	104.2	104.2	104.2	1050	104	104.2	-3178	104	104	104	1350	100	100	100	-75	100	-100	98	100
Middelburg_Rockdale_275/132	980	808	4228	996	500	500	1050	16	-308	-3178	996	500	500	1350	2	-38	-38	-75	2	38	88	2
Middelburg_Emkhiweni (Rockdale B)_400/132 kV	0	0	0	980	1500	1500	1050	980	1500	1050	980	3200	3200	1350	100	100	100	100	100	-100	-100	100
Highveld South_Alpha_765/400 kV	0	1216	1574	5880	6425	6550	3150	5880	5209	1576	5880	6425	6550	3150	100	428	439	100	100	-428	-308	100
Highveld South_Sol_400/132 kV	980	374	1574	2021	2200	2200	3150	1041	1826	1576	2021	2200	2200	5350	106	488	488	100	106	-488	-40	106
Highveld South_Mulalo_400/132 kV	0	0	0	2062	2200	2200	3150	2062	2200	3150	2062	2200	2200	5350	100	100	100	100	100	-100	-100	100
Highveld South_Zeus_765/400 kV	0	7325	1574	5880	5650	5650	3150	5880	-1675	1576	5880	5100	5100	5350	100	-23	-23	100	100	30	-224	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Highveld South_Normandie_132/88 kV	157	0	1787	195	1650	1650	3150	38	1650	1363	195	2425	2425	5350	24	100	100	76	24	-100	-36	24
Highveld South_Normandie_400/88 kV	314	0	1787	352	2300	2300	3150	38	2300	1363	352	0	0	5350	12	100	100	76	12	0	100	12
Highveld South_Normandie_400/132 kV	490	162	1787	528	2300	2300	3150	38	2138	1363	528	0	0	5350	8	1320	1320	76	8	100	100	8
Lowveld_Gumeni_400/132 kV	980	690	5698	1005	2300	2300	2300	25	1610	-3398	1005	0	0	0	3	233	233	-60	3	100	100	3
Lowveld Khanyazwe 275/132 kV	245	350	5698	255	800	800	2300	10	450	-3398	255	0	0	0	4	129	129	-60	4	100	100	4
Lowveld_Komatipoort_275/132 kV	245	275	5698	282	750	750	2300	37	475	-3398	282	0	0	0	15	173	173	-60	15	100	100	15
Lowveld_Marathon_132/66 kV	59	0	5698	103	103	103	2300	45	103	-3398	103	0	0	0	76	100	100	-60	75	0	100	75
Lowveld_Marathon_275/132 kV	956	619	5698	1068	1850	1850	2300	113	1231	-3398	1068	0	0	0	12	199	199	-60	12	100	100	12
Lowveld_Prairie_275/132 kV	464	921	4228	479	1550	1550	2300	16	629	-1928	479	0	0	0	3	68	68	-46	3	100	100	3
Lowveld_Simplon_275/132 kV	490	177	5698	530	1000	1000	2300	40	823	-3398	530	0	0	0	8	465	465	-60	8	100	100	8
Witbank_Vulcan_400/132 kV	0	0	0	1105	4400	4400	2350	1105	4400	2350	1105	4075	4075	2550	100	100	100	100	100	-100	-100	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Witbank_Vulcan_400/132 kV	0	0	0	599	4400	4400	2350	599	4400	2350	599	4075	4075	2550	100	100	100	100	100	-100	-100	100
Witbank_Kruispunt_275/132 kV	980	592	4228	980	1150	1150	2350	0	558	-1878	980	1250	1250	2550	0	94	94	-44	0	-111	70	0
Witbank_Vulcan_400/132 kV	0	0	0	2085	4400	4400	2350	2085	4400	2350	2085	4075	4075	2550	100	100	100	100	100	-100	-100	100
Karoo_Hydra_400/220 kV	617	0	3669	617	700	700	1550	0	700	-2119	617	700	700	1550	0	100	100	-58	0	-100	81	0
Karoo Hydra 400/132 kV	980	1722	3669	812	700	700	1550	-168	-1022	-2119	812	700	700	1550	-17	-59	-59	-58	-17	59	81	-17
Karoo_Hydra_400/132 kV	980	1722	3669	0	700	700	1550	-980	-1022	-2119	0	700	700	1550	-100	-59	-59	-58	-100	59	81	-100
Karoo_Hydra_765/400 kV	0	0	3669	1960	5050	5050	1550	1960	5050	-2119	1960	5050	5050	1550	100	100	100	-58	100	-100	-38	100
Karoo_Hydra B_400/132 kV	980	780	3669	535	5050	5050	1550	-445	4270	-2119	535	5050	5050	1550	-45	547	547	-58	-45	-547	-38	-45
Karoo_Kronos_400/132 kV	-209	915	3669	371	1700	1700	1550	580	785	-2119	371	1700	1700	1550	-278	86	86	-58	-278	-86	54	-278
Karoo_Roodekuil_220/132 kV	0	83	3669	122	575	575	1550	123	492	-2119	123	575	575	1550	100	593	593	-58	100	-593	84	100
Karoo_Ruigtevallei_132/66 kV	0	0	3669	59	58.8	58.8	1550	59	58.8	-2119	59	59	59	1550	100	100	100	-58	100	-100	98	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Karoo Ruigtevallei 220/132 kV	0	169	3669	245	245	245	1550	245	76	-2119	245	245	245	1550	100	45	45	-58	100	-45	93	100
Namaqualand_Aggeneis_220/66 kV	39.2	98	2348	33	600	950	1425	-6	502	-923	33	600	950	1425	-16	512	869	-39	-16	-512	74	-16
Namaqualand_Aggeneis_400/220 kV	155	121	2348	640	550	550	1425	485	429	-923	640	550	550	1425	312	355	355	-39	312	-355	77	312
Namaqualand_Aries_400/22 kV	30	116	2348	44	1425	1425	1425	14	1309	-923	44	1425	1425	1425	48	1128	1128	-39	48	-1128	39	48
Namaqualand_Gromis_220/66 kV	78	33	2348	79	400	400	1425	1	367	-923	79	400	400	1425	1	1112	1112	-39	1	-1112	83	1
Namaqualand_Gromis_400/220 kV	0	180	2348	309	700	700	1425	310	520	-923	310	700	700	1425	100	289	289	-39	100	-289	70	100
Namaqualand_Nama_220/66 kV	157	150	2348	112	175	350	1425	-45	25	-923	112	175	350	1425	-29	17	133	-39	-29	-17	93	-29
Namaqualand_Oranjemond_220/66 kV	157	100	2348	157	700	700	1425	0	600	-923	157	700	700	1425	0	600	600	-39	0	-600	70	0
Namaqualand_Paulputs_132/33 kV	0	0	2348	13	13	13	1425	13	12.8	-923	13	13	13	1425	100	100	100	-39	100	-100	99	100
Namaqualand_Paulputs_220/132 kV	373	120	2348	126	425	450	1425	-247	305	-923	126	425	450	1425	-66	254	275	-39	-66	-254	82	-66
Namaqualand_Paulputs_220/132 kV	373	120	2348	493	425	450	1425	120	305	-923	493	425	450	1425	32	254	275	-39	32	-254	82	32

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Namaqualand_Helios_22/66 kV	0	0	0	10	10	10	1425	10	10	1425	10	10	10	1425	100	100	100	100	100	-100	-100	100
Namaqualand_Helios_132/66 kV	0	0	0	19	19.6	19.6	1425	20	20	1425	20	20	20	1425	100	100	100	100	100	-100%	-100	100
Namaqualand_Helios_400/22 kV	39	571	2715	44	700	950	1425	5	129	-1290	44	700	950	1425	13	23	66	-48	12	-23	74	12
Namaqualand_Helios_400/132 kV	146	571	2715	1483	700	950	1425	1337	129	-1290	1483	700	950	1425	915	23	66	-48	915	-23	74	915
Kimberly Upington 400/132 kV	604	680	2348	980	900	1600	2150	376	220	-198	980	900	1600	2150	62	32	135	-8	62	-32	62	38
Kimberly_Ferrum_132/66 kV	0	0	4744	259	259	259	2150	259	259	-2594	259	259	259	2150	100	100	100	-55	100	-100	95	100
Kimberly_Ferrum_275/132 kV	270	427	4744	465	1450	1450	2150	195	1023	-2594	465	1450	1450	2150	72	240	240	-55	72	-240	69	72
Kimberly_Ferrum_400/132 kV	882	974	4744	950	1775	1775	2150	68	801	-2594	950	1775	1775	2150	8	82	82	-55%	8	-82	63	8
Kimberly Garona 275/132 kV	73	241	4744	127	1250	1250	2150	54	1009	-2594	128	1250	1250	2150	73	419	419	-55	74	-419	74	74
Kimberly_Nieuwehoop_400/132 kV	245	750	2348	490	1000	1000	2150	245	250	-198	490	1000	1000	2150	100	33	33	-8	100	-33	57	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Kimberly_Olien_275/132 kV	60	403	4744	347	1350	1350	2150	287	947	-2594	347	1350	1350	2150	480	235	235	-55	480	-235	72	480
Rustenburg_Ararat_275/88 kV	926	143	1929	1021	850	850	2600	95	707	671	1021	900	900	5650	10	494	494	35	10	-529	53	10
Rustenburg_Bighorn_275/88 kV	926	143	1929	1136	2300	2600	2600	210	2157	671	1136	2600	2200	5650	23	1508	1718	35	23	-1718	-35	23
Rustenburg_Bighorn_400/275 kV	973	299	1929	1778	4200	4200	2600	805	3901	671	1778	4200	4200	5650	83	1305	1305	35	83	-1305	-118	83
Rustenburg_Dinaledi_400/132 kV	980	567	1295	1612	4050	4050	2600	632	3483	1305	1612	3950	3950	5650	64	614	614	101	64	-597	-205	64
Rustenburg_Marang_400/88 kV	980	205	1929	1322	2700	2700	2600	343	2495	671	1323	2650	2650	5650	35	1217	1217	35	35	-1193	-37	35
Rustenburg_Ngwedi (Mogwase)_400/132 kV	980	350	1929	1067	3300	3300	2600	87	2950	671	1067	3225	3225	5650	9	843	843	35	9	-821	-67	9
Rustenburg_Trident_275/88 kV	617	149	1929	770	1550	1650	2600	153	1401	671	770	2500	1550	5650	25	940	1007	35	25	-1578	-30	25
Carletonville_Carmel_275/132 kV	980	92	1302	1040	1000	1000	2650	60	908	1348	1040	1100	1100	2650	6	987	987	104	6	-1096	16	6
Carletonville_Hermes_132/88 kV	529	291	1302	596	596.2	596.2	2650	67	305	1348	596	596	596	2650	13	105	105	104	13	-105	54	13

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Carletonville Hermes 400/132 kV	980	291	1302	1606	2400	2400	2650	626	2109	1348	1606	2400	2400	2650	64	725	725	104	64	-725	-84	64
Carletonville_Midas_400/132 kV	980	172	1302	1142	2550	2550	2650	162	2378	1348	1142	2500	2500	2650	17	1383	1383	104	17%	-1353	-92	17
Carletonville_Mookodi_400/132 kV	906	924	4744	1070	1525	1525	2650	164	601	-2094	1070	1450	1450	2650	18	65	65	-44	18	-57	69	18
Carletonville_Pluto_400/275 kV	980	311	1302	1470	4000	4000	2650	490	3689	1348	1470	3750	3750	2650	50	1186	1186	104	50	-1106	-188	50
Carletonville_Watershed_275/132 kV	172	172	1302	245	850	850	2650	74	678	1348	245	800	800	2650	43	394	394	104	43	-365	39	43
Carletonville_Watershed_132/88 kV	353	0	1302	435	435	435	2650	82	434	1348	435	435	435	2650	23	100	100	104	23	-100	67	23
Carletonville_Watershed_275/88 kV	617	0	1302	631	4000	4000	2650	14	4000	1348	631	3750	3750	2650	2	100	100	104	2	-100	-188	2
West Coast_Aurora_400/132 kV	735	1702	2715	899	1650	1650	2150	165	-52	-565	899	1575	1575	2875	22	-3	-3	-21	22	7	42	22
West Coast_Juno_132/66 kV	148	0	2715	120	120	120	2150	-27	120	-565	121	121	121	2875	-18	100	100	-21	-18	-100	96	-18
West Coast_Juno_400/132 kV	980	442	2715	994	2100	3400	2150	14	1658	-565	994	1575	1575	2875	1	375	669	-21	1	-256	42	1
Peninsula Acacia 132/66 kV	0	0	5052	445	445	445	5575	445	445.2	523	445	445	445	4450	100	100	100	10	100	-100	91	100

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Peninsula Acacia 400/132 kV	980	729	5052	1680	3700	3700	5575	700	2971	523	1680	3700	3700	4450	71%	408%	408%	10%	71%	-408	27%	71%
Peninsula_Muldersvlei_132/66 kV	156.8	0	5052	259.2	4750	4750	5575	102	4750	523	259	2375	2375	4450	65	100	100	10	65	-100	53	65
Peninsula_Muldersvlei_400/132 kV	980	729	5052	1572	4750	4750	5575	592	4021	523	1572	2375	2375	4450	60	552	552	10	60	-226	53	60
Peninsula_Philippi_400/132 kV	980	729	5052	1195	1950	1950	5575	215	1221	523	1195	1450	1450	4450	22	167	167	10	22	-99	71	22
Peninsula_Pinotage_400/132 kV	980	605	5052	1088	1500	1500	5575	108	895	523	1088	1500	1500	4450	11	148	148	10	11	-148	70	11
Peninsula_Sterrekus_765/400 kV	0	562	5052	1960	3100	3100	5575	1960	2538	523	1960	3100	3100	4450	100	452	452	10	100	-452	39	100
Peninsula_Stikland_400/132 kV	980	528	5052	1680	3100	3100	5575	700	2572	523	1680	3100	3100	4450	71	487	487	10	71	-487	39	71
Outeniqua_Agullas_400/132 kV	980	550	3460	980	1650	1650	4850	0	1100	1390	980	1650	1650	2725	0	200	200	40	0	-200	52	0
Outeniqua_Asteria_400/132 kV	0	0	0	1031	1650	1650	4850	1031	1650	4850	1031	1650	1650	2725	100	100	100	100	100	-100	-100	100
Outeniqua_Bacchus_400/132 kV	888	924	3460	1009	3300	3300	4850	121	2376	1390	1009	2400	2400	2725	14	257	257	40	14	-160	31	14
Outeniqua_Droerivier_400/132 kV	235	951	3460	204	4875	4875	4850	-31	3924	1390	204	3125	3125	2725	-13	413	413	40	-13	-229	10	-13

