The Eskom Transmission Development Plan 2019 - 2028

25 October 2018

The Eskom Transmission Development Plan 2019 - 2028

(TDP 2018)

Public Forum

25 October 2018

Keynote address

By: Willy Majola

Group Executive: Transmission (Acting)

Setting-the-scene

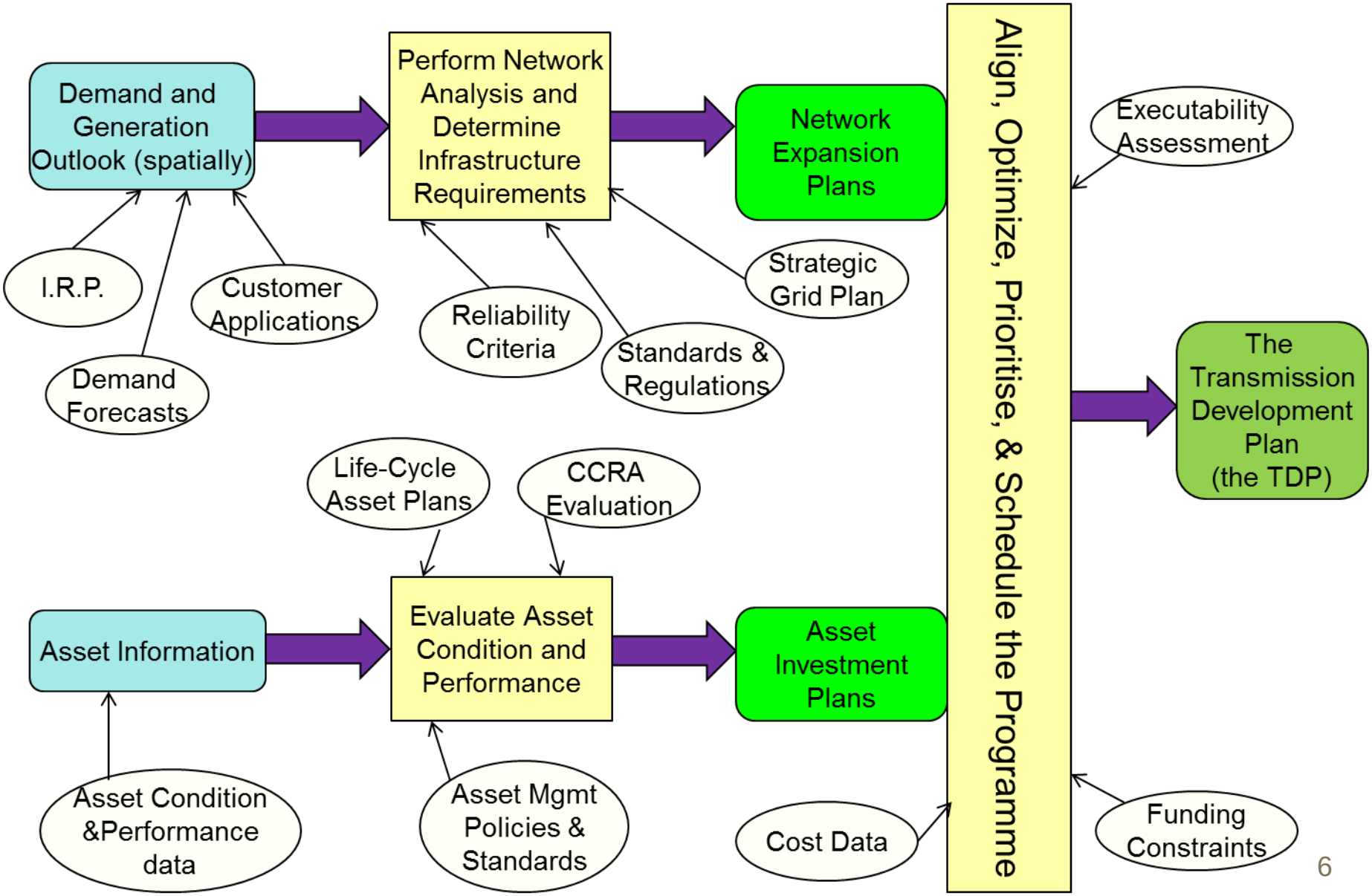
Presented by: Mbulelo Kibido

General Manager: Transmission Grid Planning

Desired Outcomes for this Public Forum

- Contextualise the planning timelines relating to the demand forecast and generation patterns
- Share assumptions and results from the Transmission Development Plan 2019 – 2028
- Share information and results relating to the integration of IPPs as per the DOE IPP programs and address future requirements as per the IRP
- Share information on the estimated Transmission Capital Investment Requirements for period 2019 – 2028
- More importantly, to solicit comments and further inputs to improve these plans

Our Infrastructure Investment Planning Model



Basis of the TDP 2018

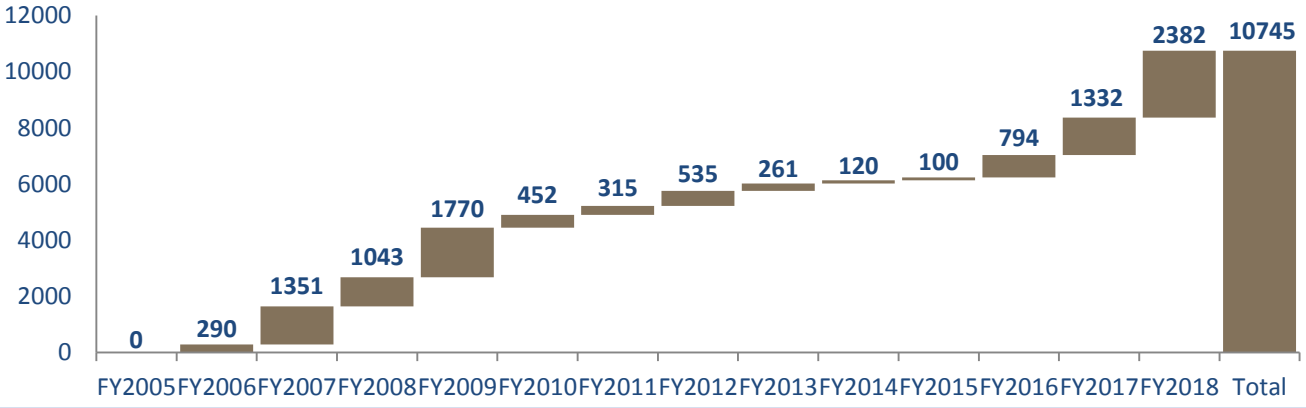
The TDP 2018 was formulated to address the following, subject to the Eskom Corporate Plan:

- Attain Grid Code compliance by resolving both substation and line violations
- Determine new network infrastructure requirements to sustain and allow for future demand growth
- Determine new network infrastructure requirements to integrate new generation (Eskom and IPPs)
- Provide detail on the refurbishment requirements of the Transmission network.

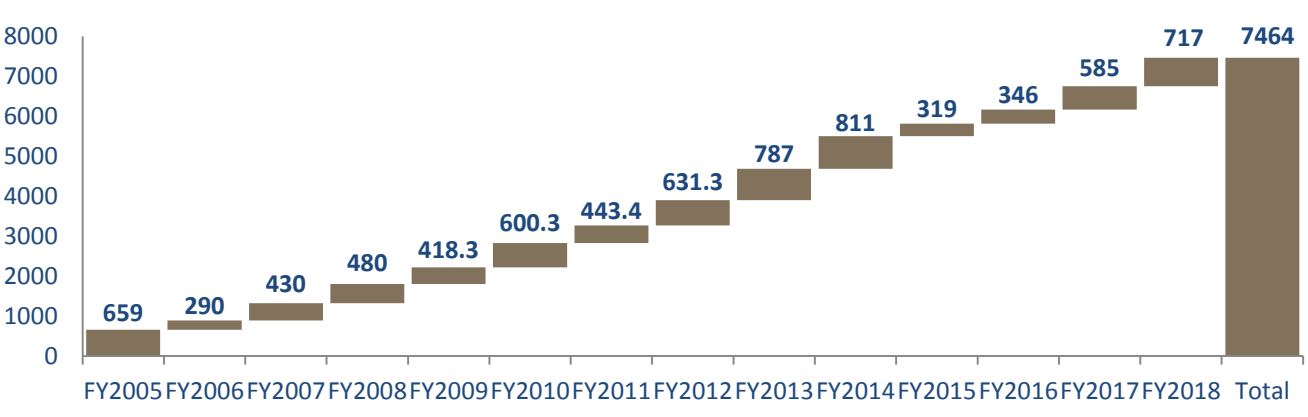
Recent Transmission Network Expansion Successes

Significant grid expansion over the last decade: integrated ~11 GW new generation; ~8000 km of new transmission lines, and ~37000 MVA substation capacity

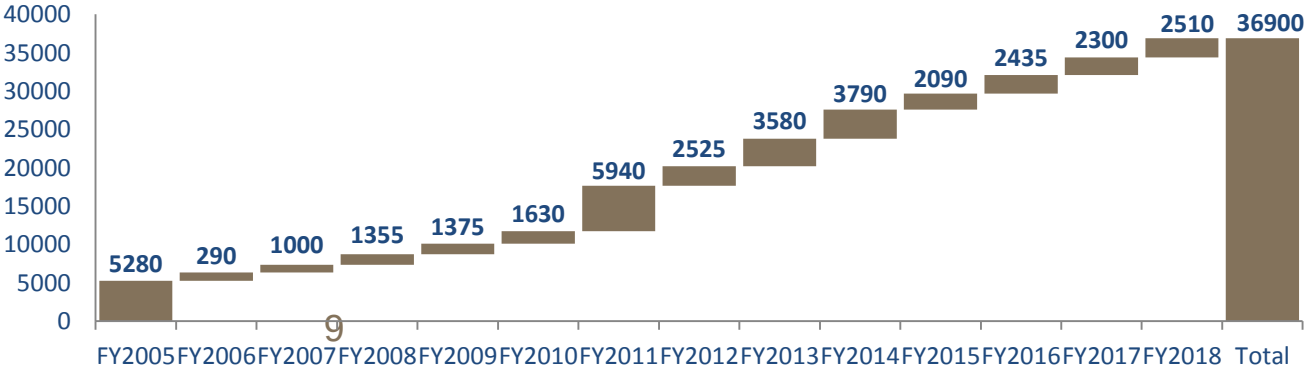
Generation (MW)



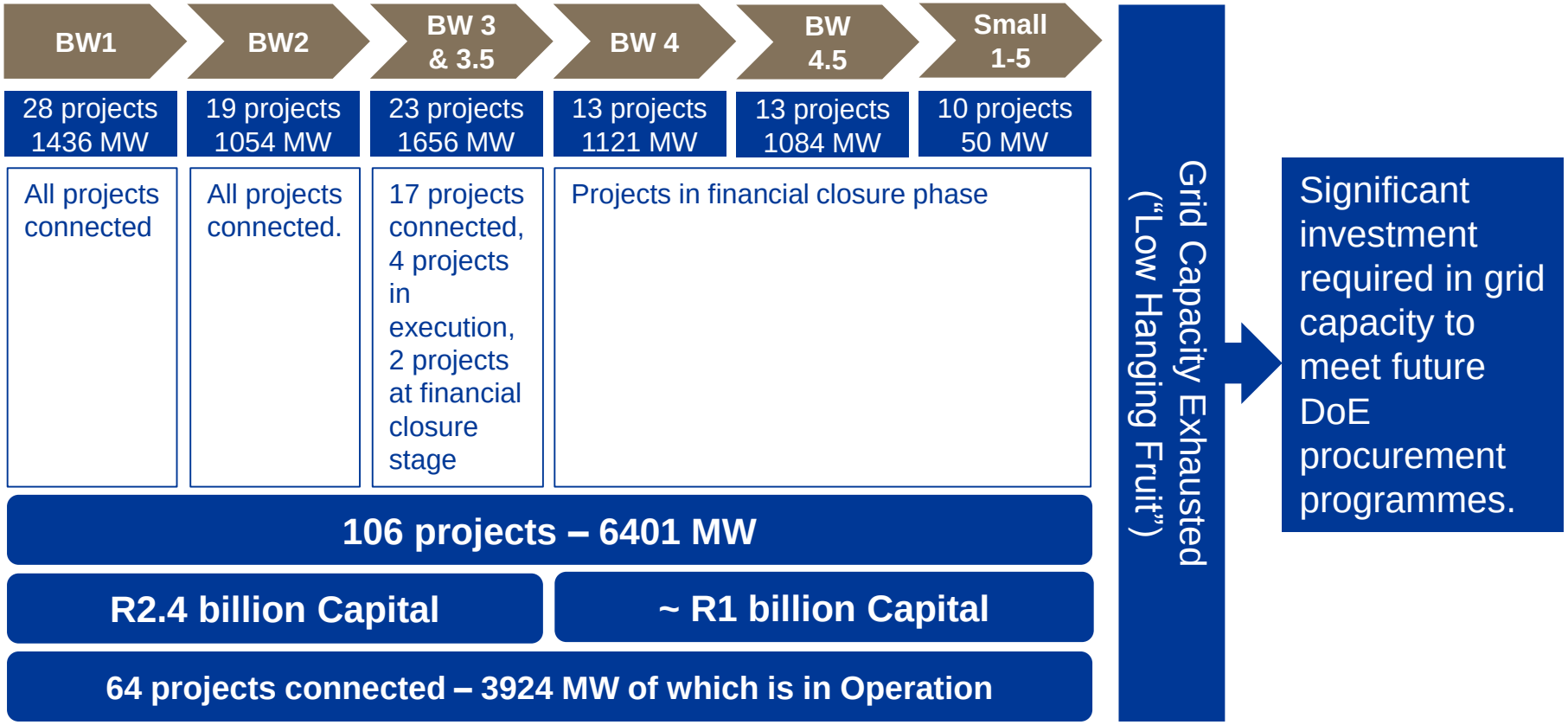
Transmission lines (km)



Transmission Substations (MVA)

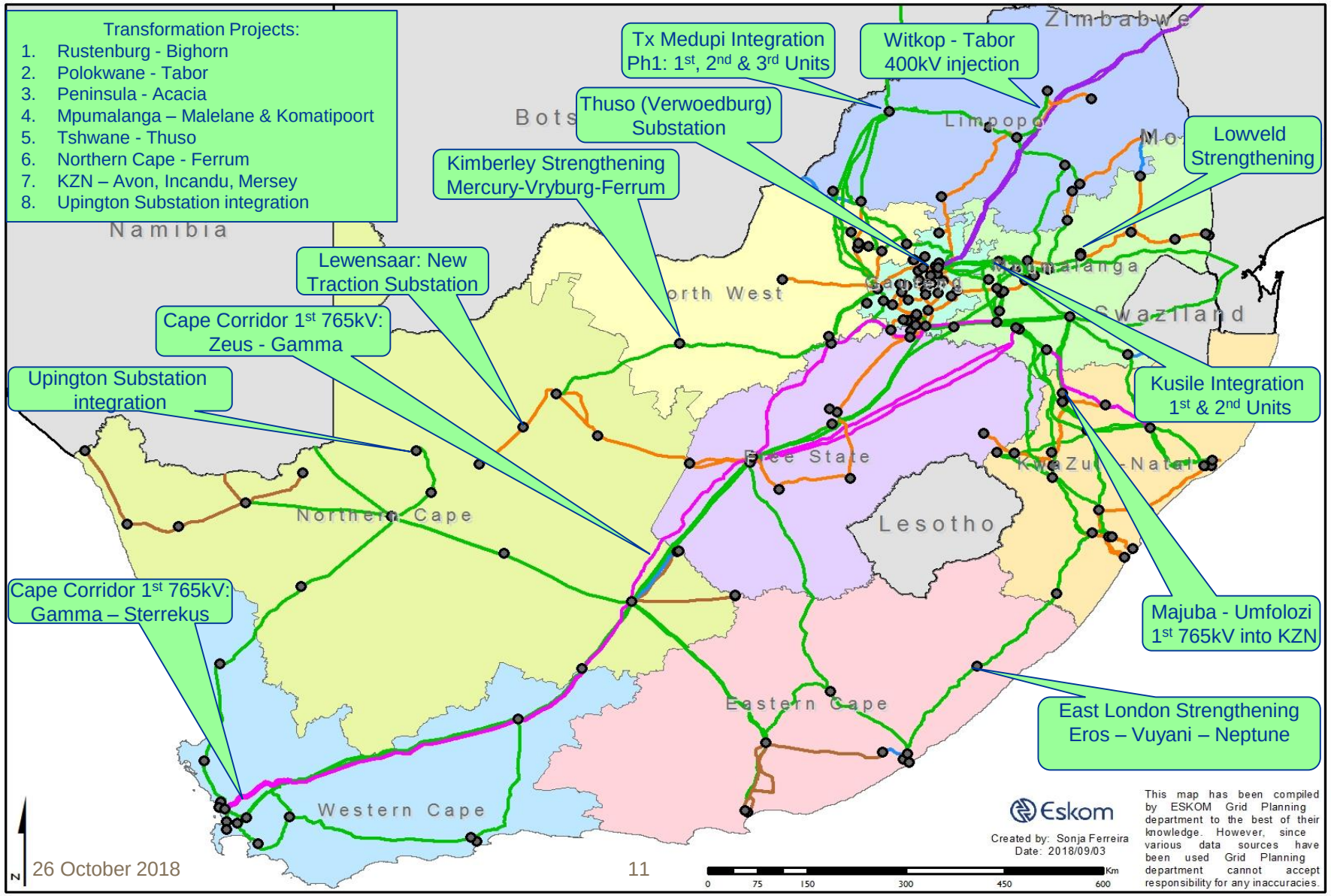


REIPP Programme Overview – end July 2018



Eskom has committed Capital to enable the integration of successful bidders (Bid Window 1 – 4B, including Small REIPPs) into the National Grid.

Summary of Major Transmission Expansion Projects Completed Recently



The Different Plans

Integrated Resource Plan (IRP)

- The Department of Energy (Energy Planner) is accountable for the Country Electricity Plan, which is called the Integrated Resource Plan For Electricity (IRP 2016 - draft).
- The Integrated Resource Plan (IRP) is intended to drive all new generation capacity development.
- NERSA licences new generators according to this determination.

Strategic Grid Plan (SGP)

- The Strategic Grid Plan formulates long term strategic transmission corridor requirements
- The Plan is based on a range of generation scenarios, and associated strategic network analysis
- 20 years planning horizon, updated every 2 - 3 years

Transmission Development Plan (TDP)

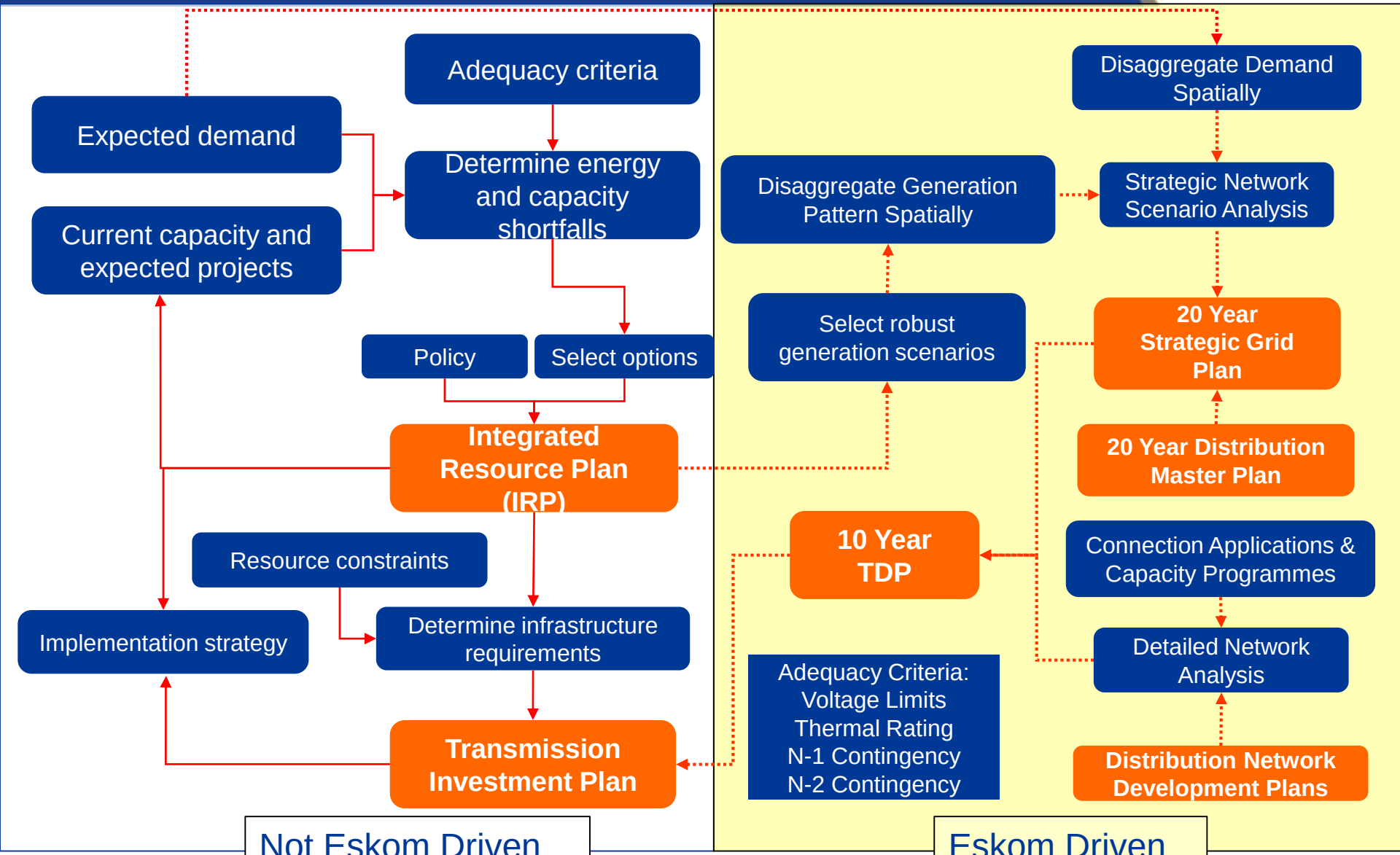
- The Transmission Development Plan (TDP) represents the transmission network infrastructure investment requirements
- 10 year planning horizon, updated annually
- Indicates financial commitments required in the short to medium term

Planning for the South African Integrated Power System

The TDP Assumptions

Presented by: Ronald Marais

Linkages Between the Various Plans



TDP Timelines

License obligation & Grid Code compliance

Open access & Reliability

TDP Ten Year Period

TDP Scenario Assumptions

Strategic Grid Plan

Stakeholder Engagement

Assumptions Generation & Demand

TDP 2019 - 2028

2019----------2023----------2028

1 - 3 | 4 - 6 | 7 - 10

Implementation & Preparation

Detailed studies & Business case

Uncertainty & Readiness

EIA & Servitude to enable, robust and flexible speed of implementation

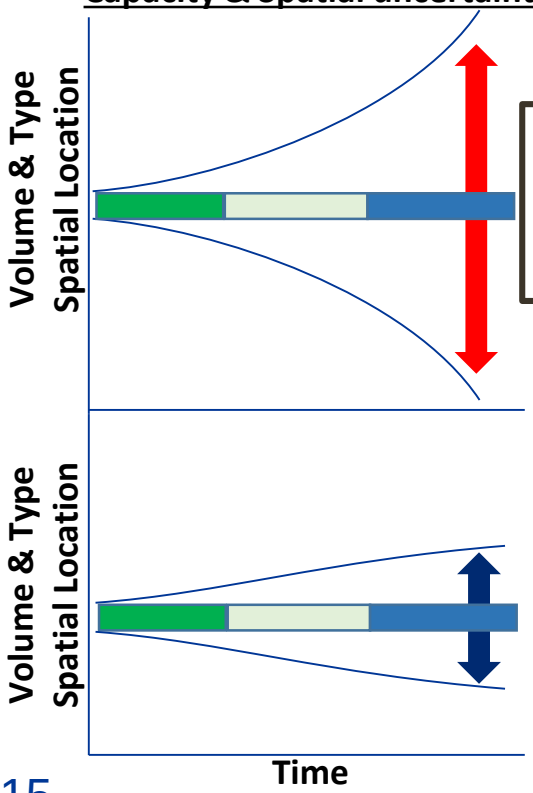
Annual TDP Update

1 - 3 | 4 - 6 | 7 - 10

Review and adjusting uncertainty

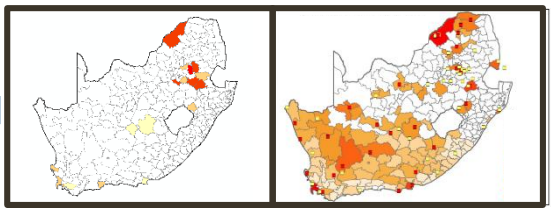
1 - 3 | 4 - 6 | 7 - 10

Capacity & Spatial uncertainty



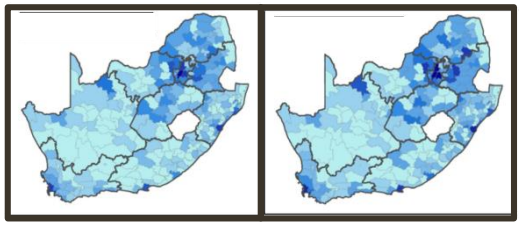
Generation

High spatial and capacity risk



Demand

Low spatial and capacity risk



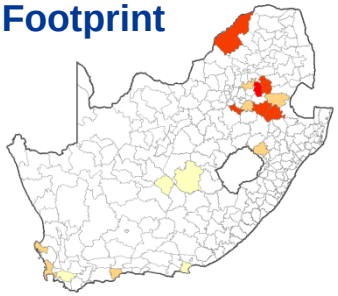
Tx Strategy to increase Grid Access to meet future needs of the IRP and customers

Change in generation diversity has major impact on future Tx Grid

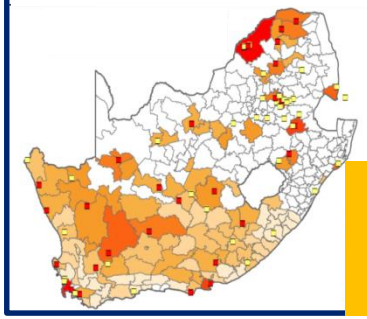
- Grid Access – Increased connection capacity needed in new areas (delivery time > 8yr)
- On Time Connection – Smaller IPP generation plant can be constructed faster (delivery time <5yr)
- Unknown locations - Multiple unspecified IPP sites require market access for best price

Change in Location - Spatial Footprint

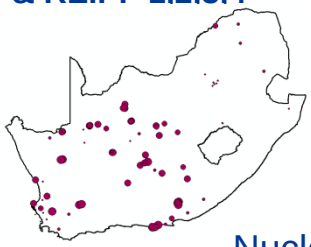
Current Generation Footprint



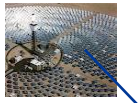
Future Generation Potential Footprint



Current Eskom Wind, Solar & REIPP 1.2.3.4



Solar



Wind

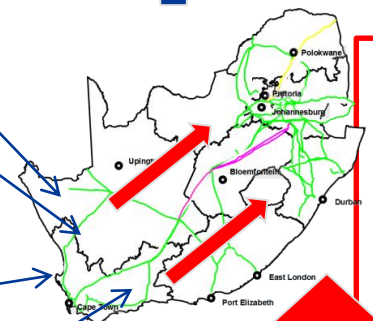
Gas

Nuclear

Beyond 2020 Demand Balance significantly changed by dispersed generation in South

Change of Spatial Footprint into areas with limited Demand requires additional Transmission Capacity

Change in Construction 3yr - 5yr Speed of IPP plant rollout



Significantly More Transmission Corridors and Grid Access required

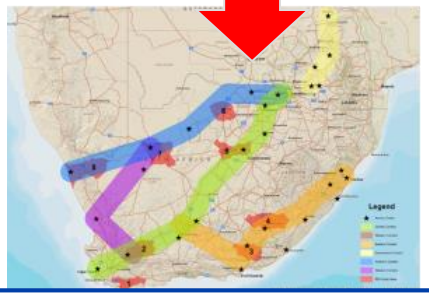
Strategic EIAs & Servitudes can enable faster grid development

Transmission Line Project Timeline

1. Strategic Investment in the EIAs & Land acquisition is critical to meet future IRP connection timeframes

2. Reducing Tx investment today compounds future Tx Grid roll out leading to high risk of Gx capacity delays

SEA Corridors



Need to reduce the time to increase grid access by investing in strategic access and corridors servitudes

Demand Assumptions
IRP compared to TDP

Demand Forecasts (MW) for the TDP period 2019-2028

INTEGRATED RESOURCE PLAN 2018

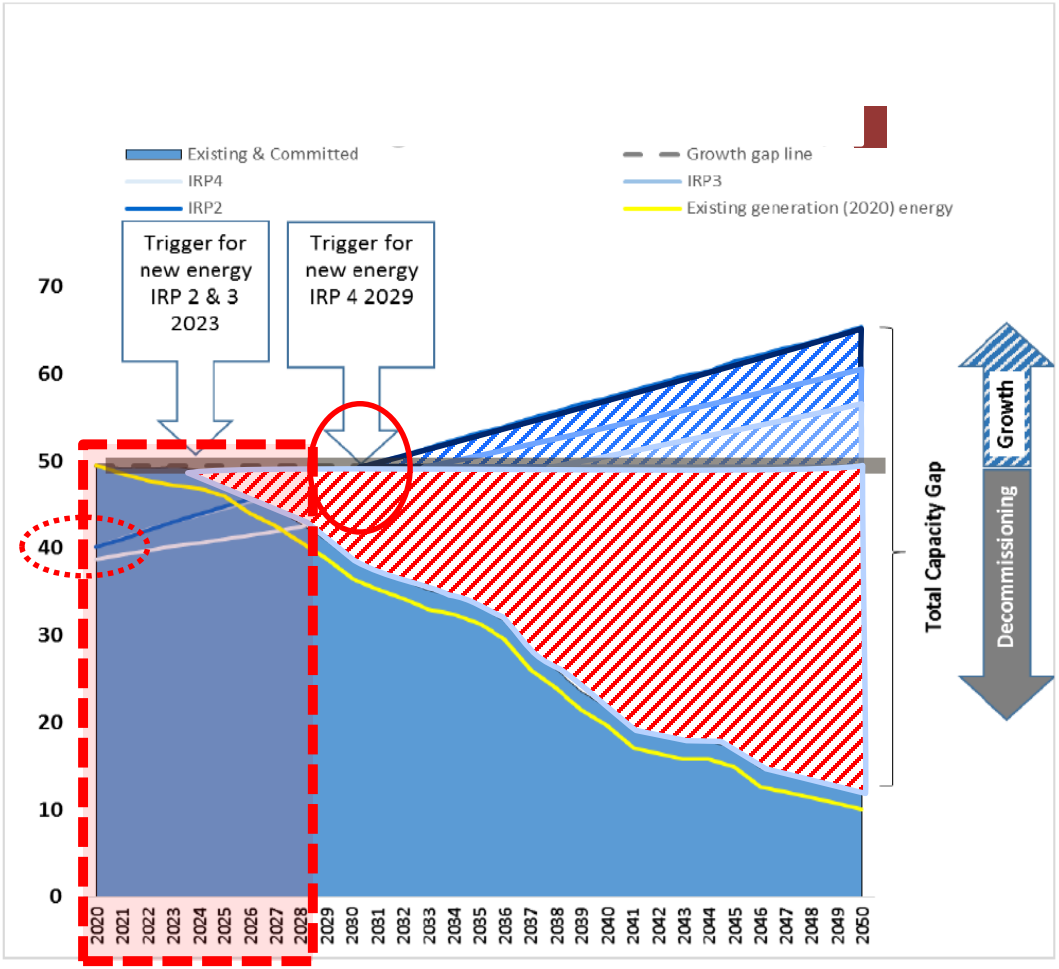
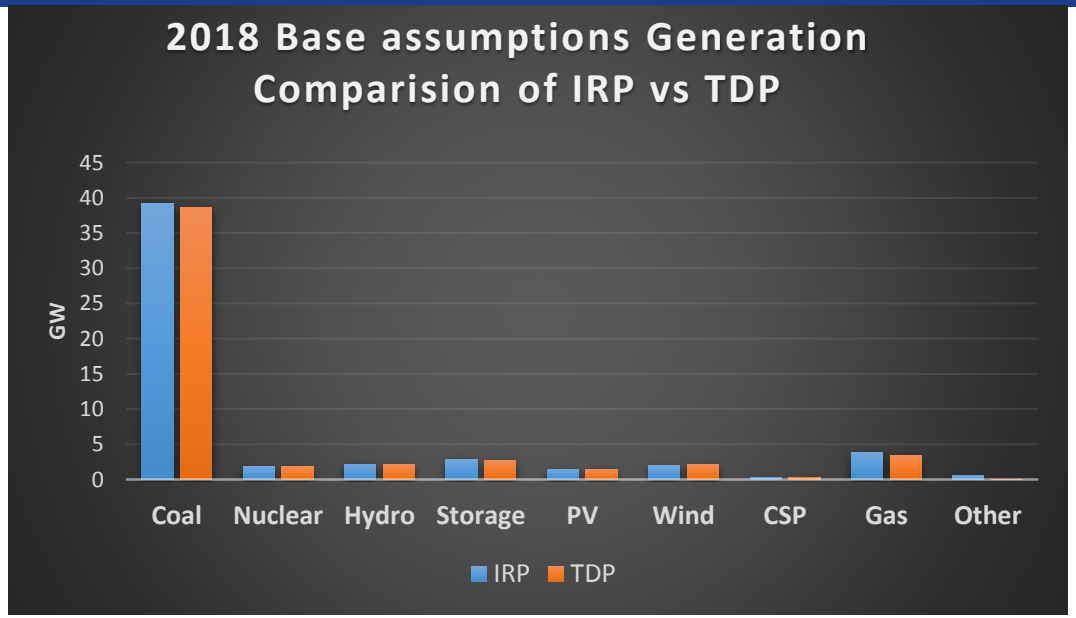
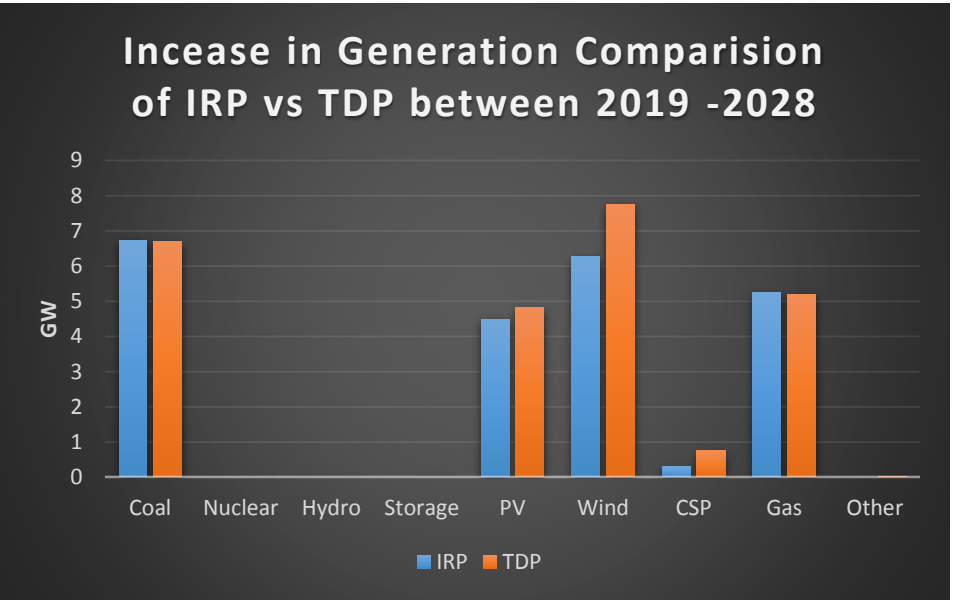


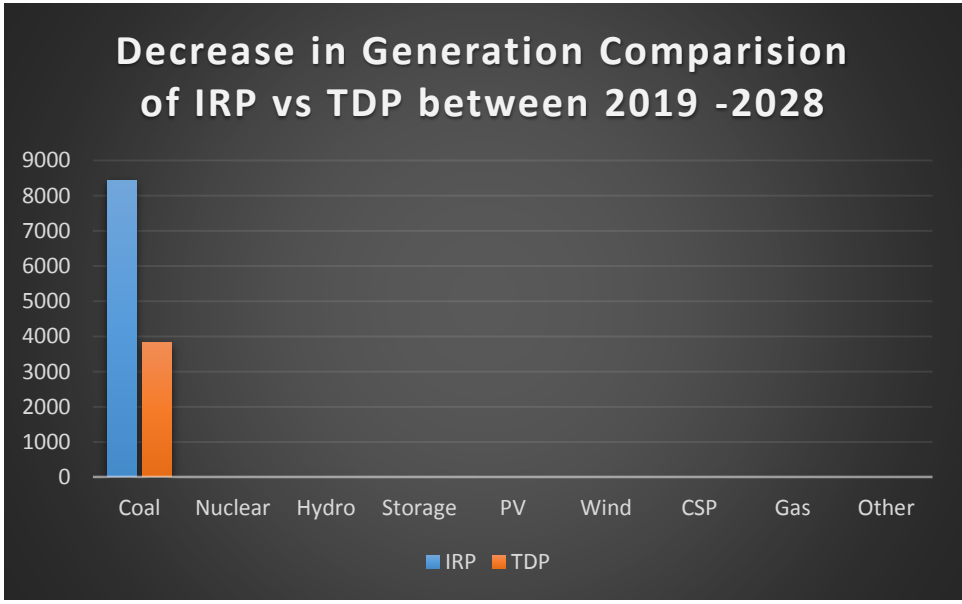
Figure 22: Illustration of Capacity and Energy Driver

2020	2021	2022	2023	2024	2025	2026	2027	2028
41.1	42.4	43.7	44.9	46.3	47.7	49.2	50.9	52.2
44.9	46.1	47.3	48.5	49.7	51.0	52.3	53.6	54.6
40.2	41.4	42.7	44.0	45.3	46.7	48.0	49.4	50.7
39.0	40.0	41.1	42.2	43.3	44.4	45.6	46.7	47.8
37.9	38.5	39.1	39.8	40.4	41.0	41.7	42.3	43.0