Province and Substation Name	2015 GCCA 2022			2018 GCCA - 2022 Light Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)			2018 GCCA - 2022 Midday Load				%Variance 2015 GCCA vs 2018 GCCA (Light Load)				%Variance 2015 GCCA vs 2018 GCCA (Midday Load)			
2018 Province & Substation	2022 MV Limit (MW)	2022 HV Limit (MW)	2022 CLN Limit (MW)	2022 MV Limit LL (MW)	2022 HV Limit LL (MW)	2022 HV Limit LL (MW)	2022 CLN Limit LL (MW)	2022 MV Limit Variance (MW)	2022 HV Limit Variance (MW)	Variance 2022 CLN Limit LL (MW)	2022 MV Limit MDL(MW)	2022 HV Limit (MDL)	2022 HV Area Limit MDL (MW)	2022 MW CLN Limit MDL (MW)	MV LL Limit %Variance	HV LL Limit %Variance	HV LL Limit Area %Variance	CLN LL Limit %Variance	MV MDL Limit %Variance	HV MDL Limit %Variance	HV MDL Limit Area %Variance	CLN MDL Limit %Variance
Outeniqua_Kappa_765/400 kV	0	910	3460	1960	3700	3700	4850	1960	2790	1390	1960	2625	3700	2725	100	307	307	40	100	-188	24	100
Outeniqua_Proteus_132/66 kV	157	0	3460	291	160	160	4850	134	160	1390	291	160	160	2725	85	100	100	40	86	-100	95	86
Outeniqua_Proteus_400/132 kV	980	485	3460	1114	1200	1200	4850	134	715	1390	1114	1750	1750	2725	14	147	147	40	14	-261	49	14
Outeniqua_Komsberg_400/132 kV	0	0	0	317	1300	1300	4850	317	1300	4850	317	2000	2000	1350	100	100	100	100	100	-100	-100	100

APPENDIX D: EXISTING AND PROPOSED TRANSMISSION LINES BY 2022

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Komati Matla deviation	**1.80**	0.0	**1.8**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.8**	Energised	Energised
Apollo Dinaledi	**11.60**	0.0	0.0	**11.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**11.6**	Energised	Energised
Kusile: Duvha - Minerva line Deviation	**10.90**	0.0	0.0	**10.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**10.9**	Energised	Energised
Tabor Spencer	**86.00**	0.0	0.0	0.0	**86.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**86.0**	Energised	Energised
Zeus bypass: Sol Camden	**1.30**	0.0	0.0	0.0	0.0	0.0	**1.3**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**	Energised	Energised
Duvha Leseding	**205.60**	0.0	0.0	0.0	0.0	0.0	0.0	**205.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**205.6**	Energised	Energised
Lowveld: Marathon Komatipoort 275kV turn in	**1.20**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**	Energised	Energised
Kusile: Kusile Minerva 400kV line (Kusile loop 1)	**3.34**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.3**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.3**	Energised	Energised
Kusile: Kusile Duvha No1 400kV line (Kusile loop 1)	**5.65**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.6**	Energised	Energised
Medupi Spitskop 1	**186.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**186.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**186.0**	Energised	Energised
Medupi Spitskop 2	**188.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**188.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**188.0**	Energised	Energised

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Medupi Marang	**280.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**280.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**280.0**	Energised	Energised
Spitskop Dinaledi 1	**117.55**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**117.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**117.5**	Energised	Energised
Spitskop Dinaledi 2	**110.30**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**110.3**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**110.3**	Energised	Energised
HPM: 132kV interconnecting line	**18.70**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**18.7**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**18.7**	Energised	Energised
Lowveld Strengthening Scheme: Hendrina Gumeni 400kV line	**83.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**83.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**83.0**	Energised	Energised
Kusile: Kusile loop 2 (Kusile - Apollo, Kusile - Kendal)	**6.90**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.9**	Energised	Energised
Anglo deviation	**1.88**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.9**	Energised	Energised
Kusile: Vulcan bypass (Kendal Arnot, Duvha Vulcan)	**1.71**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**	0.0	0.0	0.0	0.0	0.0	0.0	**1.7**	Energised	Energised
Medupi: Borutho loop in lines	**1.21**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.2**	Energised	Energised
Kusile: Kusile Vulcan No1 400kV Line (Duvha bypass)	**1.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.0**	0.0	0.0	0.0	**0.0**	**Future**	**2019/20**
Medupi: Medupi Masa	**40.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**40.0**	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/19**
Medupi: Ngwedi loop in lines	**56.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/18**

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Medupi: Borutho Witkop	**48.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/18**
Kusile: Kusile Zeus 400kV (Kendal Bypass)	**73.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/19**
Kusile: Kendal Zeus 1st 400kV line	**74.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/19**
Kusile Lulamisa 400kV line	**95.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.0	0.0	0.0	0.0	**0.0**	**Furture**	**2019/20**
Medupi: Medupi Borutho	**175.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	175.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/19**
Highveld North West Lowveld North: Manogeng Silimela	**78.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	0.0	**0.0**	**Future**	**2019/20**
Highveld North West Lowveld North: Duvha-Silimela and Leseding Silimela LILO	**34.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	0.0	0.0	0.0	**0.0**	**Future**	**2019/20**
Majuba – Umfolozi	**214.90**	0.0	0.0	0.0	0.0	**214.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**214.9**	**Energised**	**Energised**
Perseus - Hydra	**304.21**	0.0	0.0	0.0	0.0	0.0	**304.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**304.2**	**Energised**	**Energised**
Hydra Gamma 765kV line	**125.70**	0.0	0.0	0.0	0.0	**125.7**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**125.7**	**Energised**	**Energised**
Zeus - Mercury	**293.46**	0.0	0.0	0.0	0.0	0.0	0.0	**293.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**293.5**	**Energised**	**Energised**
Mercury – Perseus	**234.00**	0.0	0.0	0.0	0.0	0.0	0.0	**234.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**234.0**	**Energised**	**Energised**

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Hydra Gamma 1st 765kV	**127.70**	0.0	0.0	0.0	0.0	0.0	**127.7**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**127.7**	Energised	Energised
Gamma - Kappa Line Sec A	**182.91**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**182.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**182.9**	Energised	Energised
Koeberg Muldervlei 400kV	**3.14**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.1**	Energised	Energised
Gamma - Kappa Line Sec B	**187.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**187.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**187.0**	Energised	Energised
Kappa Turn in	**13.90**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**13.9**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**13.9**	Energised	Energised
Kappa Sterrekus A B and C	**173.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**173.0**	0.0	0.0	0.0	0.0	0.0	0.0	**173.0**	Energised	Energised
Masa Ngwedi 1 and 2	**400.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
Ankerlig Sterrekus 400kV Line	**18.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
KZN 765kV Empangeni Strengthening: Tutuka - Lambda & Majuba – Lambda 400kV Lines	**27.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.0	0.0	0.0	**0.0**	**Future**	**2020/2021**
KZN 765kV Empangeni Strengthening: Umfolozi – Mbewu 765kV Line	**98.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.0	0.0	0.0	**0.0**	**Future**	**2020/2021**
KZN 765kV Empangeni Strengthening: Mbewu 400kV Loop in/ out's	**4.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	**0.0**	**Future**	**2020/2021**

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
KZN 765kV Empangeni Strengthening: Mbewu – Invubu 2nd 400kV Line	**30.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	**0.0**	**Future**	**2020/2021**
OCGT: Gourikwa	**20.50**	**20.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**20.5**	**Energised**	**Energised**
OCGT: Ankerlig	**11.60**	**11.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**11.6**	**Energised**	**Energised**
CSWG: Palmiet - Stikland line	**56.00**	0.0	**56.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**56.0**	**Energised**	**Energised**
Southern Grid: Beta - Delphi	**417.00**	**365.0**	**52.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**417.0**	**Energised**	**Energised**
PE Strengthening: Dedisa Grass ridge line	**6.20**	0.0	0.0	**6.2**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.2**	**Energised**	**Energised**
PE Strengthening: Dedisa Poseidon line	**7.00**	0.0	0.0	**7.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7.0**	**Energised**	**Energised**
PE Strengthening: Grassridge Poseidon line	**100.50**	0.0	0.0	0.0	**100.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**100.5**	**Energised**	**Energised**
Ferrum - Garona - 275kV line	**0.65**	0.0	0.0	0.0	0.0	0.0	**0.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.6**	**Energised**	**Energised**
Lewensaar - Ferrum - 275kV	**0.07**	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**	**Energised**	**Energised**
Lewensaar 275kV Line – Garona	**0.07**	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**	**Energised**	**Energised**
Lewensaar 88kV Line	**9.59**	0.0	0.0	0.0	0.0	0.0	0.0	**9.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**9.6**	**Energised**	**Energised**

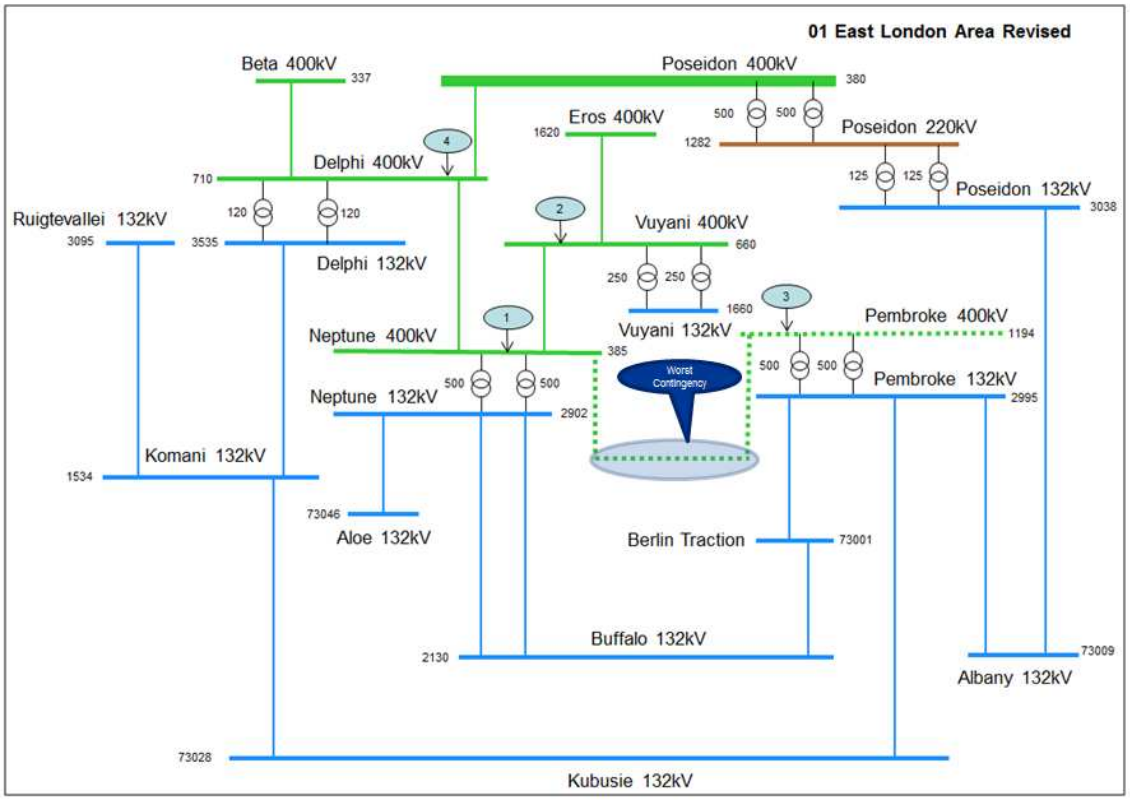
Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Tabor-Witkop 400kV line	**96.59**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**96.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**96.6**	Energised	Energised
Neptune - Vuyani 400kV line	**183.67**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**183.7**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**183.7**	Energised	Energised
Ferrum - Mookodi - 400kV line	**199.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**199.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**199.0**	Energised	Energised
Mercury Mookodi 400kV line	**228.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**228.0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**228.0**	Energised	Energised
Aries Nieuwehoop Line	**67.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**67.0**	0.0	0.0	0.0	0.0	0.0	0.0	**67.0**	Energised	Energised
Gromis Oranjemund 400kV line	**130.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
Ankerlig Koeberg line	**5.10**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
Upington Strengthening Ph1: Aries-Upington	**89.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/2018**
Ferrum Nieuwehoop	**260.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	260.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/2018**
Ingula Venus Line	**115.26**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**115.3**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**115.3**	Energised	Energised
Verwoerdburg Loop-in / out	**4.60**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4.6**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4.6**	Energised	Energised
Eros-Vuyani Line	**167.10**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**167.1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**167.1**	Energised	Energised
Kookfontein 3rd Transformer line to	**2.50**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.5**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.5**	Energised	Energised

Line Name / Grid	TOTALAC KM	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	Total km's Energized	Total Km's to be energized	Energization planned for Quarter
Glockner																					
Dedisa Grassridge 132kV Line	**6.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/2018**
Bloemfontein Strengthening Phase 1B: Eve	**130.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2017/2018**
KZN Pinetown Strengthening - Ariadne/Eros	**294.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	294.0	0.0	0.0	0.0	**0.0**	**Future**	**2019/2020**
KZN Pinetown Strengthening - Ariadne/Venus	**137.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	137.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
Vaal Strengthening phase 2B: Etna Glockner	**60.00**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	0.0	0.0	0.0	**0.0**	**Future**	**2018/2019**
Power Delivery Projects	**7237.5**	**397.1**	**109.8**	**35.7**	**186.5**	**340.6**	**433.9**	**742.8**	**292.8**	**1204.1**	**890.5**	**241.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4875.4**	**0.0**	

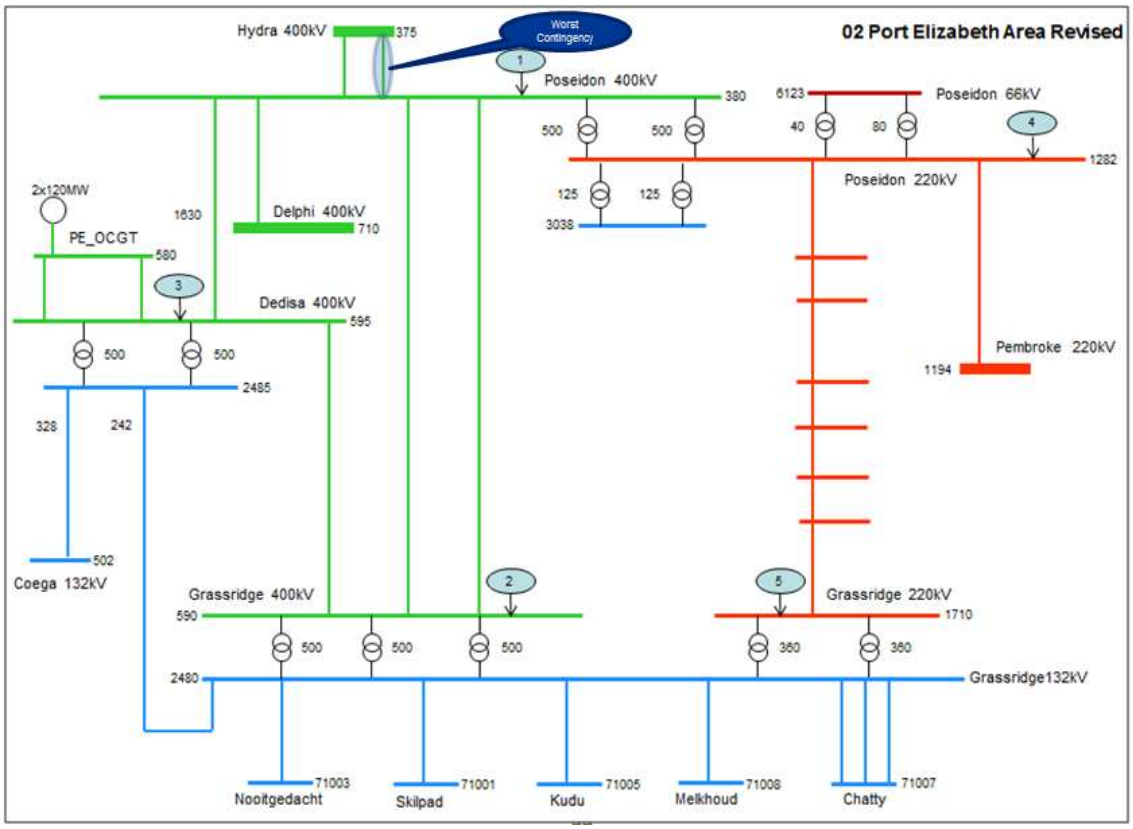
APPENDIX E: CUSTOMER LOAD NETWORK (CLN) SINGLE LINE DIAGRAMS

Interface line shown by being connected to a thicker substation busbar, indicating that it is outside of the CLN. The single line diagrams also show the worst contingency in each CLN, highlighted by a blue oval, which is the one limiting the available generation connection capacity.