Generation Assumptions
IRP compared to TDP

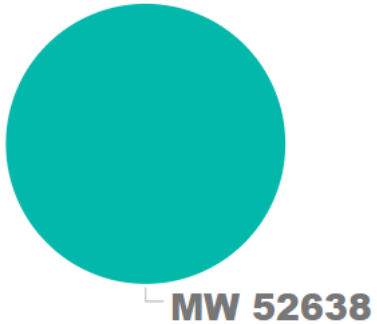


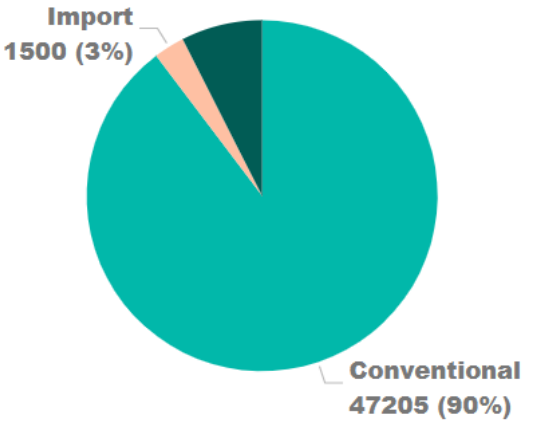




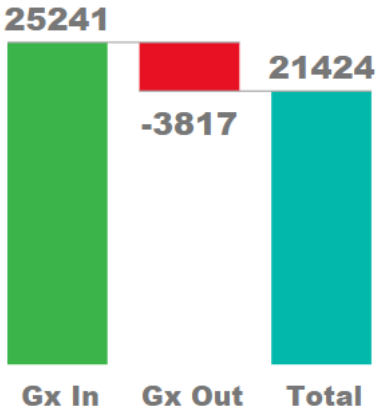
TDP Change in Generation Capacity

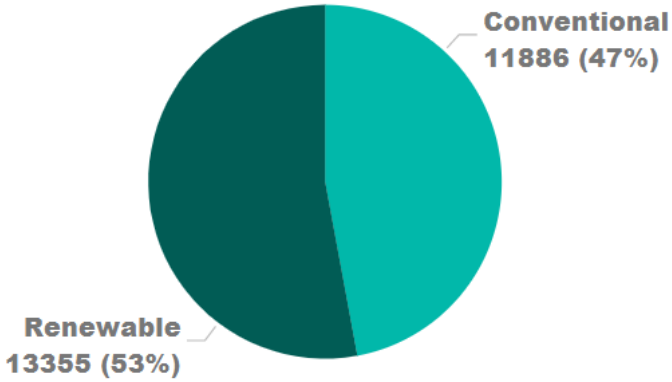
Generation 2018 Overview



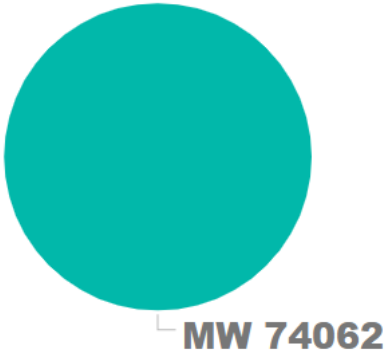


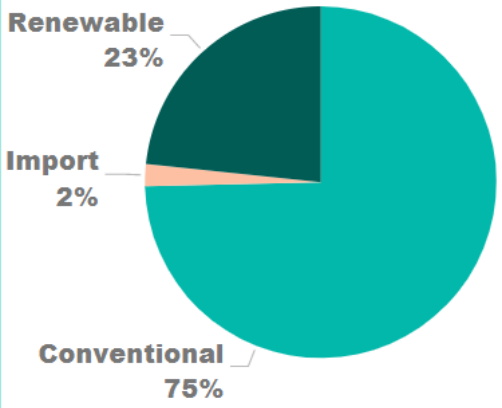
Change in Gx 2019 - 2028





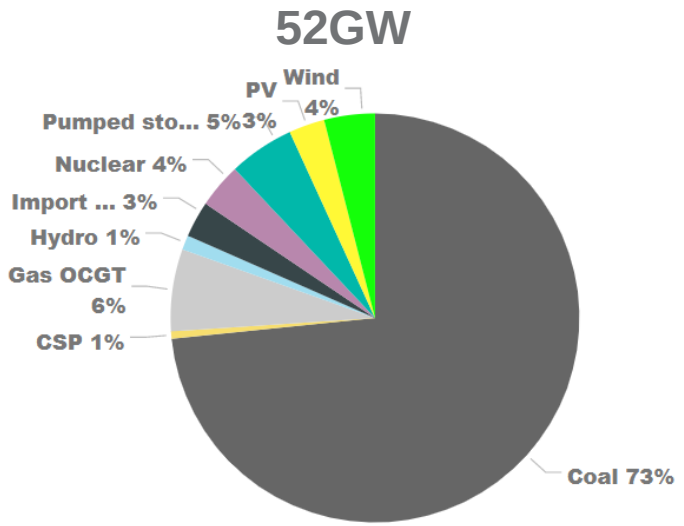
Generation 2028 Overview

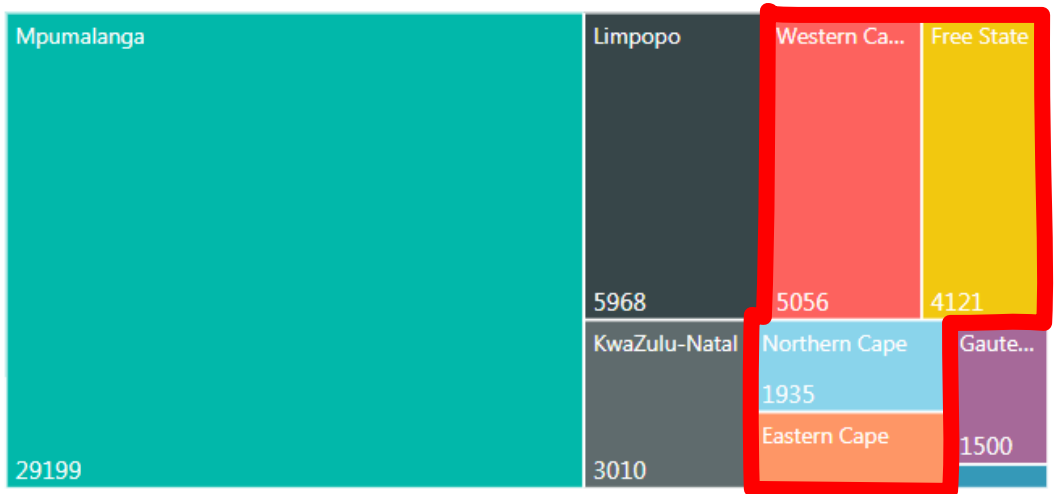




……visualisation

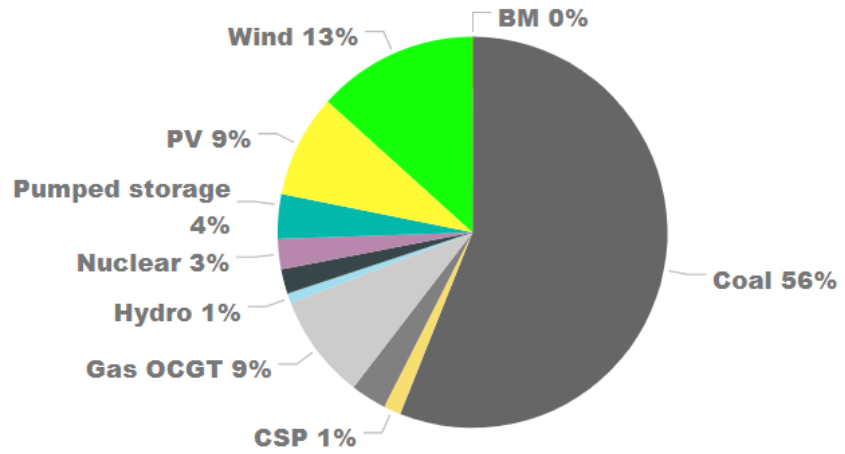
Change in mix & location

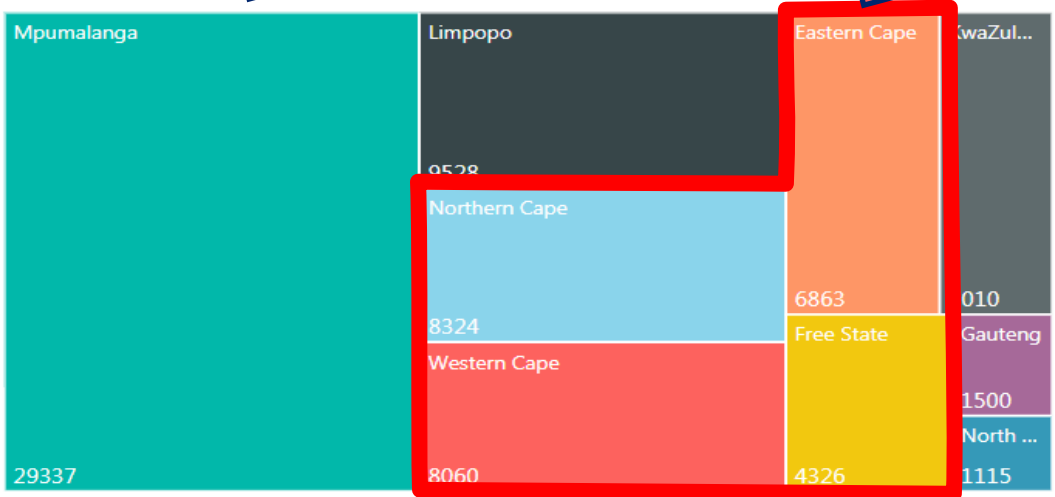




Reducing

Increasing

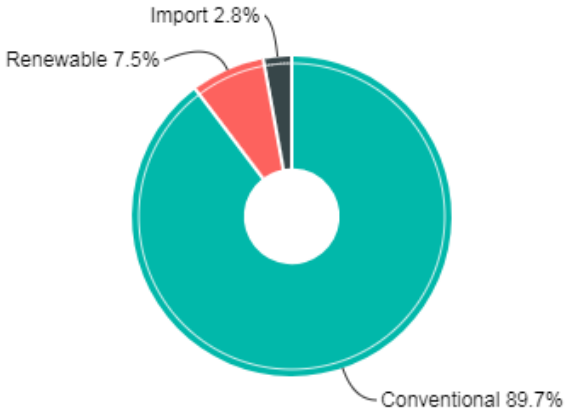




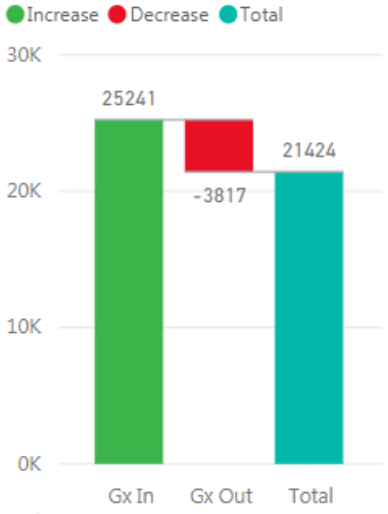
Summary

52GW

Total 2018 Generation View

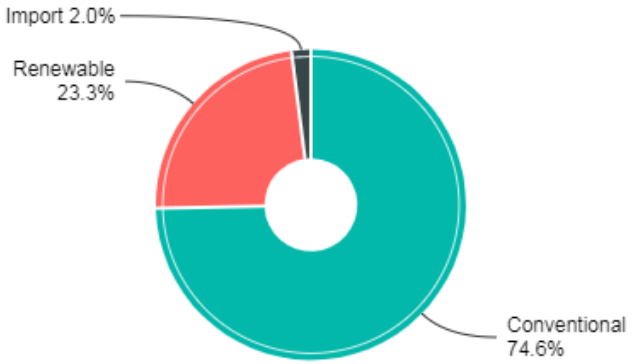


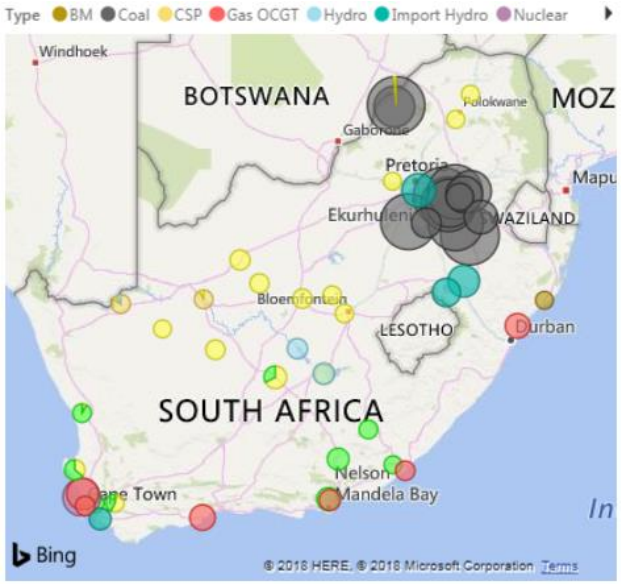
2019 -2028 Total Gx

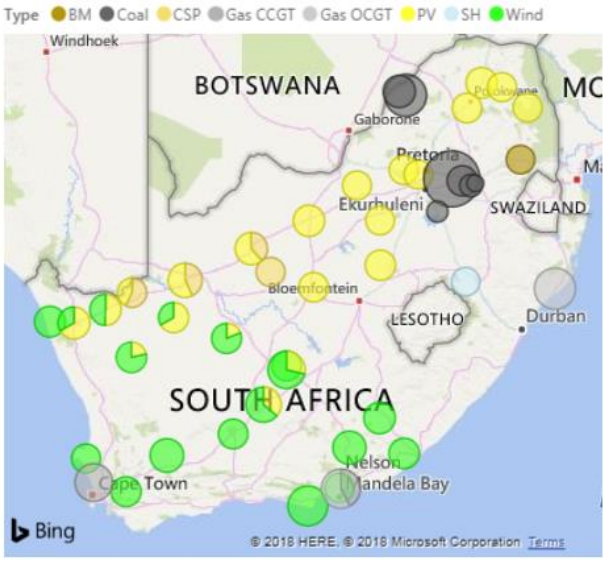


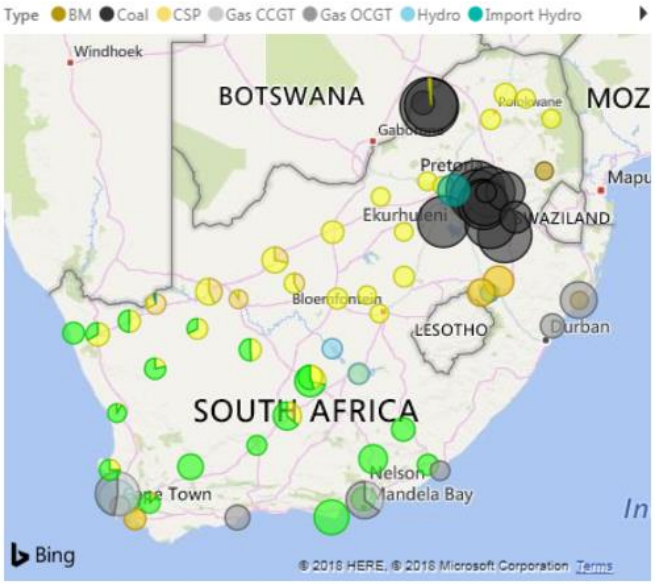
74GW

Total 2028 Generation









Questions?

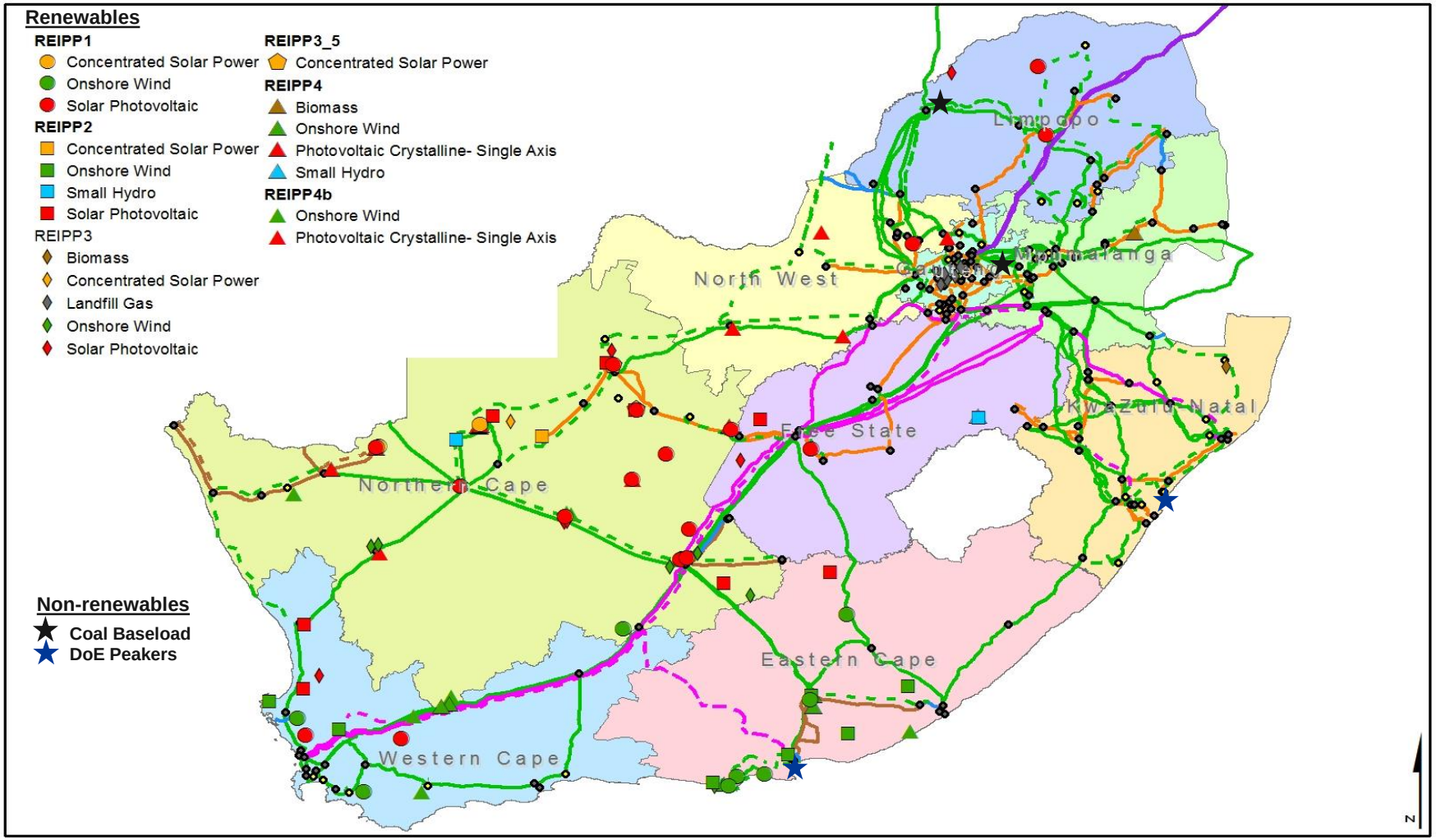
Planning for the Integration of Independent Power Producers (IPPs)

Presented by: Makoanyane Theku

Independent Power Producer (IPP) integration Status to date (End July 2018)

Program	No. of Projects	MW Contribution	Current Status
REIPPPP BW 1	28	1 436	All projects connected
REIPPPP BW 2	19	1 054	All projects connected
REIPPPP BW 3&3.5	23	1 656	17 projects connected, 4 in execution, 2 awaiting financial close
REIPPPP BW 4	13	1 121	Projects in financial closure phase
REIPPPP BW 4B	13	1 084	Projects in financial closure phase
Smalls (1-5 MW)	10	50	Projects in financial closure phase
DoE Peakers	2	1 005	All projects connected
Coal Baseload	2	864	Budget quotation phase
Total	110	8 269	

Approved IPPs



Planned Substations
Existing Substations
Planned Lines 132 220 275 400 765
Existing Lines 88 132 220 275 400 533 765

IPPs

Created by: Sonja Ferreira
Date: 2018/09/06

0 90 180 360 540 720 Km

This map has been compiled by ESKOM Grid Planning department to the best of their knowledge. However, since various data sources have been used Grid Planning department cannot accept responsibility for any inaccuracies.

Transmission integration plans for approved IPPs - Recently Commissioned Transmission Infrastructure

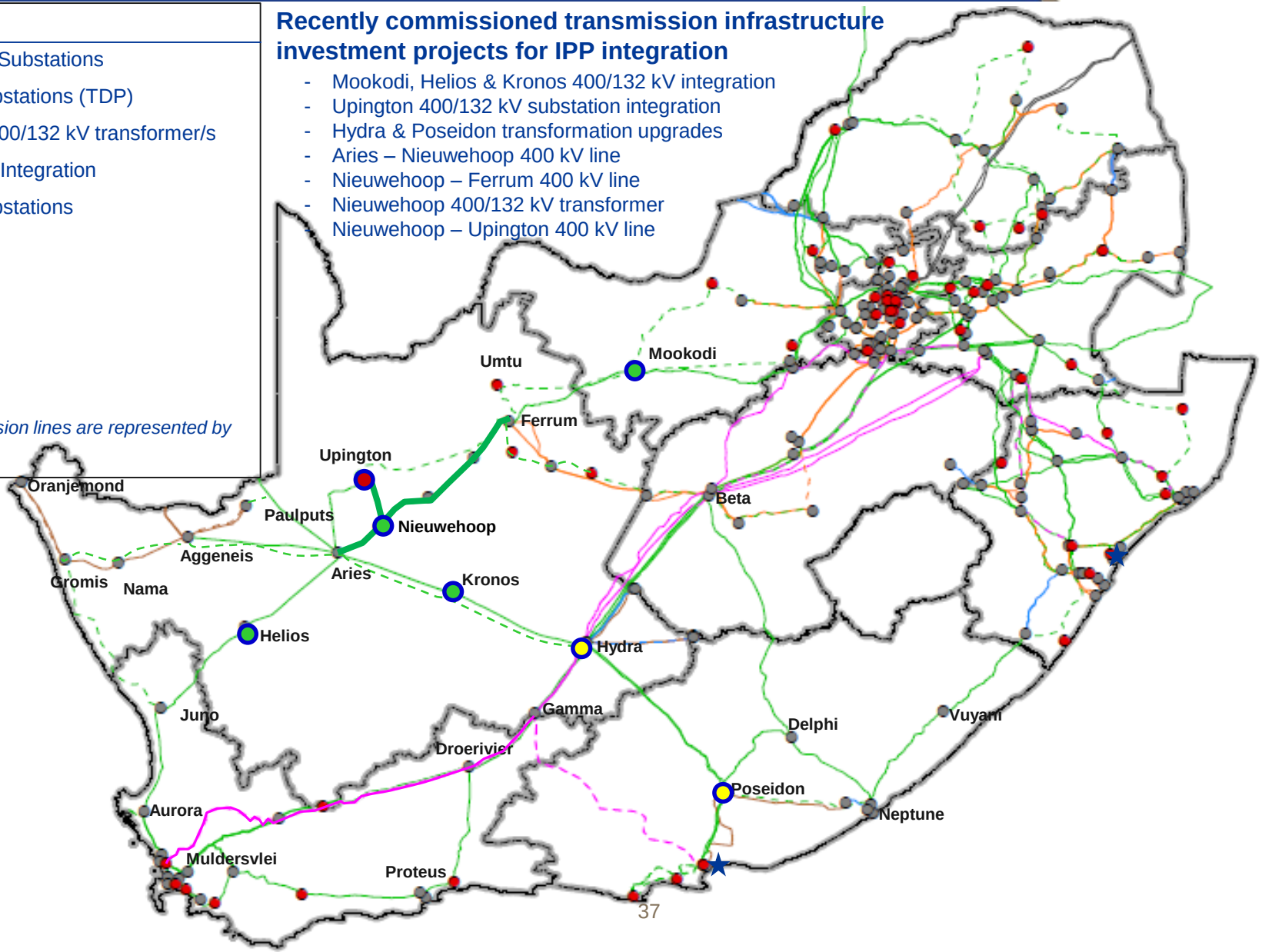
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132 kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

Planned transmission lines are represented by broken lines

Recently commissioned transmission infrastructure investment projects for IPP integration

- Mookodi, Helios & Kronos 400/132 kV integration
- Upington 400/132 kV substation integration
- Hydra & Poseidon transformation upgrades
- Aries – Nieuwehoop 400 kV line
- Nieuwehoop – Ferrum 400 kV line
- Nieuwehoop 400/132 kV transformer
- Nieuwehoop – Upington 400 kV line



Transmission integration plans for approved IPPs - Ongoing projects to complete connection of the approved projects

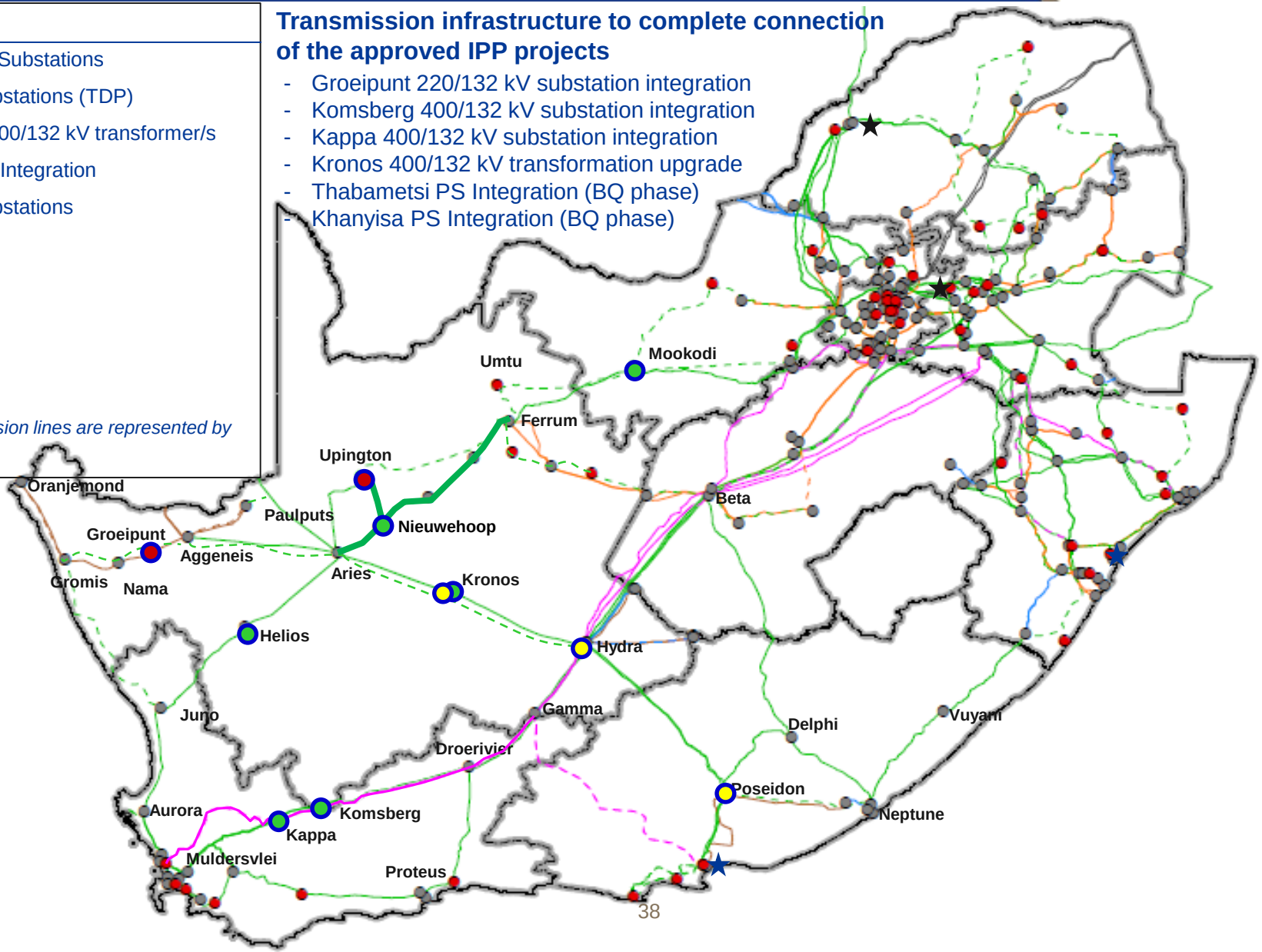
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132 kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

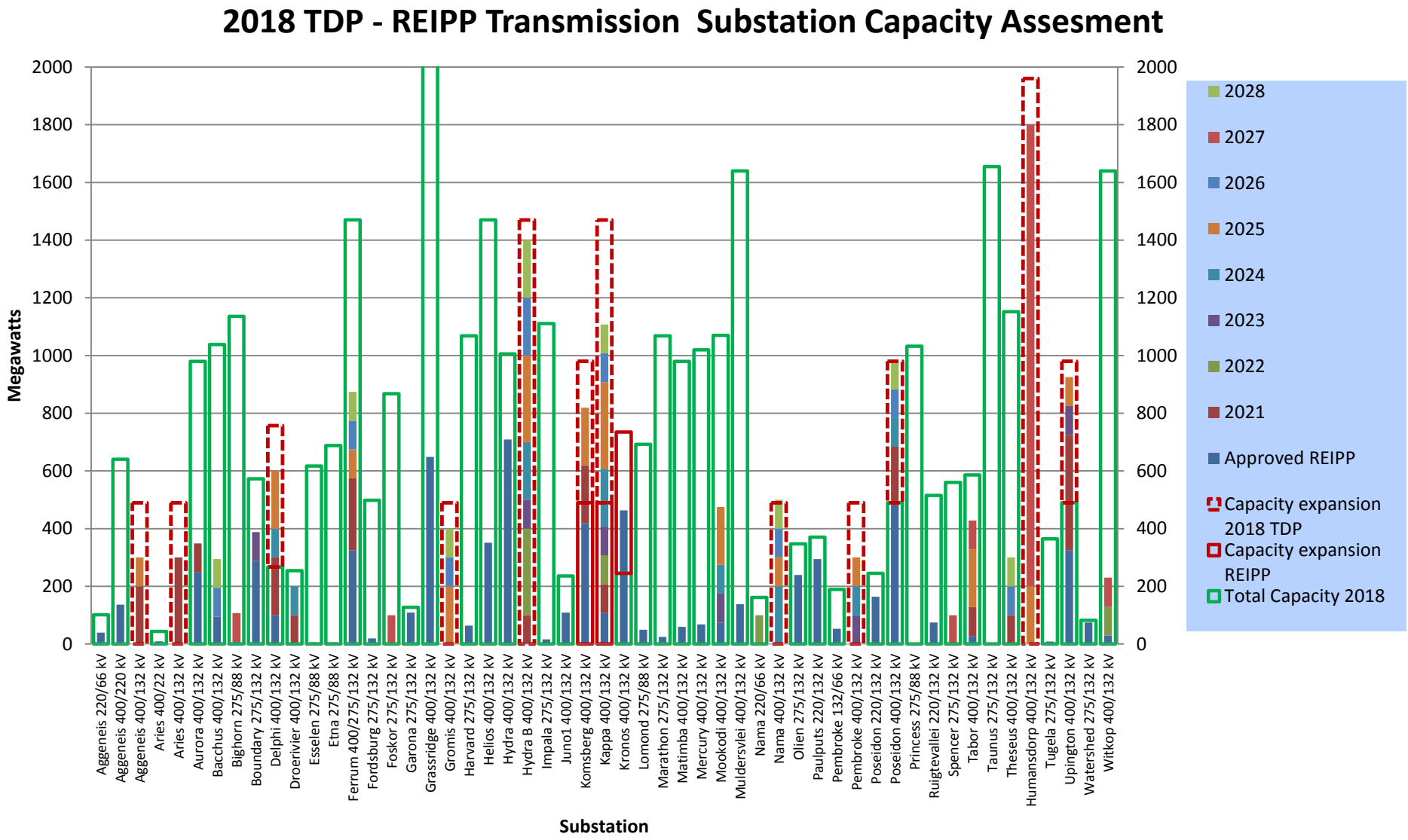
Planned transmission lines are represented by broken lines

Transmission infrastructure to complete connection of the approved IPP projects

- Groeipunt 220/132 kV substation integration
- Komsberg 400/132 kV substation integration
- Kappa 400/132 kV substation integration
- Kronos 400/132 kV transformation upgrade
- Thabametsi PS Integration (BQ phase)
- Khanyisa PS Integration (BQ phase)



Transformer Capacity enhancement for IPP Integration - TDP Period



Transmission integration plans for approved IPPs - Plan for N-1 and the integration of future IPPs (TDP Projects in execution)

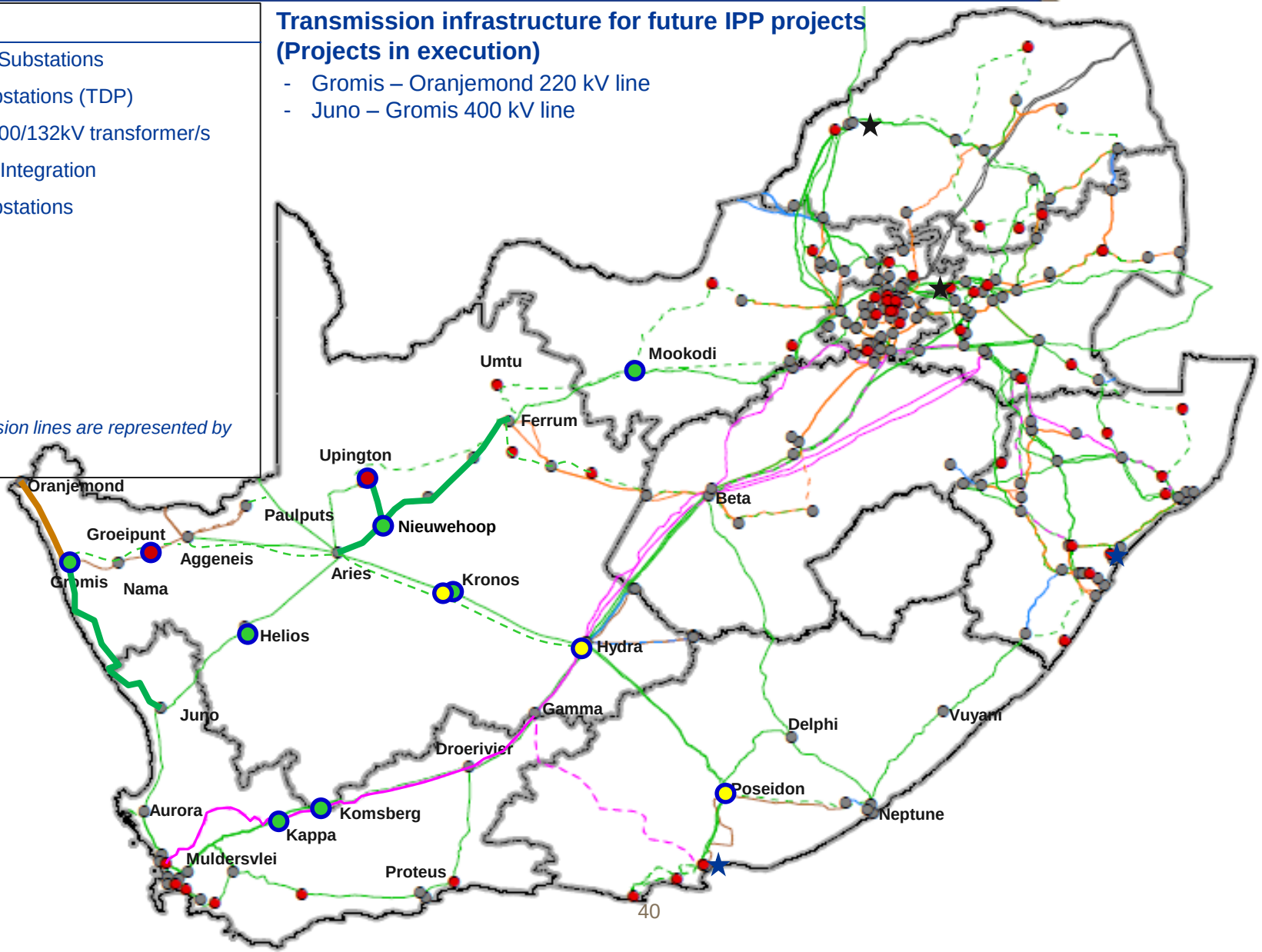
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

Planned transmission lines are represented by broken lines

Transmission infrastructure for future IPP projects (Projects in execution)

- Gromis – Oranjemond 220 kV line
- Juno – Gromis 400 kV line



Transmission integration plans for approved IPPs - Plan for N-1 and the integration of future IPPs (TDP Projects – Business case development phase)

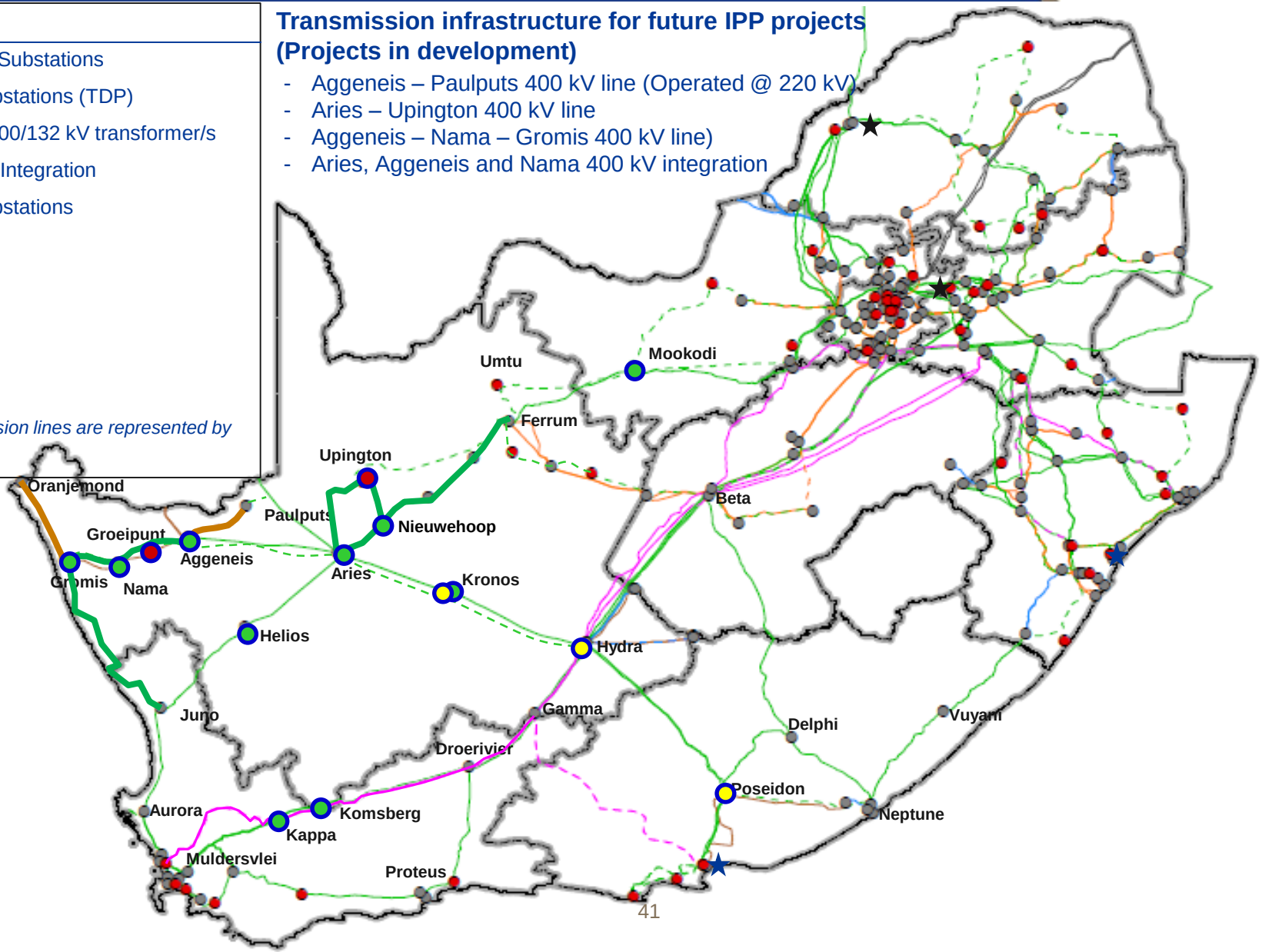
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132 kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

Planned transmission lines are represented by broken lines

Transmission infrastructure for future IPP projects (Projects in development)

- Aggeneis – Paulputs 400 kV line (Operated @ 220 kV)
- Aries – Upington 400 kV line
- Aggeneis – Nama – Gromis 400 kV line)
- Aries, Aggeneis and Nama 400 kV integration



Transmission integration plans for future IPPs - Plan for the integration of projected IPPs (Transmission expansion for future IPPs – Provincial Corridors)

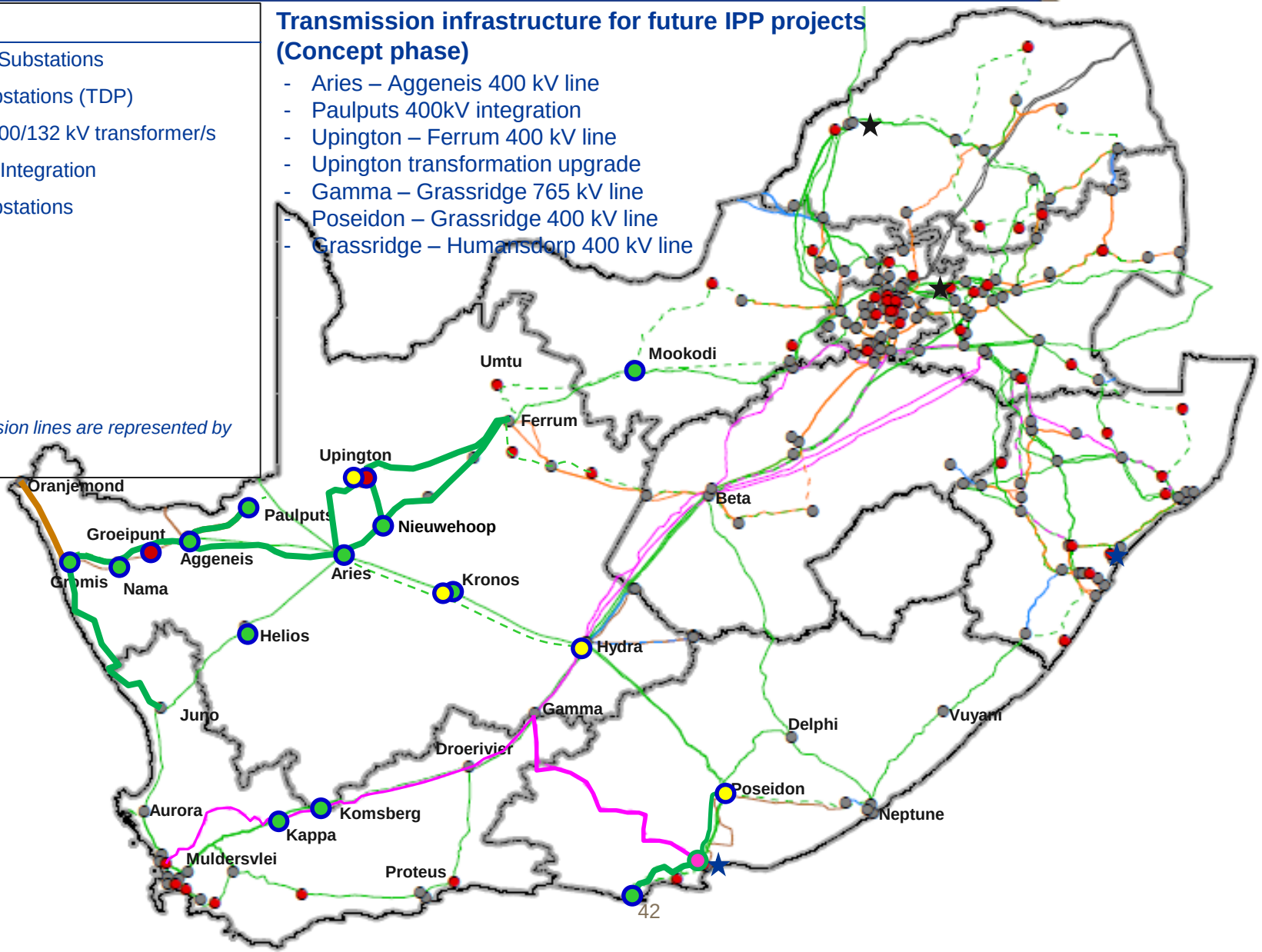
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132 kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

Planned transmission lines are represented by broken lines

Transmission infrastructure for future IPP projects (Concept phase)

- Aries – Aggeneis 400 kV line
- Paulputs 400kV integration
- Upington – Ferrum 400 kV line
- Upington transformation upgrade
- Gamma – Grassridge 765 kV line
- Poseidon – Grassridge 400 kV line
- Grassridge – Humansdorp 400 kV line



Transmission integration plans for future IPPs - Plan for the integration of projected IPPs (Transmission expansion for future IPPs – Major Corridors)