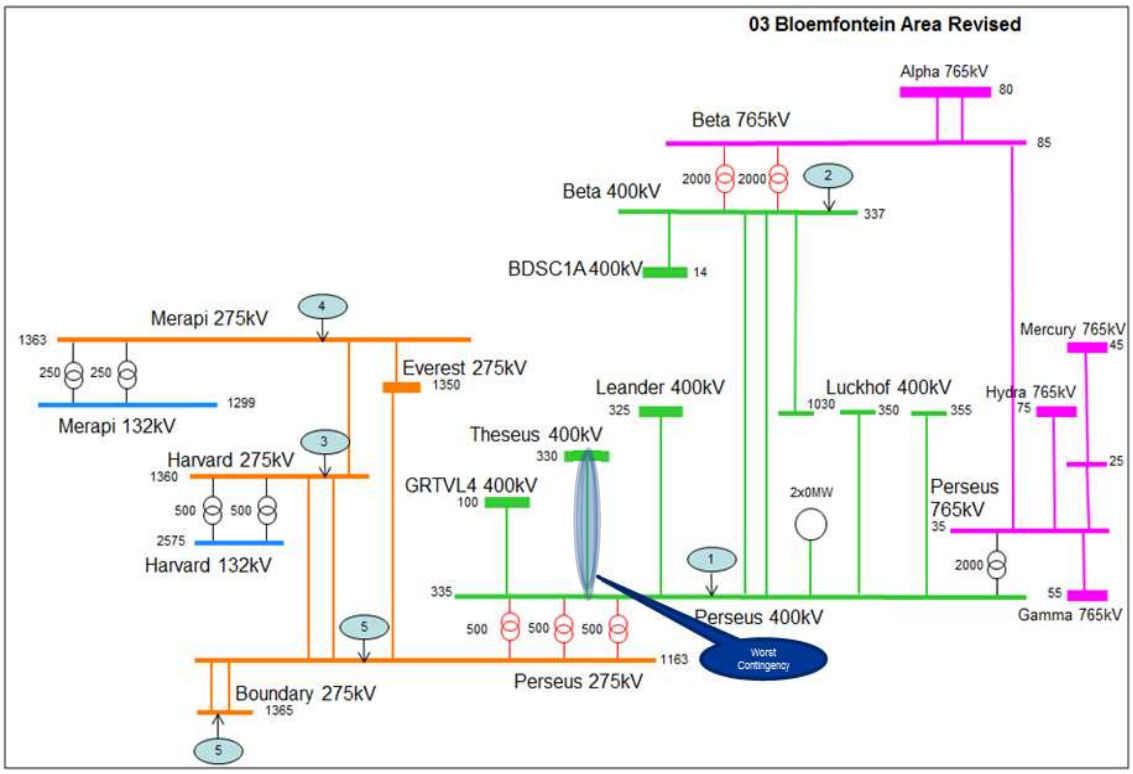
E1. EAST LONDON SINGLE LINE DIAGRAM



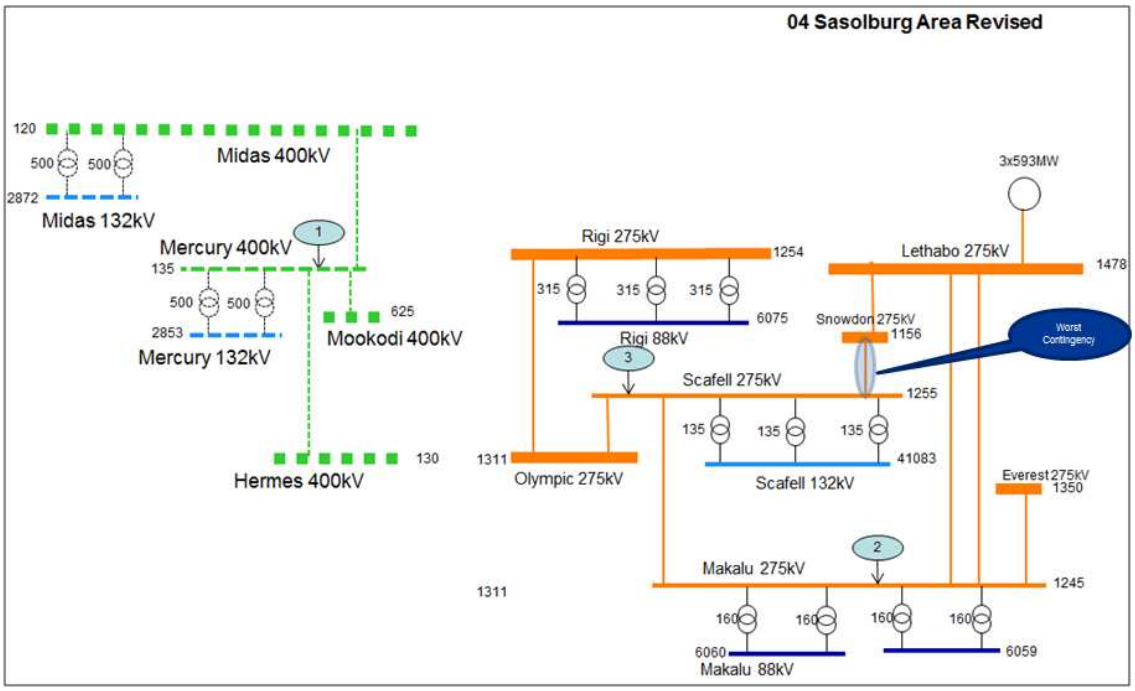
E2. PORT ELIZABETH SINGLE LINE DIAGRAM



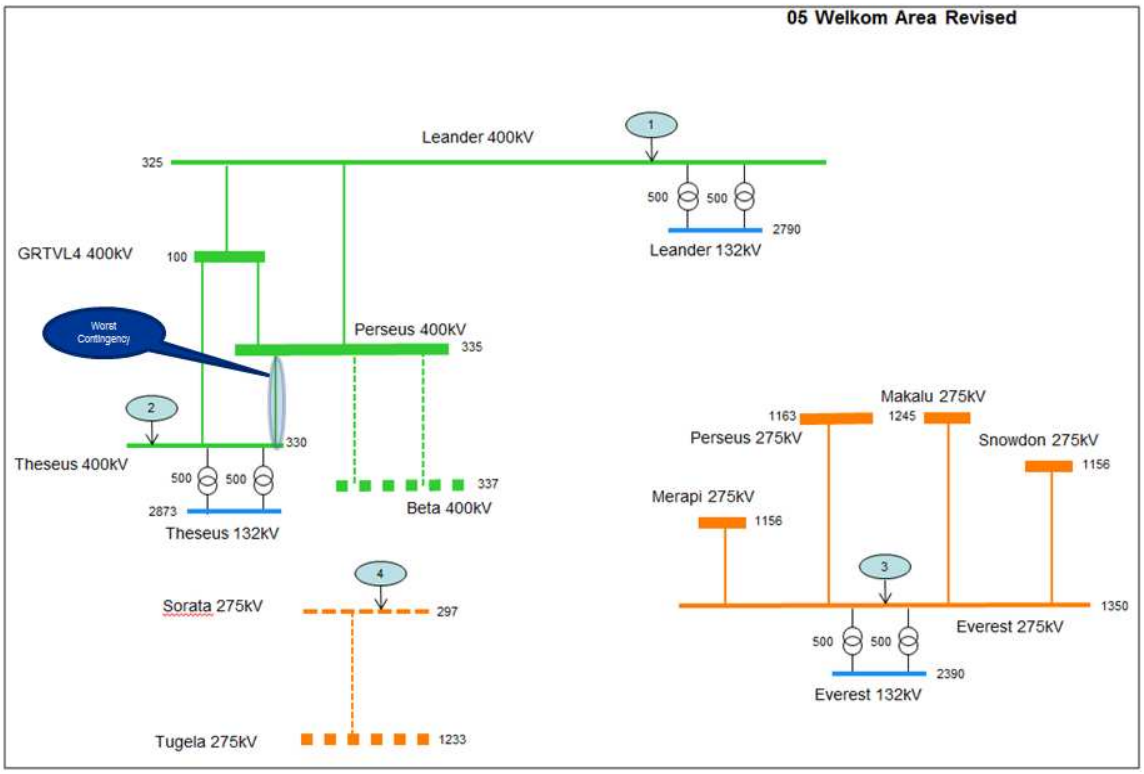
E3. BLOEMFONTEIN SINGLE LINE DIAGRAM



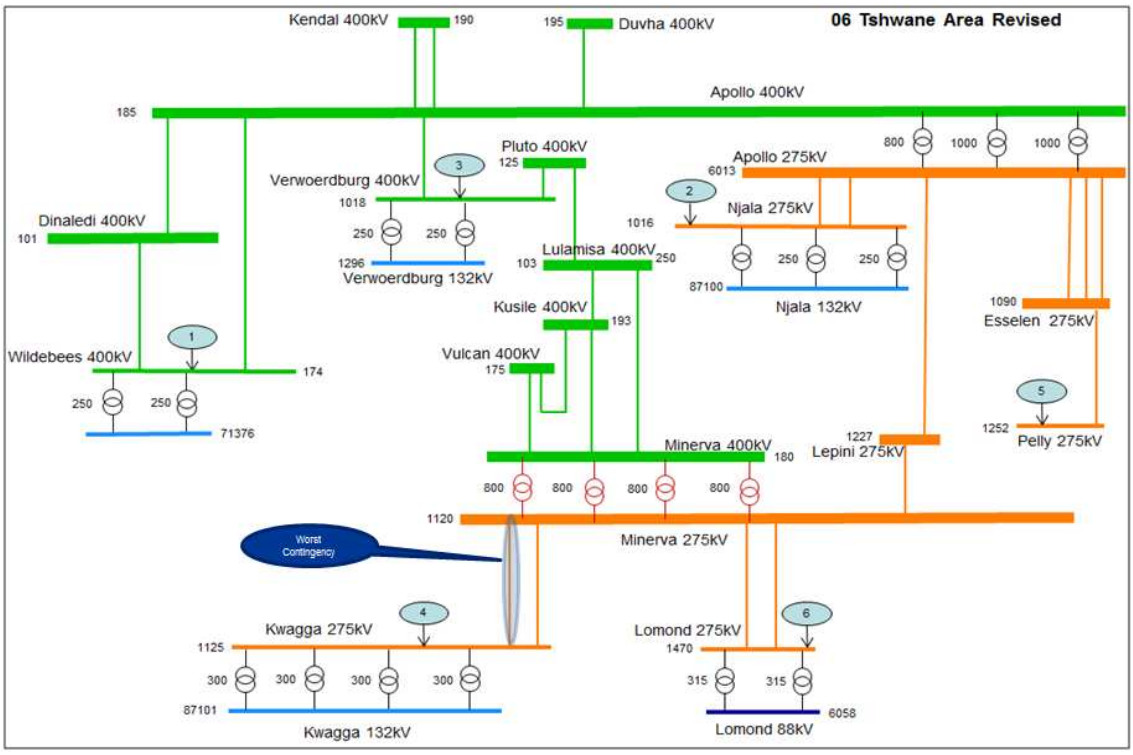
E4. SASOLBURG SINGLE LINE DIAGRAM



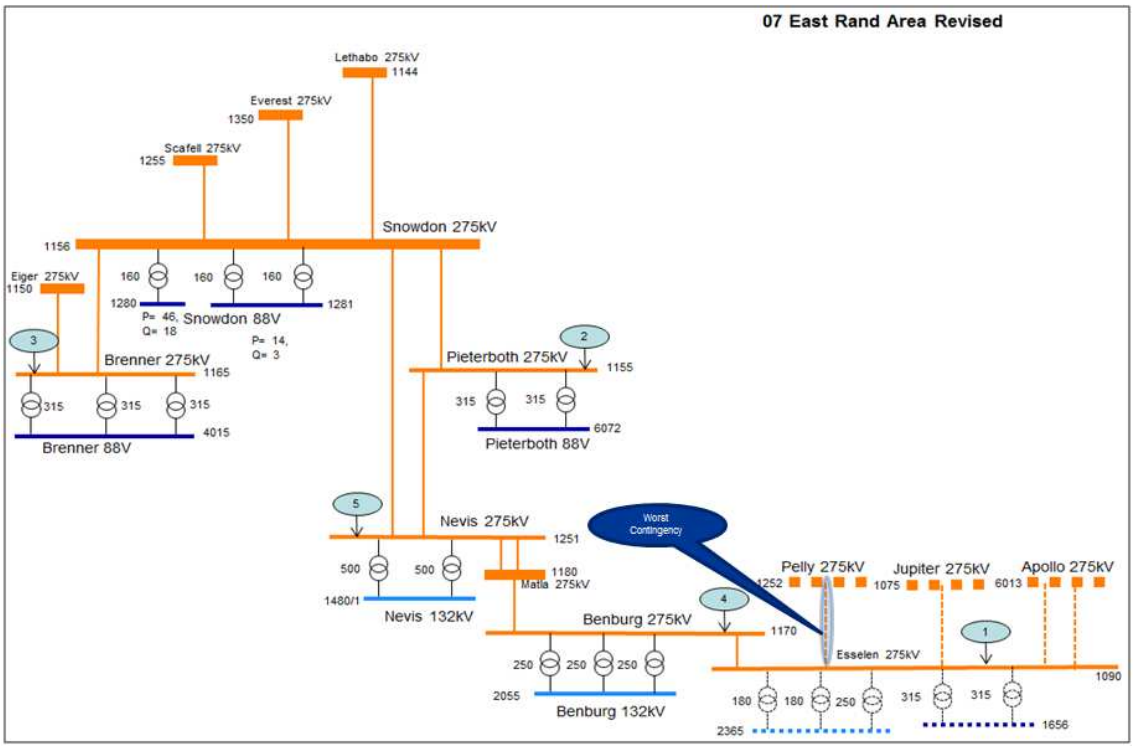
E5. WELKOM SINGLE LINE DIAGRAM



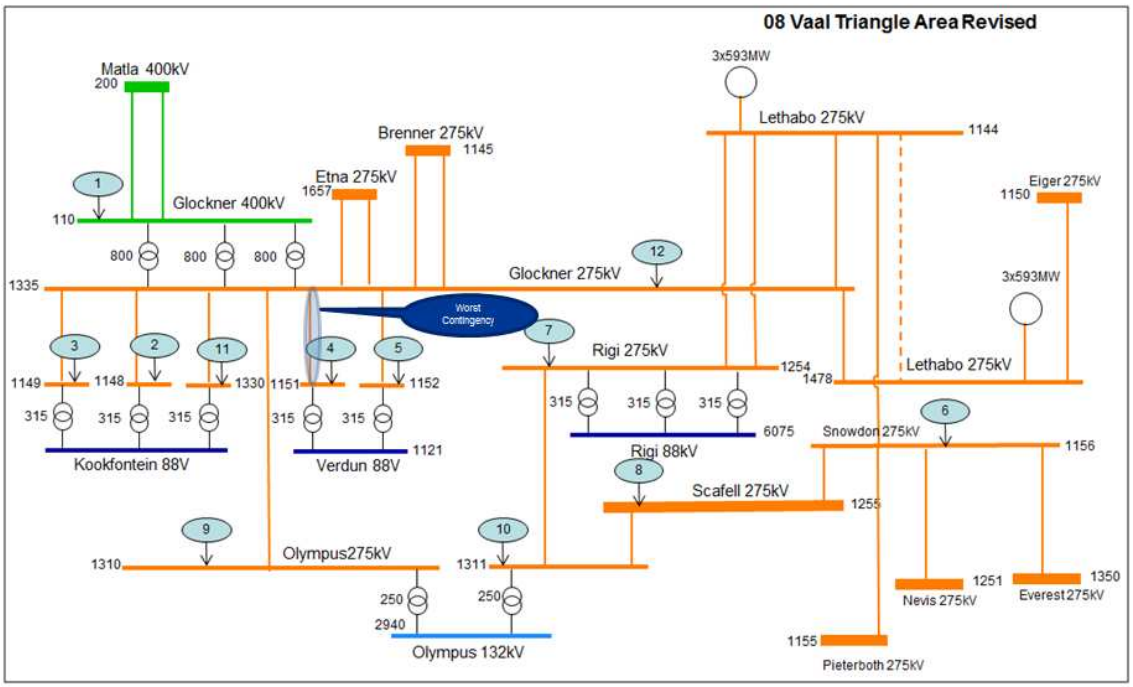
E6. TSHWANE SINGLE LINE DIAGRAM



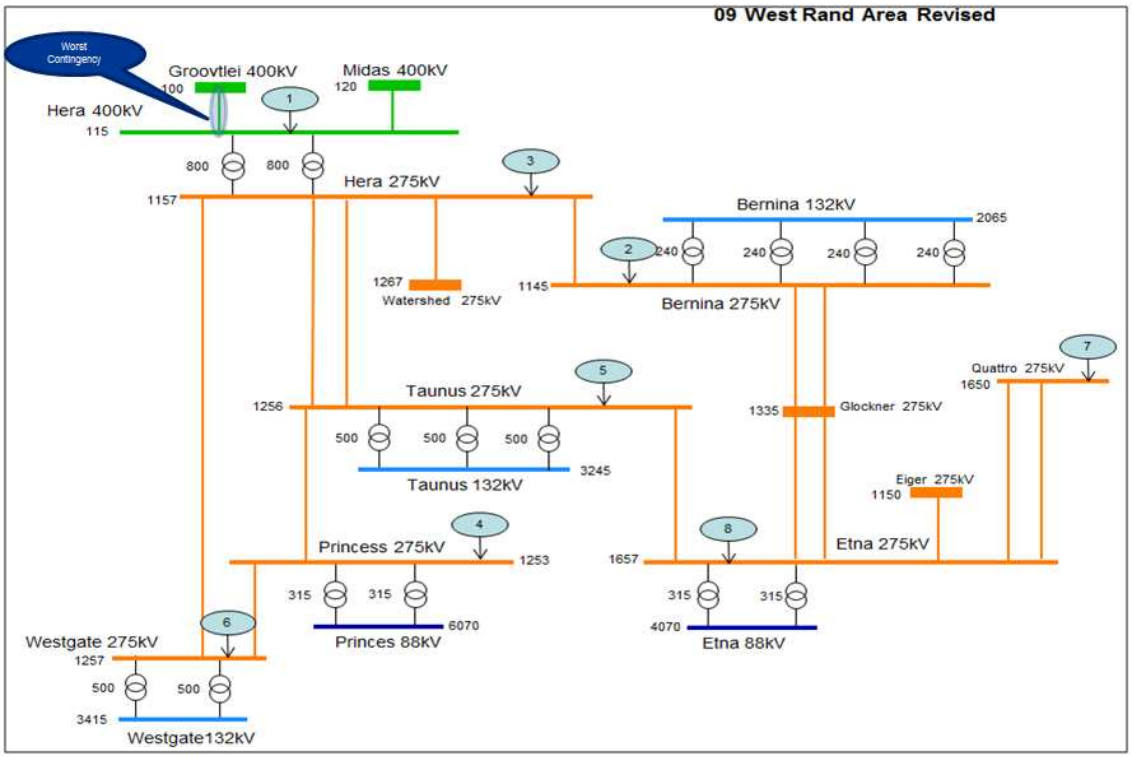
E7. EAST RAND SINGLE LINE DIAGRAM



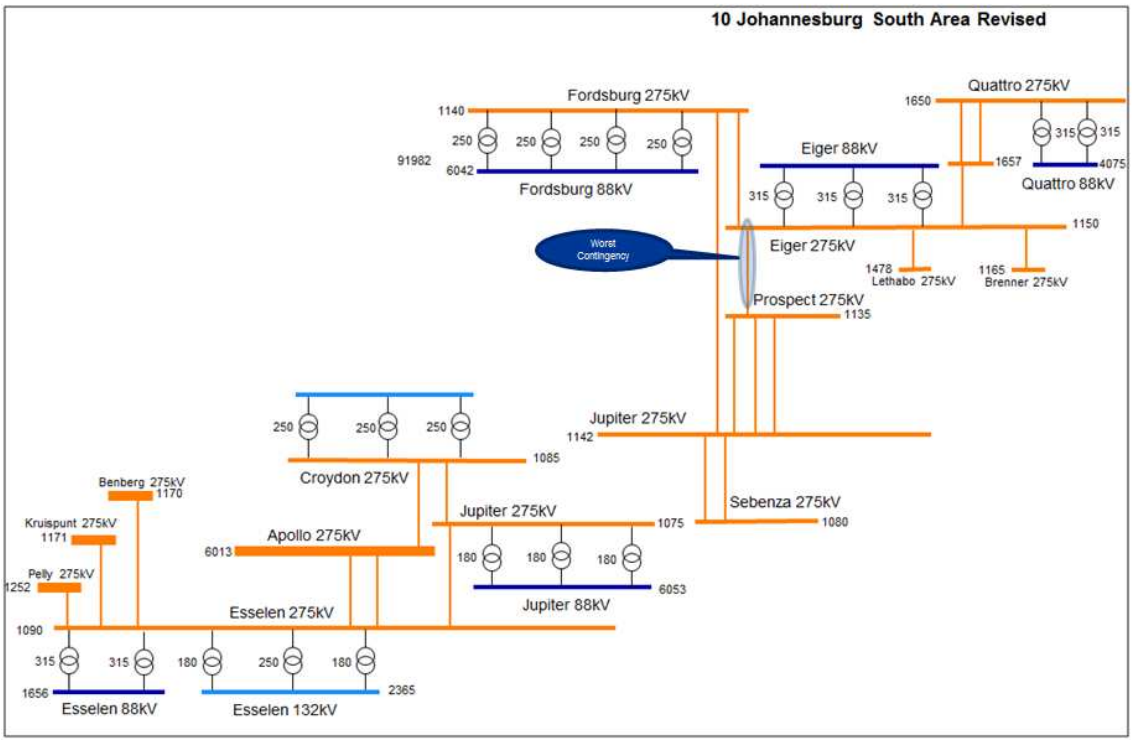
E8. VAAL TRIANGLE SINGLE LINE DIAGRAM



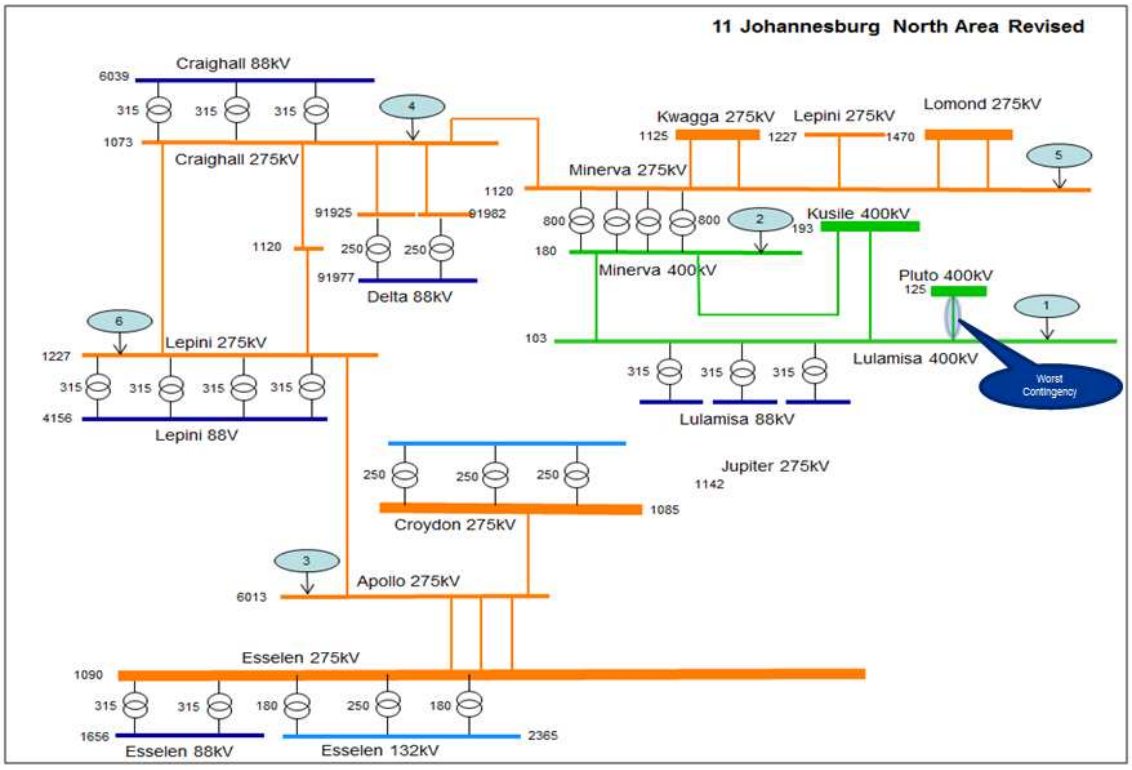
E9. WEST RAND SINGLE LINE DIAGRAM



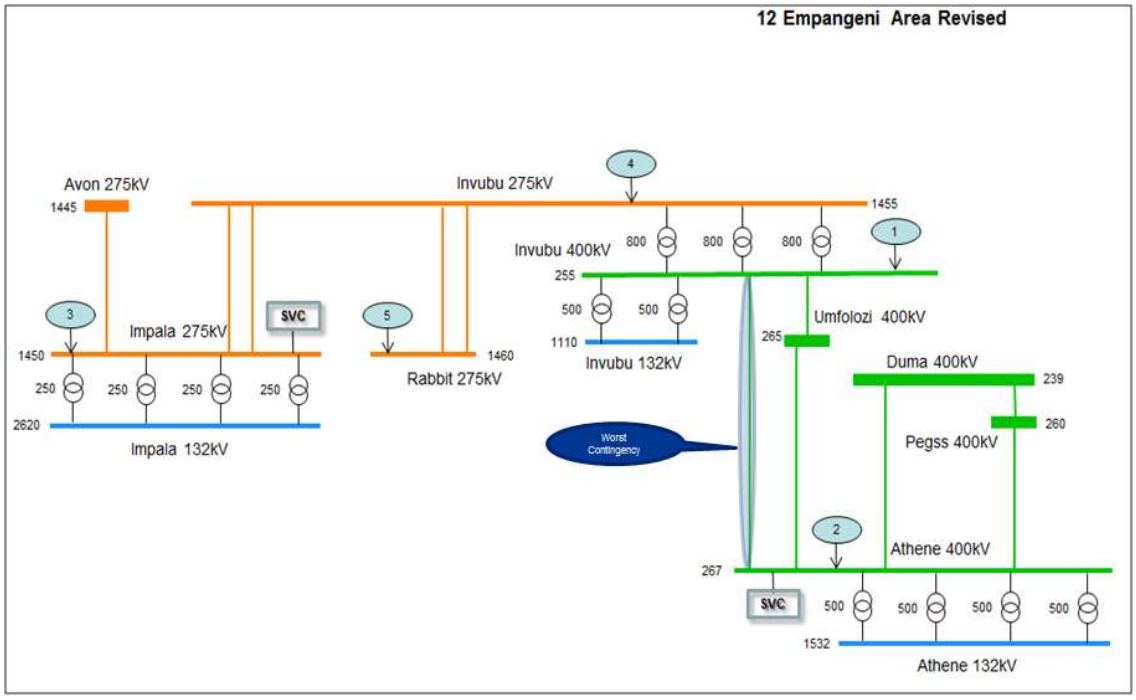
E10. JOHANNESBURG SOUTH SINGLE LINE DIAGRAM