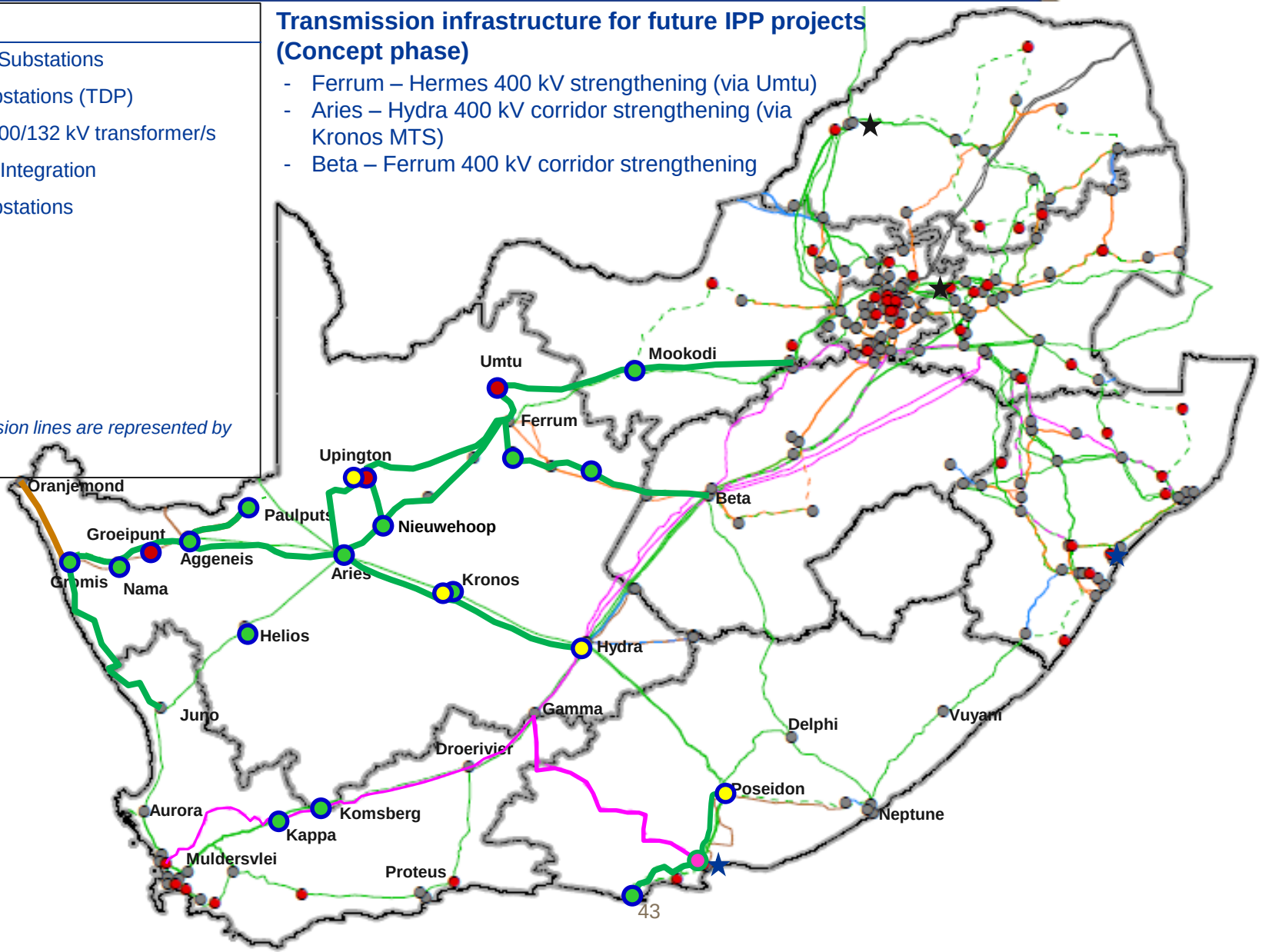
LEGEND

- Existing Tx Substations
- New Tx Substations (TDP)
- Additional 400/132 kV transformer/s
- 400/132 kV Integration
- New Tx Substations
- 765 kV line
- 400 kV line
- 275 kV line
- 220 kV line
- 132kV line

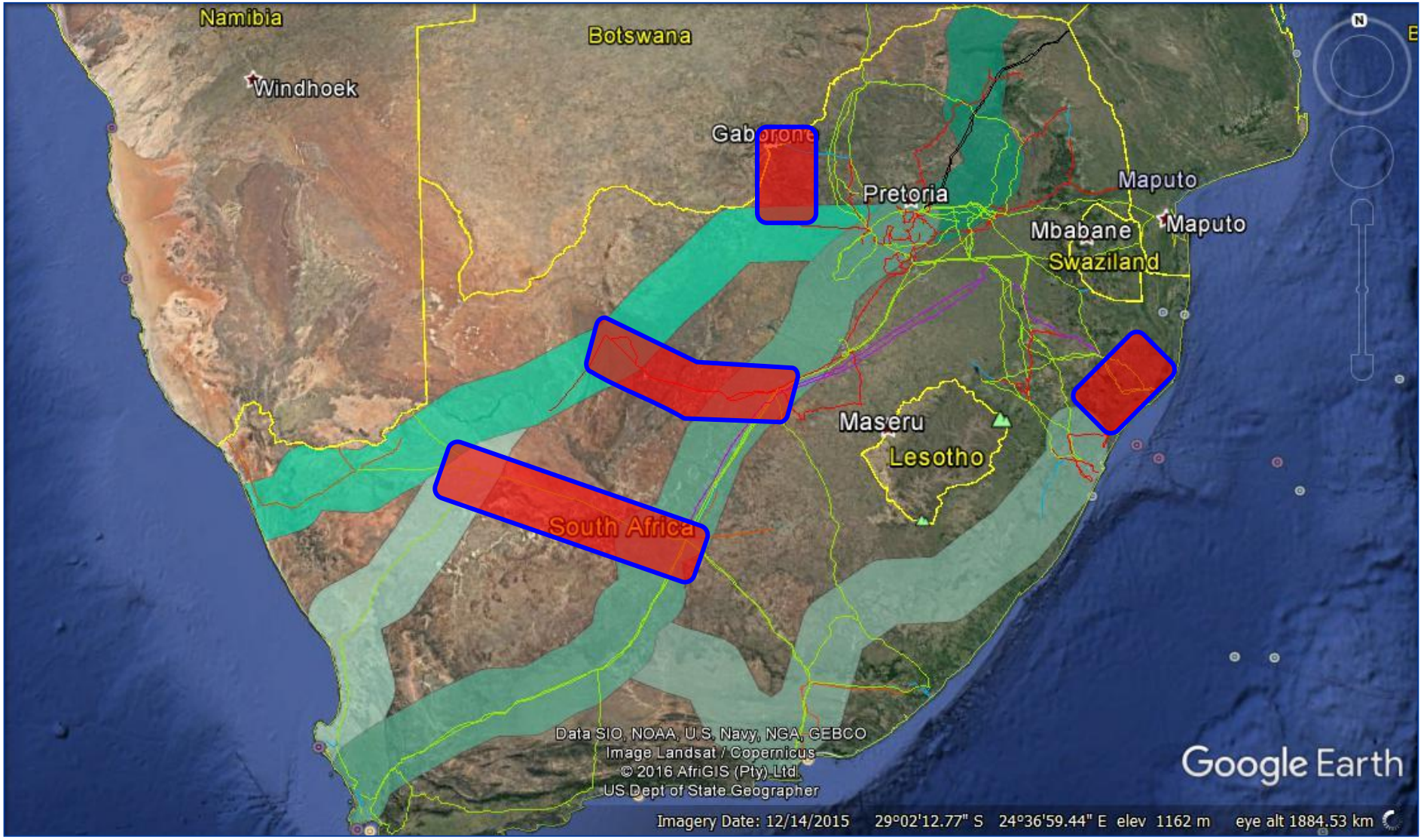
Planned transmission lines are represented by broken lines

Transmission infrastructure for future IPP projects (Concept phase)

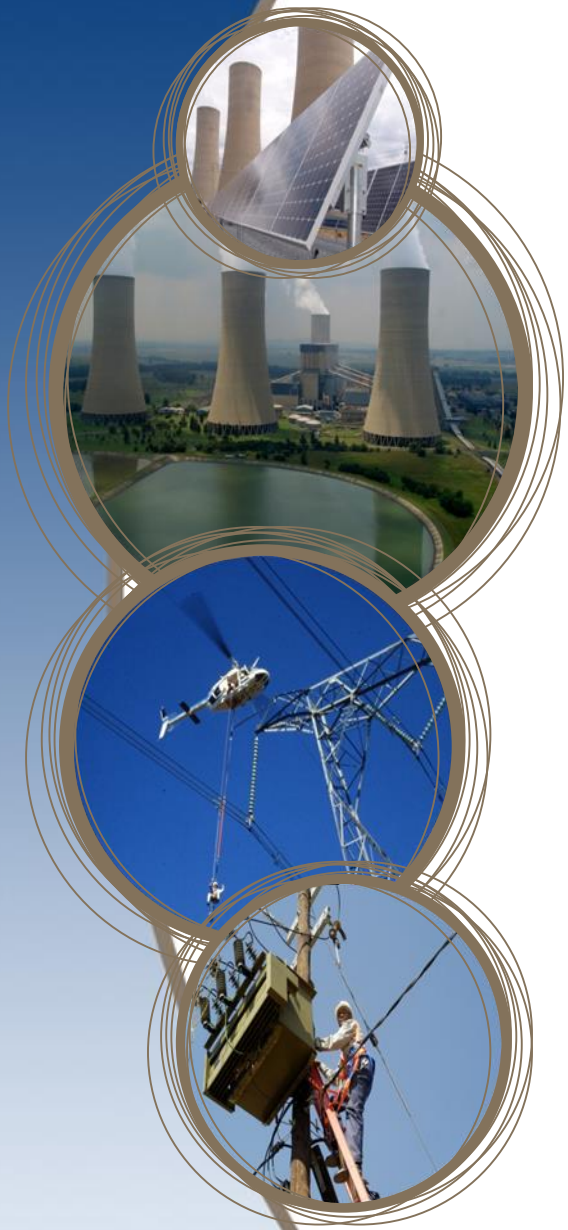
- Ferrum – Hermes 400 kV strengthening (via Umtu)
- Aries – Hydra 400 kV corridor strengthening (via Kronos MTS)
- Beta – Ferrum 400 kV corridor strengthening



Transmission integration plans for future IPPs - Additional SEA Corridors



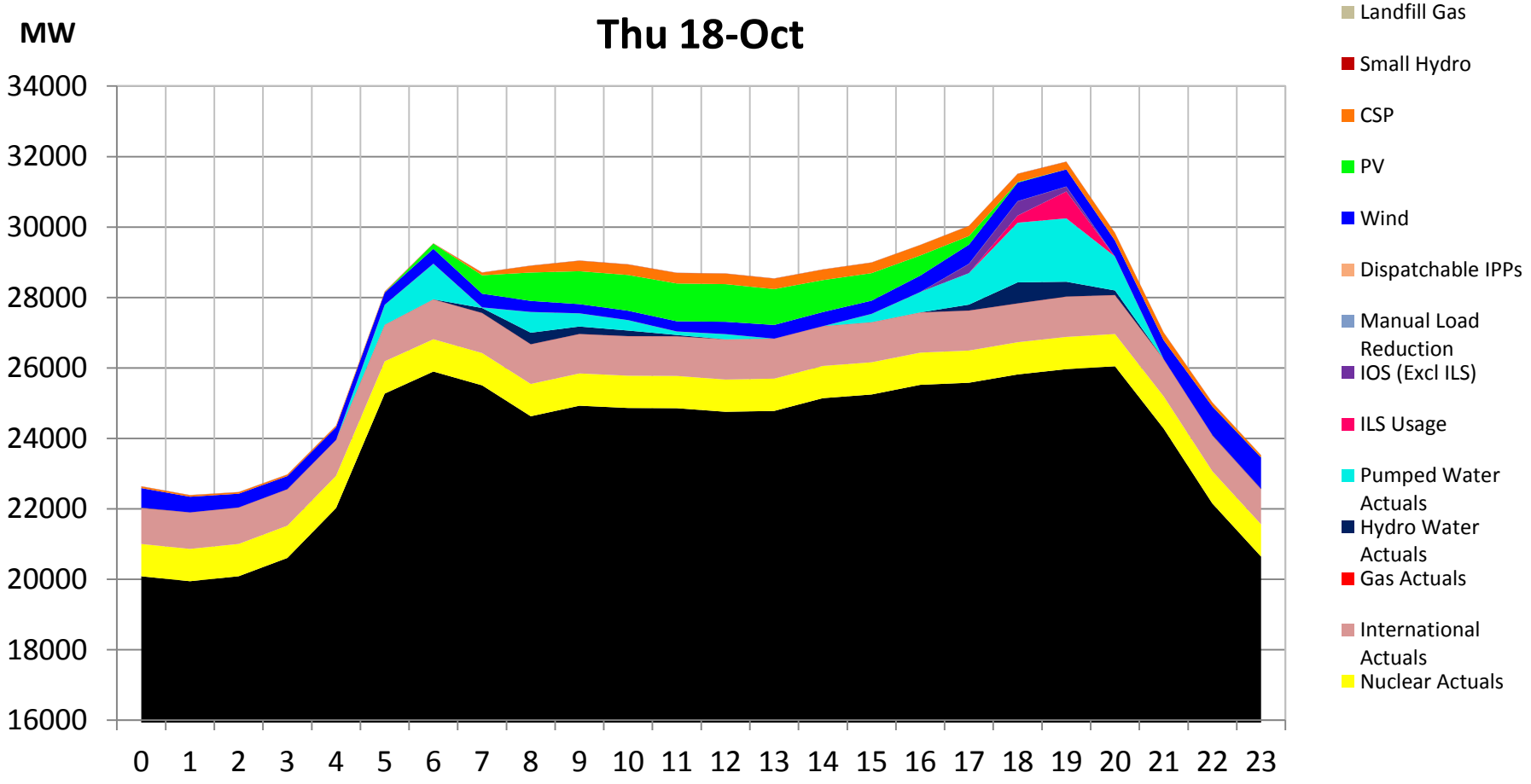
Questions?



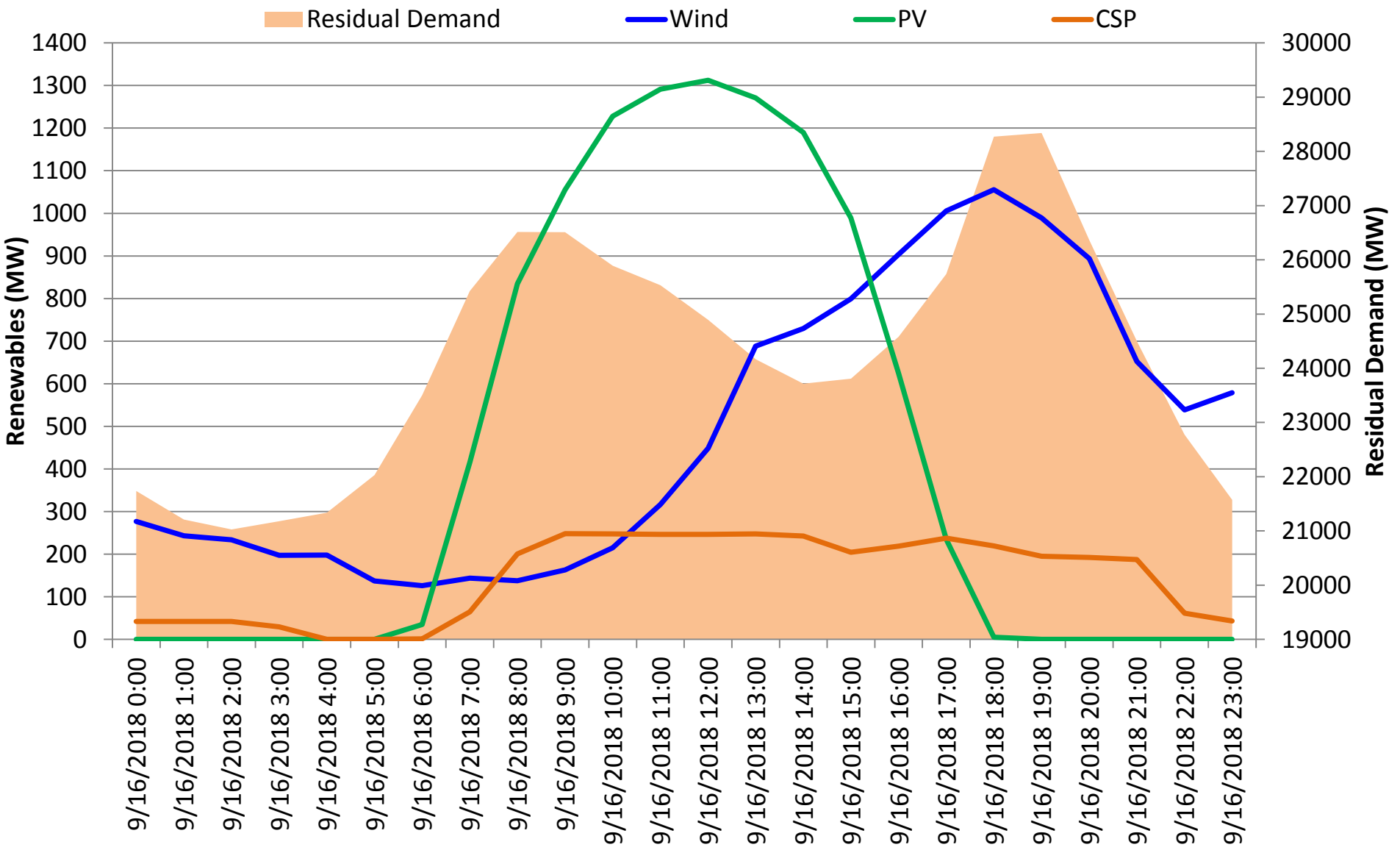
Operational Impact of Renewable Generation

Presented by: Paul Davel

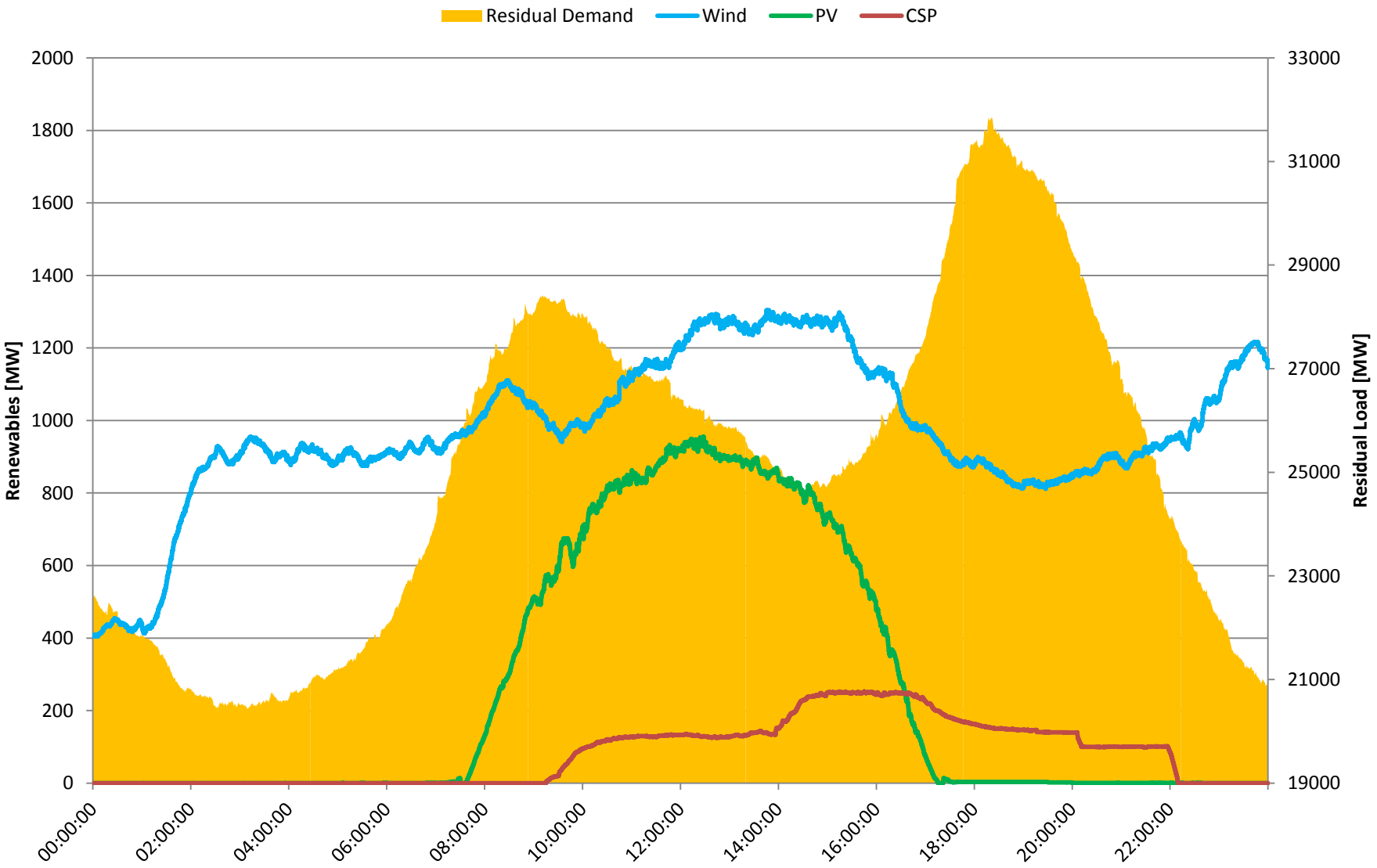
Station Build-up for the Peak Demand day of the week



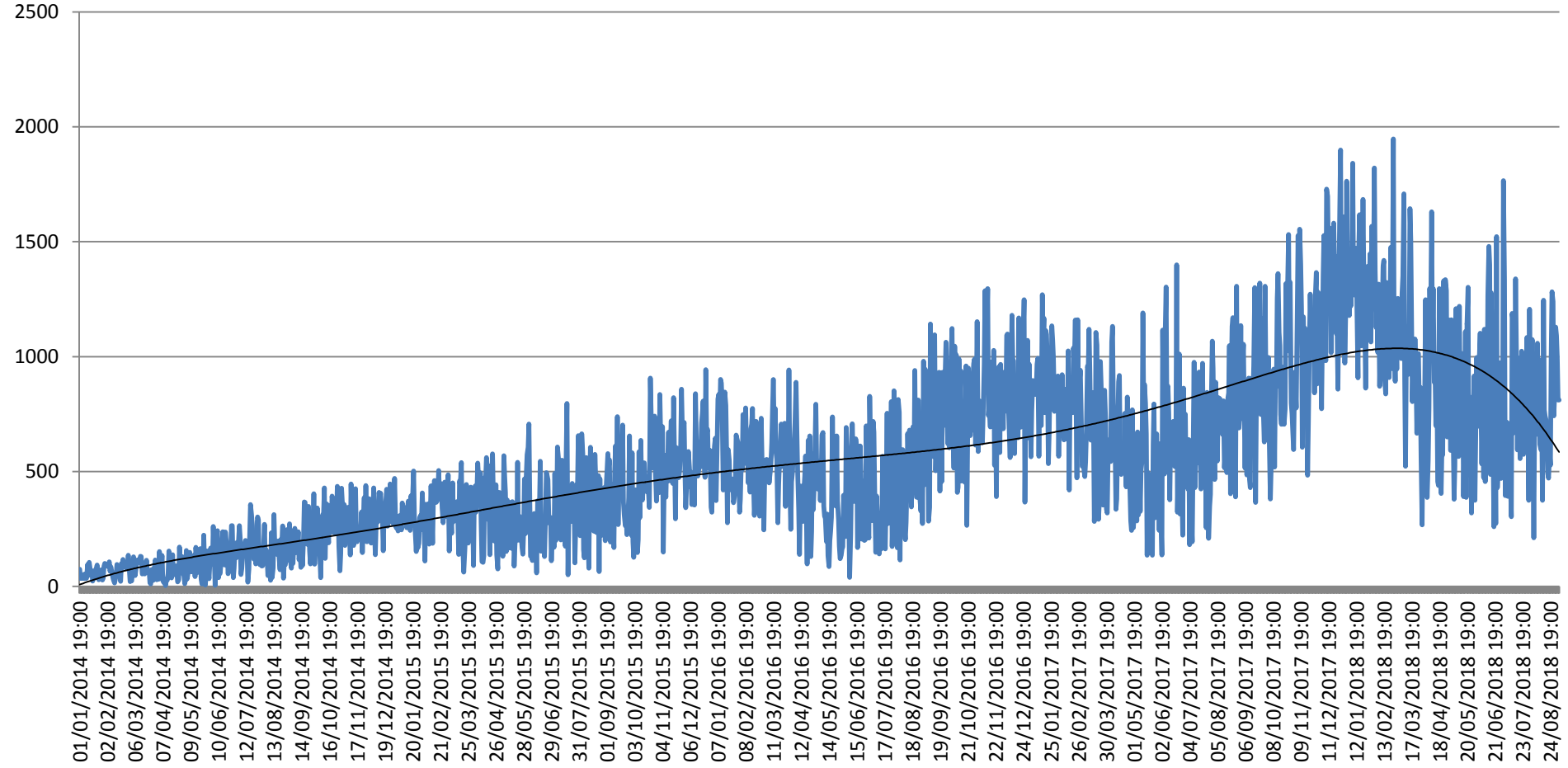
Example of Daily Renewable Generation



Example of Daily Renewable Generation

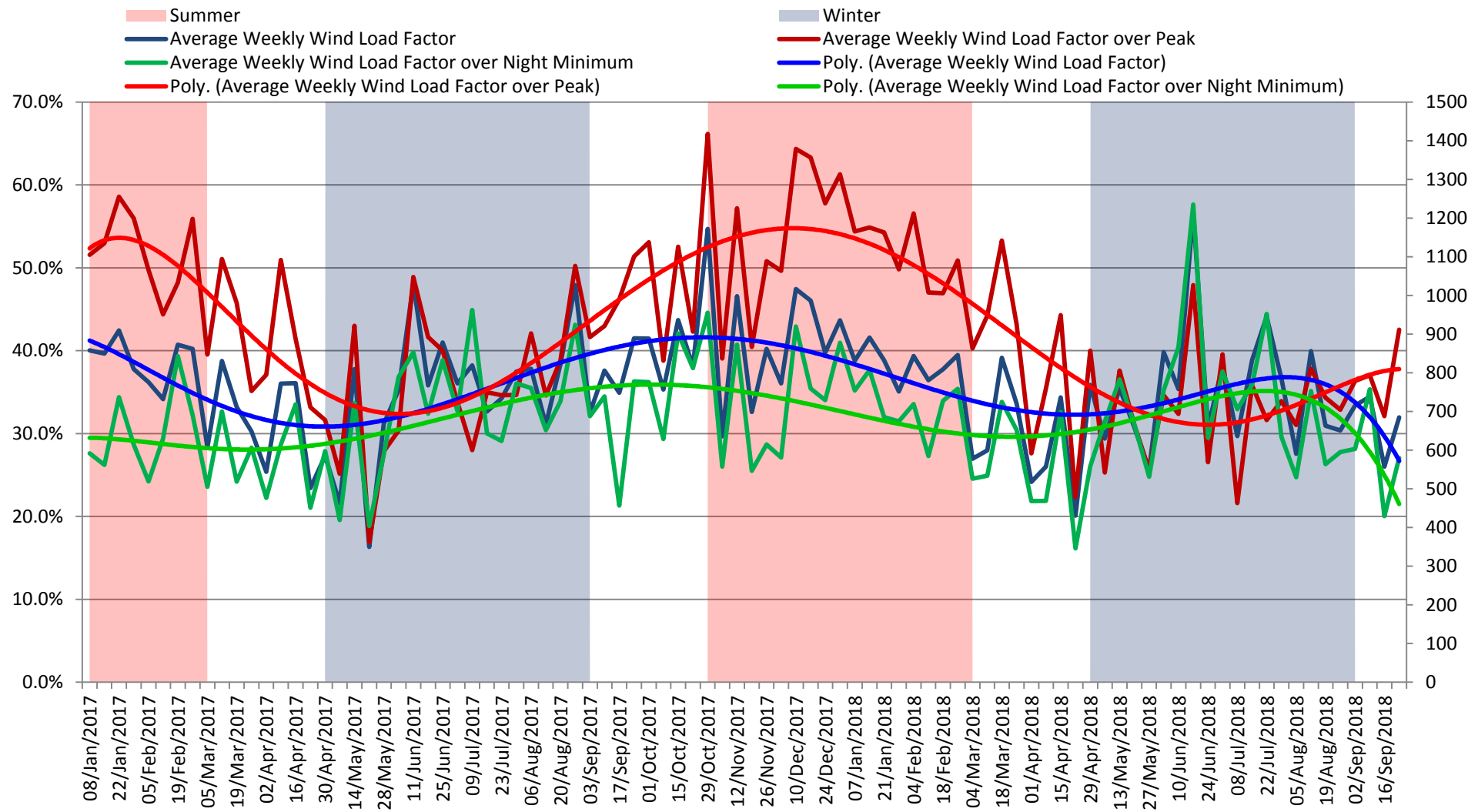


Total Renewable Generation over Evening Peaks



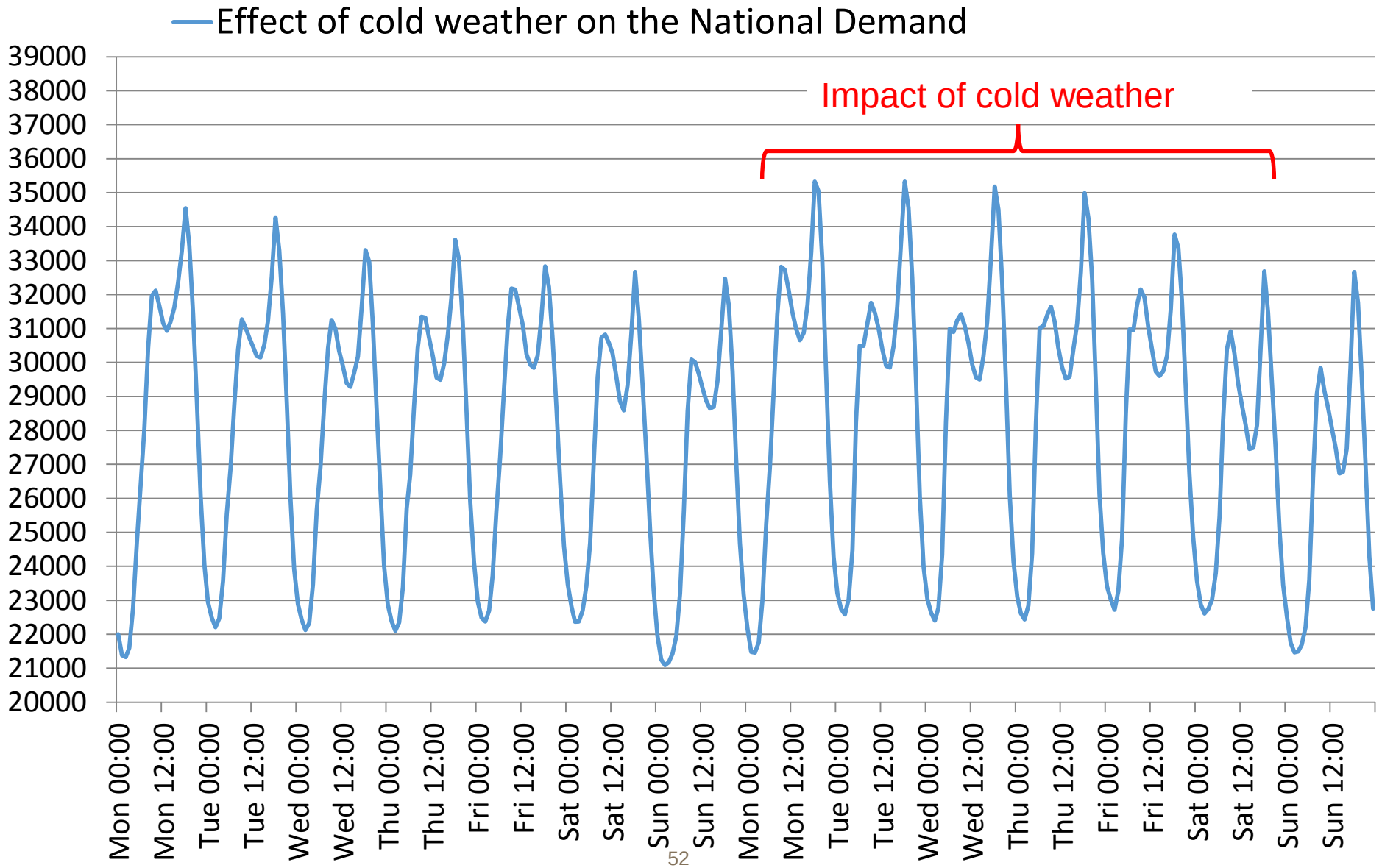
- This diagram is indicative of the increasing installed capacity but also highlights the magnitude of the variability (particularly from wind).
- It is too early to draw any conclusions about seasonal variations. However, some seasonal behaviour can be observed.
- Forecasting helps in the short term but not for planning purposes.

Wind Generation and Load Factors during 2017 and 2018



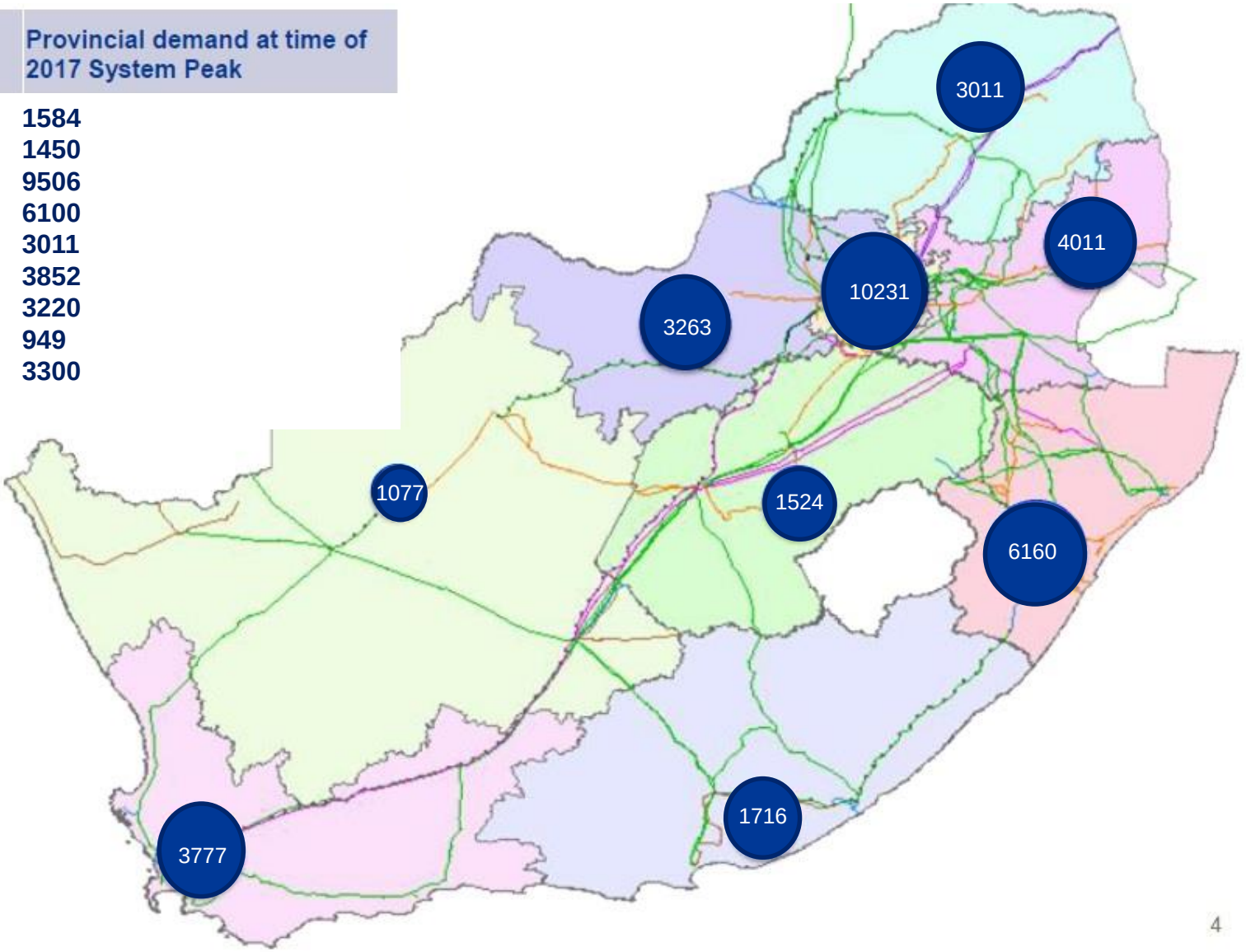
- High load factors over evening peaks in summer can be observed, dropping during the winter months. A similar behaviour can be observed over all hours in a week, however to a much lesser extent.
- This behaviour is consistent, even with the increase in wind generation.

Effect of cold weather on the National Demand – during winter 2018



Effect of cold weather on the National Demand

Province	Provincial demand at time of 2017 System Peak
Eastern Cape	1584
Free State	1450
Gauteng	9506
KZN	6100
Limpopo	3011
Mpumulanga	3852
North West	3220
Northern Cape	949
Western Cape	3300



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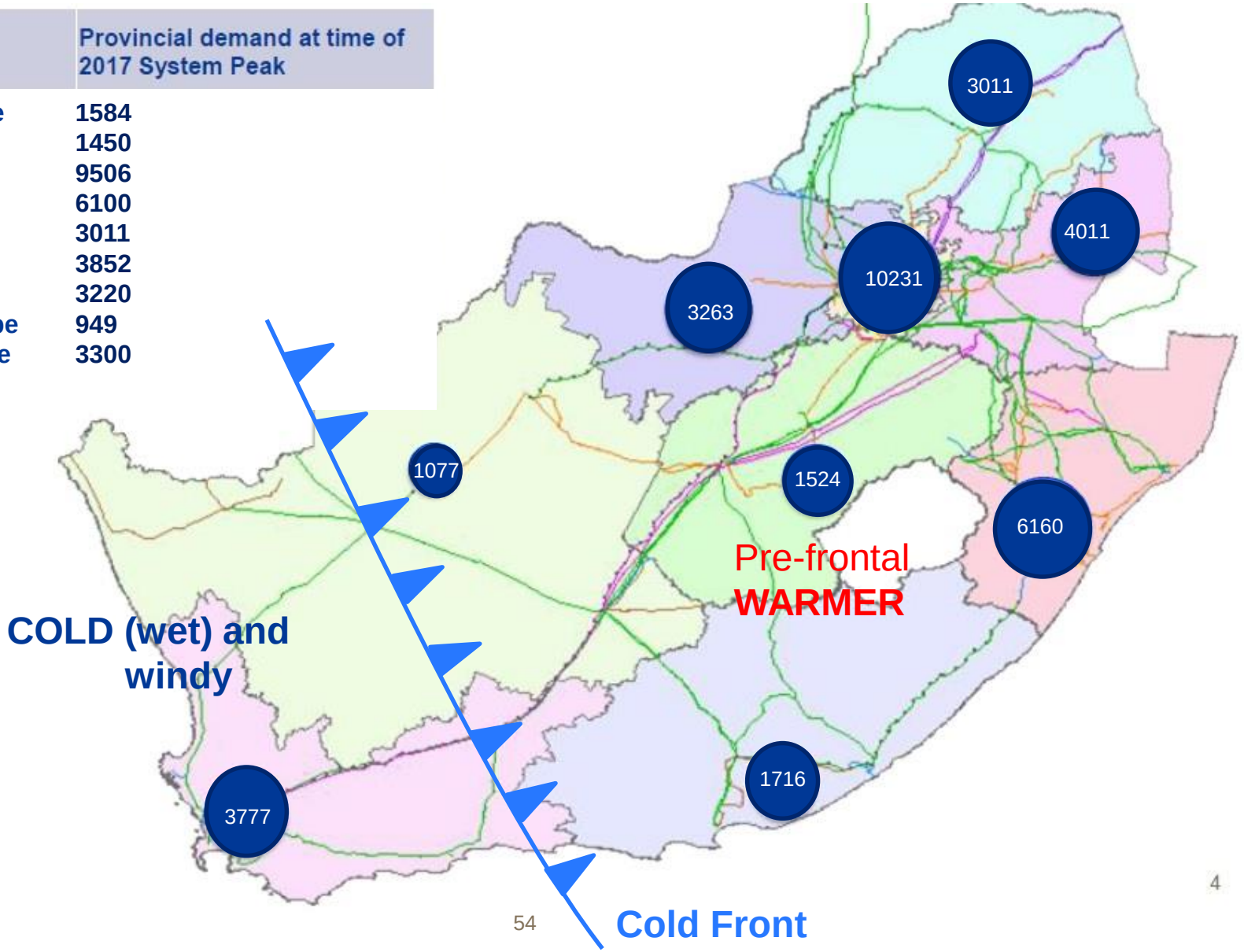
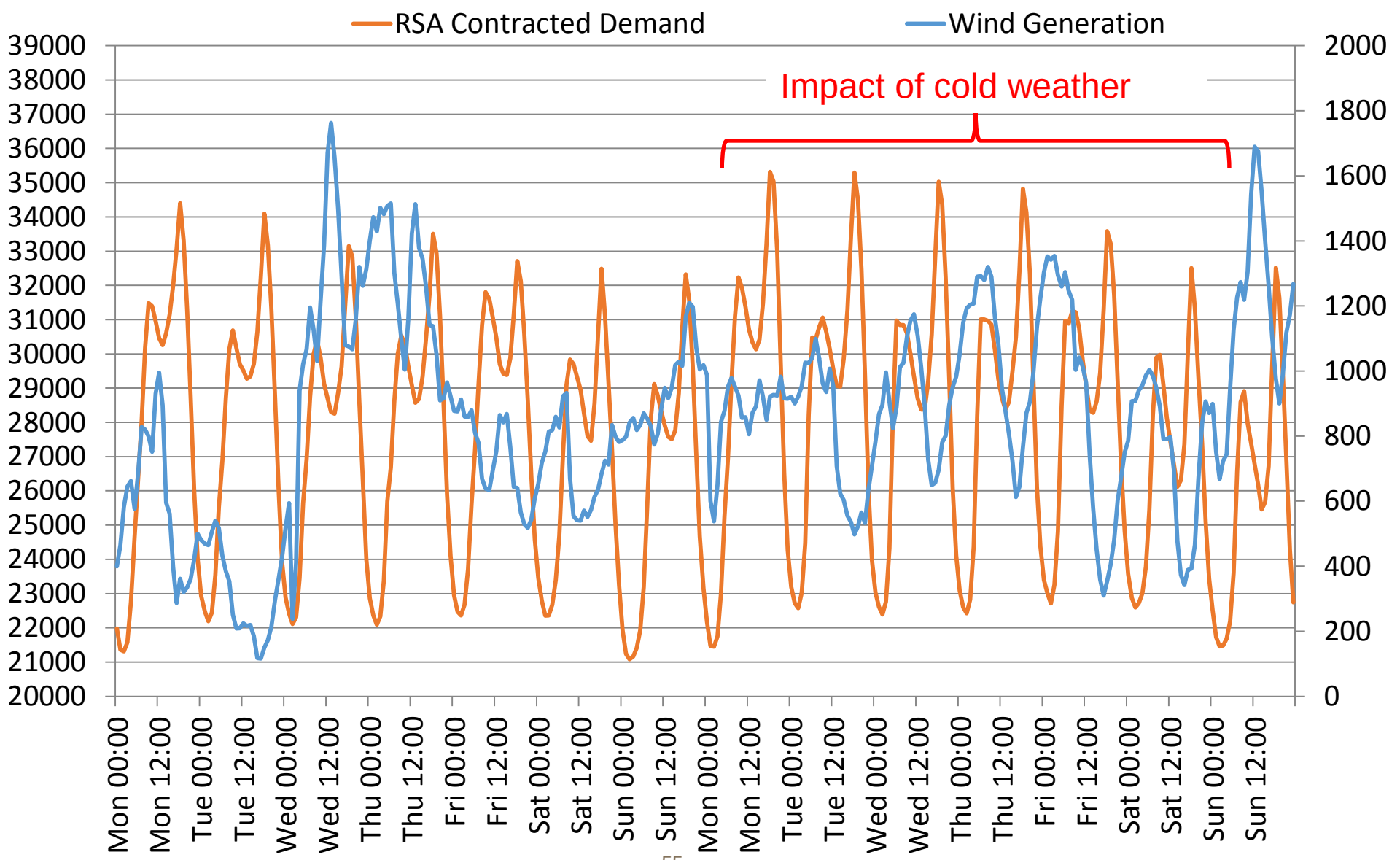
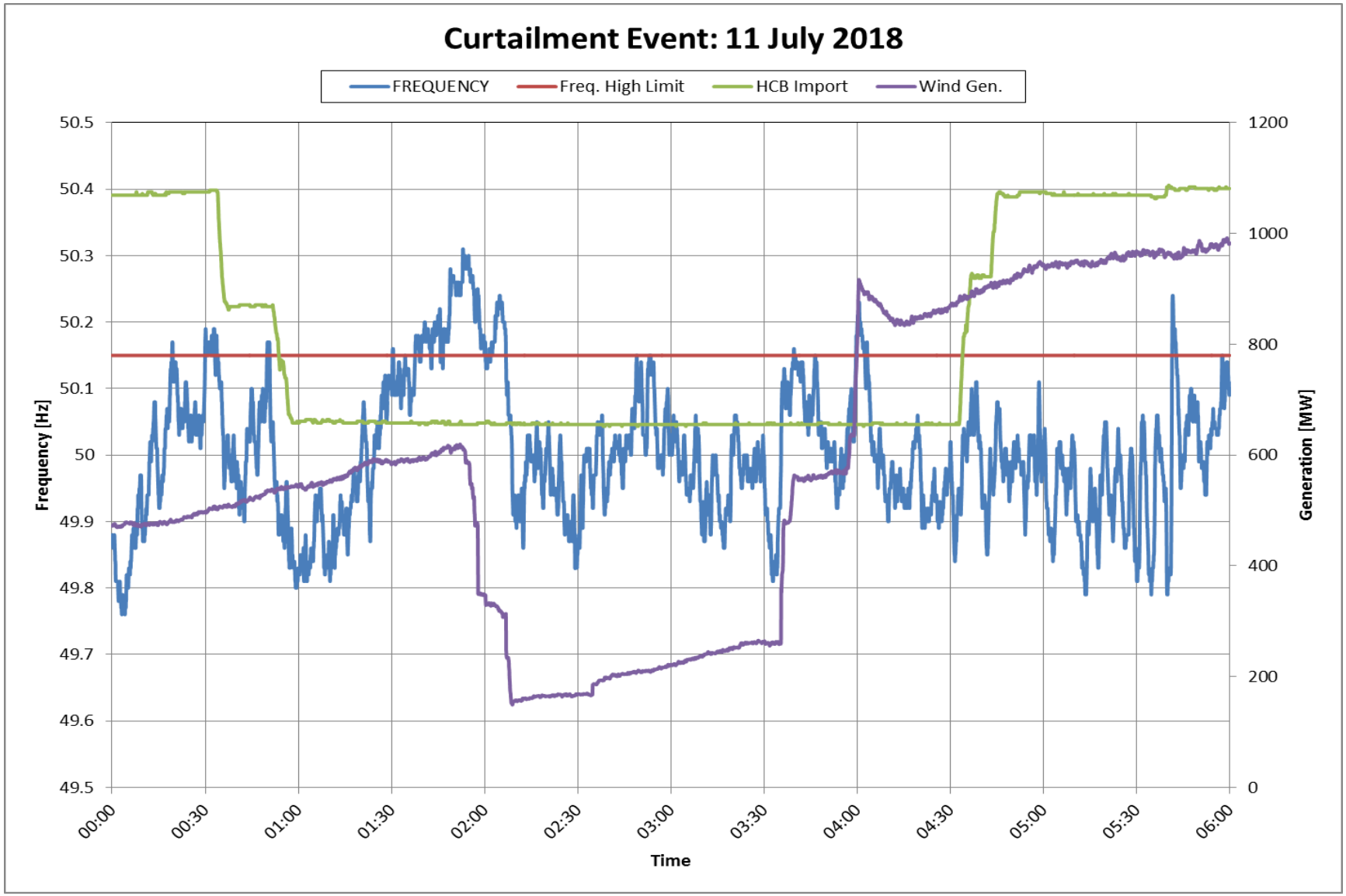


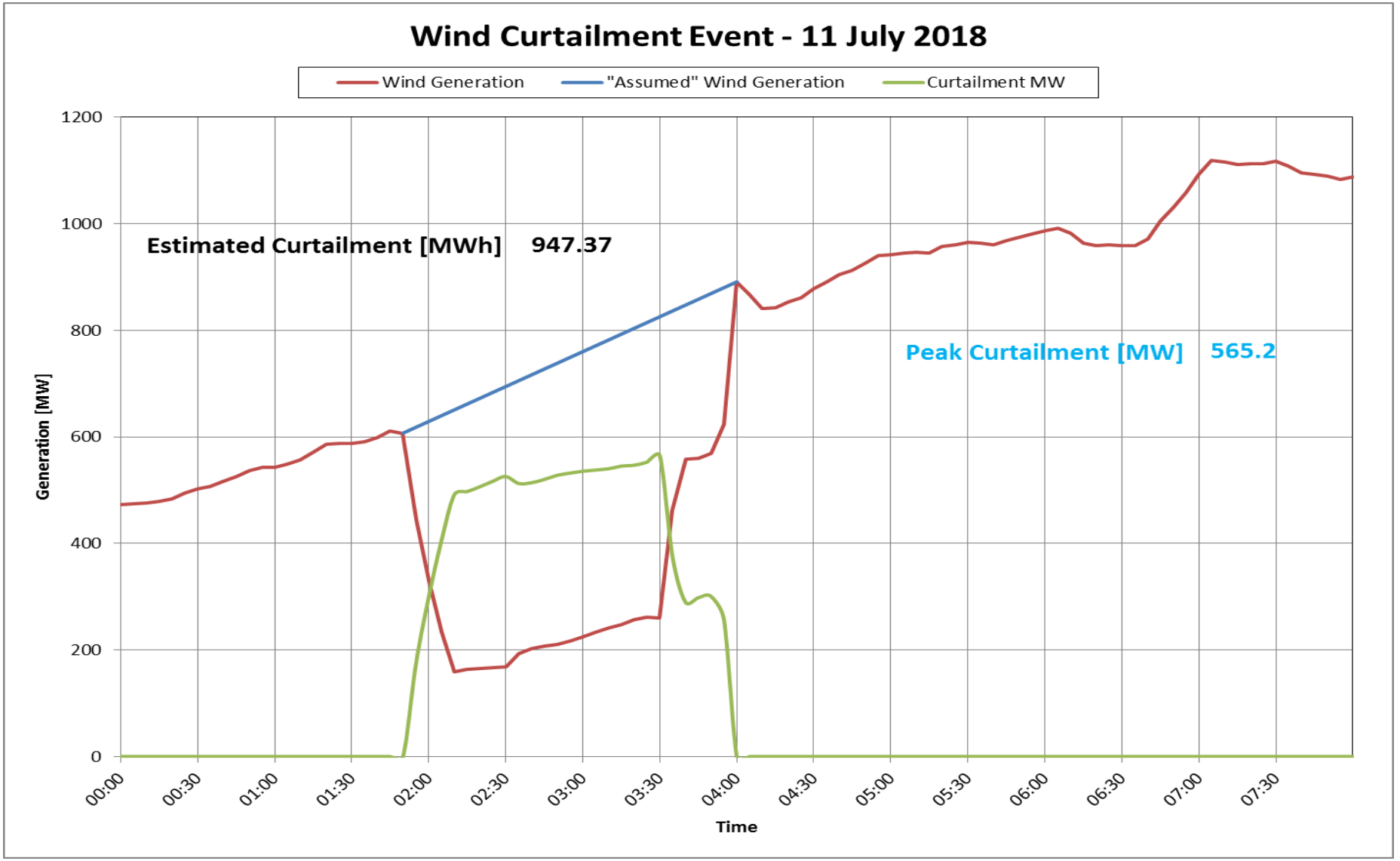
Effect of cold weather on the National Demand – during winter 2018



Effect of high wind generation during low load periods



Effect of high wind generation during low load periods

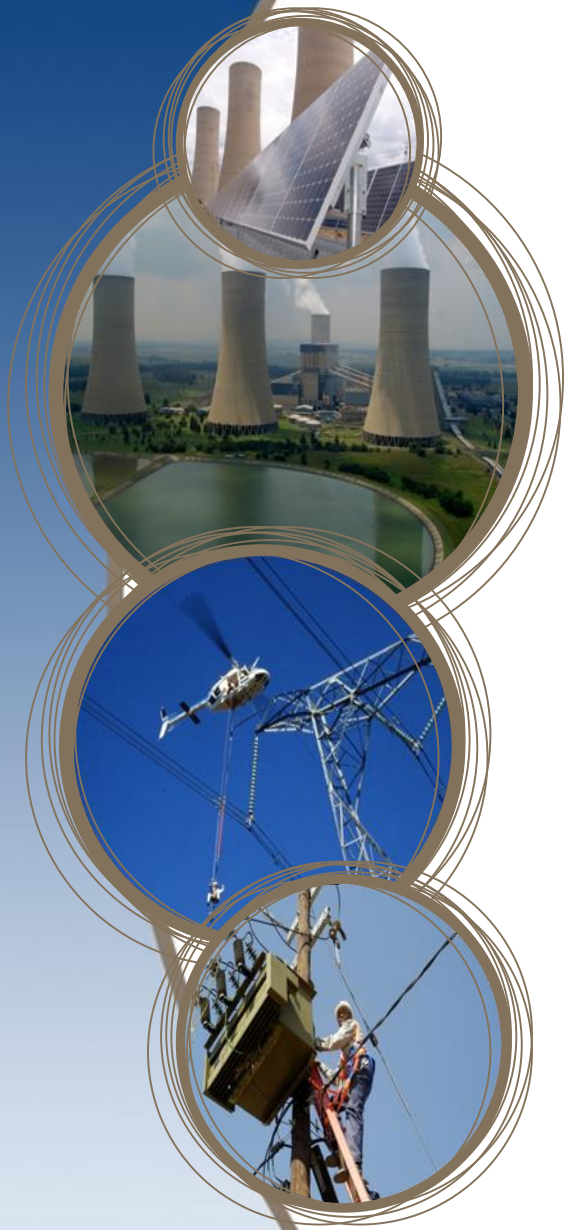


Summary of Operational Challenges posed by Renewable Generation

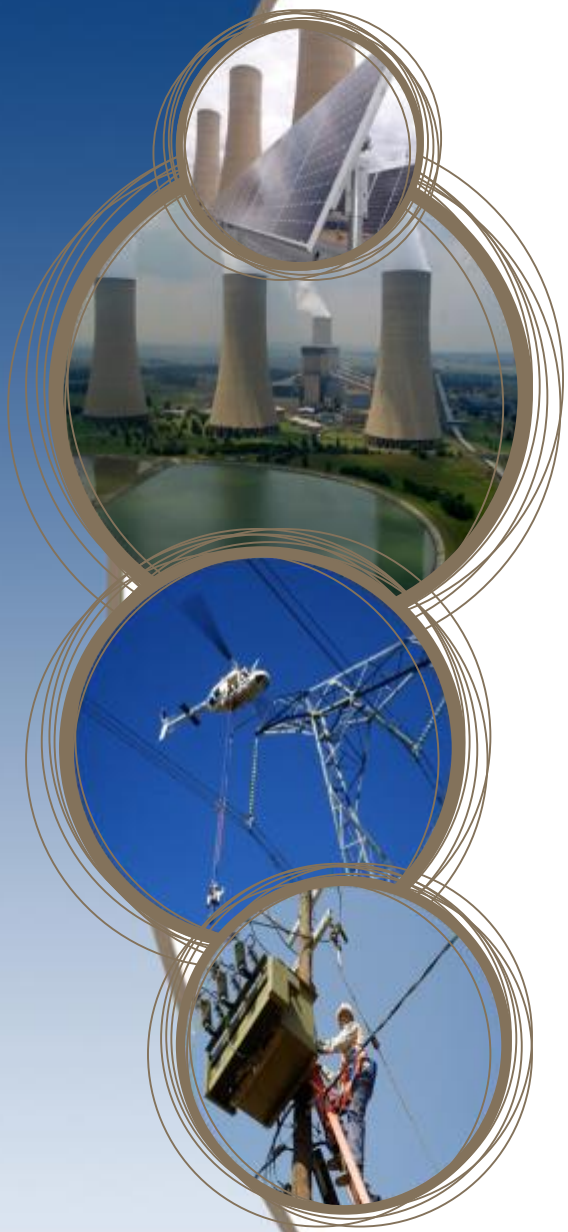
- **OPERATIONAL CHALLENGES**
- PV drop off before evening peak
- Unpredictability of wind generation, particularly over system peak
- Operating regime of CSP, which is not aligned to system requirements
- “Excessive” wind generation over night minimum, requiring curtailment

- **POSSIBLE MITIGATION**
- Installation of large scale storage (pilot projects are presently in execution)
- Closer alignment of power purchase agreements to system requirements

Questions?



Provincial Development Plans 2019 – 2028



Limpopo Province

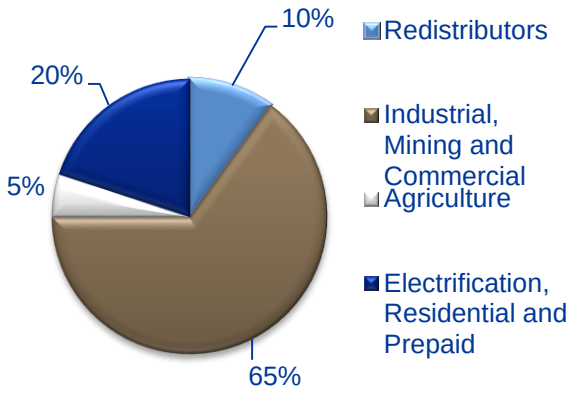
TDP 2019 - 2028

Presented by: Caroleen Naidoo

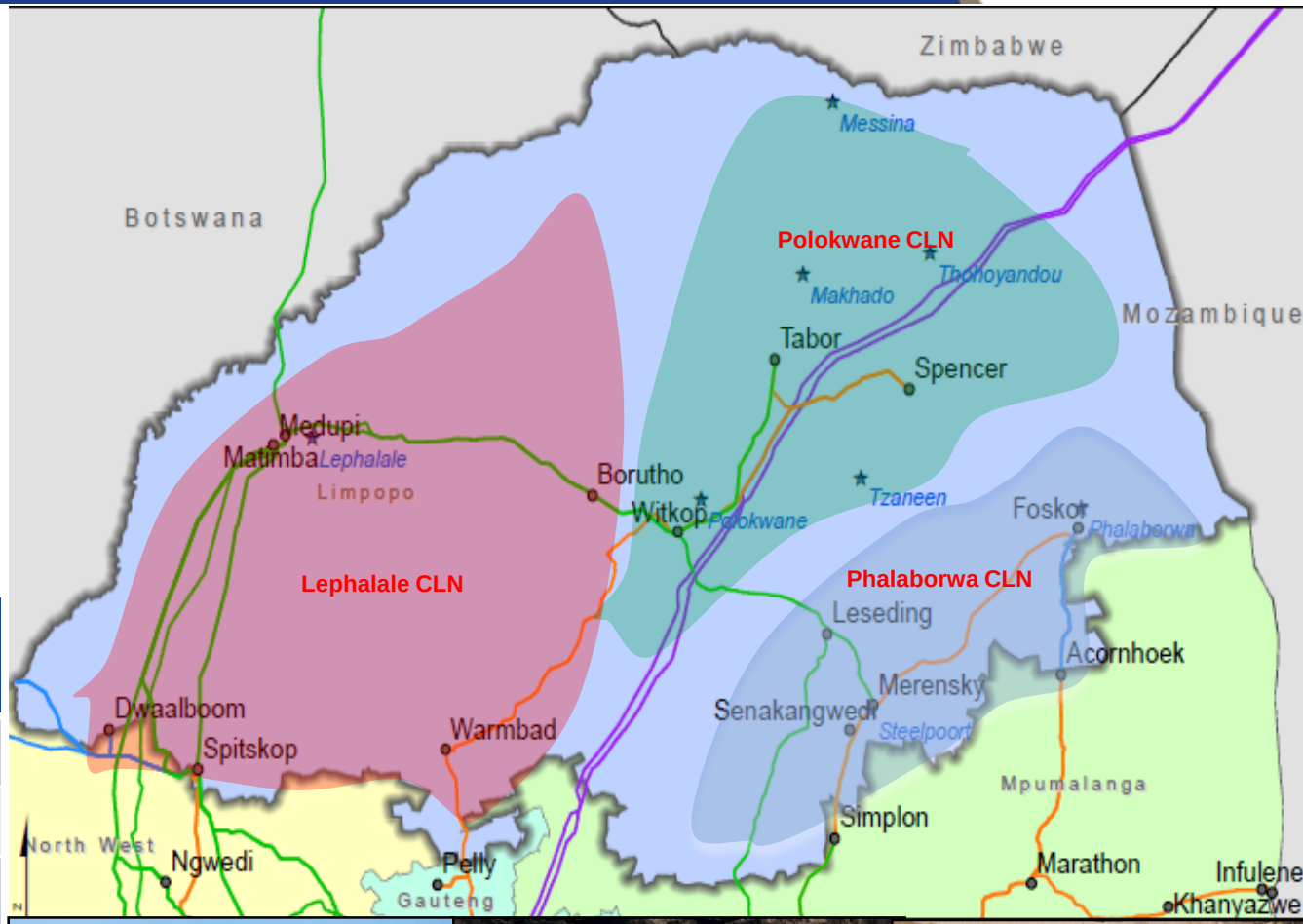
Limpopo Province Profile

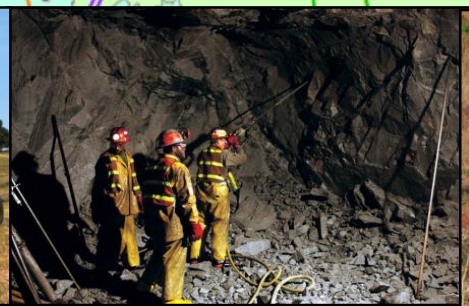
- **Peak load of 3011 MW :**

  30th May 2017



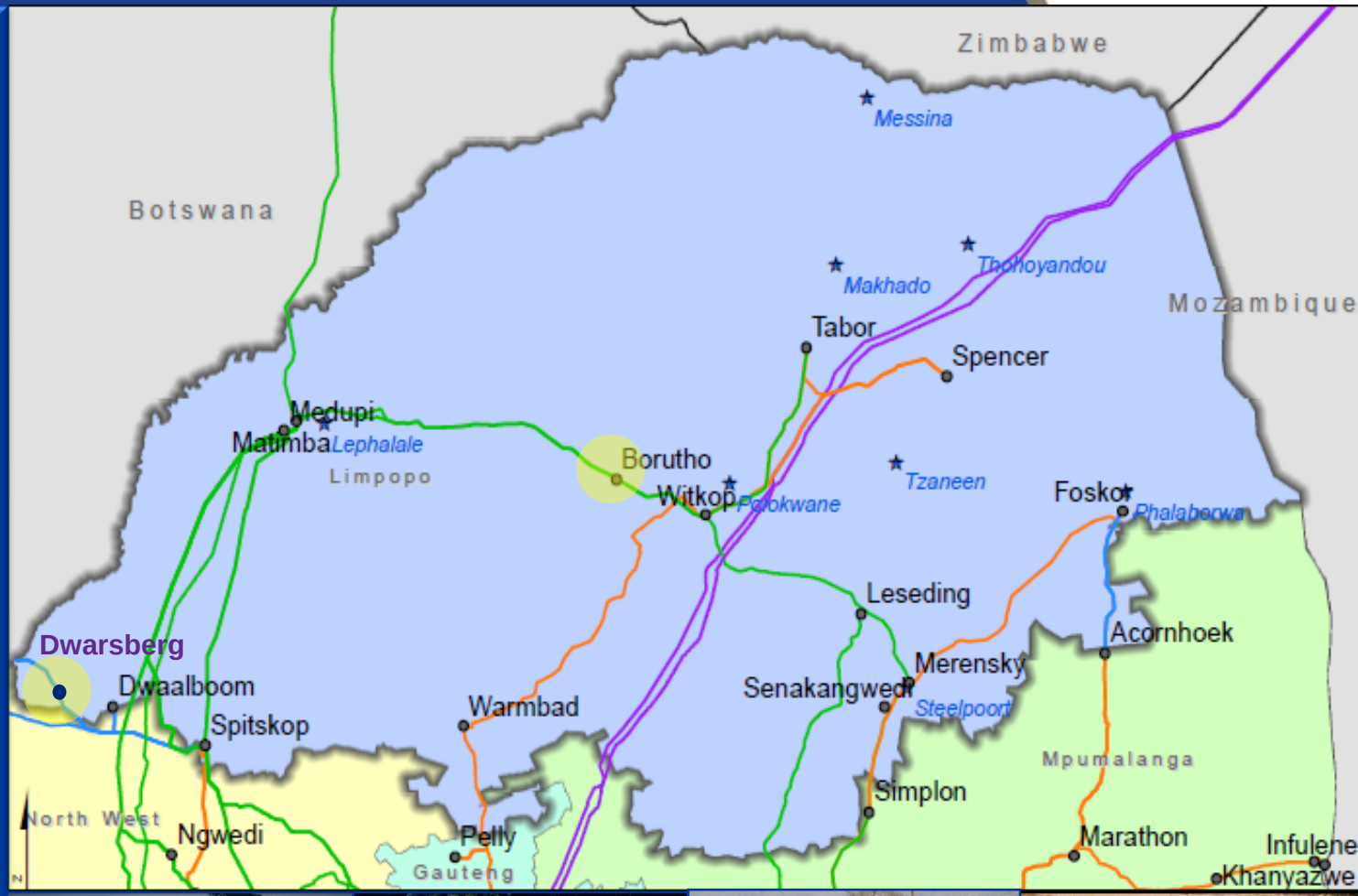
Type	Name	Output
Base Load	Matimba	3990 MW
	Medupi	2382 MW
Renewables	Witkop PV	30 MW
	Soutpan PV	28 MW
	Villa Nora PV	60 MW
Total Installed Generation		6490 MW

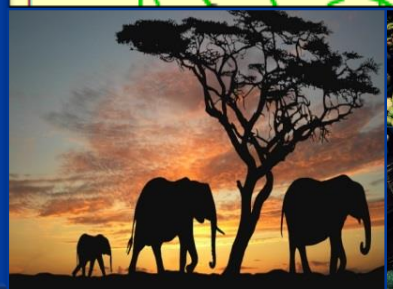


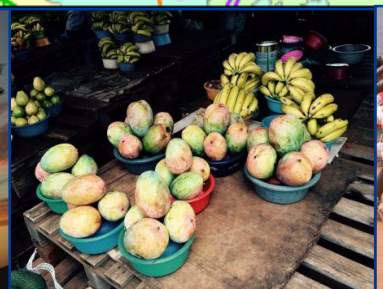


Completed Projects

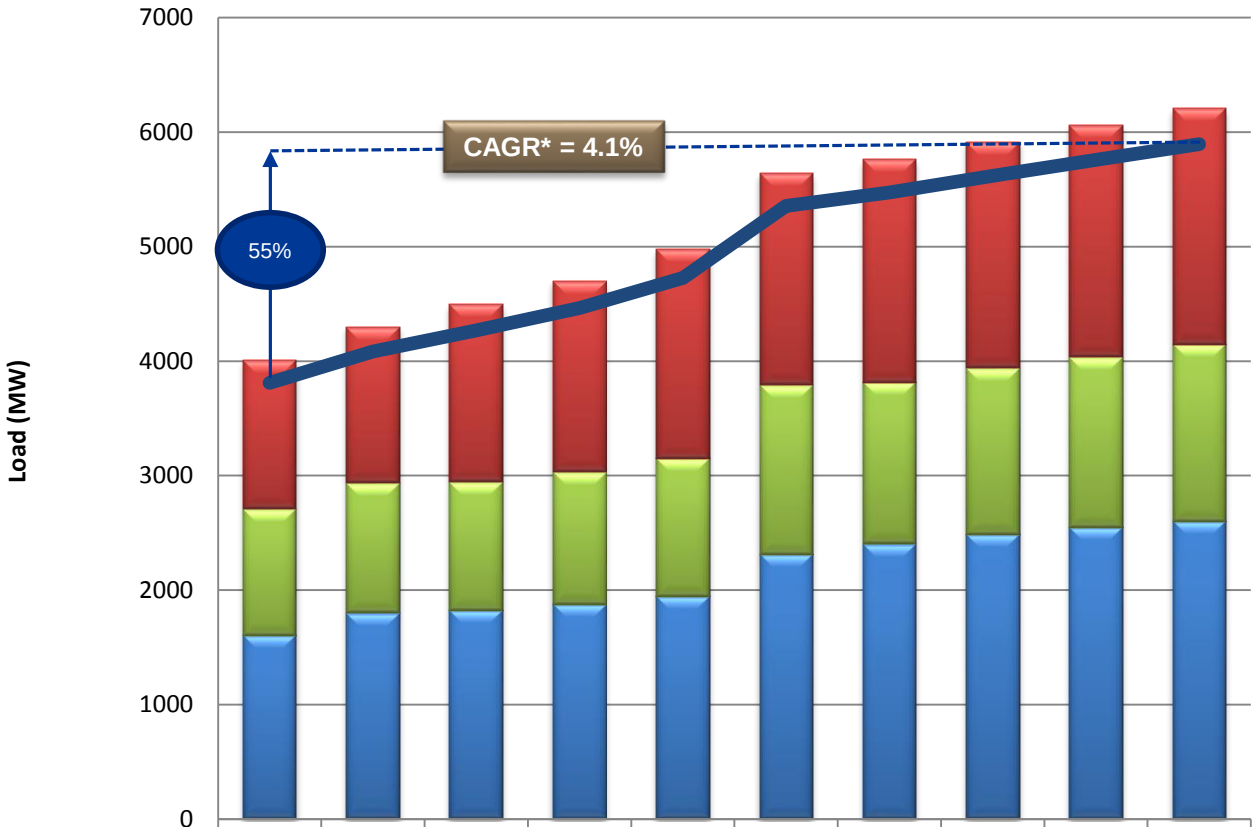
- **Borutho 400/132kV Substation**
- **Dwarsberg 132kV Switching Station**







Limpopo Province Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Lephalale CLN Peak	1301	1365	1551	1668	1827	1843	1944	1973	2027	2060
Polokwane CLN Peak	1108	1132	1120	1156	1203	1484	1413	1452	1489	1546
Phalaborwa CLN Peak	1602	1802	1823	1876	1945	2310	2403	2489	2546	2600
Limpopo Grid Peak	3810	4084	4269	4465	4726	5355	5472	5618	5759	5896

Commercial and light industrial load growth. Platinum and Coal Mining

Electrification, Agriculture, Diamond and Coal Mining commercial and light industrial

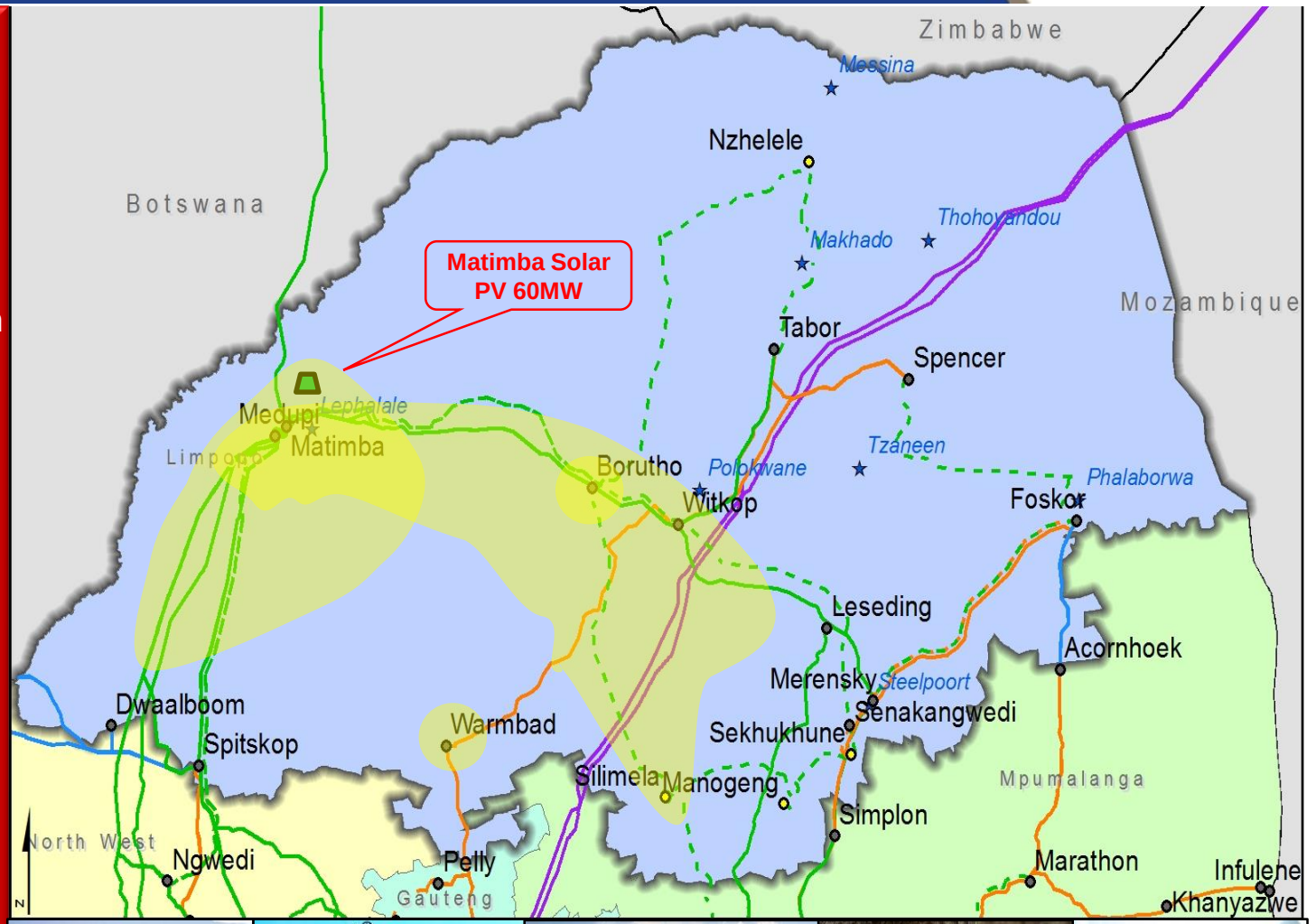
Electrification, Agriculture and Chrome Mining

*** Compound Annual Growth Rate**

TRANSMISSION DEVELOPMENT PLAN

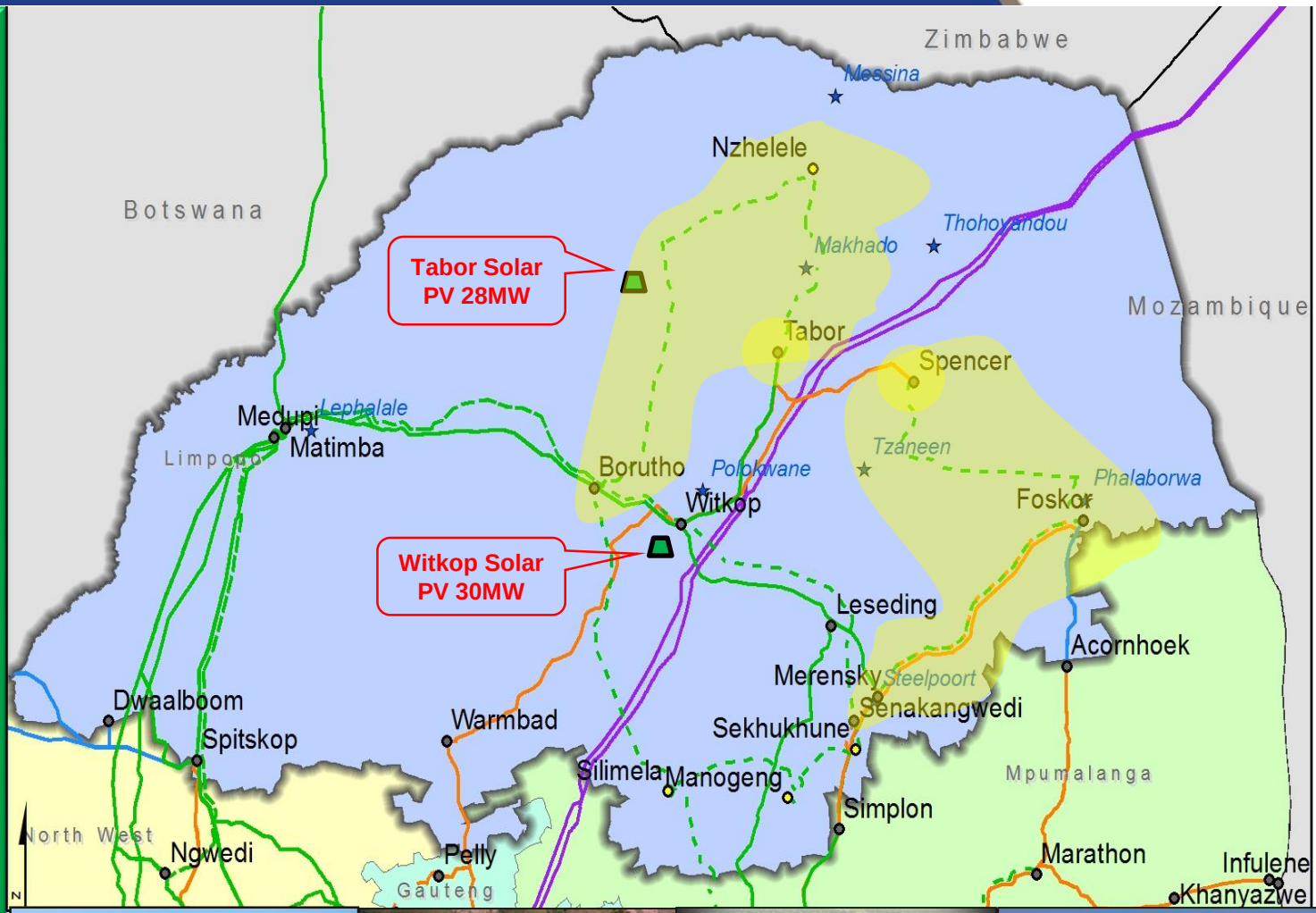
Developments in the Lephalale CLN

- **Medupi Integration: 2 x Medupi-Ngwedi 400 kV lines**
- **Waterberg Generation Integration: Medupi – Witkop & Borutho – Silimela 400 kV line**
- **Borutho 3rd 500 MVA Transformer**
- **Warmbad 1st 250 MVA Transformer**



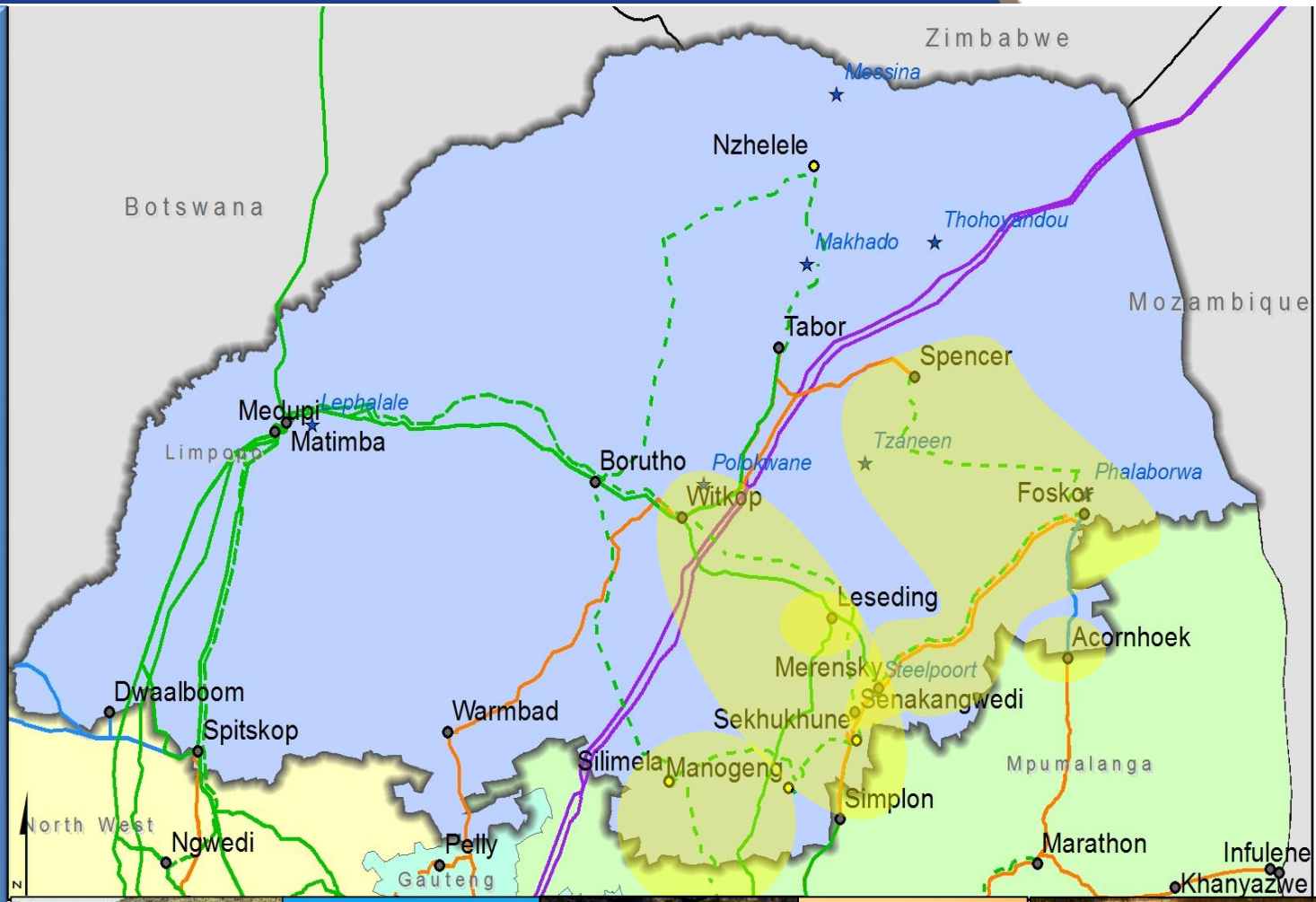
Developments in the Polokwane CLN

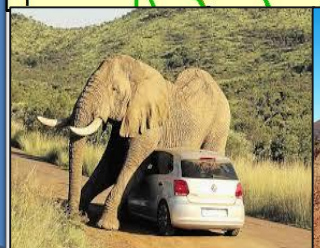
- **Nzhelele 400/132 kV Substation**
- **400 kV at Spencer Substation**
- **2 x 36 Mvar Capacitor Banks at Tabor and Spencer Substation**

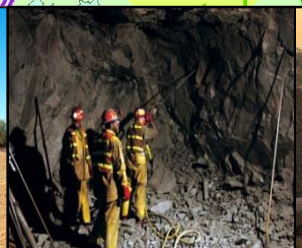


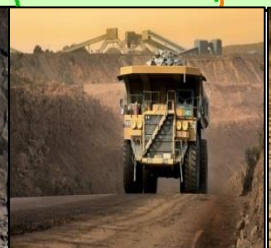
Developments in the Phalaborwa CLN

- **Manogeng Switching Station & Silimela Substation**
- **Sekhukhune Substation**
- **Foskor - Merensky 400 kV Line**
- **400 kV at Foskor Substation**
- **Leseding 3rd 500MVA Transformer**
- **Acornhoek 3rd 125MVA Transformer**

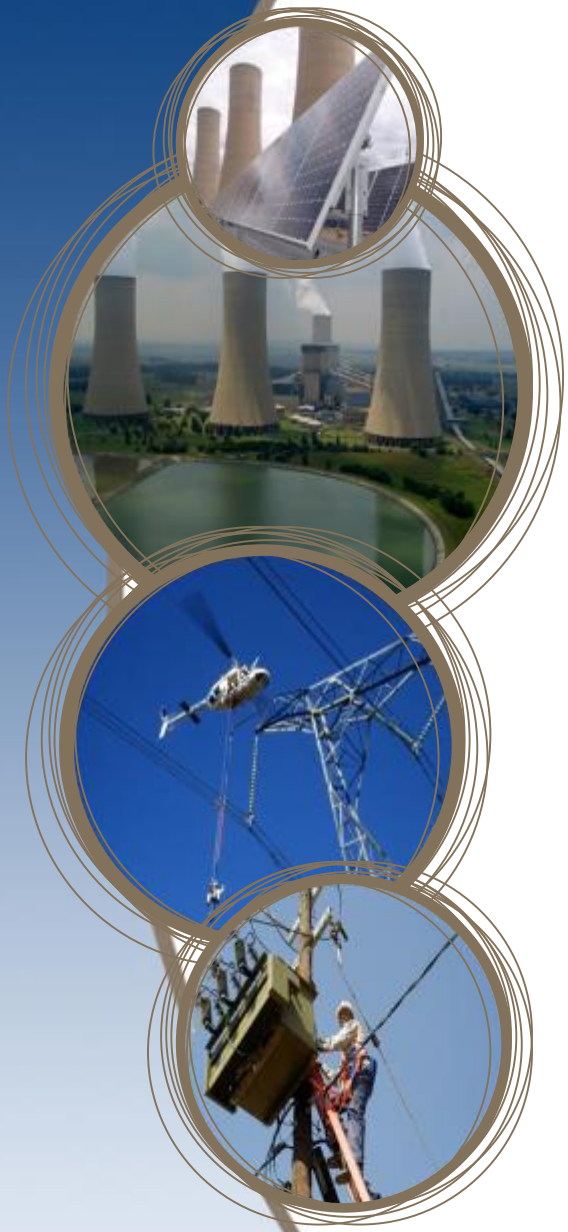








Questions?