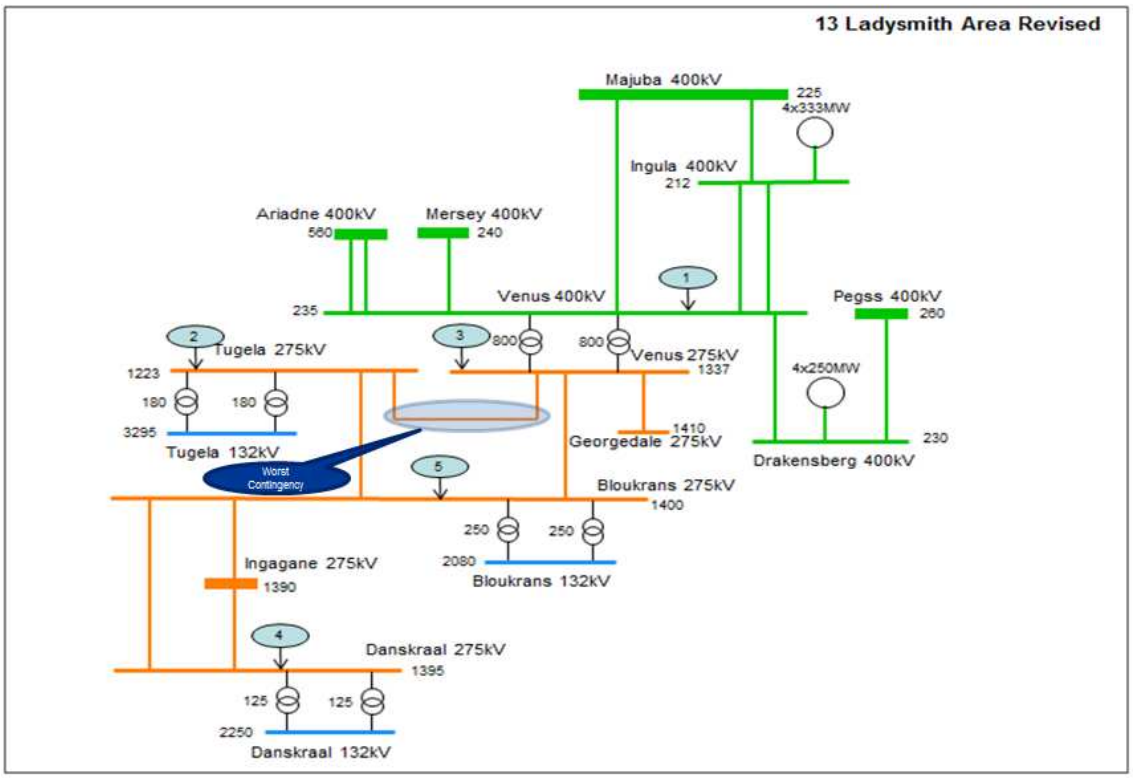
E11. JOHANNESBURG NORTH SINGLE LINE DIAGRAM