Mpumalanga Province

TDP 2019 - 2028

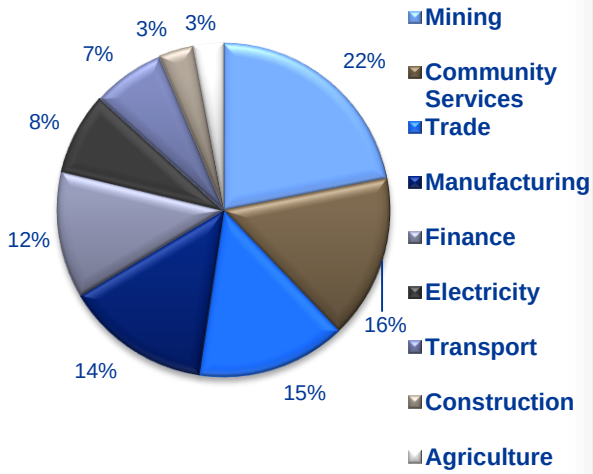
Planning Engineer: Kabir Singh

Presented by: Thamsanqa Ngcoba

Mpumalanga Province Profile

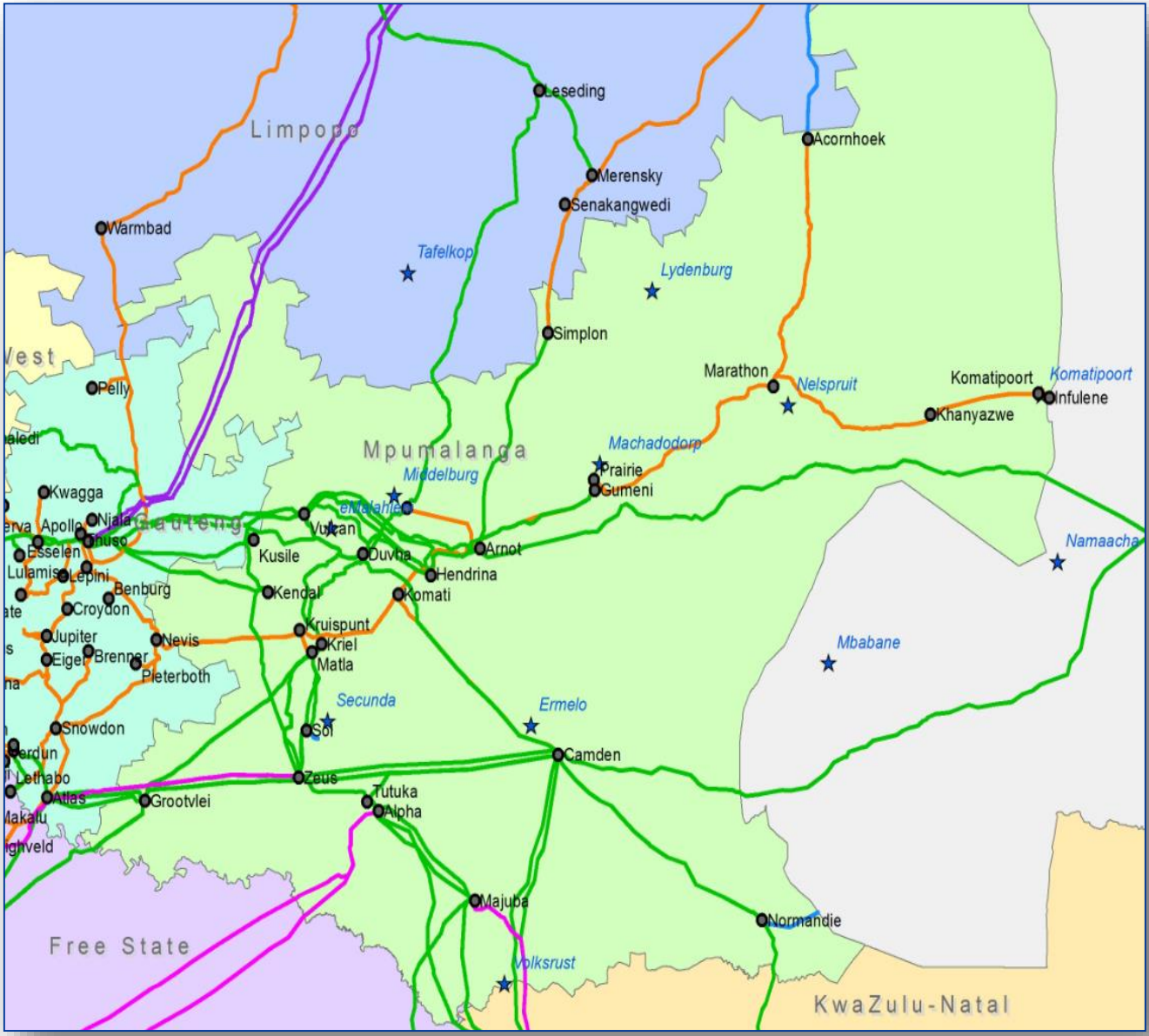
Load

- 2017 Peak load of ~4011 MW



Generation

Name	Capacity
Arnot	2232
Camden	1481
Duvha	2875
Grootvlei	570
Hendrina	1478
Kendal	3840
Komati	699
Kriel	2850
Kusile	*720*
Majuba	3843
Matla	3450
Tutuka	3510
Arnot	2232
Total Installed Generation	29780

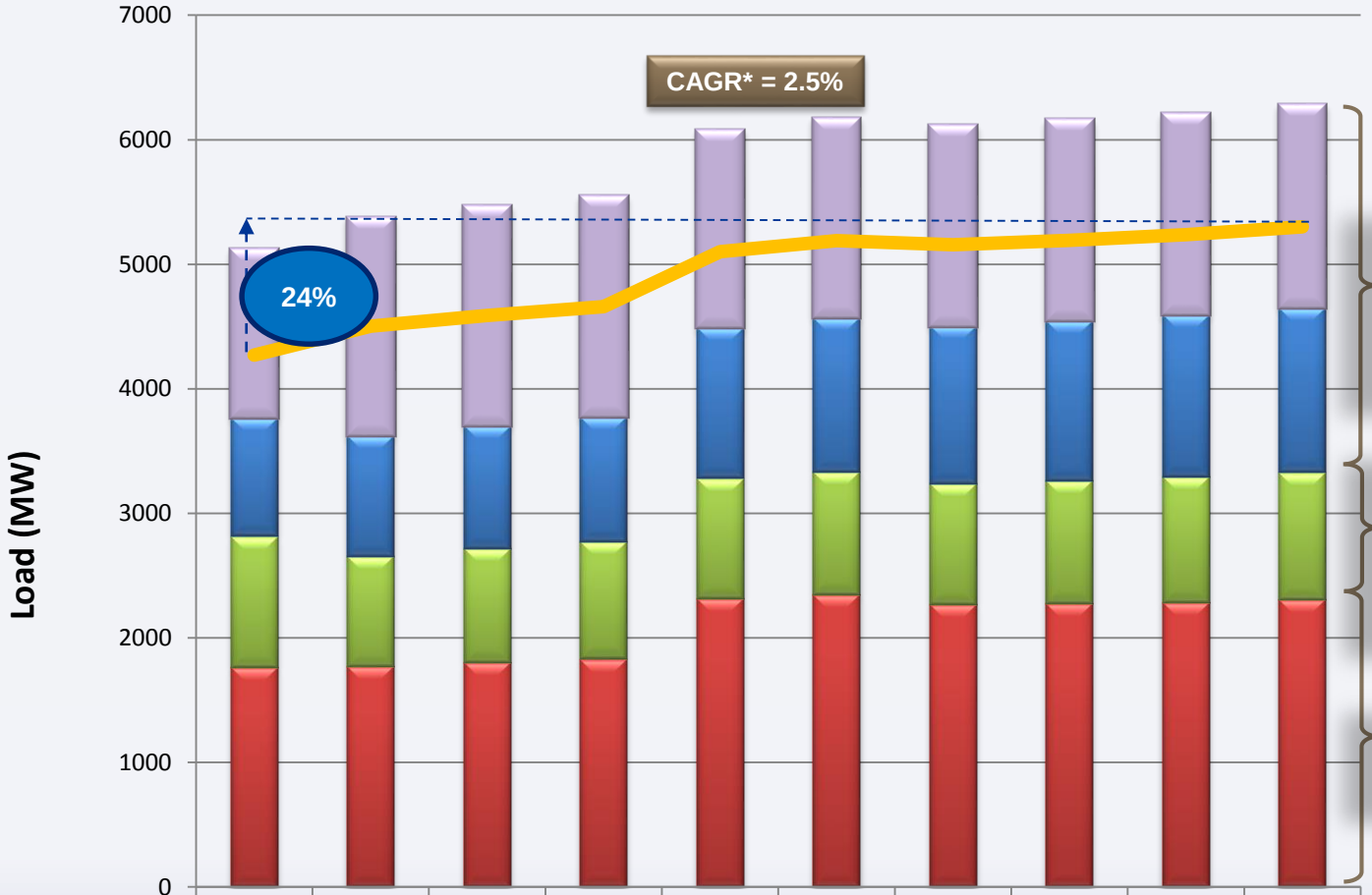


Completed projects

- **Gumeni 400/132 kV 500 MVA substation**
- **Hendrina-Gumeni 400 kV line**

- **Kusile 400 kV Yard**
- **Duvha-Minerva Loop-in to Kusile**
- **Kendal-Apollo Loop-in to Kusile**
- **Kusile-Zeus**
- **2nd Kendal-Zeus**

Mpumalanga Load Forecast 2019 - 2028



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Witbank	1352	1746	1763	1778	1587	1600	1611	1614	1619	1629
Middelburg	956	968	989	1002	1209	1242	1269	1283	1299	1324
Lowveld	1051	888	916	945	966	987	969	988	1008	1023
Highveld South	1761	1768	1800	1826	2315	2345	2266	2274	2284	2305
Provincial Peak	4270	4503	4588	4659	5102	5189	5156	5192	5237	5300

Residential, commercial and industrial development

Natural load growth, tourism and residential developments

Mining and Heavy Industry

*** Compound Annual Growth Rate**

Generation Forecast

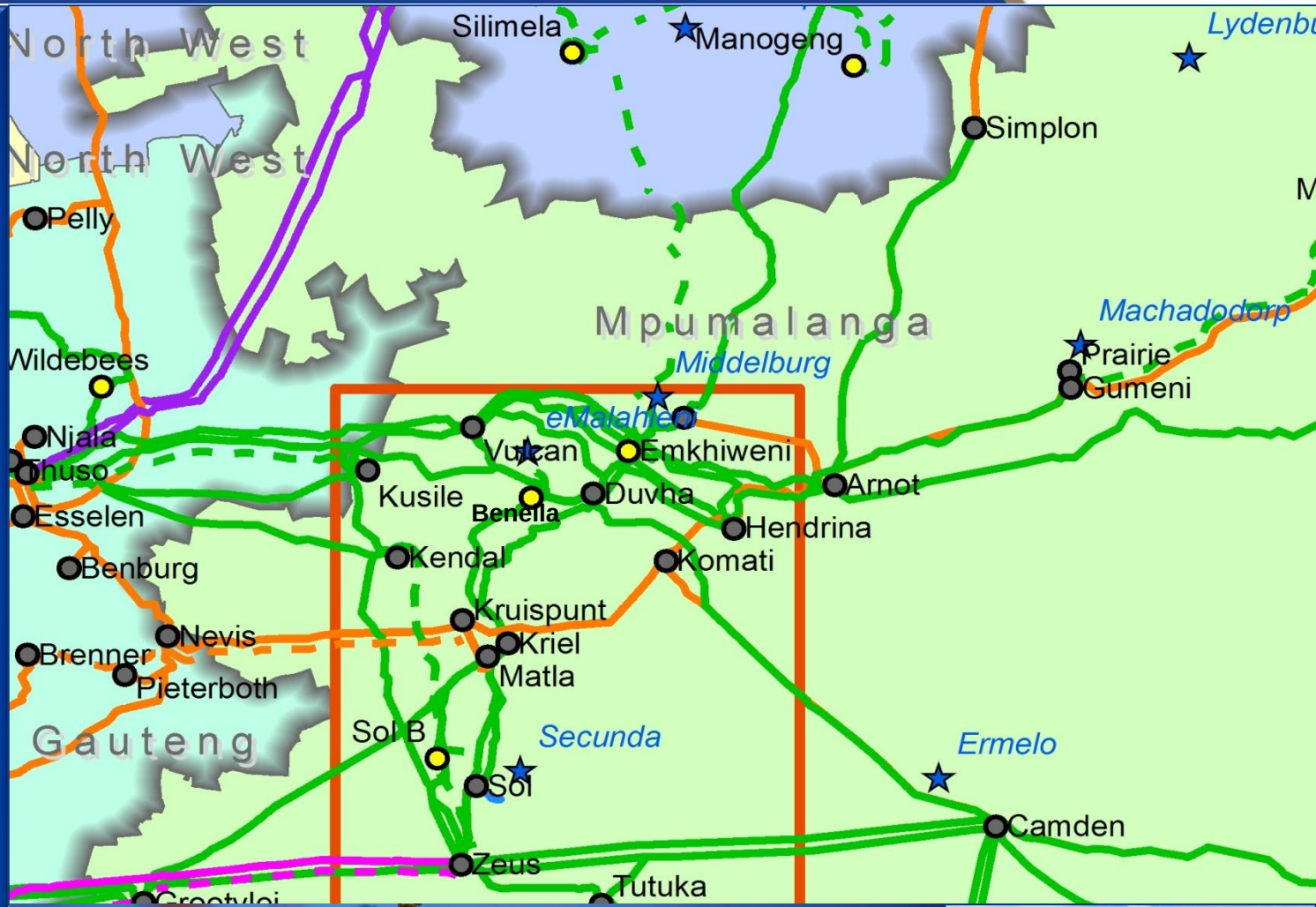
Station	Kusile		Khanyisa IPP	
Year	Unit	MW	Unit	MW
2019	2	722		
2020	3	722		
2021	4	722	1	150
			2	150
2022	5	722		
2023	6	722		
Total per station		3610		300
Total generation added				3910

Year	Hendrina		Grootvlei		Komati	
	Unit	MW	Unit	MW	Unit	MW
2019	1	187	1	190	1	114
	2	187	2	190	2	114
	3	187	3	190	3	114
	4	187			4	91
	5	185			5	91
	6	185			6	114
	7	185			7	90
	8	165			8	86
	9	165			9	90
	10	160				
2020			4	190		
			5	180		
			6	180		
Total per station	1793		1120		904	
Total assumed generation reduction						3817

TRANSMISSION DEVELOPMENT PLAN

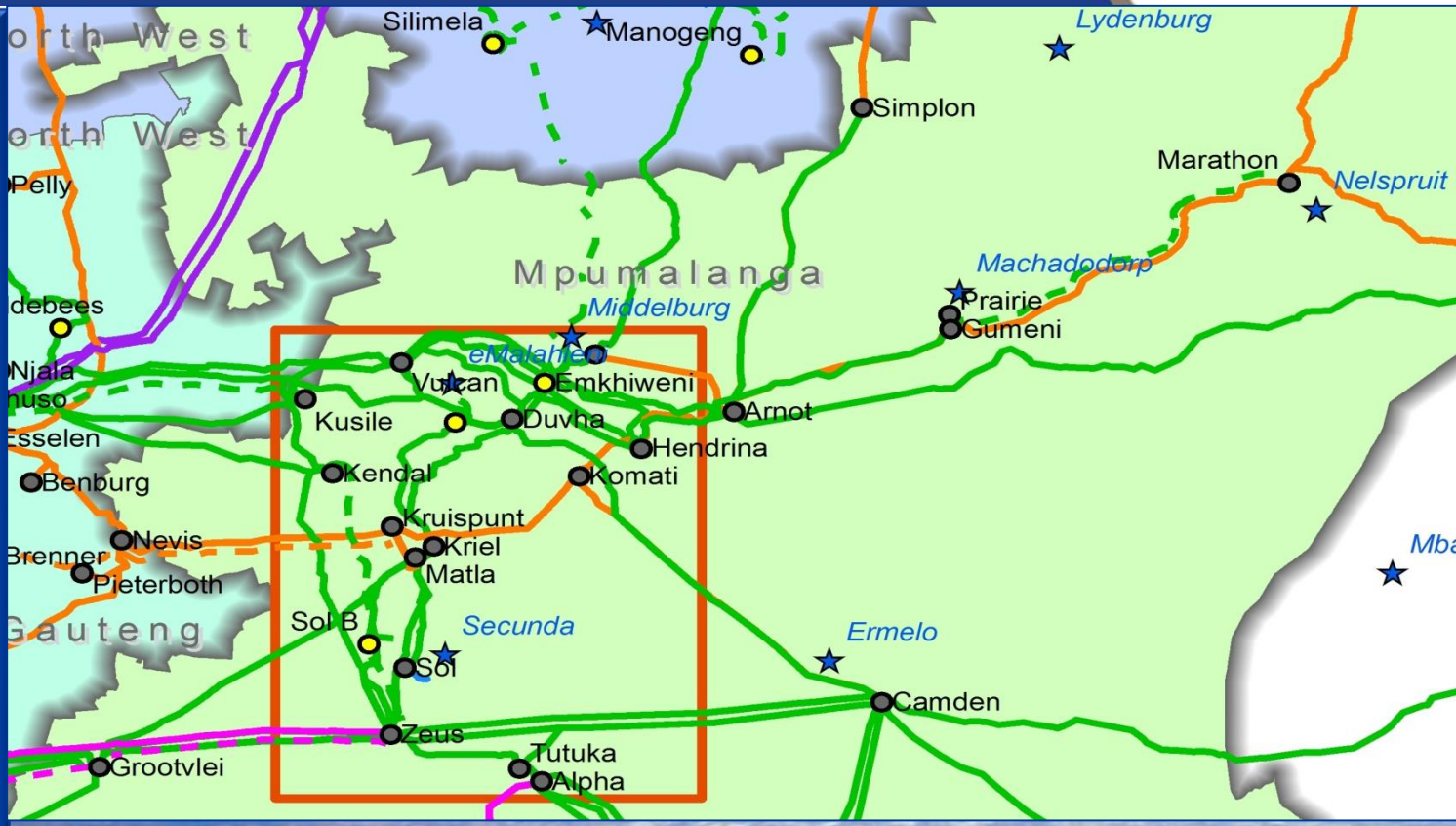
Generation Developments in Mpumalanga

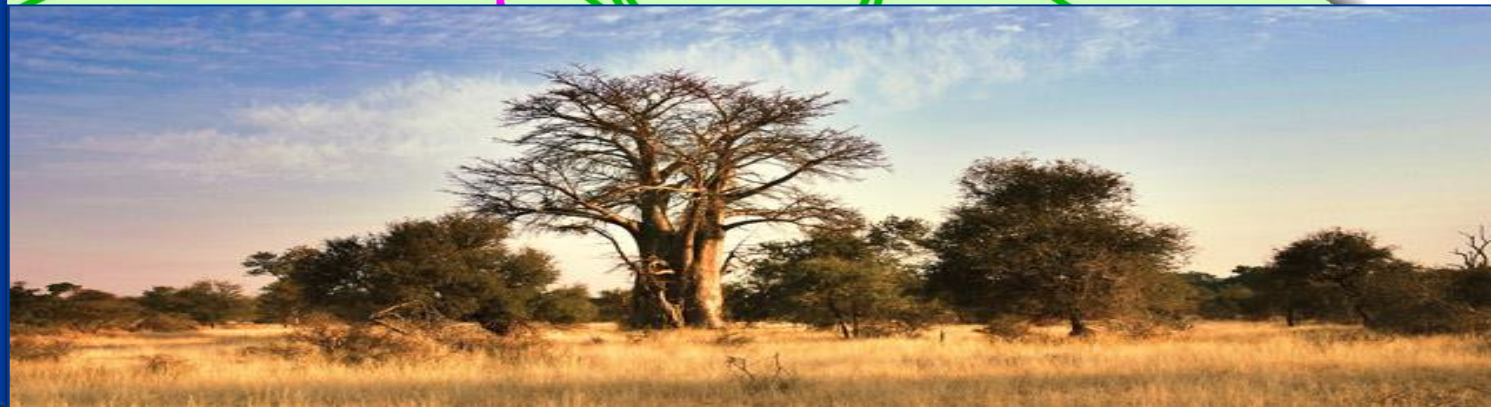
- **Kusile Integration**
  - Kusile – Duvha
  - Kusile – Minerva
  - Kusile – Apollo
  - Kusile – Lulamisa
  - Kusile – Zeus
  - Kendal – Zeus
- **Khanyisa IPP Integration**



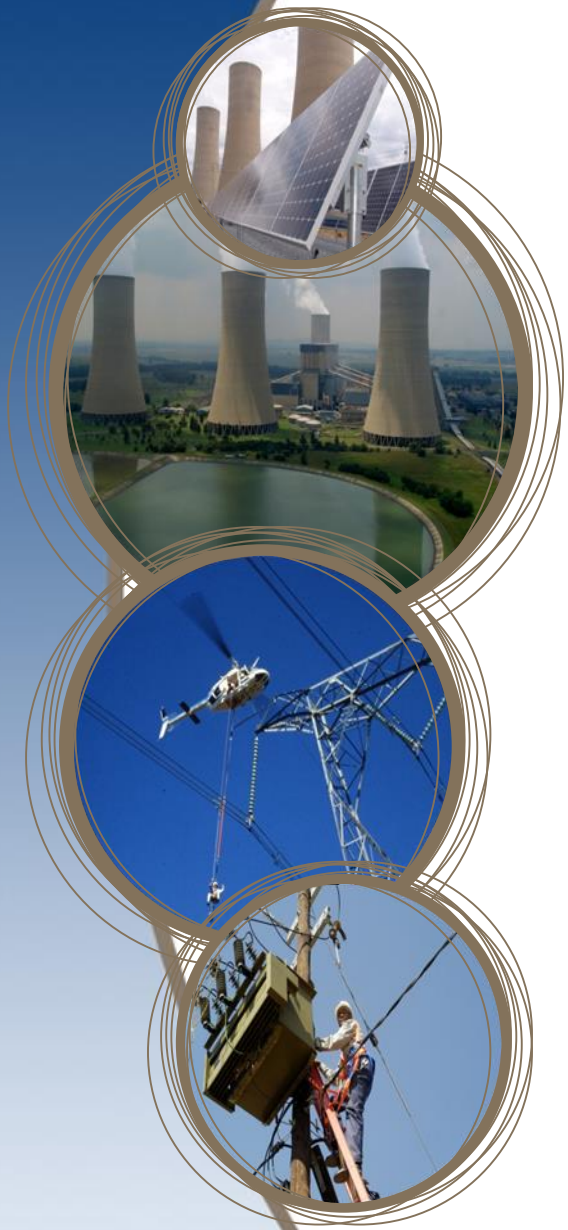
Strengthening Developments in Mpumalanga

- **Sol B Integration**
- **Emkhiweni Integration**
- **Marathon 400 kV Integration**





Questions?



Gauteng Province

TDP 2019 - 2028

Presented by: Thamsanqa Ngcoba

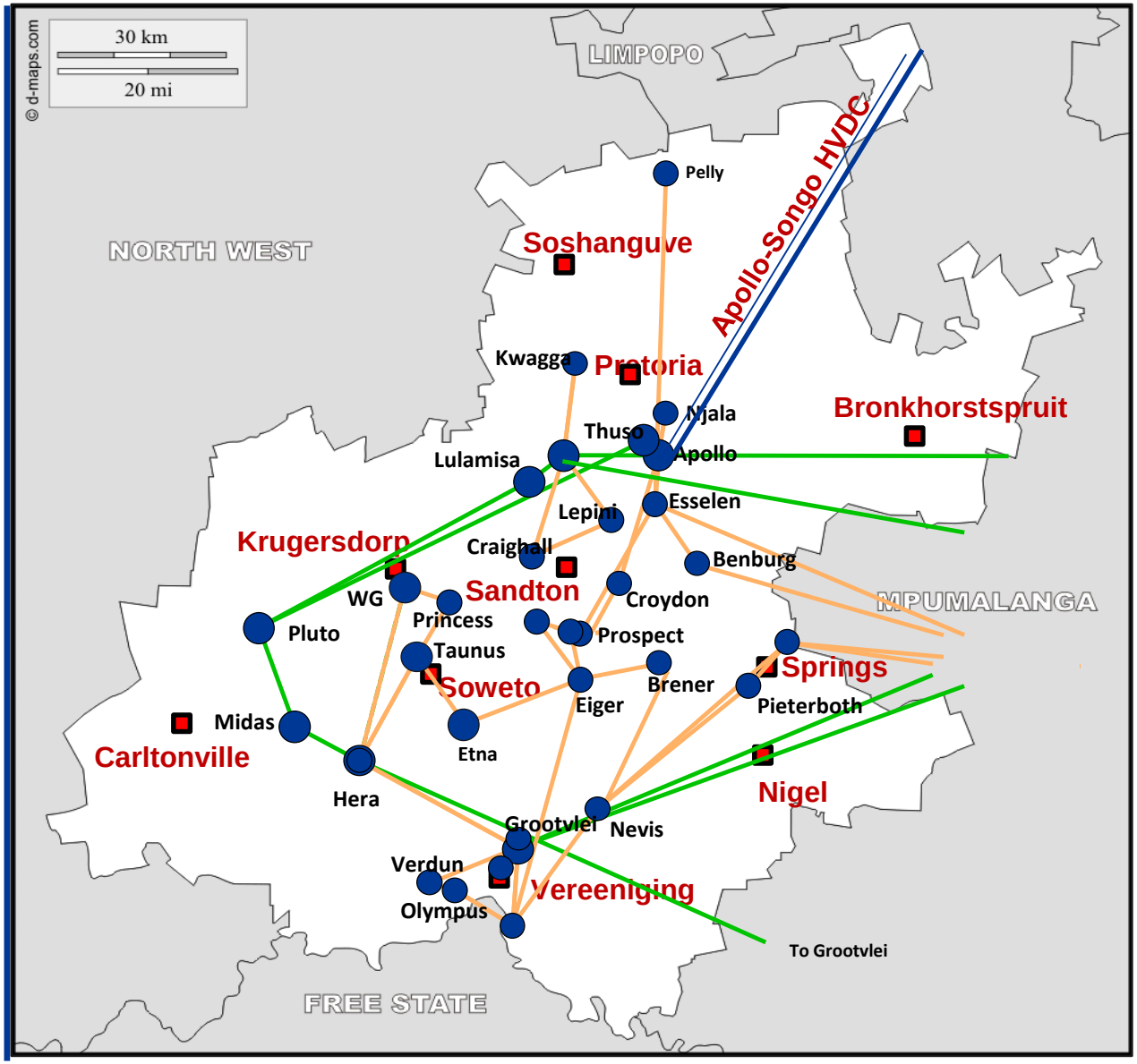
Gauteng Province Profile

- **Grid peak demand: ~11 GW**

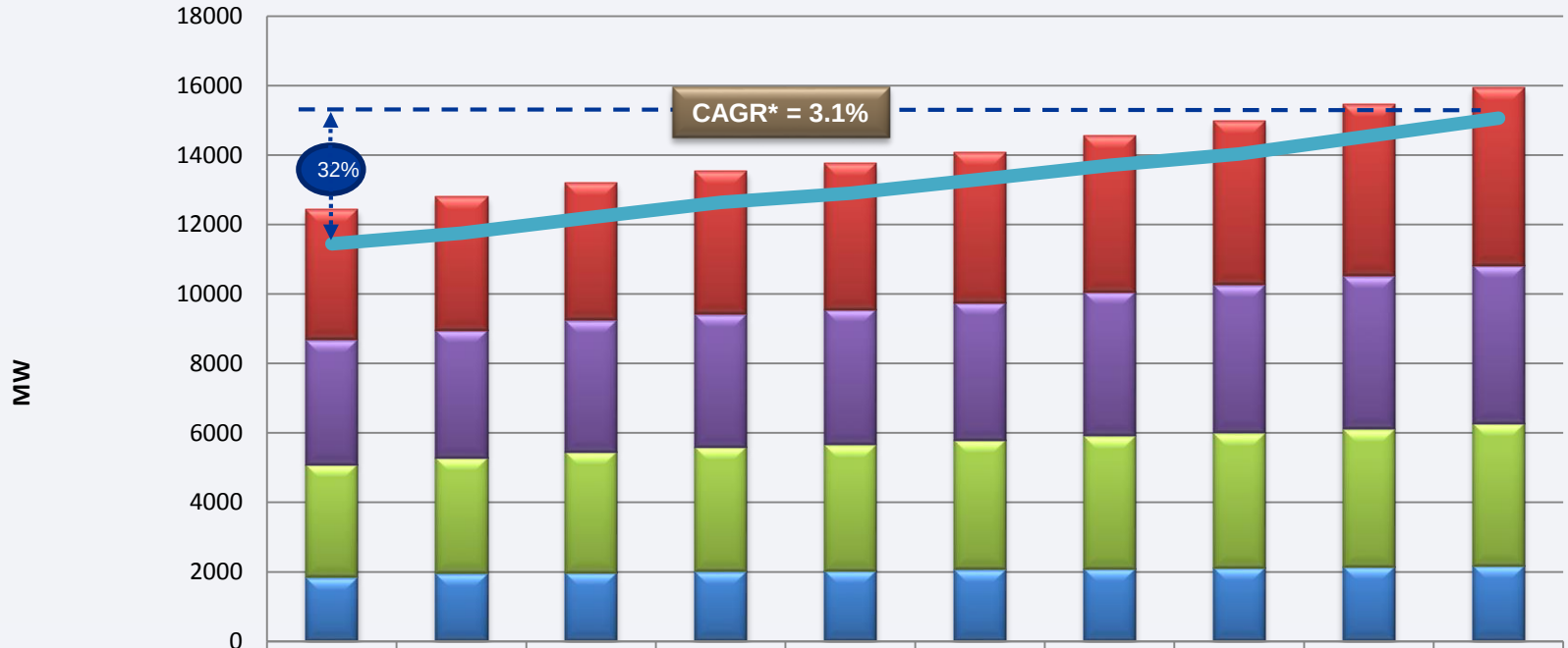
- **Economic Drivers (**Eastern, Central, Northern, Southern, and Western Corridors)**:**
  - **Industrial**
  - **Logistics**
  - **Commercial**
  - **Residential**

- **Generation**

Type / Owner	Name
City Power	Kelvin
City of Tshwane	Rooiwal / PTA West



Gauteng Load Forecast



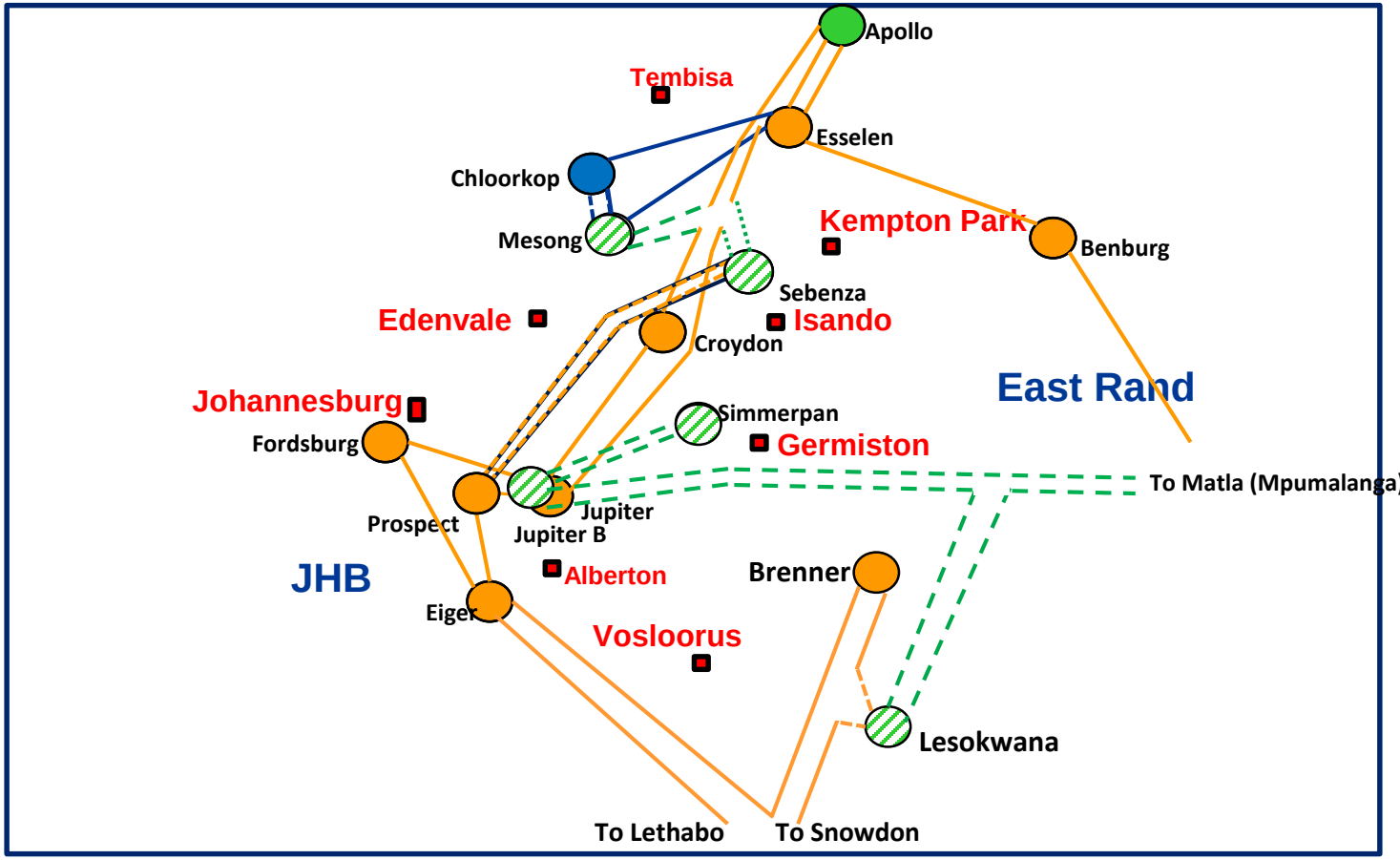
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
West Rand	3749	3841	3966	4113	4213	4334	4508	4721	4942	5138
Johannesburg	3600	3687	3794	3832	3896	3966	4141	4267	4398	4542
East Rand	3248	3314	3476	3579	3629	3717	3813	3889	3985	4100
Vaal	1838	1957	1972	2006	2025	2063	2093	2111	2135	2165
Diversified Grid Peak	11439	11751	12204	12634	12901	13299	13702	14033	14547	15057

*** Compound Annual Growth Rate**

Developments in the JHB East & South Area

Key Projects

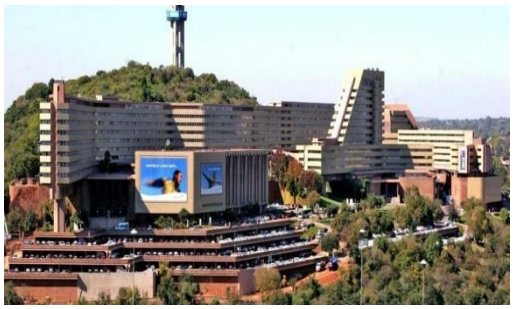
- Mesong Substation
- Sebenza Substation
- Jupiter B integration
- Sisimuka Substation
- Lesokwana Substation

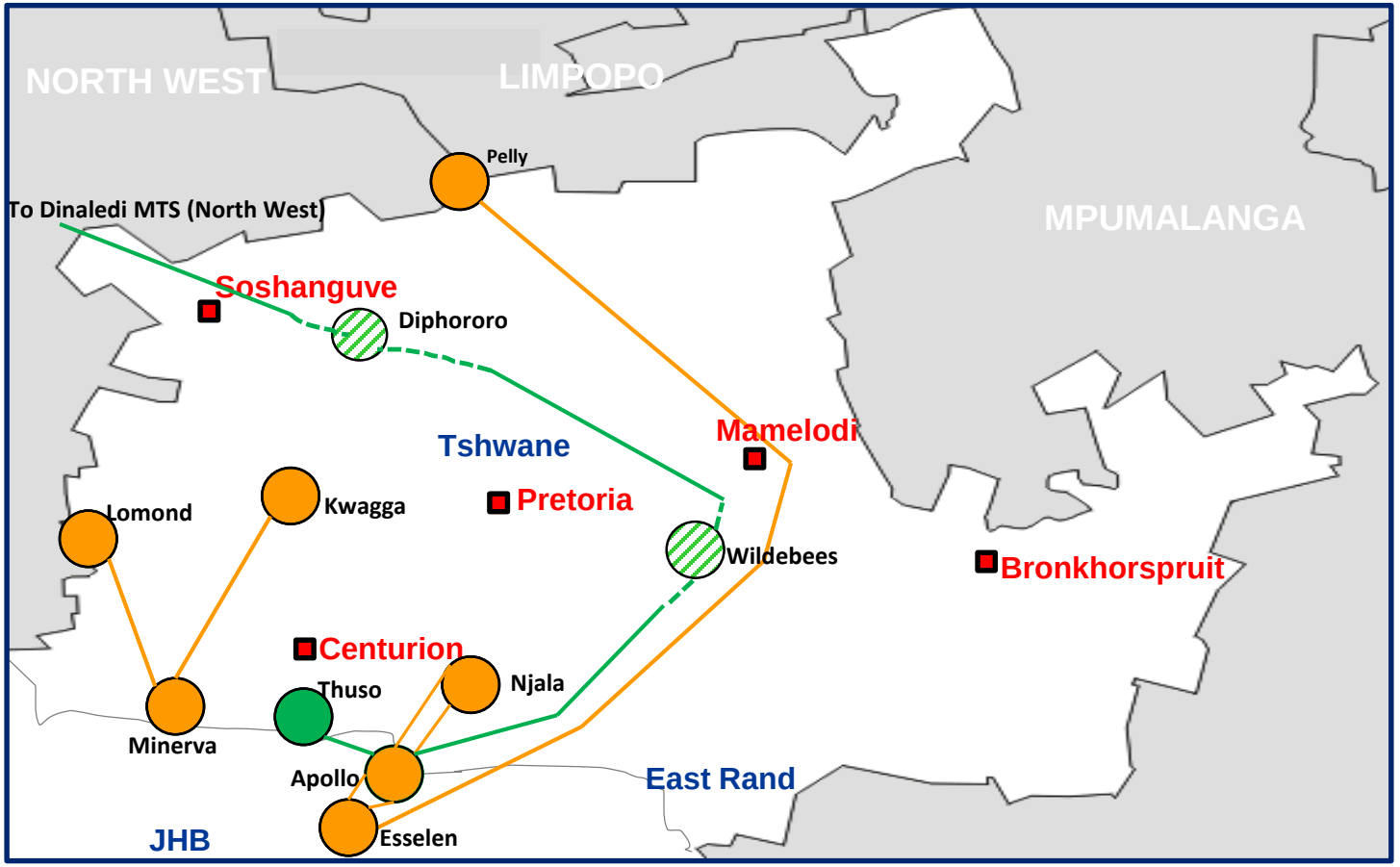


Developments in the Tshwane Area

Key Projects

- Wildebees Integration
- Diphororo Integration

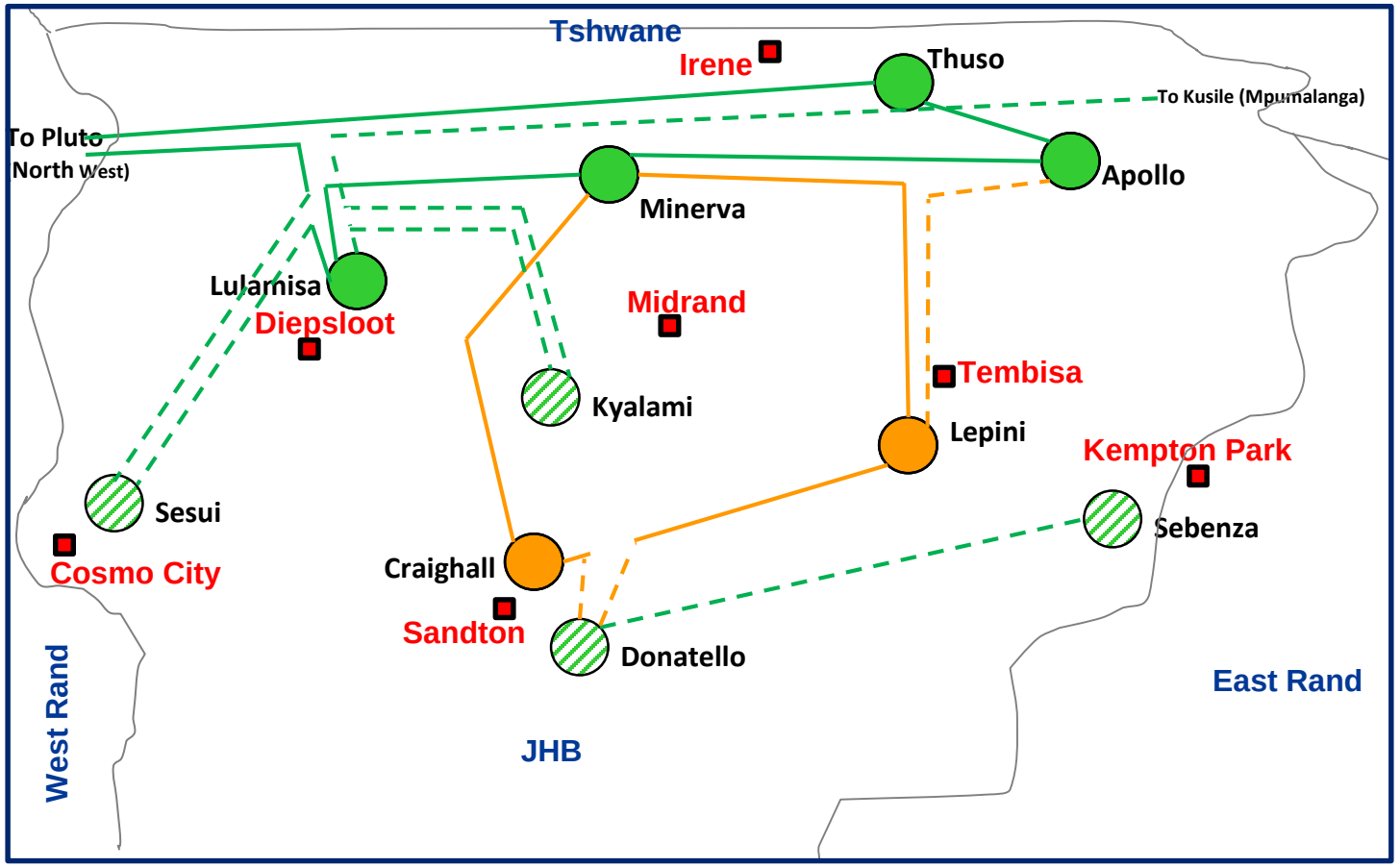




Developments in the JHB North Area

Key Projects

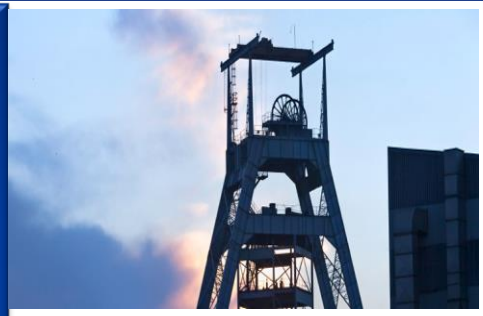
- Kusile-Lulamisa 400kV line
- Apollo-Lepini 2nd 275kV line
- New MTS Sesui 400/88kV
- New MTS Kyalami 400/88kV
- New MTS Donatello 400/88kV

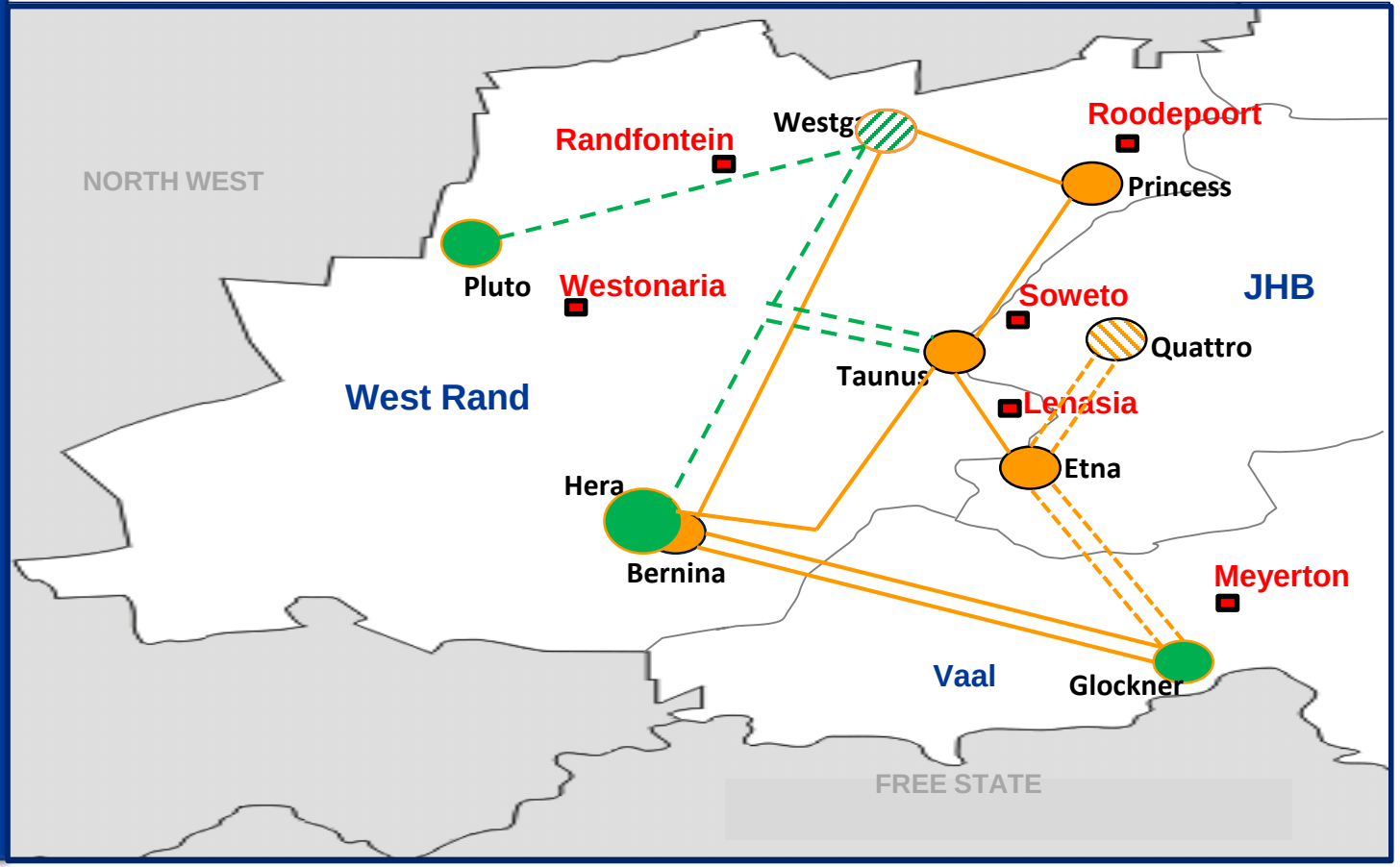


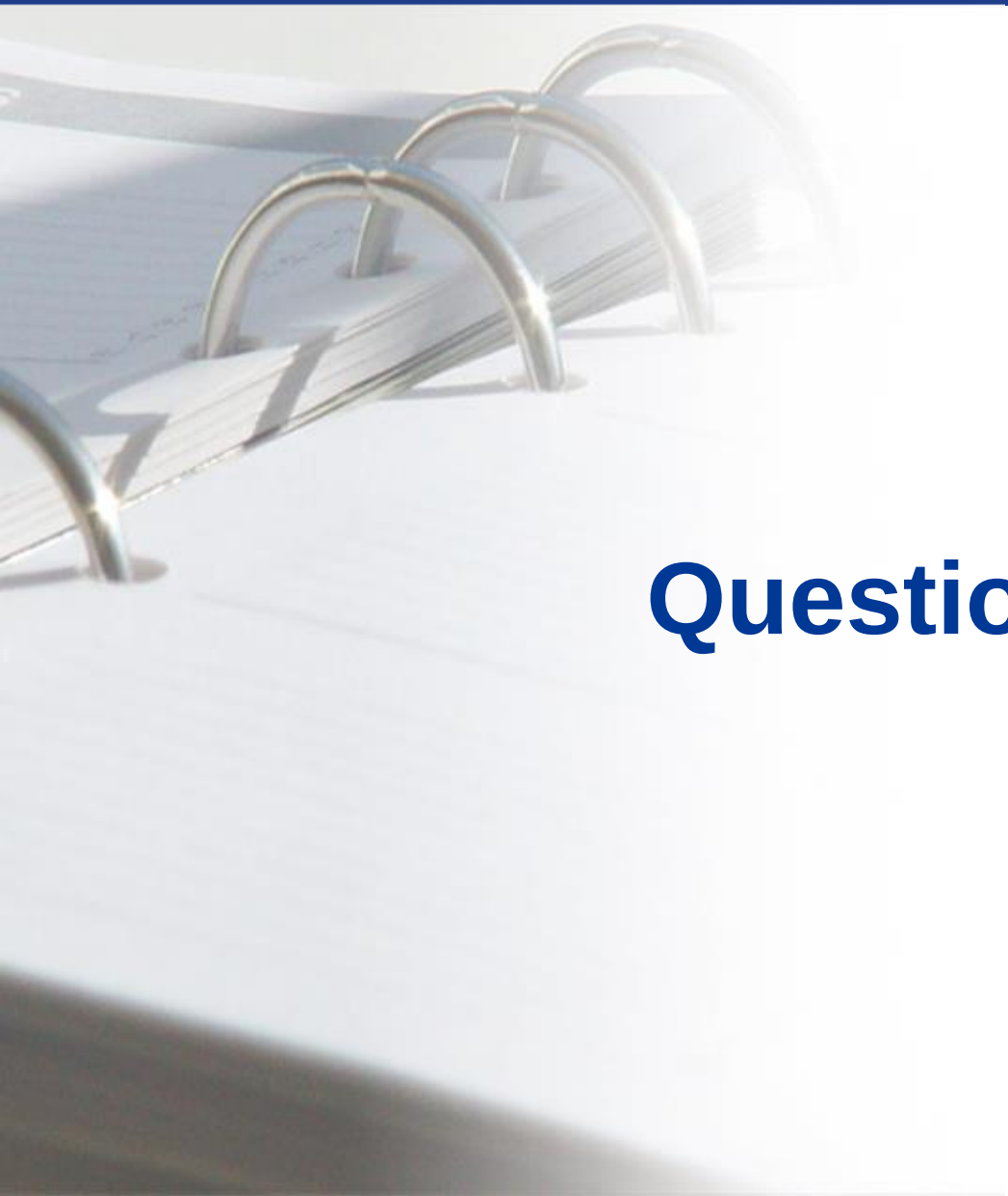
Developments in the West Rand & Vaal Area

Key Projects

- Vaal Strengthening Phase 2
- Soweto Strengthening
- West rand Strengthening Phase 1 & 2







Questions?

KwaZulu-Natal Province

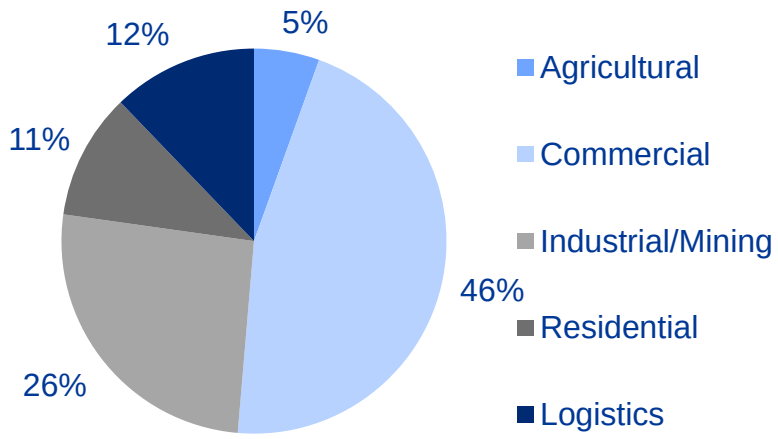
TDP 2019 - 2028

Presented by: Thokozani Bengani

KwaZulu-Natal Province Profile

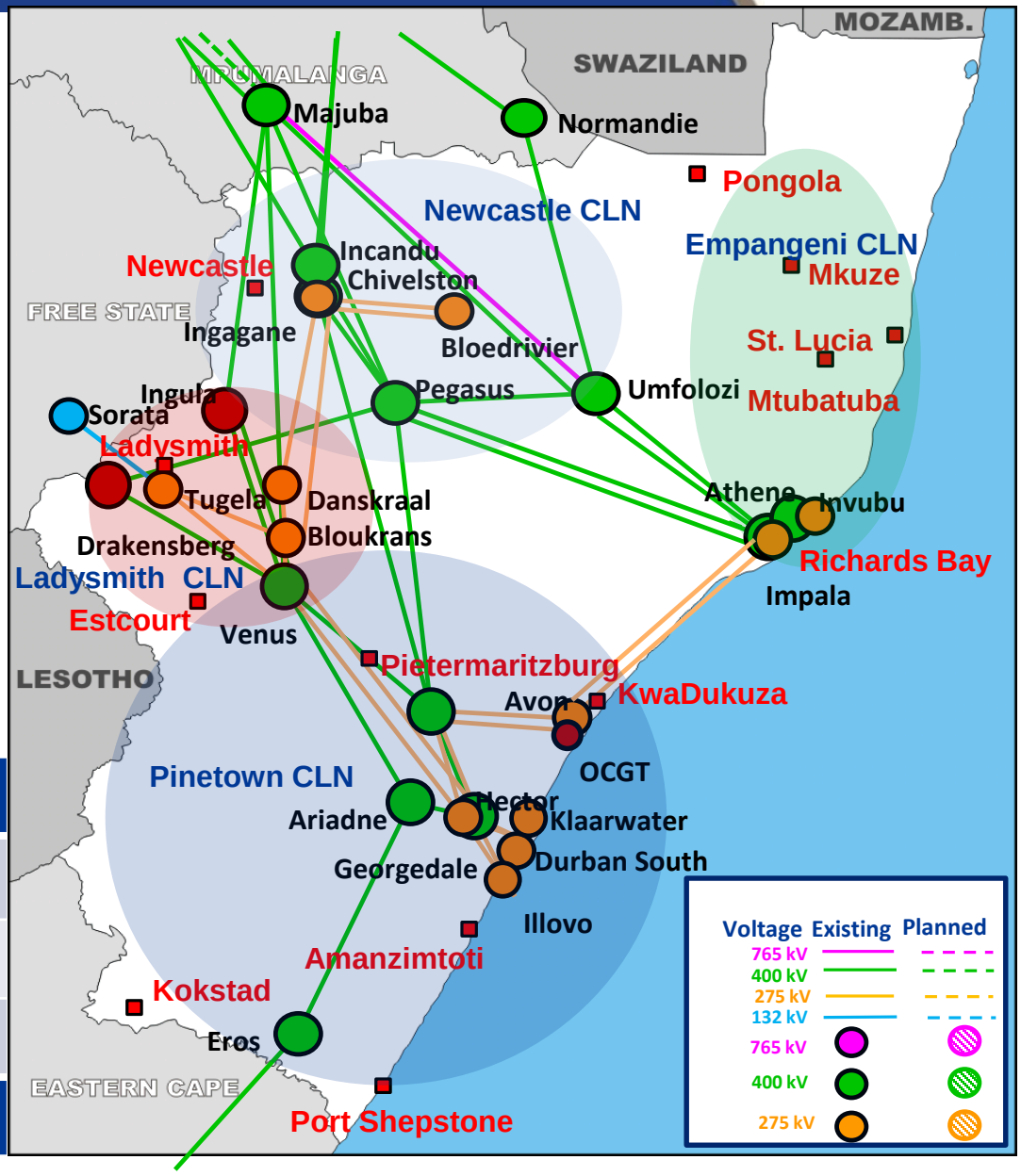
Load

Peak load of 6221 MW: 24th July 2017

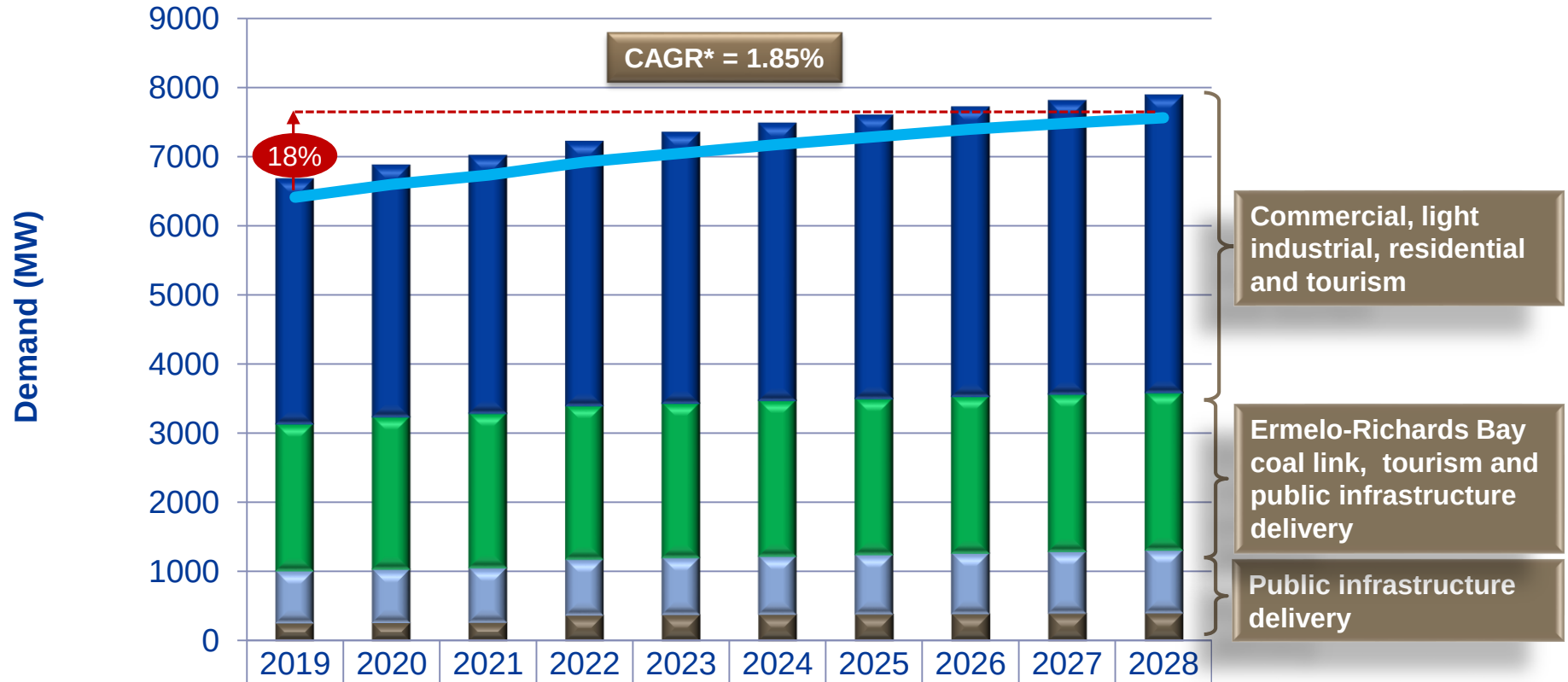


Generation

Type		Name	Output
Peaking	Pumped Storage	Drakensberg	1000 MW
		Ingula	1330 MW
IPP	Gas	Avon IPP	680 MW
Total Installed Generation			3010 MW



KwaZulu-Natal Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Pinetown	3557	3646	3736	3826	3922	4014	4100	4184	4242	4300
Empangeni	2123	2206	2234	2225	2237	2253	2259	2270	2282	2283
Newcastle	756	774	791	809	826	844	861	877	894	910
Ladysmith	258	262	266	369	375	380	384	390	395	401
Provincial Peak	6412	6598	6732	6925	7051	7176	7285	7397	7485	7562

*** Compound Annual Growth Rate**

TRANSMISSION DEVELOPMENT PLAN

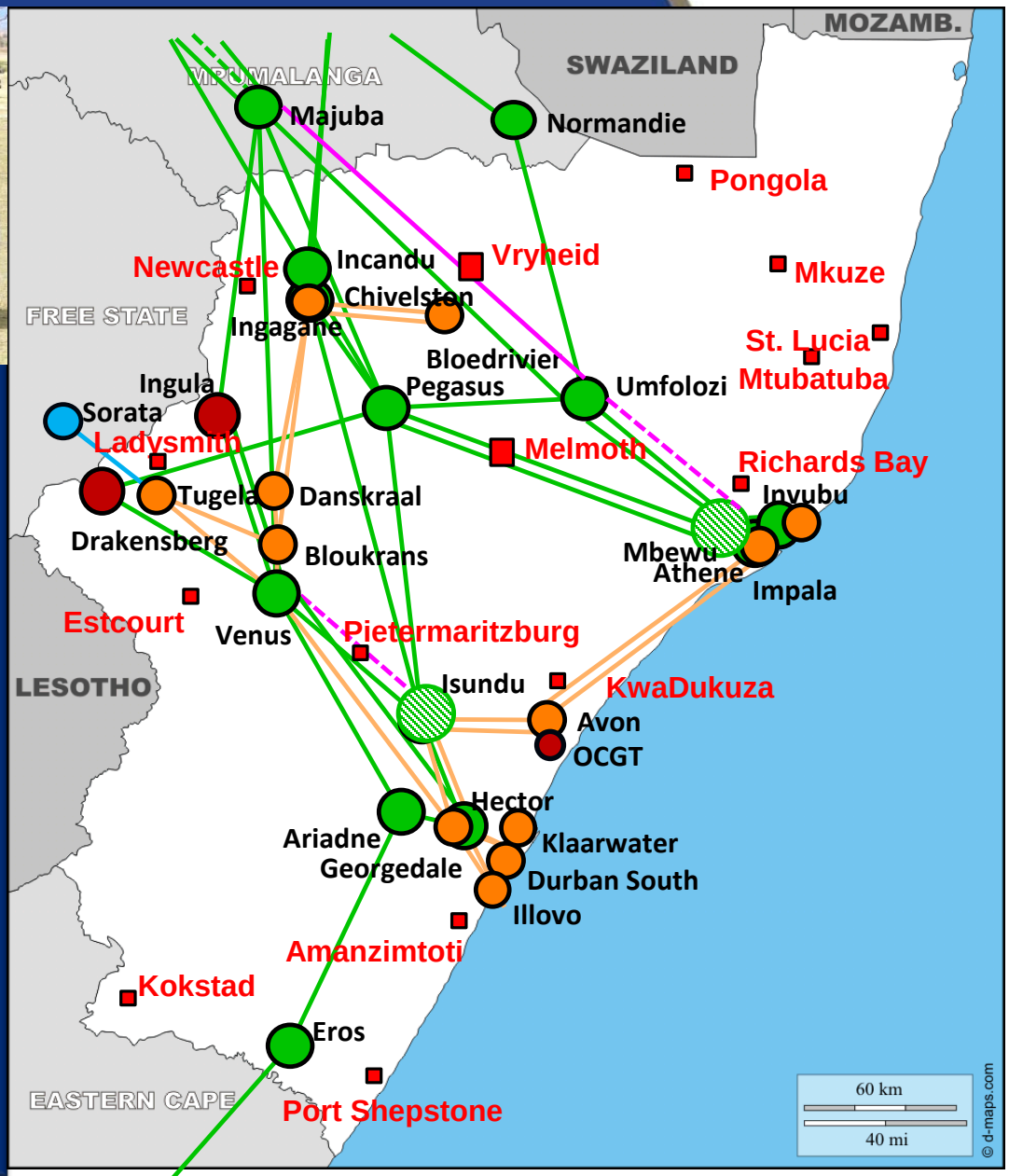
KwaZulu-Natal 765 kV Strengthening

Planned Projects:

- Empangeni Integration
- Pinetown Integration

Benefits:

- Creates additional capacity to meet the growth in demand in uMhlathuze, KwaDukuza and Dube Tradeport
- Provides network redundancy
  - Ability to switch off critical circuits for maintenance



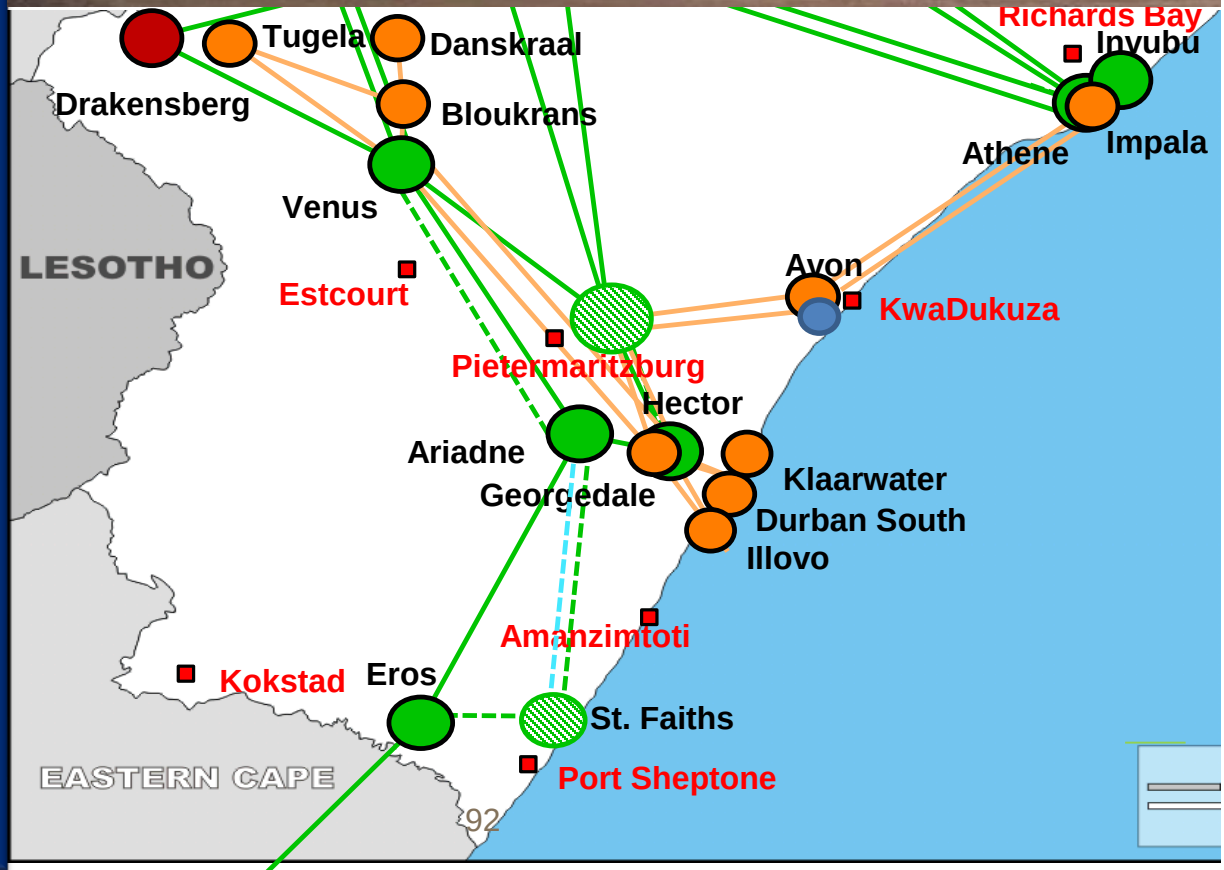
400 kV Backbone Strengthening

Planned Projects:

- Ariadne-Venus 2nd 400 kV line
- Ariadne-Eros 2nd 400 kV line
- St Faiths Substation

Benefits:

- Alleviate power transfer shortfalls in Msunduzi, eThekwini & south coast
- Create capacity to meet the growth in demand
- Provide network redundancy
  - Ability to switch off critical circuits for maintenance



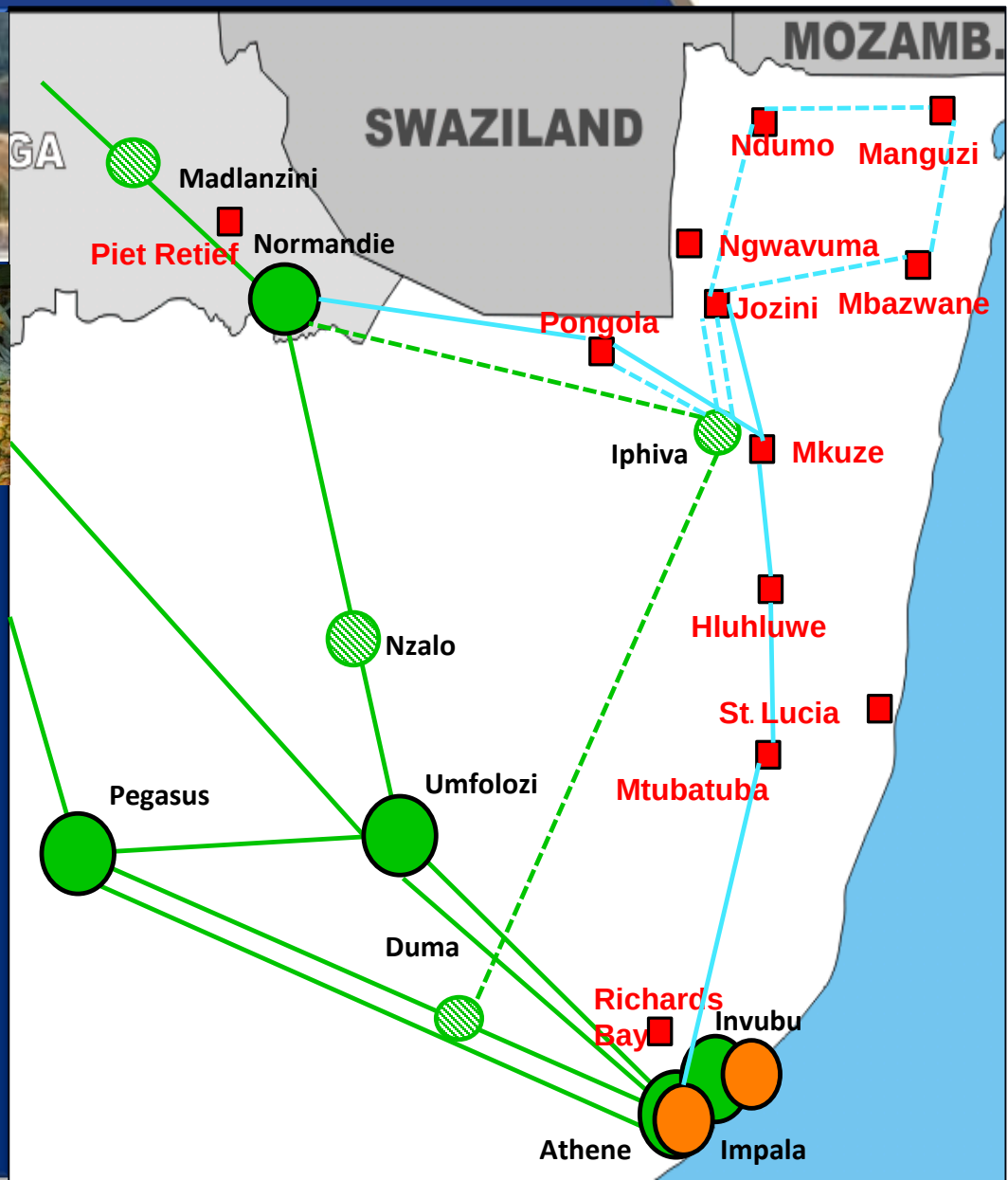
Jozini & Umhlabuyalingana Municipalities

Drivers for growth:

- iSimangaliso wetland park eco-tourism
- Agriculture
- Public infrastructure delivery

Planned Projects:

- Northern KZN Strengthening: Phase 1: Normandie – Iphiva 400 kV line and Iphiva Substation integration near Mkuze
- Phase 2: Duma – Iphiva 400 kV line



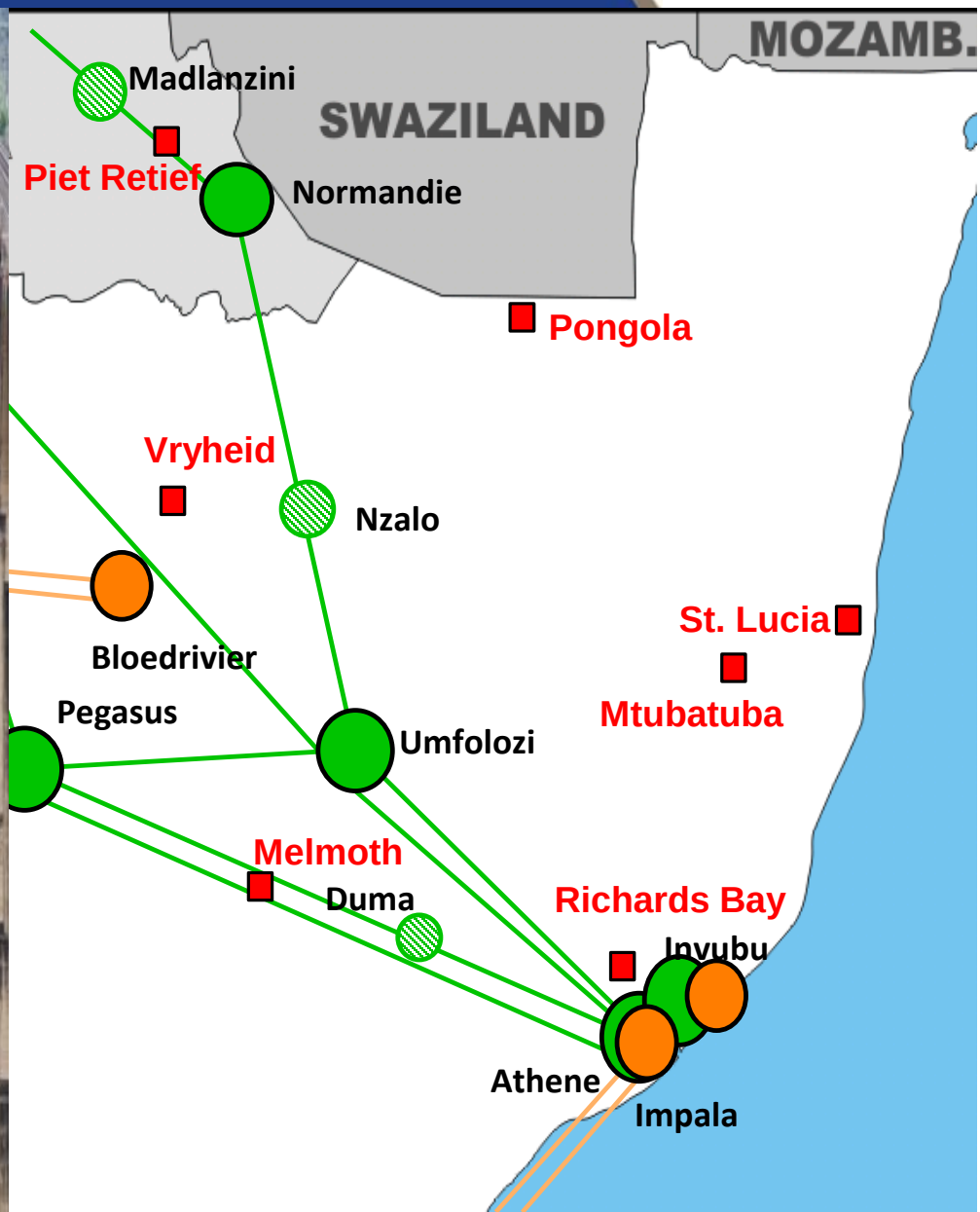
Ermelo-Richards Bay Coal link Upgrade

Drivers for load growth:

- Coal Mining & Ermelo-Richards Bay Coal line

Planned Projects:

- Madlanzini Substation loop into Camden – Normandie 400 kV line
- Nzalo Substation loop into Normandie – Umfolozi 400 kV line
- Duma Substation loop into Pegasus – Athene 400 kV line



Dube Tradeport – Durban Aerotropolis

Drivers for load growth:

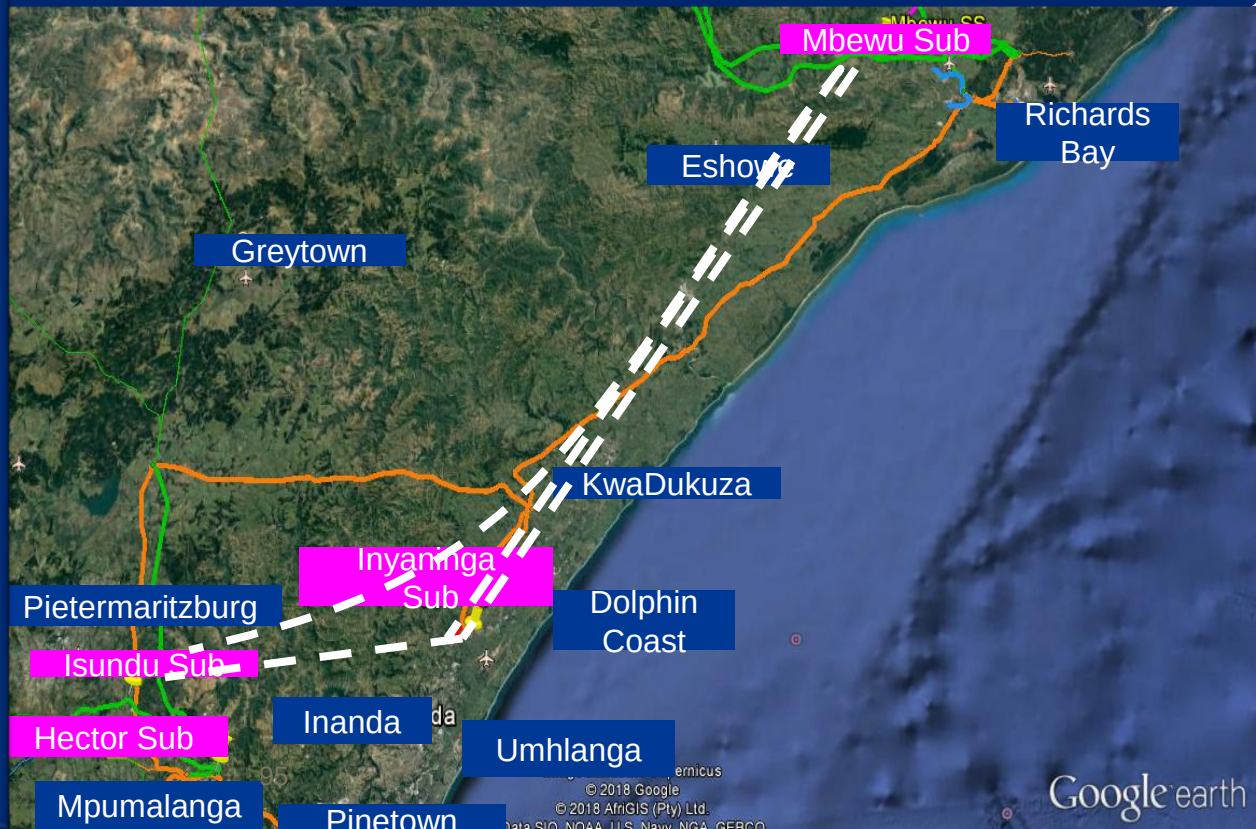
- Dube tradeport development
- eThekwini Metropolitan
- KwaDukuza Municipality

Planned Project:

- Inyaninga Substation Integration

Benefits:

- Caters for the demand growth around the Dube Tradeport
- Frees up capacity on the existing transmission network supplying eTE & iLembe DM



eThekwini Western Region

Drivers for load growth:

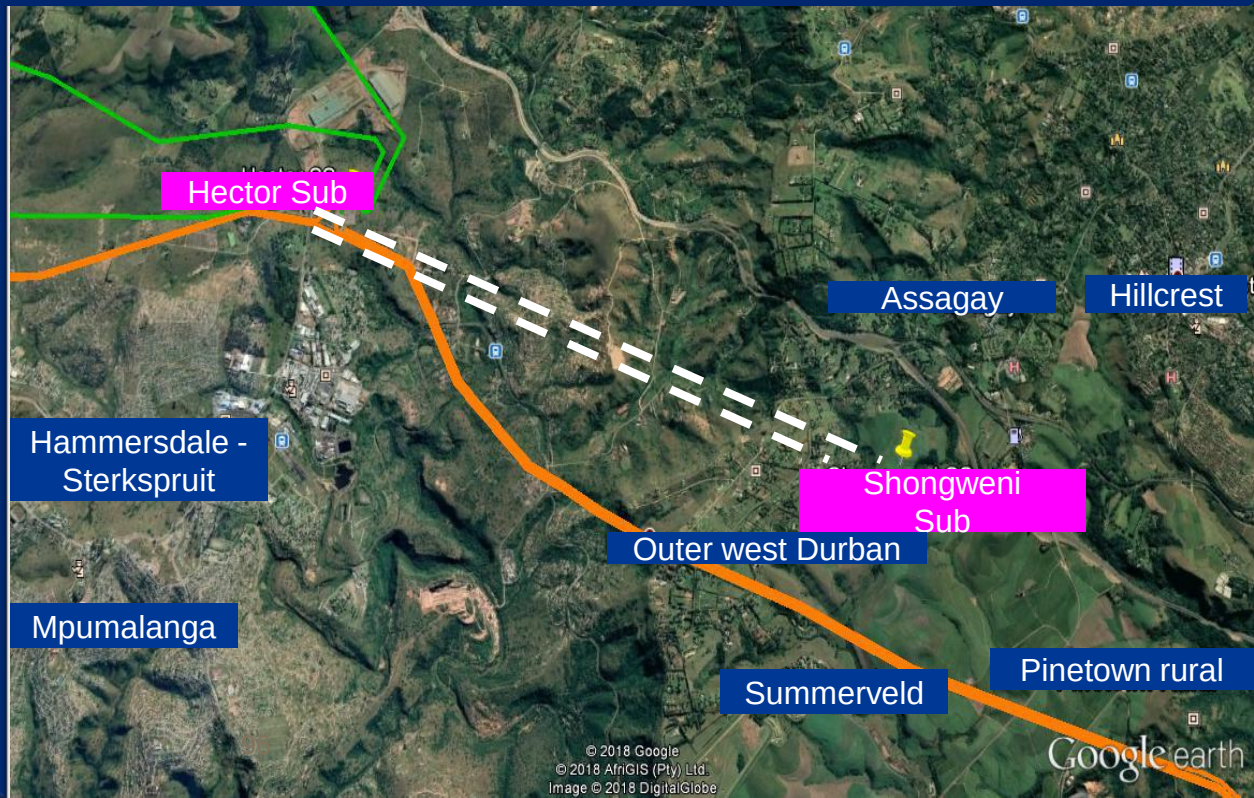
- SIP 2: Logistic Corridor
- Mixed use developments

Planned Project:

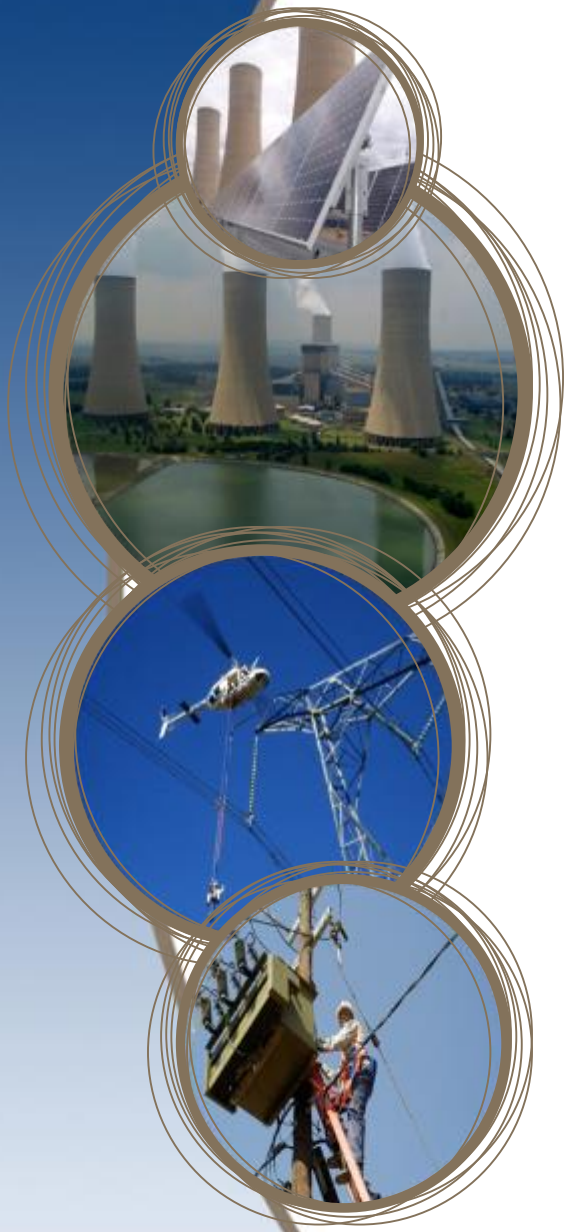
- Shongweni Substation Integration

Benefits:

- Will cater for the demand growth in the eThekwini western region
- Will free up capacity on the existing transmission network supplying eThekwini Electricity & the south coast



Questions?