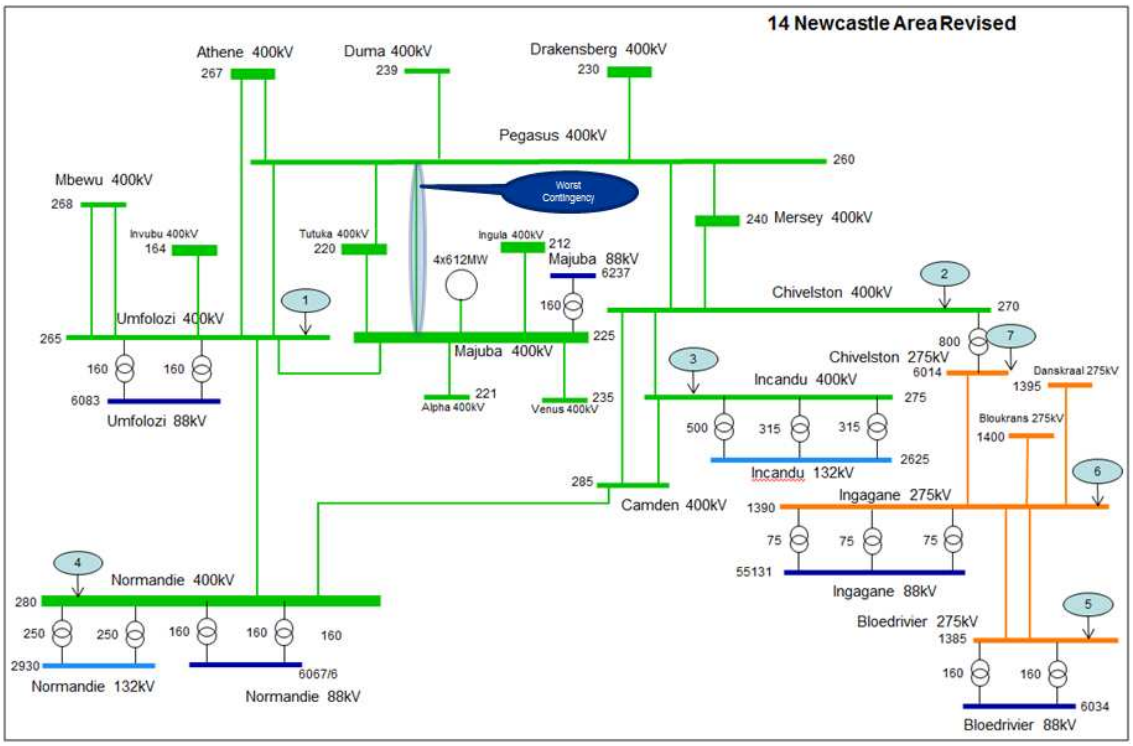
E12. EMPANGENI SINGLE LINE DIAGRAM



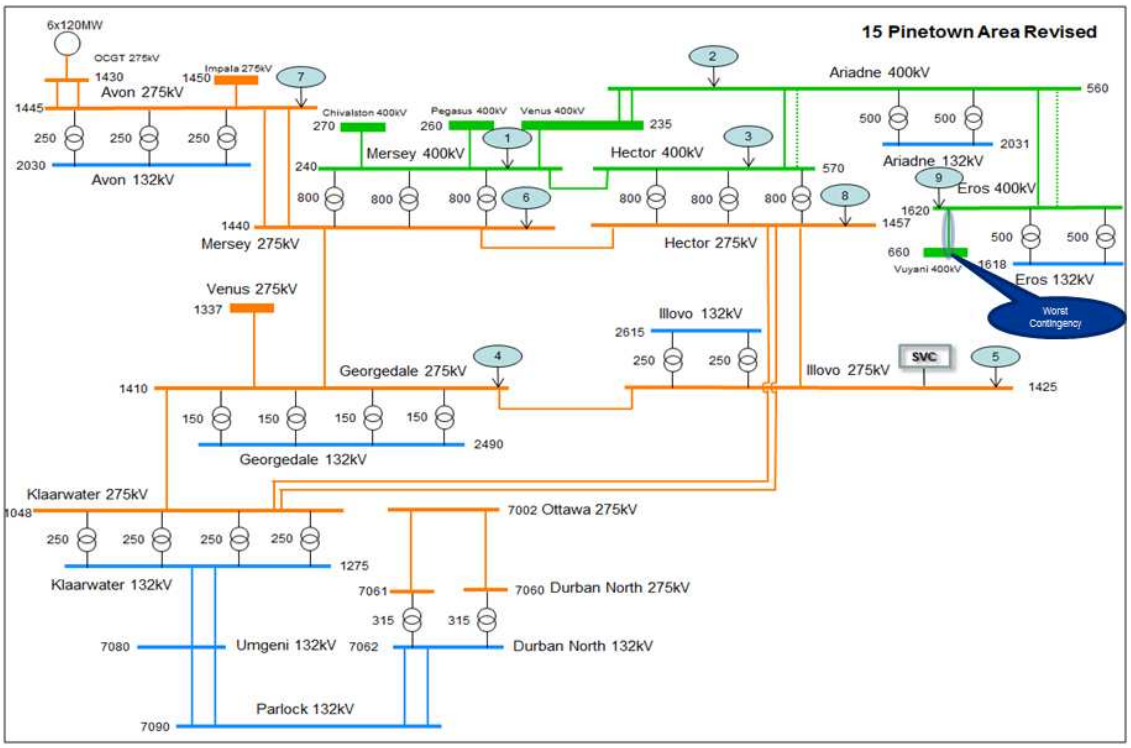
E13. LADYSMITH SINGLE LINE DIAGRAM



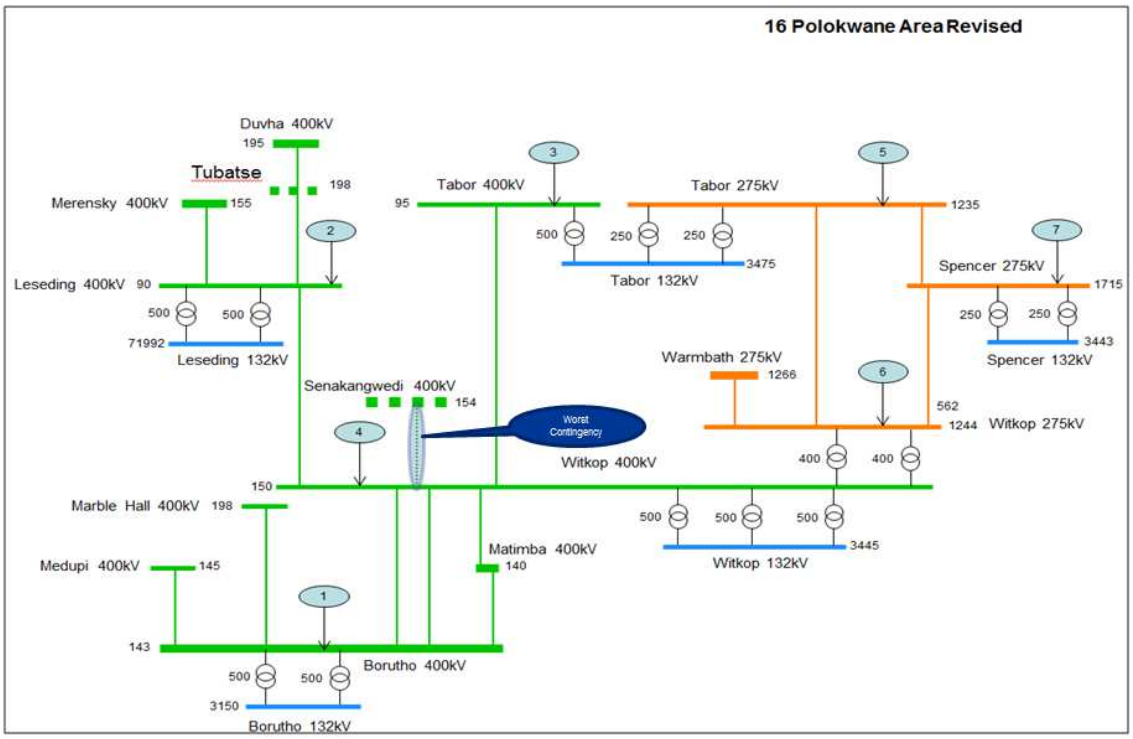
E14. NEWCASTLE SINGLE DIAGRAM



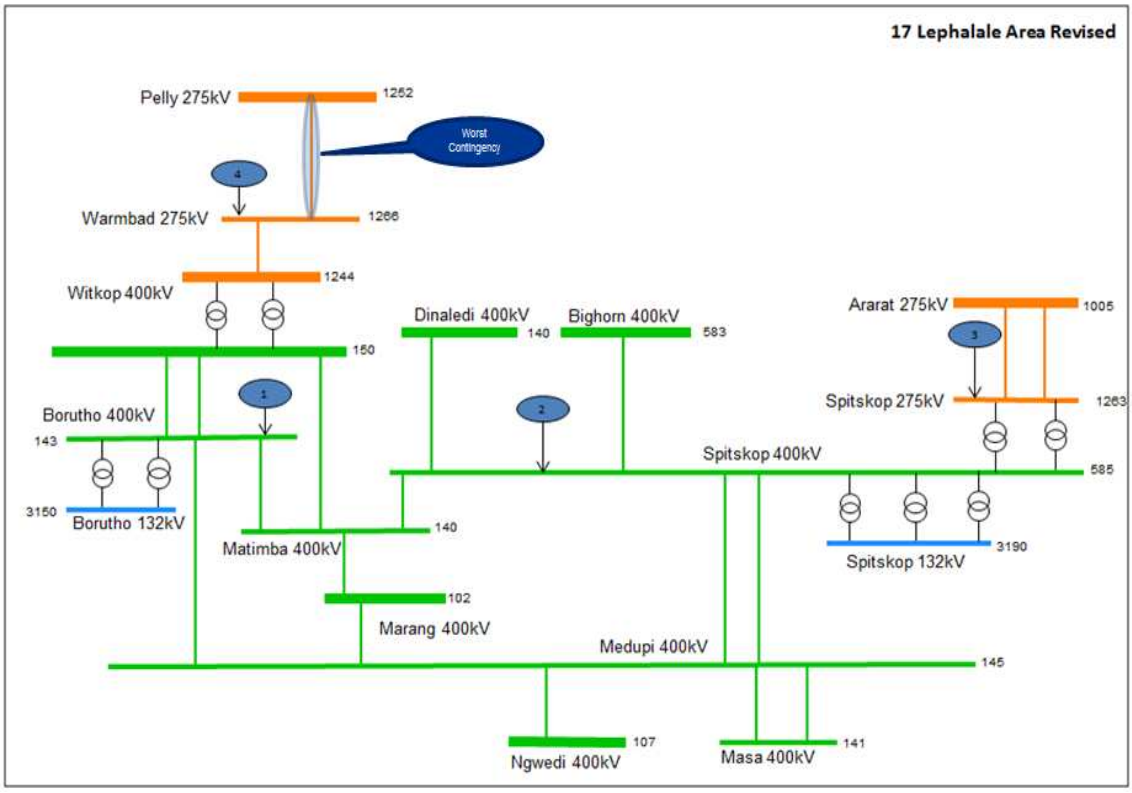
E15. PINETOWN SINGLE DIAGRAM



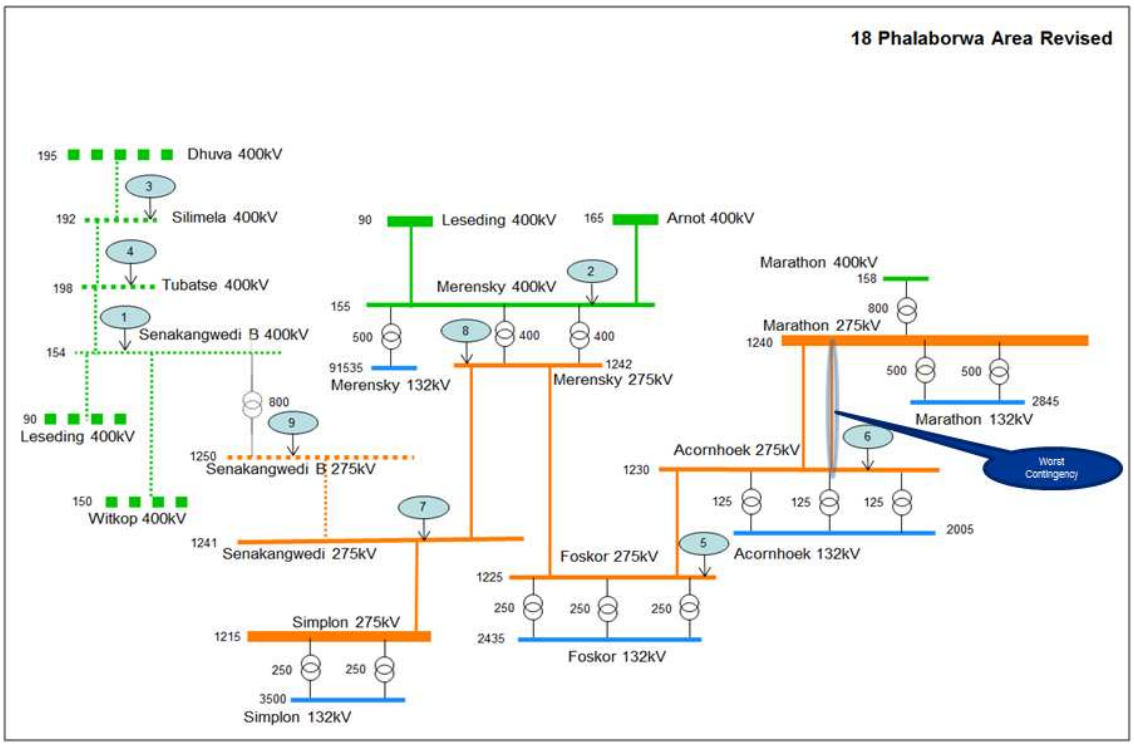
E16. POLOKWANE SINGLE LINE DIAGRAM



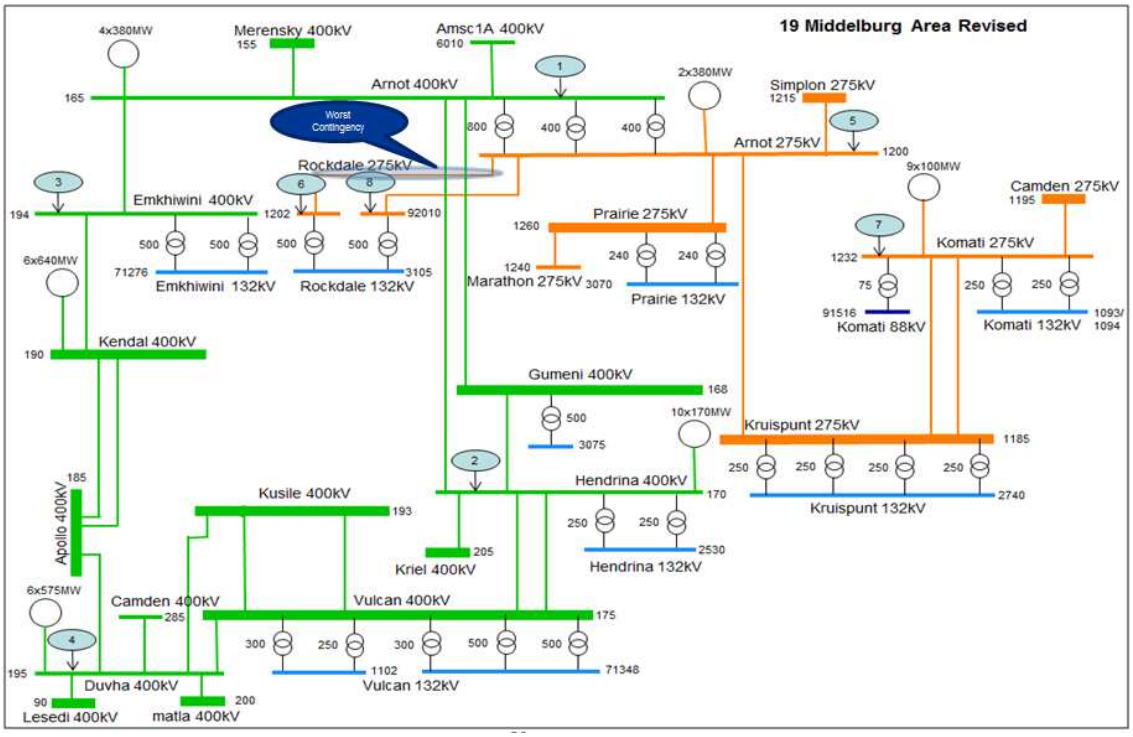
E17. LEPHALALE SINGLE LINE DIAGRAM



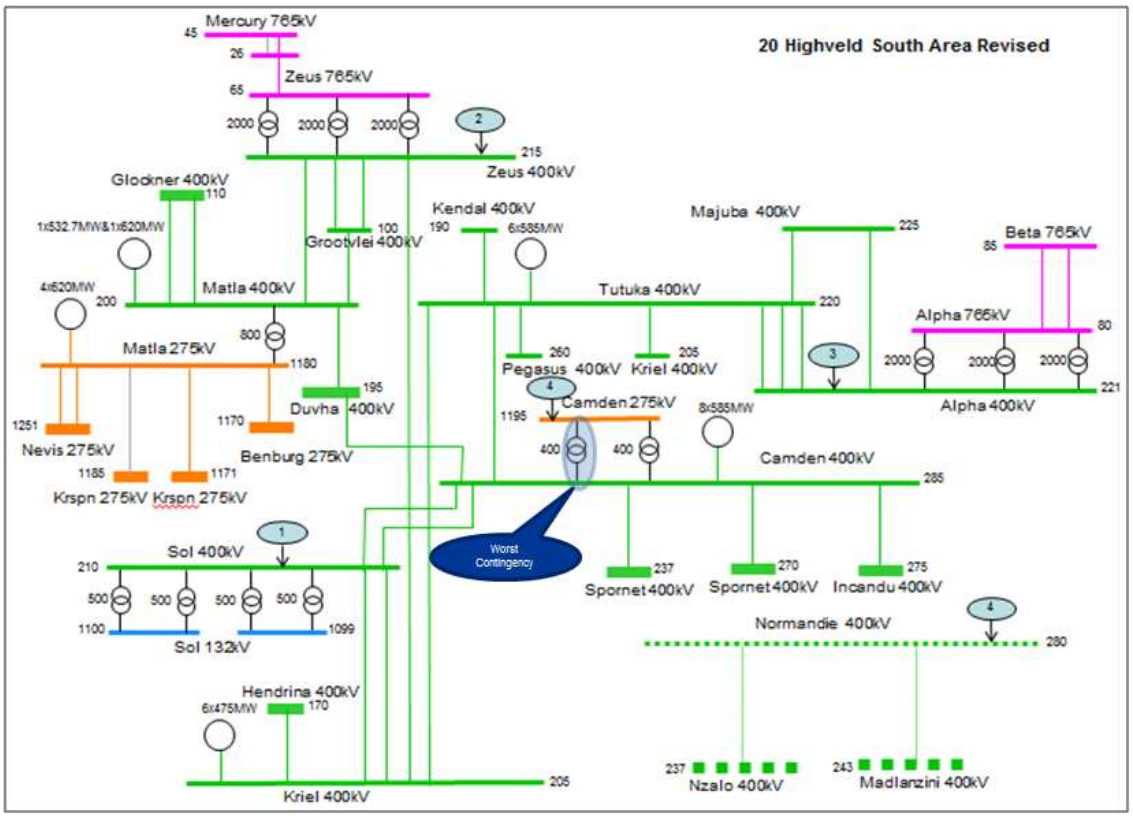
E18. PHALABORWA SINGLE LINE DIAGRAM



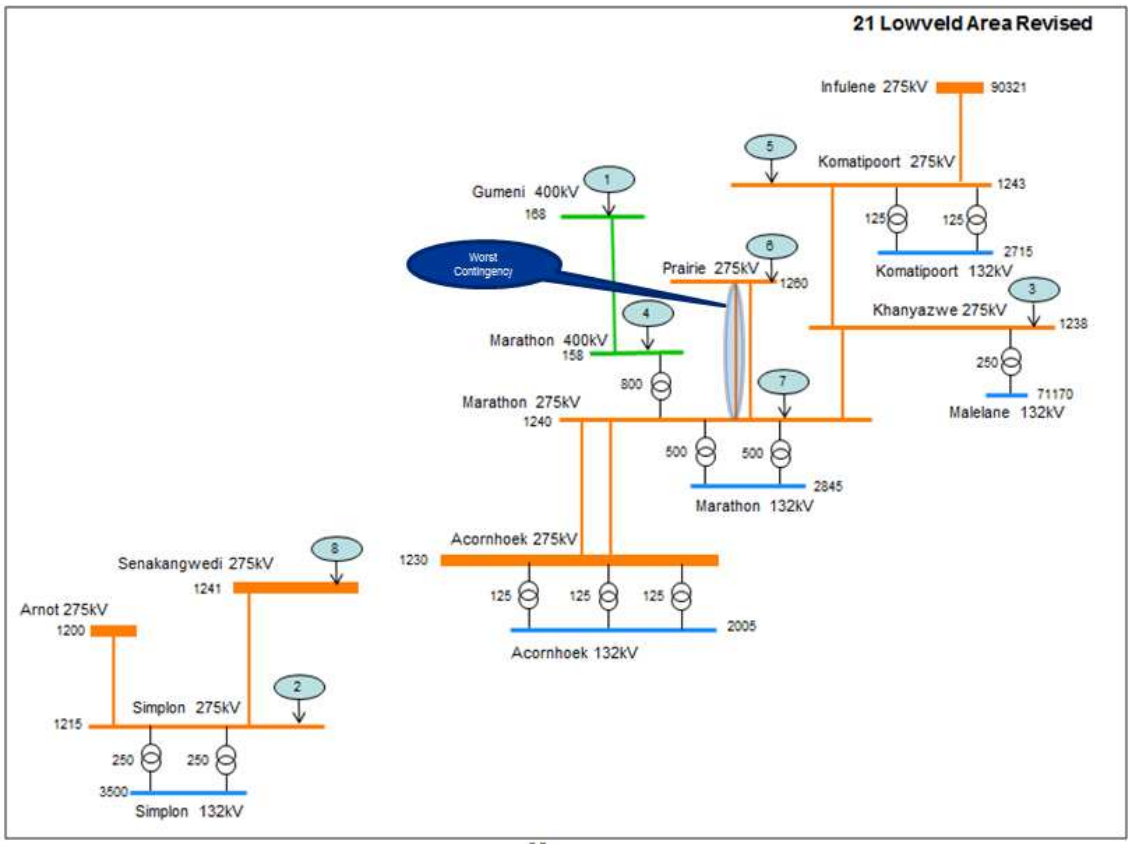
E19. MIDDELBURG SINGLE LINE DIAGRAM



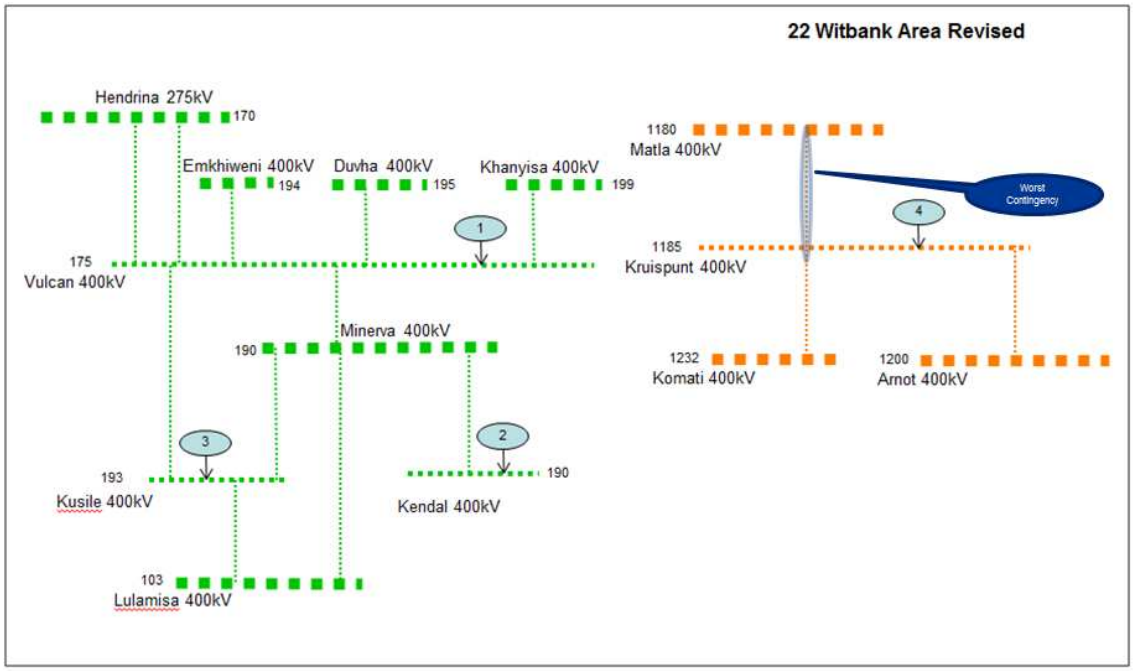
E20. HIGHVELD SOUTH SINGLE LINE DIAGRAM



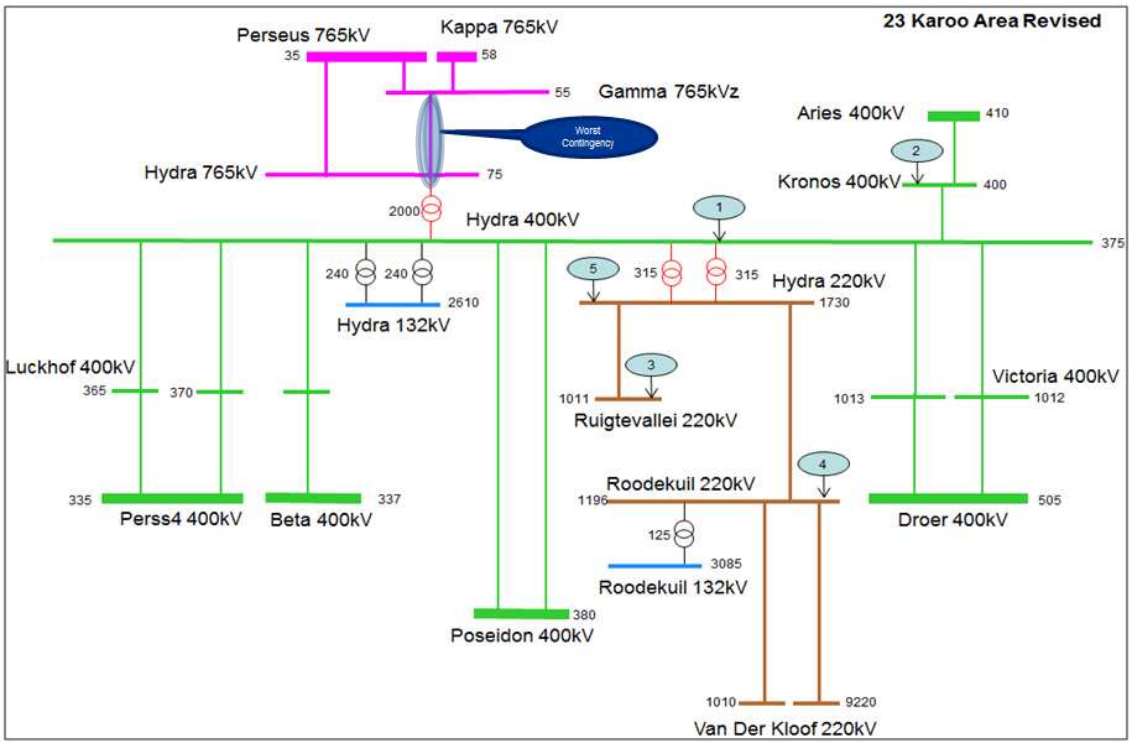
E21. LOWVELD SINGLE LINE DIAGRAM



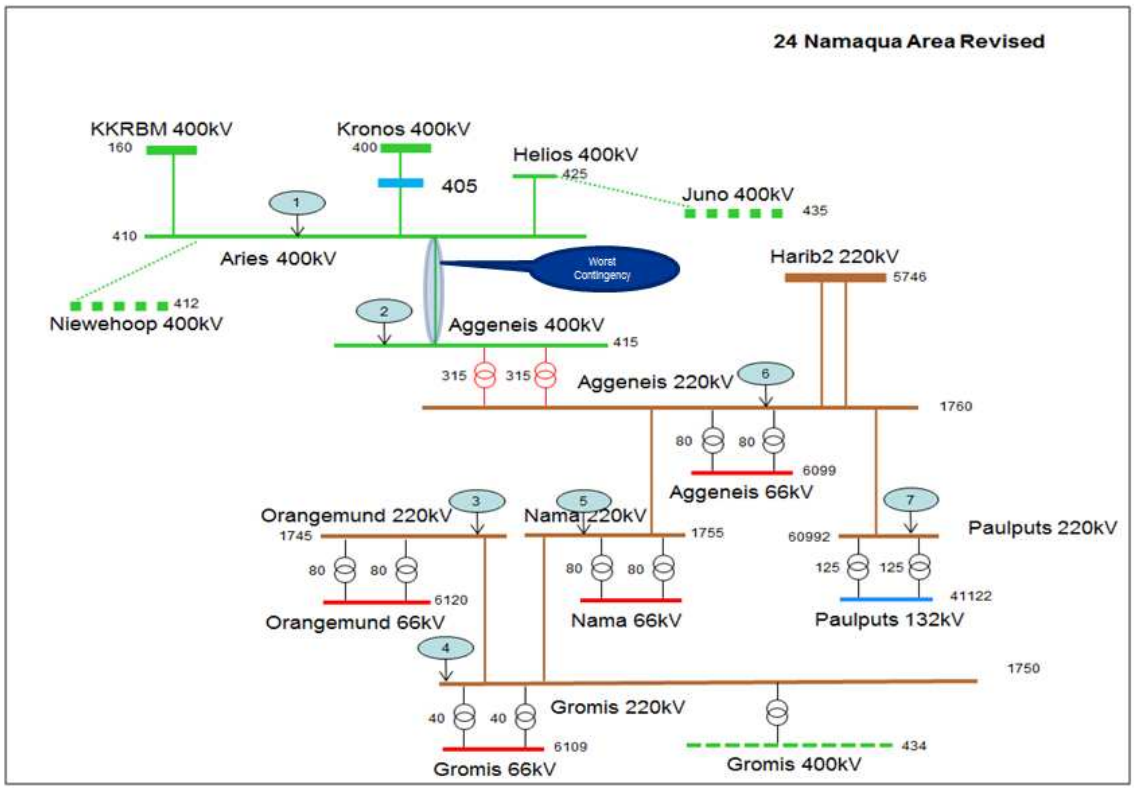
E22. WITBANK SINGLE LINE DIAGRAM



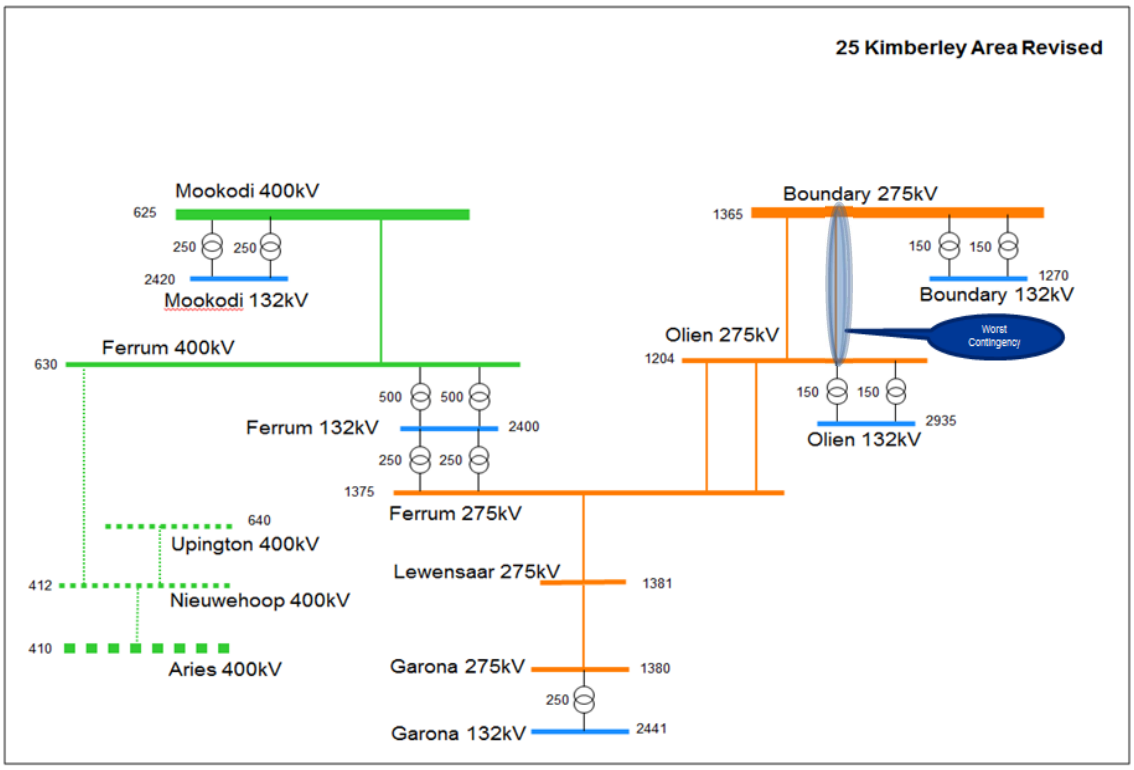
E23. KAROO SINGLE LINE DIAGRAM



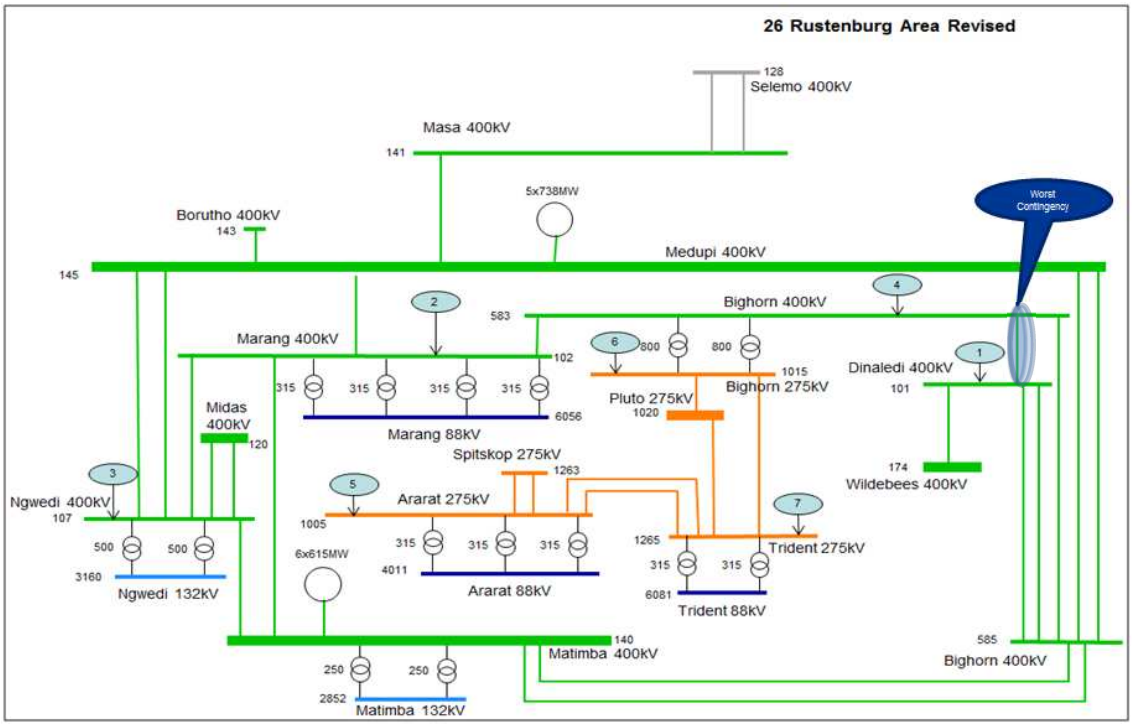
E24. NAMAQUALAND SINGLE LINE DIAGRAM



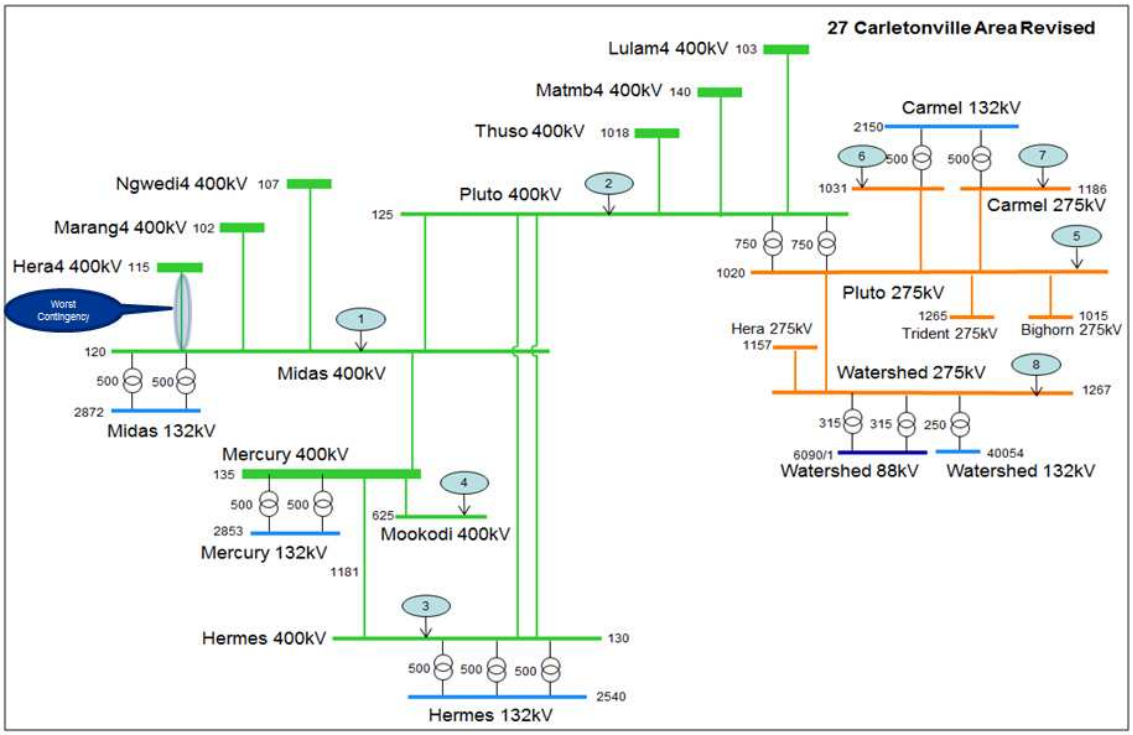
E25. KIMBERLEY SINGLE LINE DIAGRAM



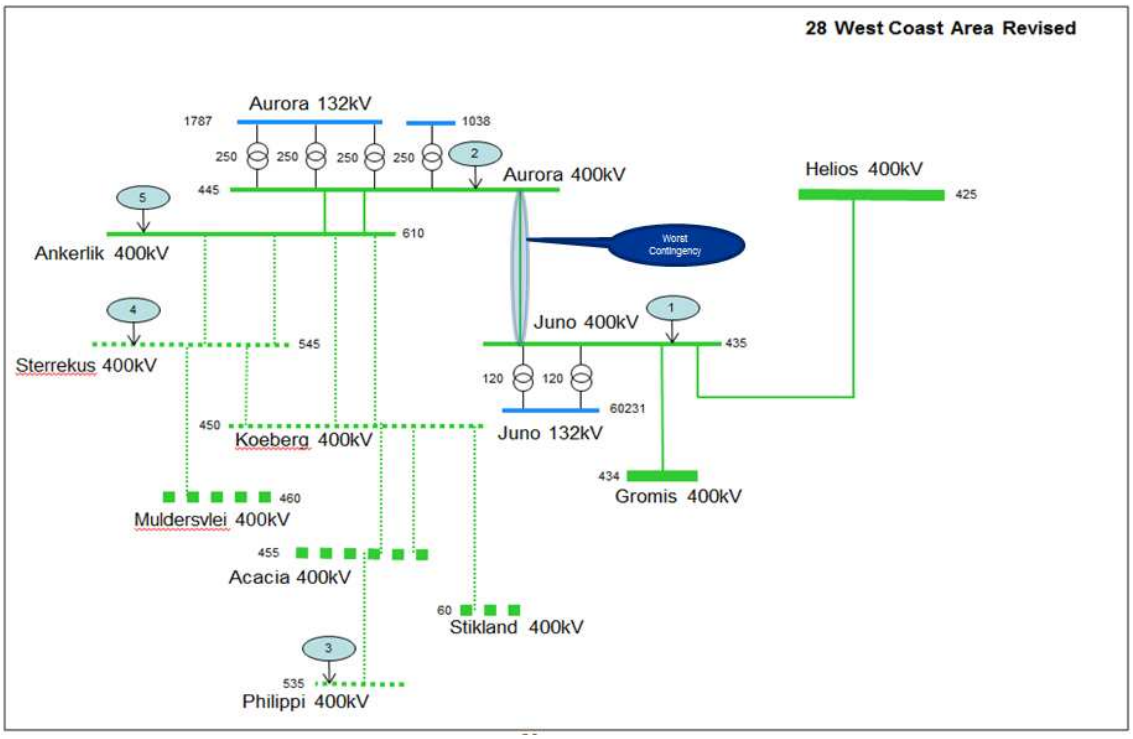
E26. RUSTENBURG SINGLE LINE DIAGRAM



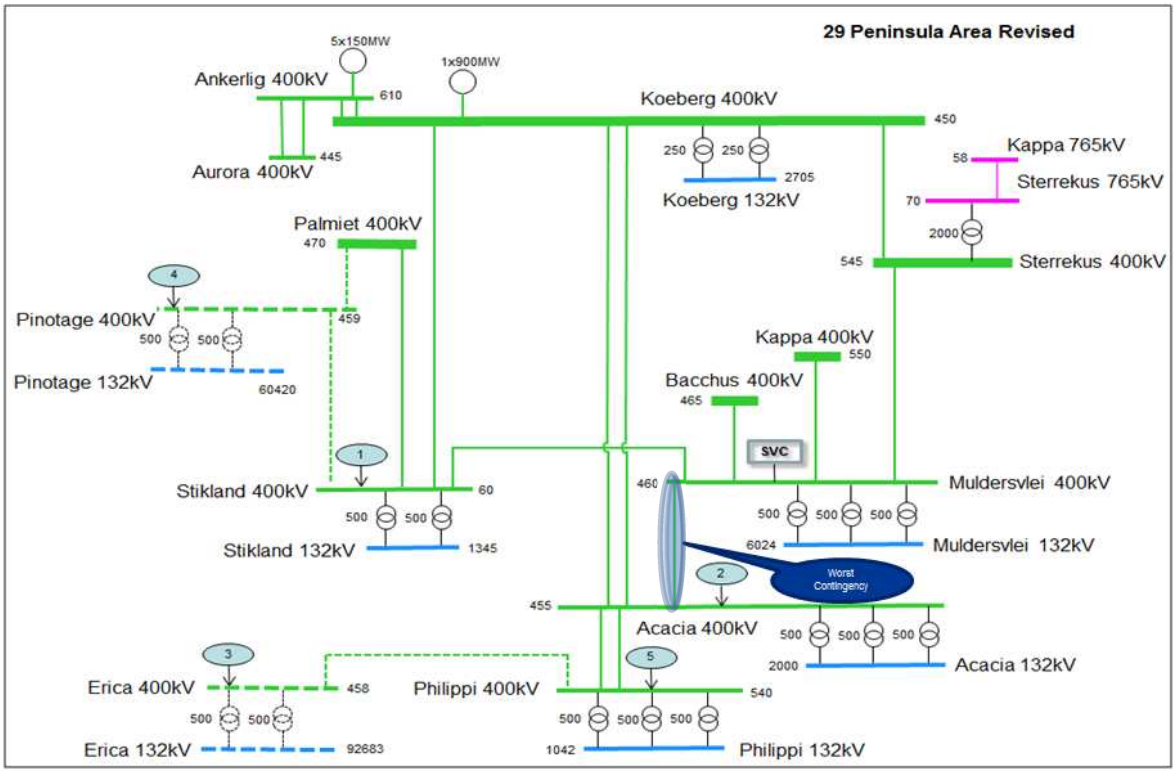
E27. CARLETONVILLE SINGLE LINE DIAGRAM



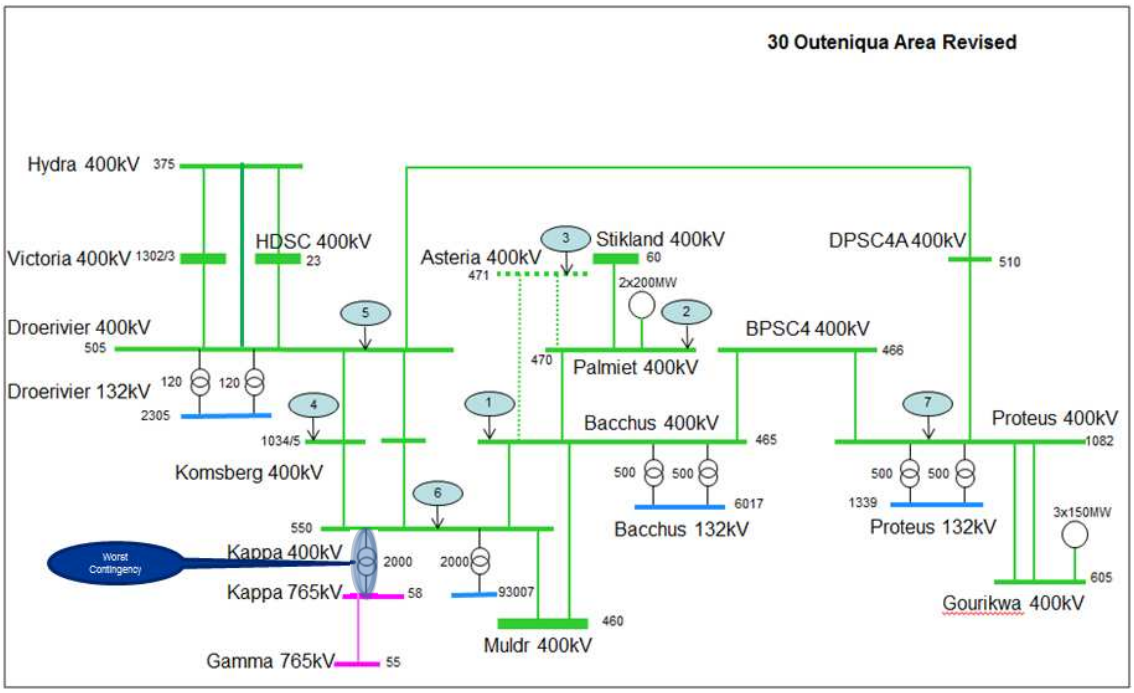
E28. WEST COAST SINGLE LINE DIAGRAM



E29. PENINSULA SINGLE DIAGRAM



E30. OUTENIQUA SINGLE LINE DIAGRAM



APPENDIX F: POTENTIAL PROJECTS FOR ADDITIONAL GRID ACCESS

Table AAI-1: Potential transmission projects for additional grid access

Tx project phase	Substation site	Unlocking (MW)	Network strengthening	Province	Duration for project development
1	Harvard	475	None	Free State	2 years
1	Hermes	306	None	North West	2 years
1	Mookodi	271	None	North West	2 years
1	Proteus	442	None	Western Cape	2 years
1	Vuyani	600	None	Eastern Cape	2 years
2	Aries	270	New 132 kV S/S, 2 x 250 MVA 400/132 kV	Northern Cape	3-4 years