Free State Province

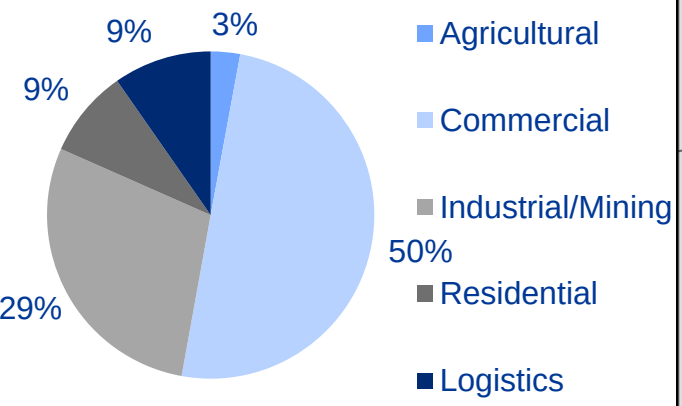
TDP 2019 - 2028

Presented by: Thokozani Bengani

Free State Province Profile

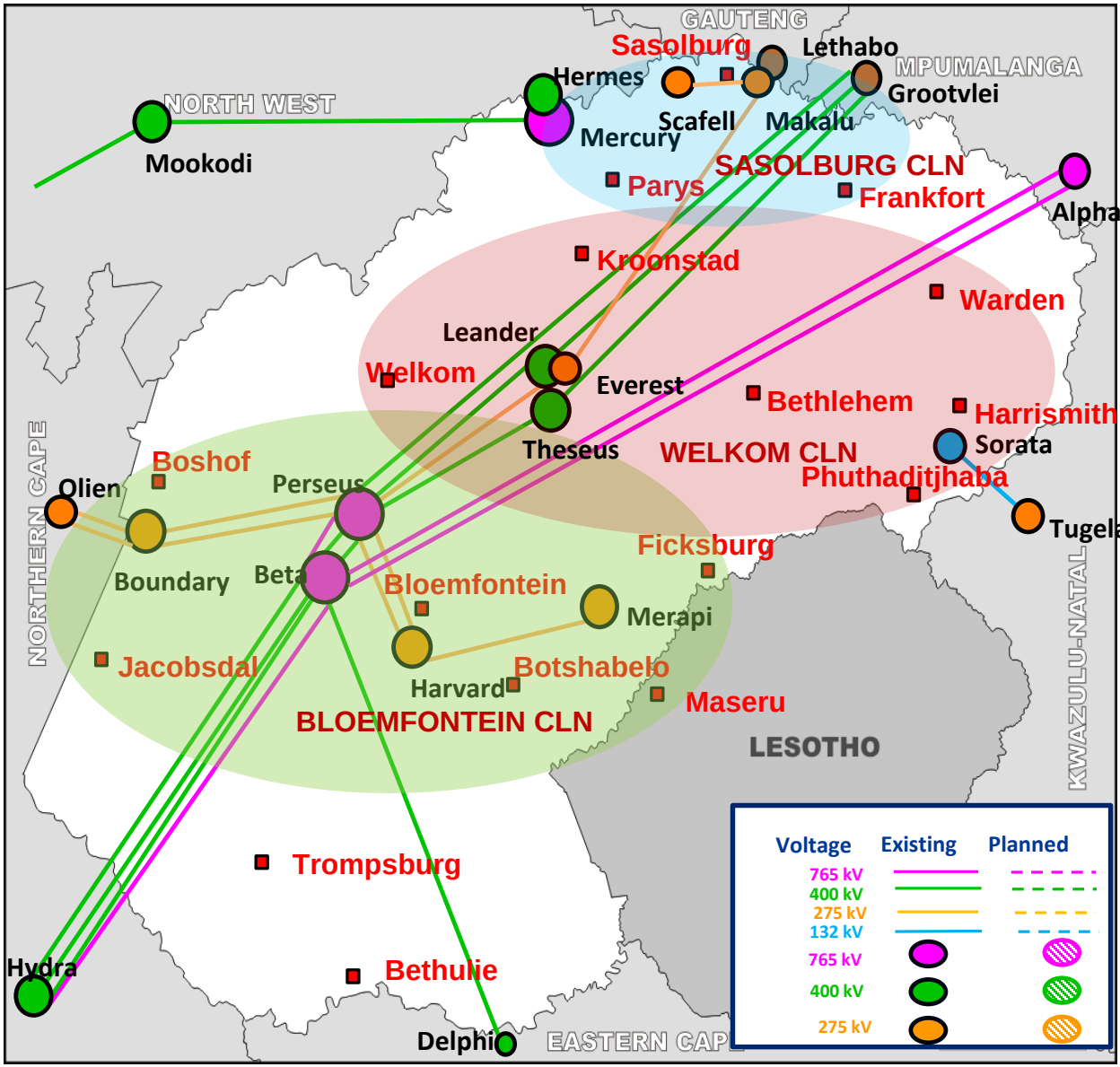
Load

Peak load of 1524 MW: 17th May 2017

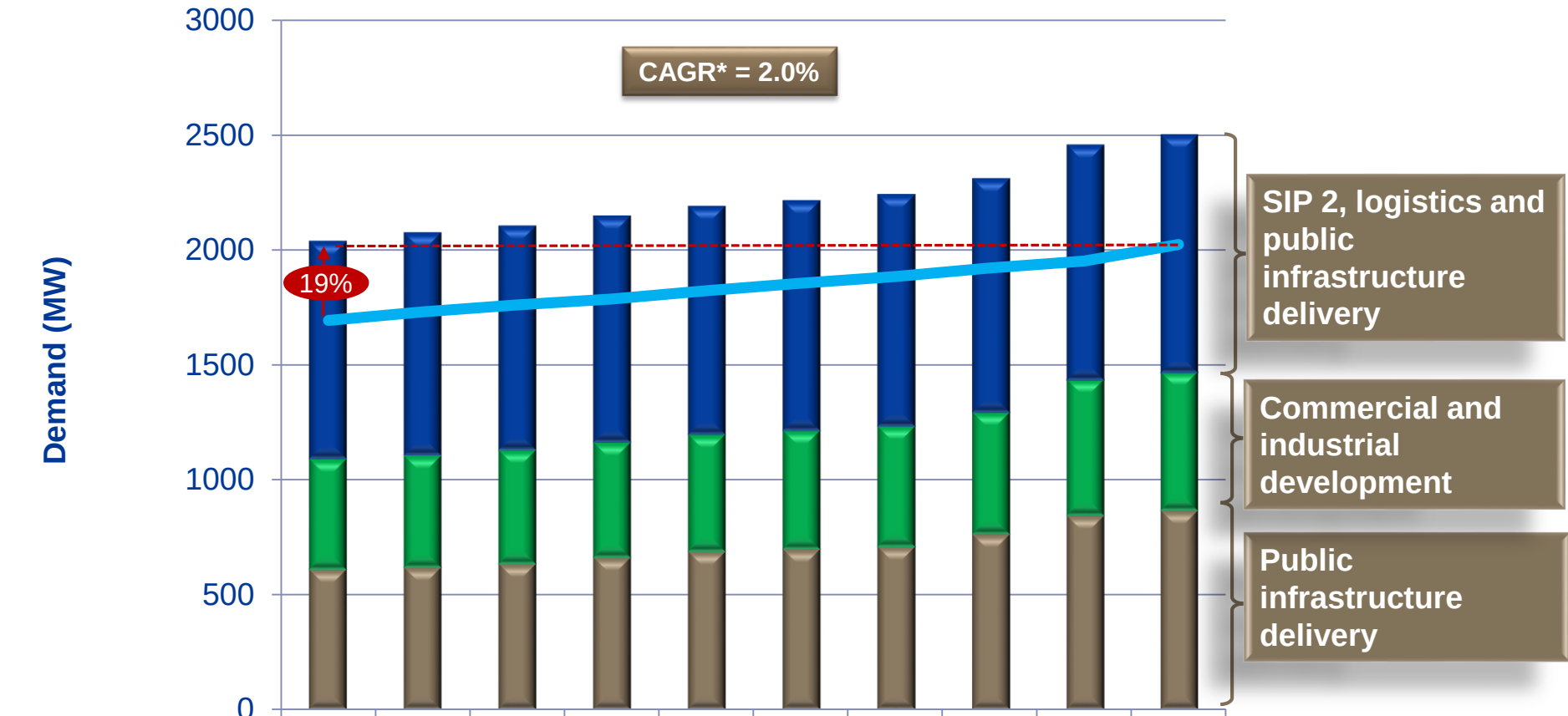


Generation

Type		Name	Output
Base Load	Coal	Lethabo	3558 MW
IPP	Hydro	IPPs	4.4 MW
	PV	IPPs	199 MW
Total Installed Generation			3761 MW



Free State Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Welkom	952	973	980	988	996	1003	1011	1019	1023	1034
Sasolburg	481	488	495	503	510	517	524	532	593	604
Bloemfontein	611	619	635	662	689	699	710	764	845	866
Provincial Peak	1694	1731	1762	1787	1823	1856	1885	1921	1952	2024

*** Compound Annual Growth Rate**

TRANSMISSION DEVELOPMENT PLAN

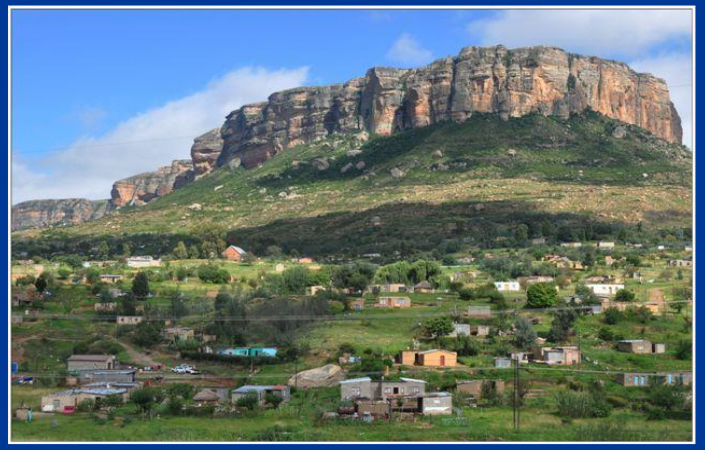
Key Developments in Eastern Free State

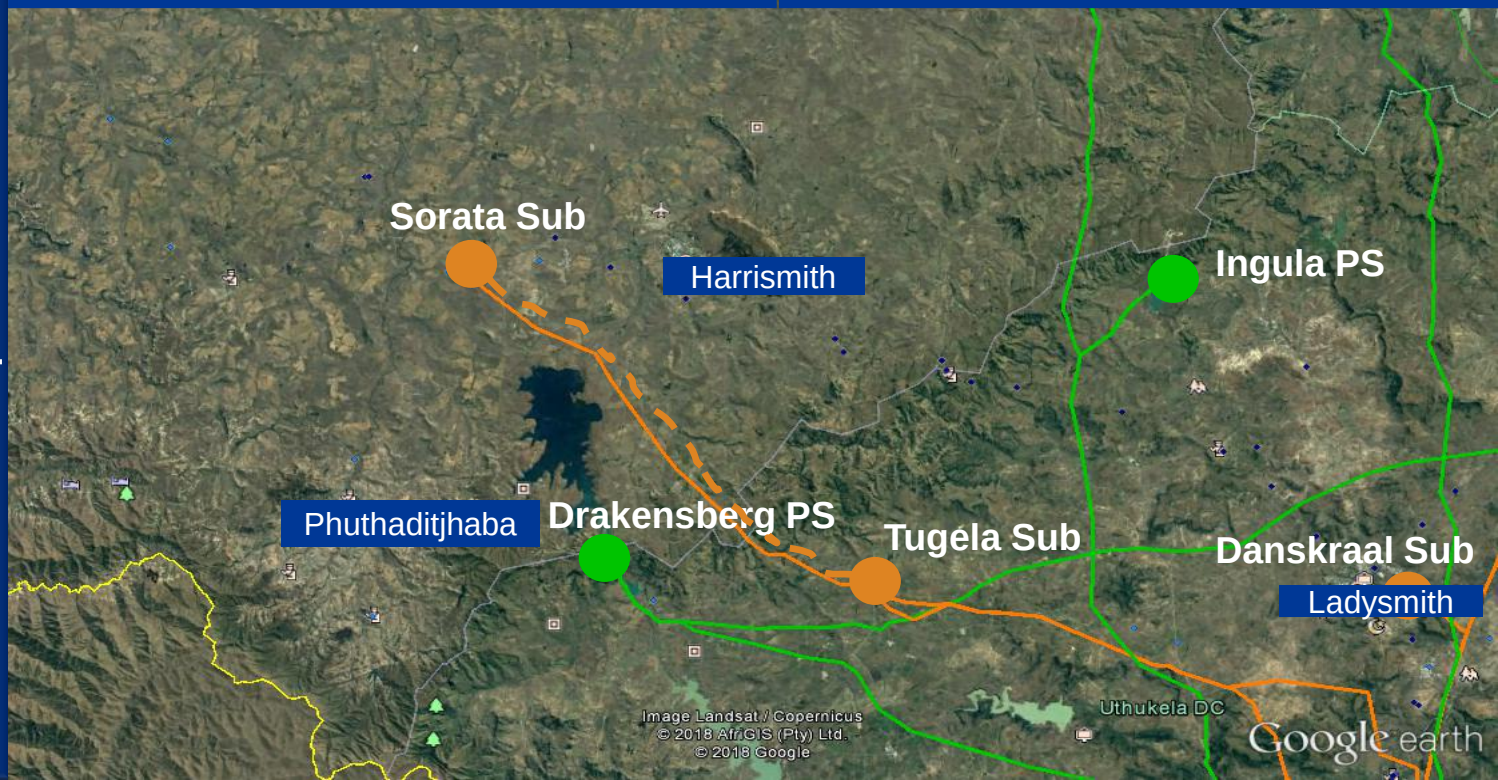
Drivers for load growth:

- Strategic Integrated Projects 2 (Harrismith Logistics Hub)
- Public infrastructure delivery

Planned Projects:

- Harrismith Strengthening: Extension of Sorata SS (Phase 1 and 2)





Key Developments in Sasolburg

Drivers for load growth:

- Mining activities
- Industrial activities
- Public infrastructure delivery

Planned Project:

- Igesi Substation Integration

Key Developments in Mangaung and Surrounding Regions

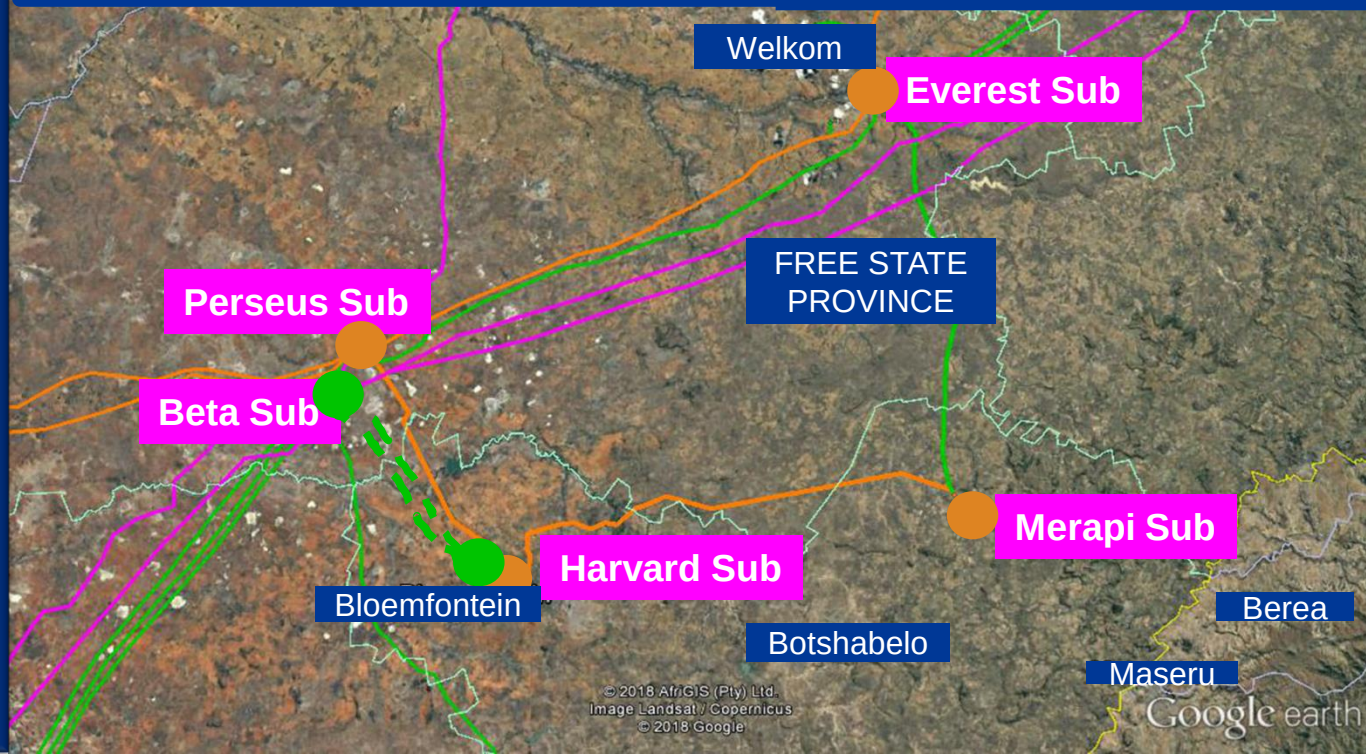
Drivers for load growth:

- Solar power generation
- Public infrastructure delivery

Planned Projects:

Bloemfontein Strengthening Phase 2:

- Everest-Merapi 400kV Line (operated @ 275kV)
- Harvard 400/132 kV Substation
- 2 x Beta-Harvard 400kV Lines



Questions?

North West Province

TDP 2019 - 2028

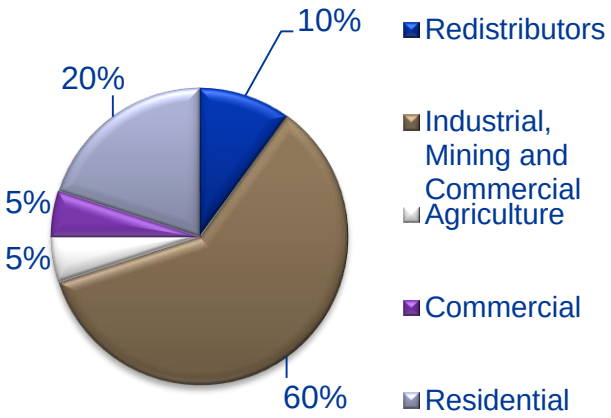
Planning Engineer: Queen Melato

Presented by: Dudu Hadebe

North West Province Profile

Load

- **Peak load of 3263MW : 30 May 2017**



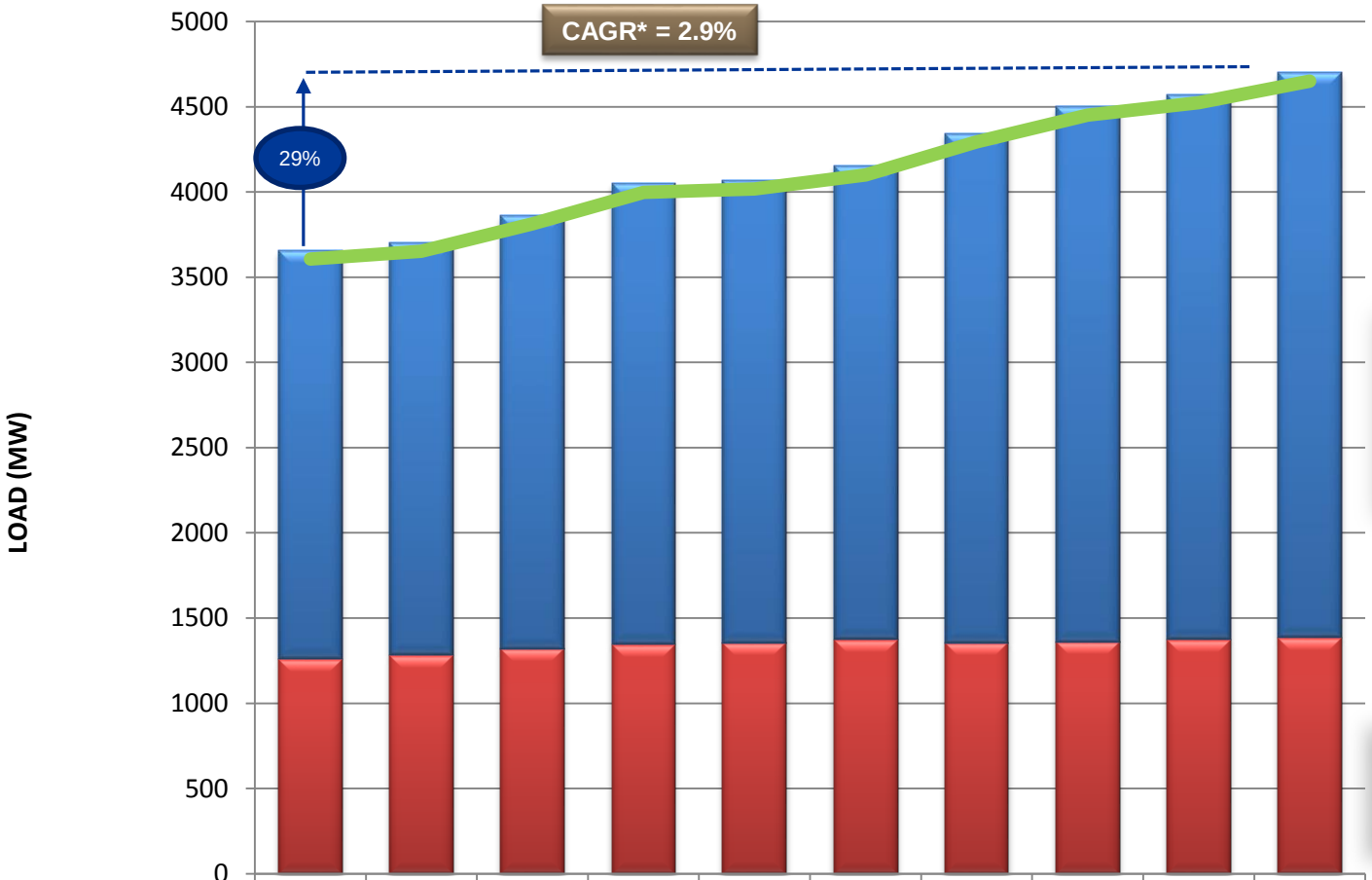
Generation

Type		Name	Output
Renewable Energy	PV	RustMo1 Solar	7MW
Total Generation			**7MW**

Completed Projects

- **Mookodi Substation Integration**
- **Dinaledi 3rd transformer**
- **Ngwedi substation integration**

North West Province Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Rustenburg CLN Peak	2398	2422	2544	2702	2714	2779	2992	3144	3199	3315
Carletonville CLN Peak	1259	1281	1320	1346	1355	1373	1353	1358	1375	1387
Provincial Peak	3606	3652	3813	3997	4018	4101	4294	4451	4523	4651

*** Compound Annual Growth Rate**

Renewable Energy in North West Province

Renewable Energy Projections:

- **Approximately 0.65 GW** (10 year horizon)

- Mookodi Substation – **475 MW**
  - Approved 75MW Waterloo Solar Park

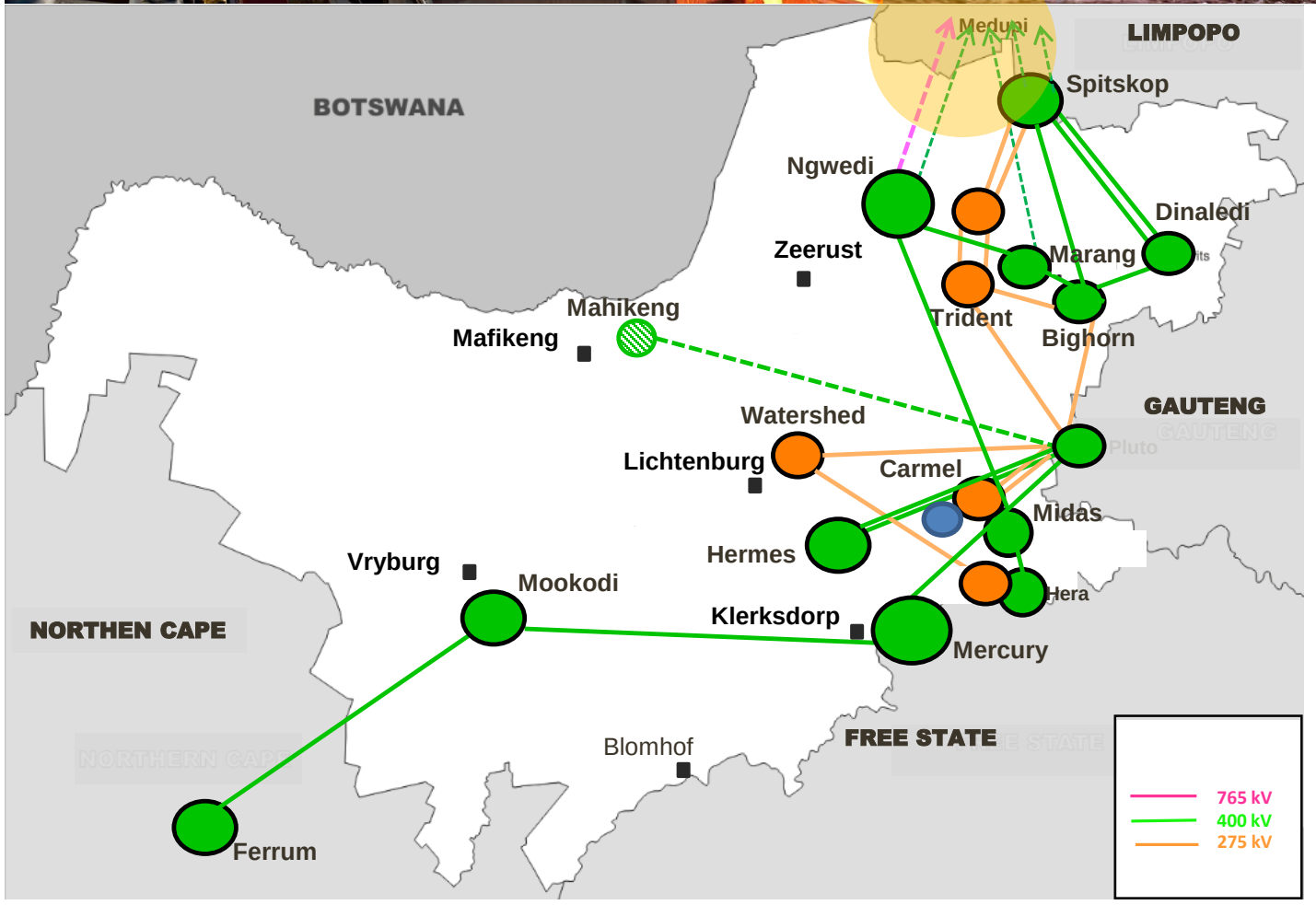
- Watershed Substation – **75 MW**
  - Approved 75MW Zeerust Solar Park

- Bighorn Substation – **100 MW**

NETWORK DEVELOPMENT PLAN

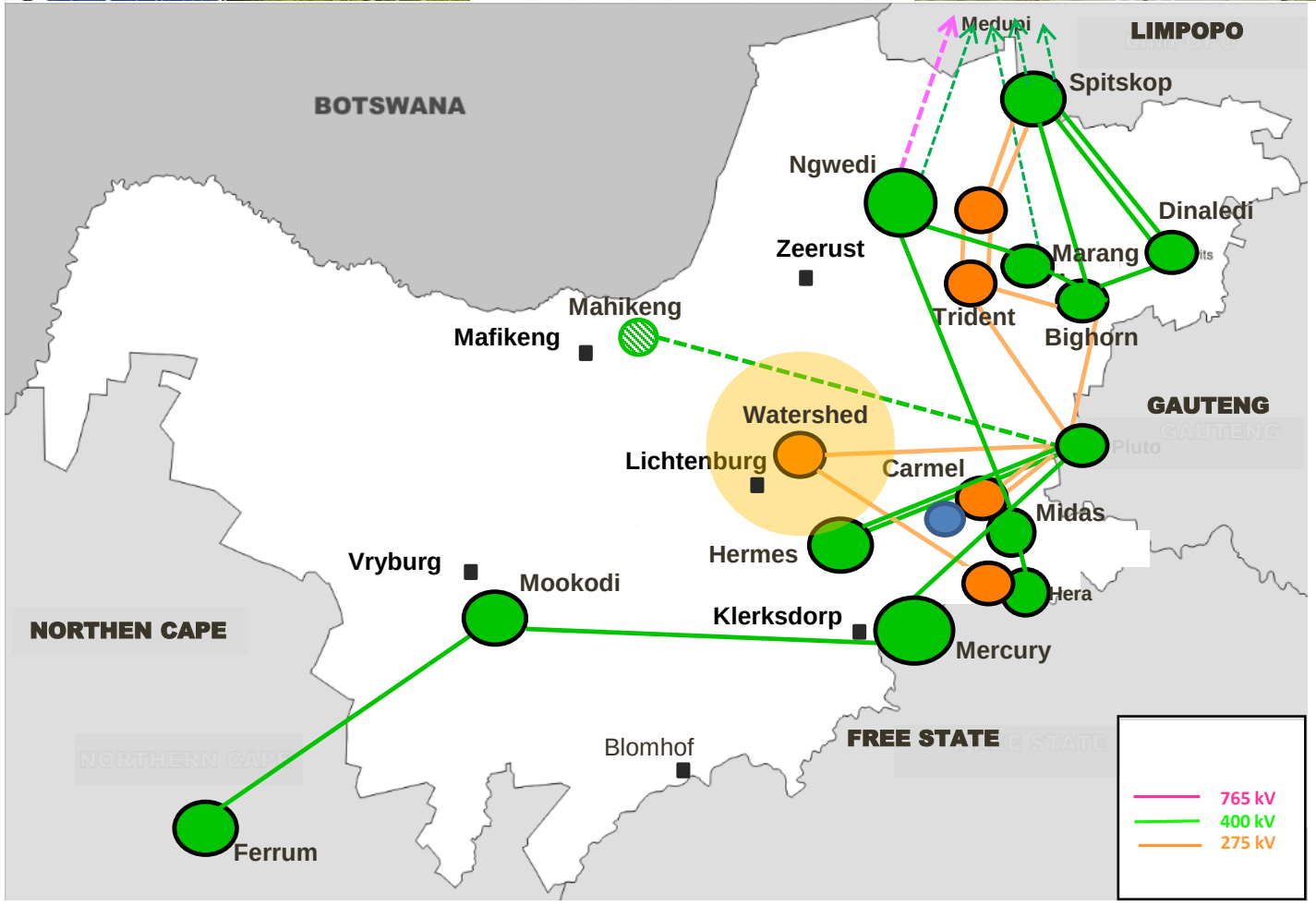
Developments in the Rustenburg CLN

- 2x Medupi – Ngwedi 400kV lines (1x 765kV design) - near Mogwase
- Bighorn Extension – near Marikana
- Rustenburg Reactive Compensation (Bighorn, Marang and Dinaledi)



Developments in the Carletonville CLN

- Watershed Strengthening
- Pluto – Mahikeng 400kV line
- Mahikeng substation



Questions?