2	Droërivier	137	500 MVA 400/132 kV	Western Cape	3-4 years
2	Helios	307	1 x 500 MVA 400/132 kV	Northern Cape	3-4 years
2	Juno	602	Replace 125 MVA 400/132 kV with 500 MVA	Western Cape	3-4 years
2	Kronos	878	3 x 500 MVA 400/132 kV, replace 250 MVA with a 500 MVA	Northern Cape	3-4 years
2	Lambda	121.2	New 88 kV S/S, 2 x 315 MVA 400/88 kV	Mpumalanga	3-4 years
3	Droërivier B	1 100	New 400 kV S/S, 500 MVA 400/132 kV, 2 x 10 km Hydra-Droërivier 3 x 400 kV loop-in	Western Cape	4-5 years

Tx project phase	Substation site	Unlocking (MW)	Network strengthening	Province	Duration for project development
3	Gamma	974	400 kV S/S, 3 x 500 MVA 400/132 kV, 2 x 4 km Hydra-Droërivier 2 400 kV loop-in	Northern Cape	4-5 years
3	Garona	624	400 kV S/S, 2 x 500 MVA 400/132 kV, 2 x 5 km Ferrum-Nieuwehoop 400 kV line loop-in	Northern Cape	4-5 years
3	Koruson (Kappa)	276	132 kV S/S, 2 x 250 MVA 400/132 kV	Western Cape	4-5 years
3	Nama	263	2 x 250 220/132 kV	Northern Cape	4-5 years
3	Sterrekus	400	132 kV S/S, 2 x 500 MVA 400/132 kV	Western Cape	4-5 years
3	Upington Solar Park	1 000	3 x 500 MVA 400/132 kV, 2 x 150 km Upington-Aries 1 and 2 plus 200 km Upington-Ferrum 400 kV line	Northern Cape	4-5 years
3	Vryheid	220	400 kV S/S, 2 x 250 MVA 400/132 kV, loop-in of Proteus-Bacchus 400 kV line	Western Cape	4-5 years
4	Blouwater/ Aurora B	1 325	New 400 kV S/S, 4 x 500 MVA 400/132 kV, 2 x 30 km Aurora-Blouwater 400 kV line	Western Cape	6-8 years
4	Boundary	690	New Ulco S/S, 2 x 500 MVA 400/132 kV, 170 km Beta-Ulco 400 kV line	Northern Cape	6-8 years
4	Delphi B	780	New 400 kV S/S, 3 x 500 MVA 400/132 kV, 2 x 50 km Poseidon-Delphi 400 kV line loop-in	Eastern Cape	6-8 years

Tx project phase	Substation site	Unlocking (MW)	Network strengthening	Province	Duration for project development
4	Gromis	440	New 400 kV busbar, 2 x 500 MVA 400/132 kV, 2 x 400 MVA 400/220 kV, 260 km 400 kV line and 130 km 400 kV line	Northern Cape	6-8 years
4	Hotazel	200	2 x 500 MVA 400/132 kV, 100 km Ferrum-Hotazel 400 kV line, 125 km Hotazel-Mookodi, Mookodi-Hermes 190 km 400 kV line	North West	6-8 years
4	Houhoek	189.22	New 400 kV S/S, 2 x 500 MVA 400/132 kV, loop-in of the Bacchus-Palmiet 400 kV line	Western Cape	6-8 years
4	Hydra B	1 355	400 kV S/S, 4 x 500 MVA 400/132 kV, 2 x 10 km 400 kV Hydra-Poseidon line loop-in	Northern Cape	6-8 years
4	Hydra C	990	400 kV S/S, 4 x 500 MVA 400/132 kV, 2 x 10 km 400 kV Hydra-Perseus 1 line loop-in	Northern Cape	6-8 years
4	Hydra D	780	400 kV S/S, 4 x 400/132 kV 500 MVA, 2 x 10 km 400 kV Hydra-Perseus 1 line loop-in	Northern Cape	6-8 years
4	Komsberg B	1 300	4 x 400/132 kV 500 MVA, 2 x 10 km Droërivier-Bacchus 400 kV line loop-in, Komsberg series cap de-rating	Western Cape	6-8 years
4	Matimba B	600	400 kV S/S, 3 x 500 MVA 400/132 kV and 2 x 10 km Matimba-Witkop 400 kV line loop-in	Limpopo	6-8 years
4	Olien	1 100	400 kV S/S, 3 x 500 MVA 400/132 kV, 70 km Olien-Ulco 400 kV line, 107 km Ferrum-Olien 400 kV line	Northern Cape	6-8 years

Tx project phase	Substation site	Unlocking (MW)	Network strengthening	Province	Duration for project development
4	Oranjemond B	150	220 kV S/S, 250 MVA 220/132 kV and 5 km Oranjemond-Gromis 220 kV loop-in	Northern Cape	6-8 years
4	Paulputs	250	400 kV S/S, replace 220/132 kV 125 MVA with 250 MVA 400/132 kV and 100 km 400 kV line	Northern Cape	6-8 years
4	Poseidon B	883	New 400 kV S/S, 3 x 500 MVA 400/132 kV, 2 x 1.5 km Poseidon-Dedisa 400 kV line	Eastern Cape	6-8 years
4	Poseidon C	1 000	New 400 kV S/S, 3 x 500 MVA 400/132 kV, 2 x 60 km Poseidon-Poseidon C 400 kV line	Eastern Cape	6-8 years
4	Thyspunt	230	New 400 kV S/S, 2 x 250 MVA 400/132 kV, 2 x 90 km Thyspunt-Dedisa 400 kV line	Eastern Cape	6-8 years
4	Victoria B	750	400 kV S/S, 3 x 500 MVA 400/132 kV, 2 x 50 km Hydra-Droërivier 3 400 kV loop-in, Victoria series cap de-rating	Northern Cape	6-8 years
5	Lephalale Coal	2 000	HVDC to Gauteng	Limpopo	8-10 years