Northern Cape Province

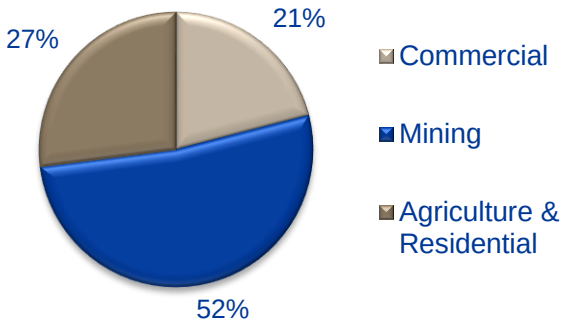
TDP 2019 – 2028

Presented by: Dudu Hadebe

Northern Cape Province Profile

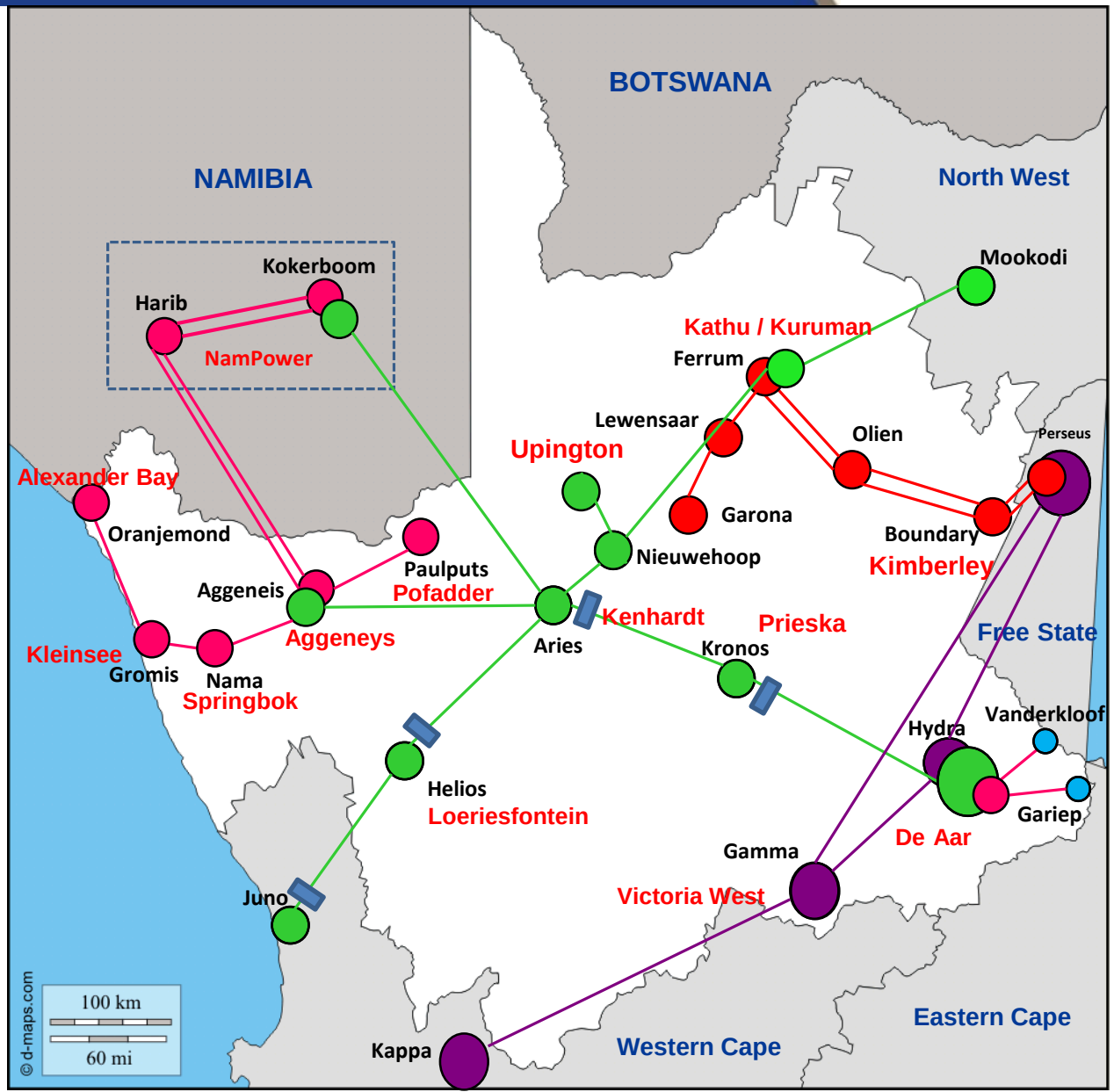
LOAD

- Peak load of 1077 MW: Feb 2017



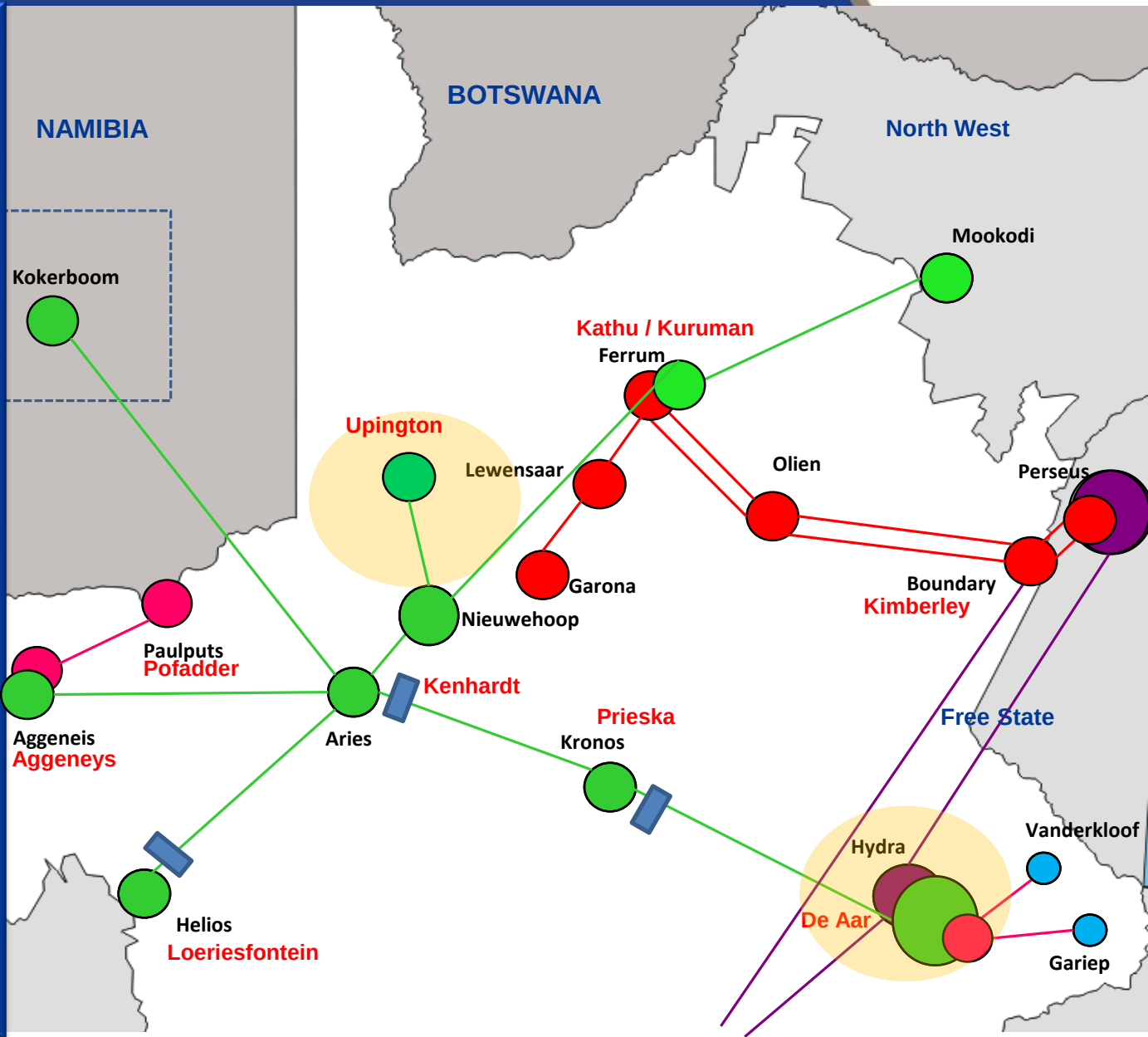
GENERATION

Type		Name	Output
Peaking	Hydro	Van Der Kloof	240 MW
		Gariep	360 MW
Eskom Total Installed			600 MW
REIPPPP Projects Installed to date		Wind	590 MW
		PV	667 MW
		CSP	300 MW
		Hydro	10 MW
REIPPPP Total			1567 MW

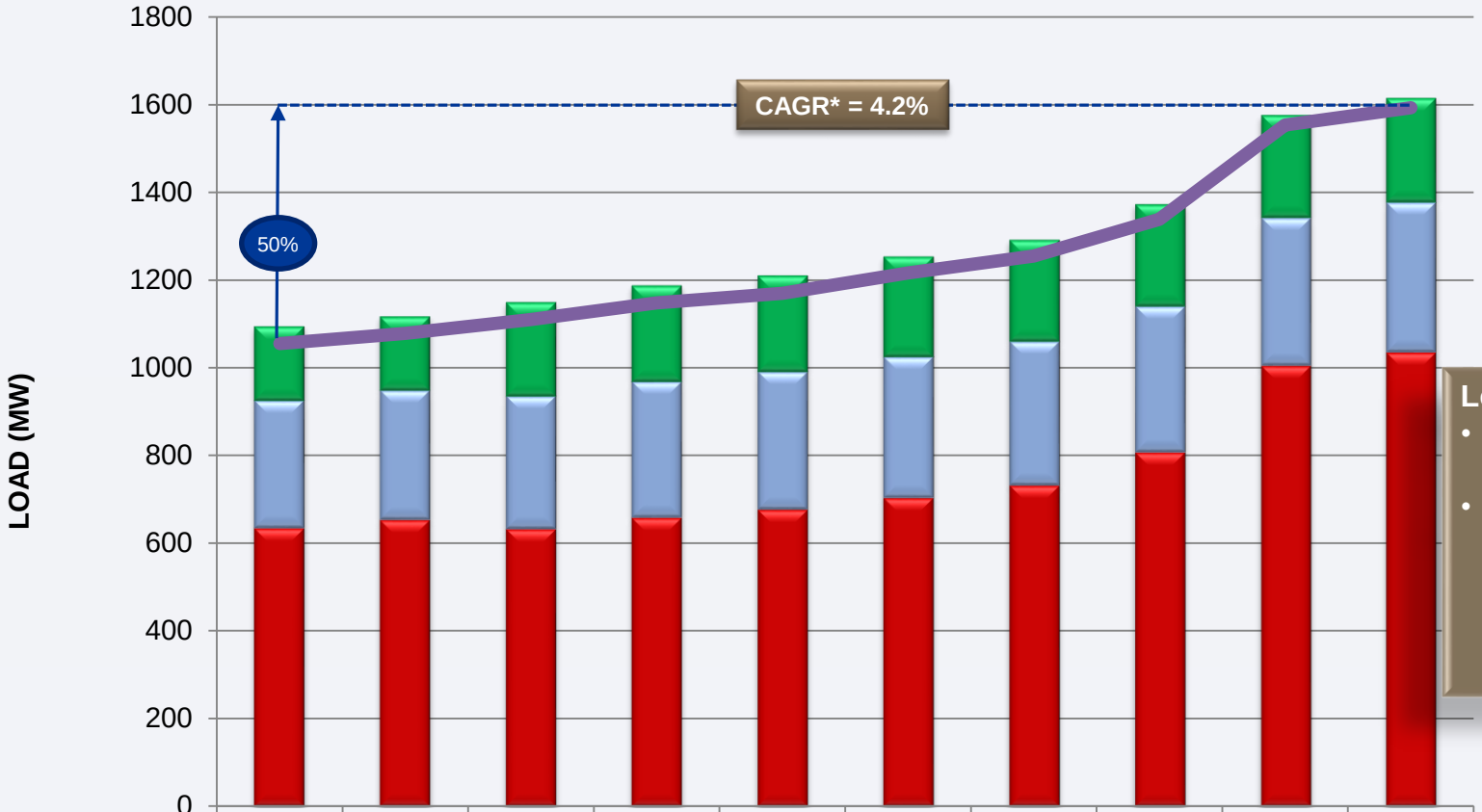


Completed Projects

- Upington Strengthening
  - Upington Substation 400/132 kV
  - Upington-Nieuwehoop 400 kV line for IPP's
- Aries – Niewehoop 400 kV line
- Nieuwehoop-Ferrum 400 kV line
- Hydra 400/132 kV transformation for IPP's



Northern Cape Province Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Namaqualand CLN	170	169	214	219	220	229	232	232	234	238
Karoo CLN	291	295	303	310	314	321	328	333	337	342
Kimberley CLN	636	655	634	660	678	705	733	808	1005	1035
Provincial Peak	1055	1078	1110	1148	1170	1216	1255	1339	1554	1593

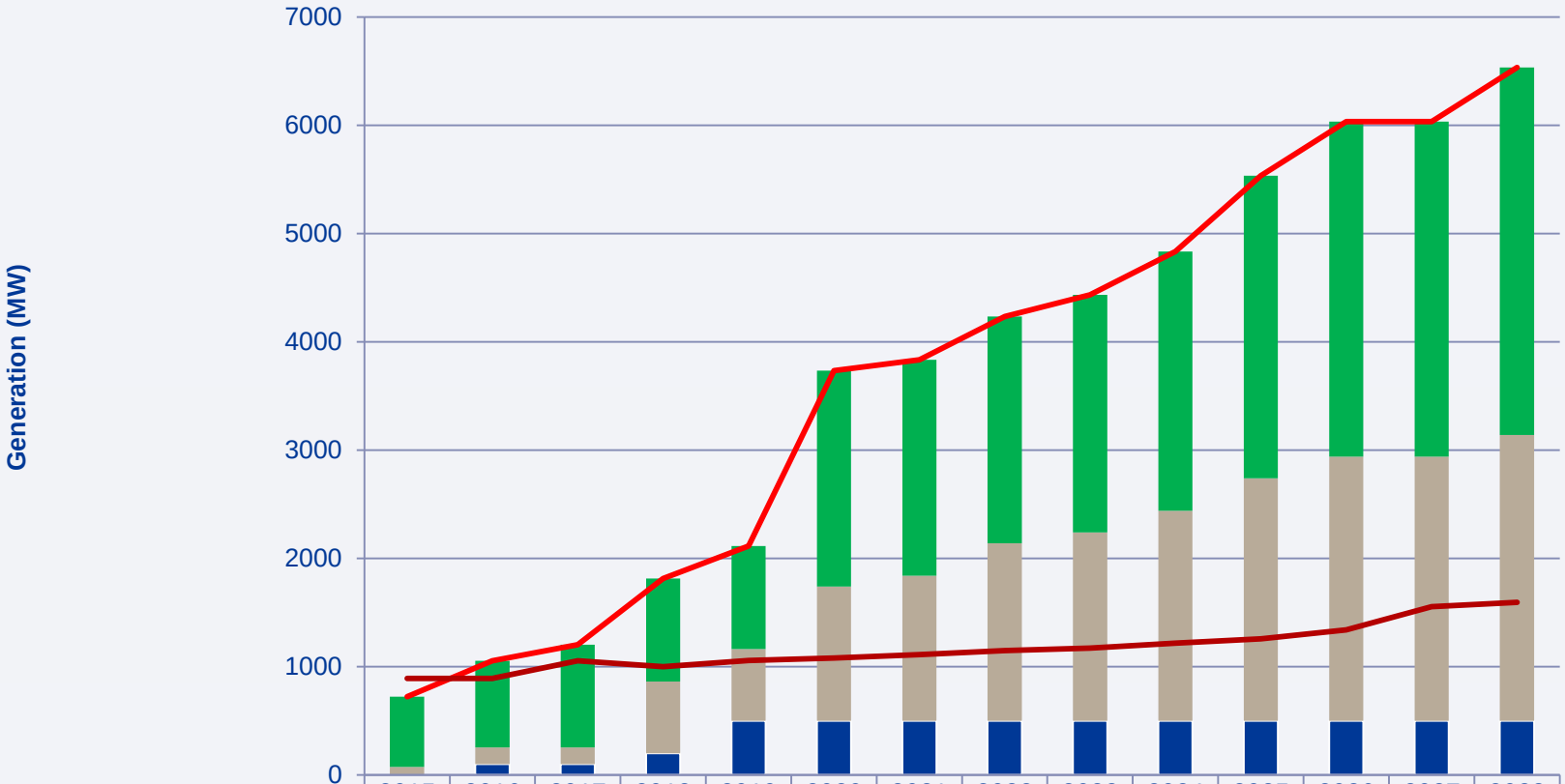
Year

Load Drivers

- **Natural load growth**
- **Anticipated mining loads in Kimberley**

*** Compound Annual Growth Rate**

Northern Cape Province Generation Forecast Renewable Energy

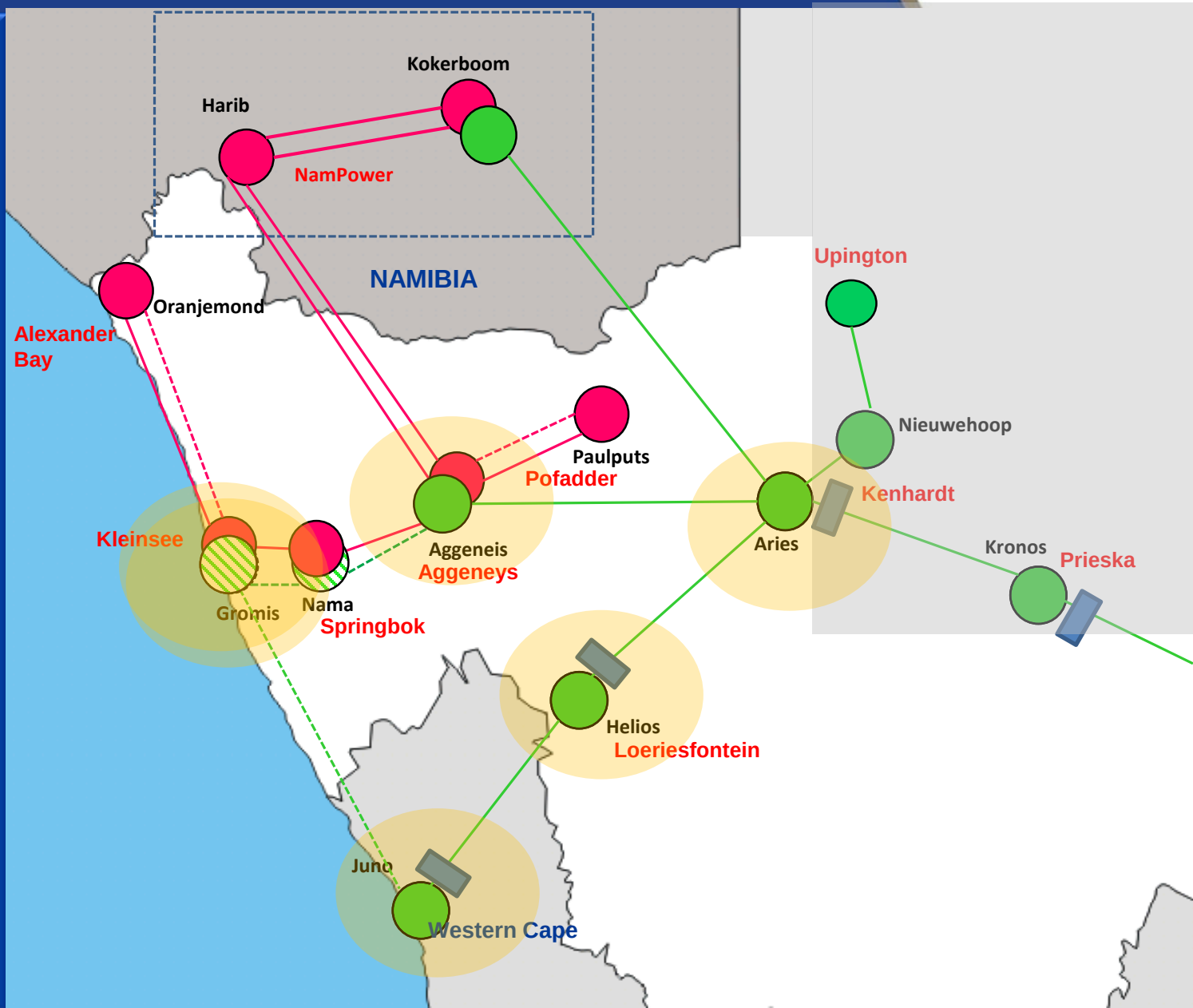


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
PV	650	800	950	950	950	1995	1995	2095	2195	2395	2795	3095	3095	3395
Wind	73	152	152	663	663	1238	1338	1638	1738	1938	2238	2438	2438	2638
CSP	0	100	100	200	500	500	500	500	500	500	500	500	500	500
Year Total	723	1052	1202	1813	2113	3733	3833	4233	4433	4833	5533	6033	6033	6533
Forecasted Load Grid Peak	891	889	1054	1000	1055	1078	1110	1148	1170	1216	1255	1339	1554	1593

TRANSMISSION DEVELOPMENT PLAN

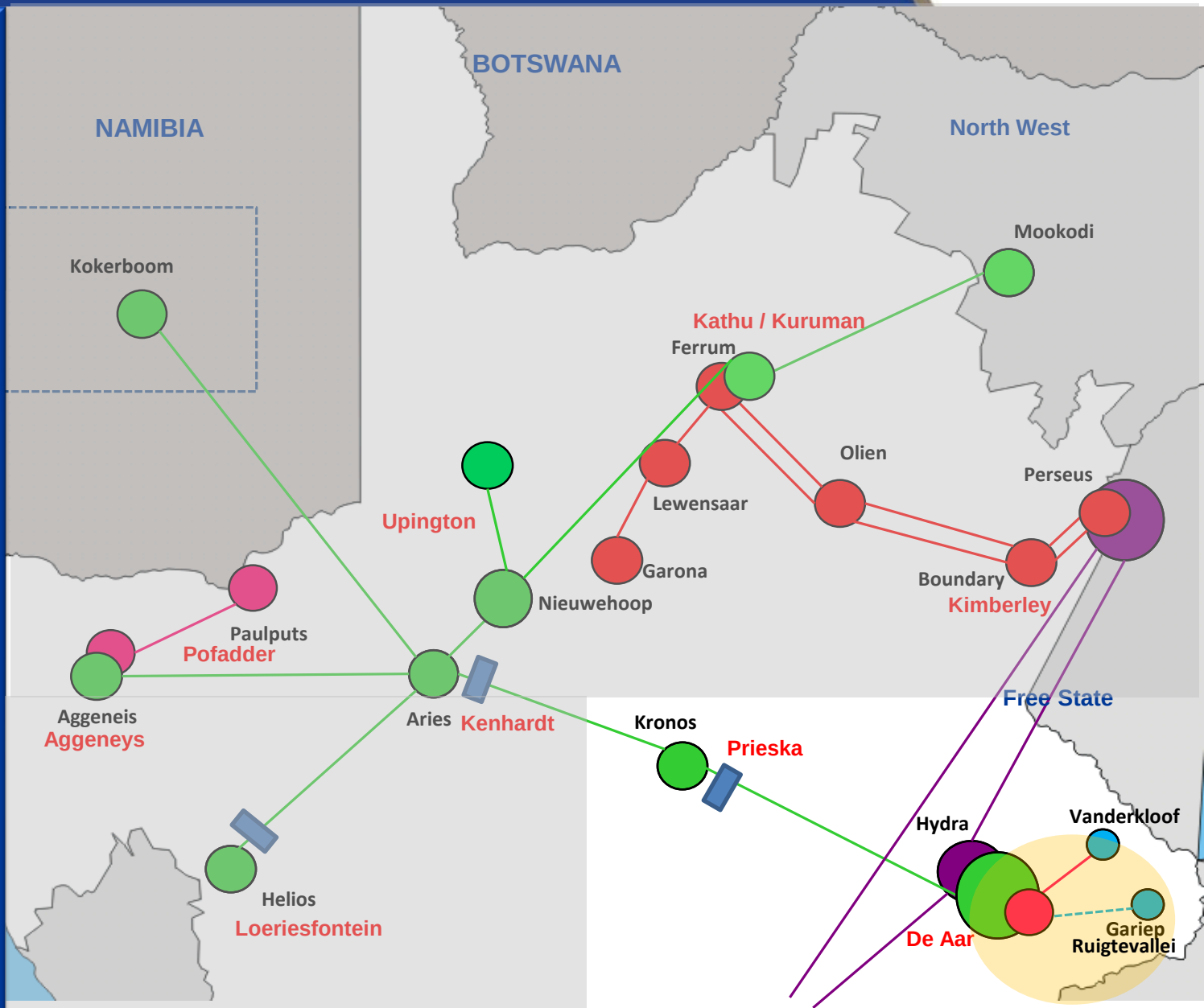
Developments in the Namaqualand CLN

- Juno-Gromis 400 kV line
- Gromis-Oranjemond 2nd 220 kV line (built at 400 kV)
- Gromis-Nama-Aggeneis 400 kV line
- Aggeneis-Paulputs 2nd 220 kV line (built at 400 kV)
- Aries SVC
- Helios 2nd 500 MVA 400/132 kV Transformer
- Helios 20 MVA 132/66 kV Transformer



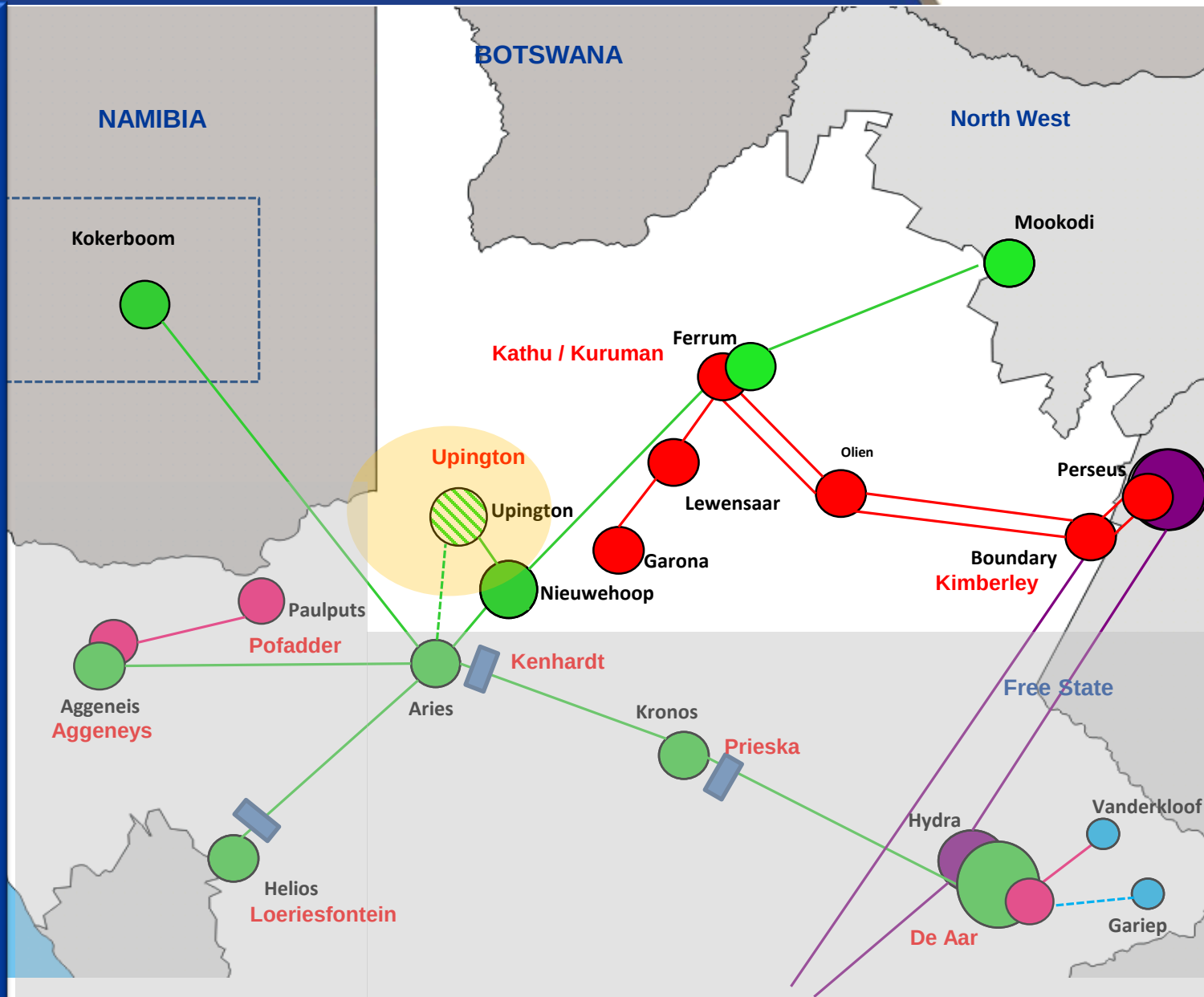
Developments in the Karoo CLN

- **Ruigtevallei transformer normalisation and transformation**
- **Gariep Strengthening – derate the 220 kV line to 132 kV**

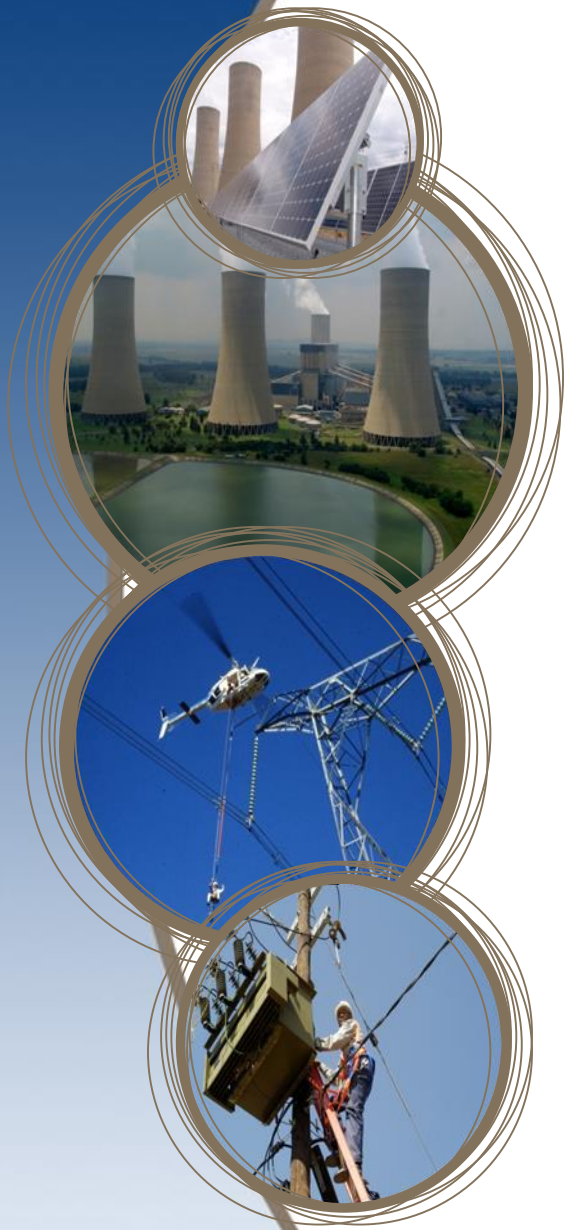


Developments in the Kimberley CLN

- **Aries-Upington 400 kV lines**



Questions?



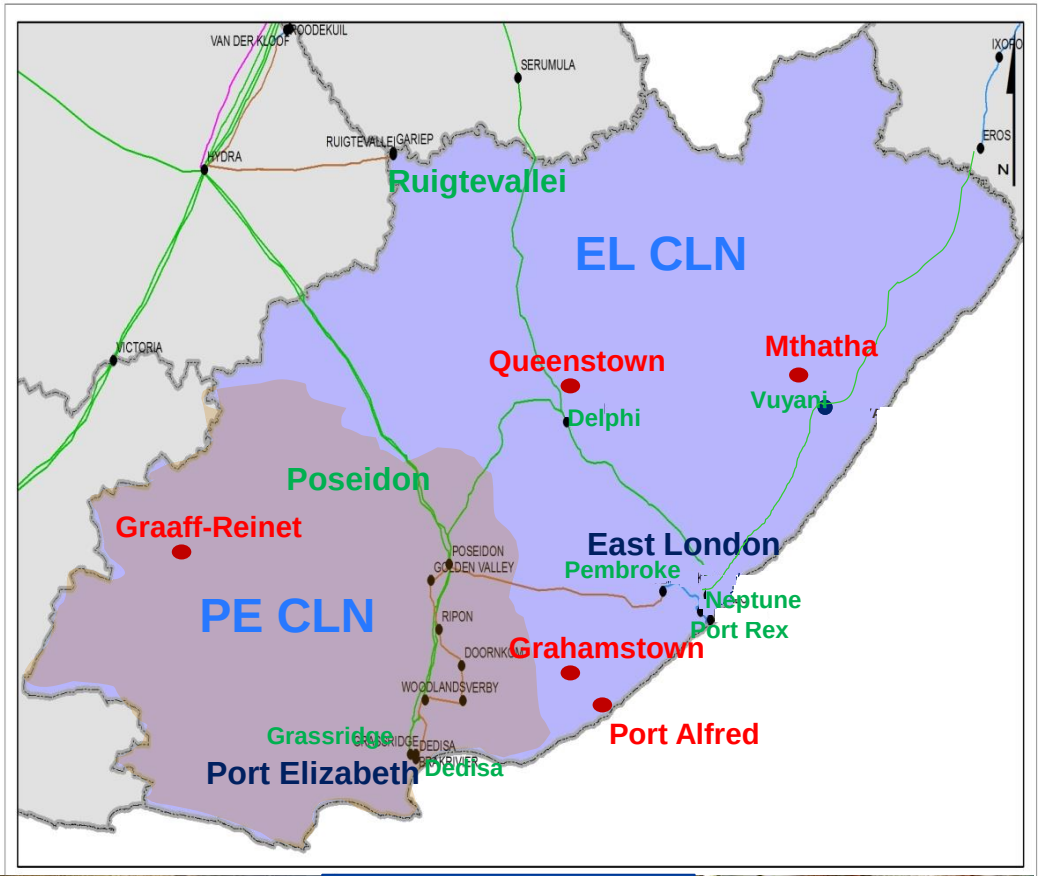
Eastern Cape Province

TDP 2019 - 2028

Planning Engineer: Queen Melato

Presented by: Ahmed Hansa

Eastern Cape Province Profile



Load Drivers

- Automotive, tourism, agriculture, agro-processing, and ocean economies

Generation

- Port Rex 171 MW
- Dedisa OCGT 372 MW
- RE IPP (Wind & Solar) ~ 1300 MW

Load Served

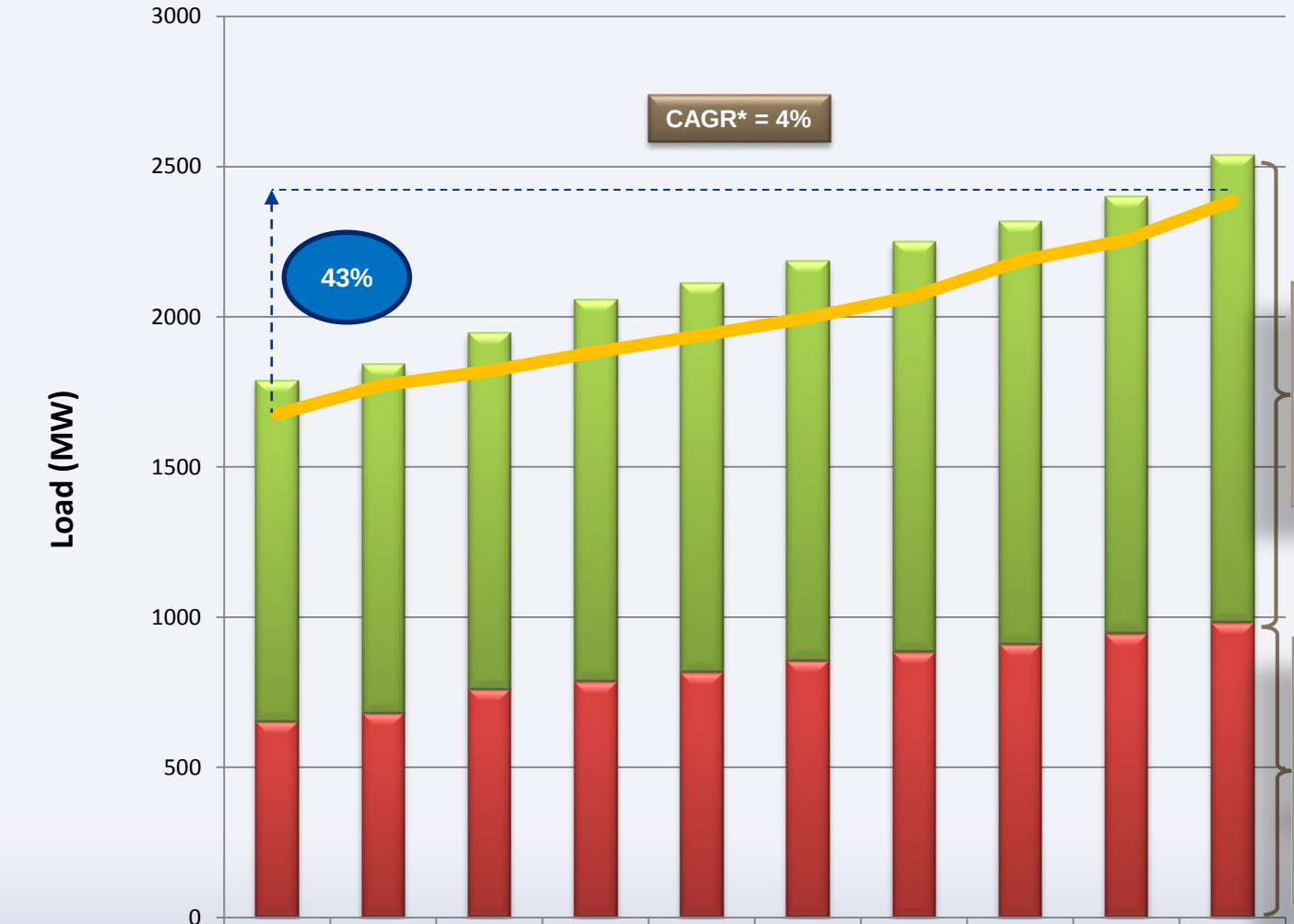
- Peak Load (10th August 2017): 1716 MW
- Geographic Areas: Nelson Mandela Metro, Buffalo City Metro, and Mthatha

nelson mandela bay

BUFFALO CITY
METROPOLITAN MUNICIPALITY

LOAD FORECAST

Eastern Cape Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Port Elizabeth	1136	1164	1187	1273	1297	1331	1368	1409	1457	1559
East London	650	678	759	785	816	854	882	910	945	980
Provincial Peak	1675	1772	1819	1882	1938	1997	2068	2186	2256	2387

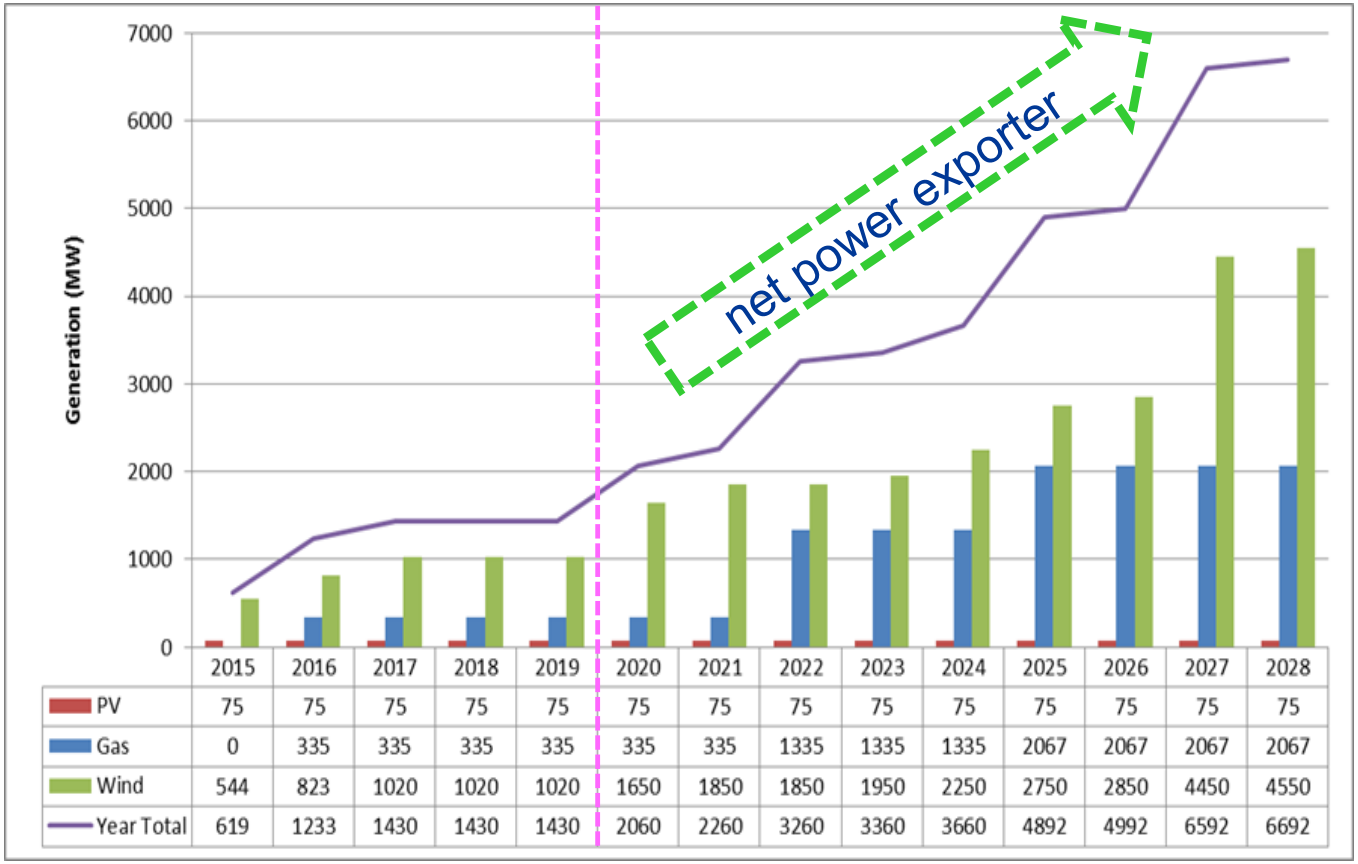
Coega IDZ –
Petro/ Ferrochrome Smelter(s)
Manufacturing –
Auto Industry Exports

Electrification
Construction –
Commercial Growth
Agriculture, Forestry and Agro-Processing
East London IDZ

*** Compound Annual Growth Rate**

GENERATION FORECAST

Eastern Cape Generation Forecast



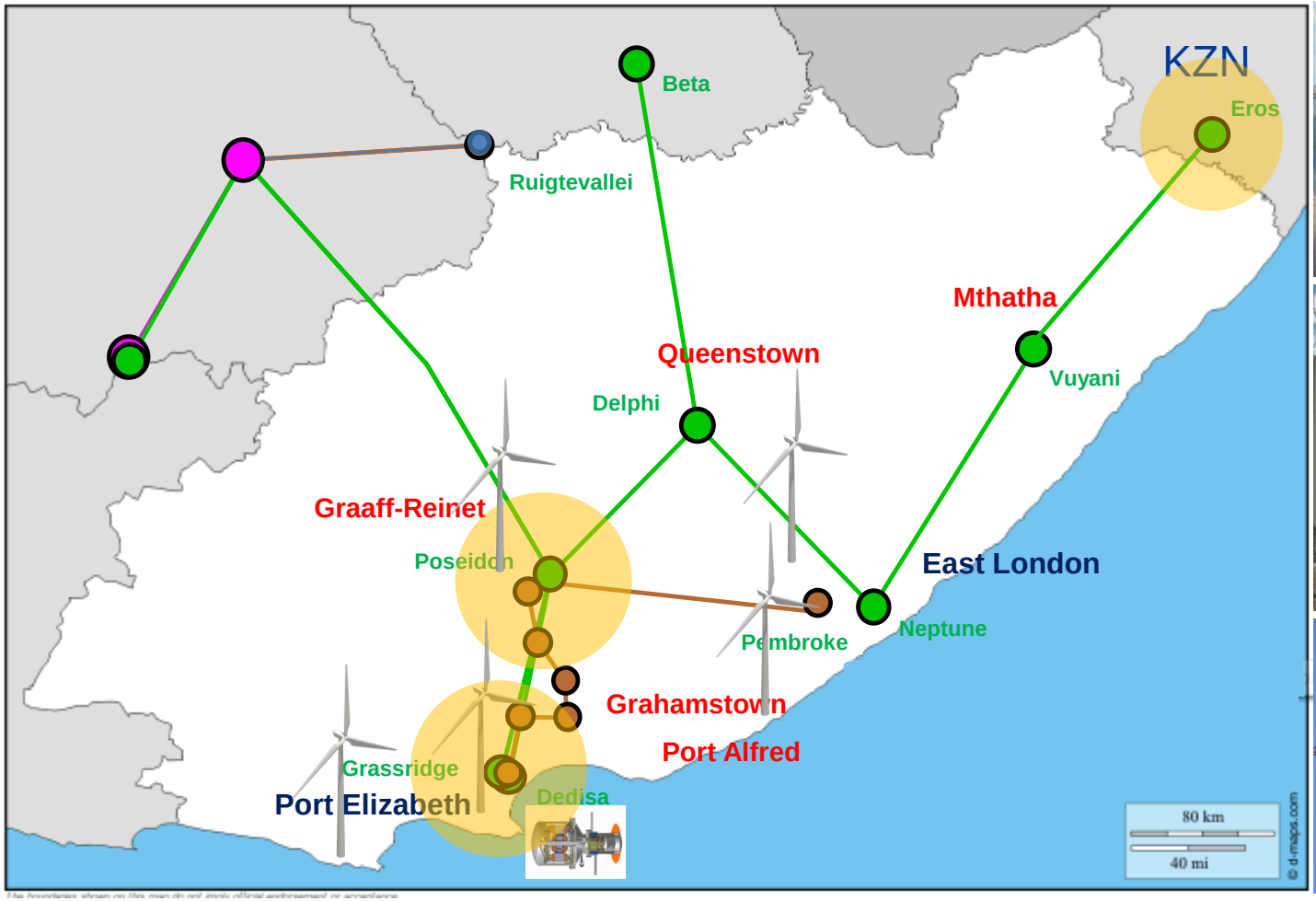
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
PV	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Gas	0	335	335	335	335	335	335	1335	1335	1335	2067	2067	2067	2067
Wind	544	823	1020	1020	1020	1650	1850	1850	1950	2250	2750	2850	4450	4550
Year Total	619	1233	1430	1430	1430	2060	2260	3260	3360	3660	4892	4992	6592	6692

Renewables (MW)		
EL	PE	Total
250	1452	1702

Gas generation ~ 2000 MW

COMPLETED PROJECTS

Completed Projects (2014 – 2017)



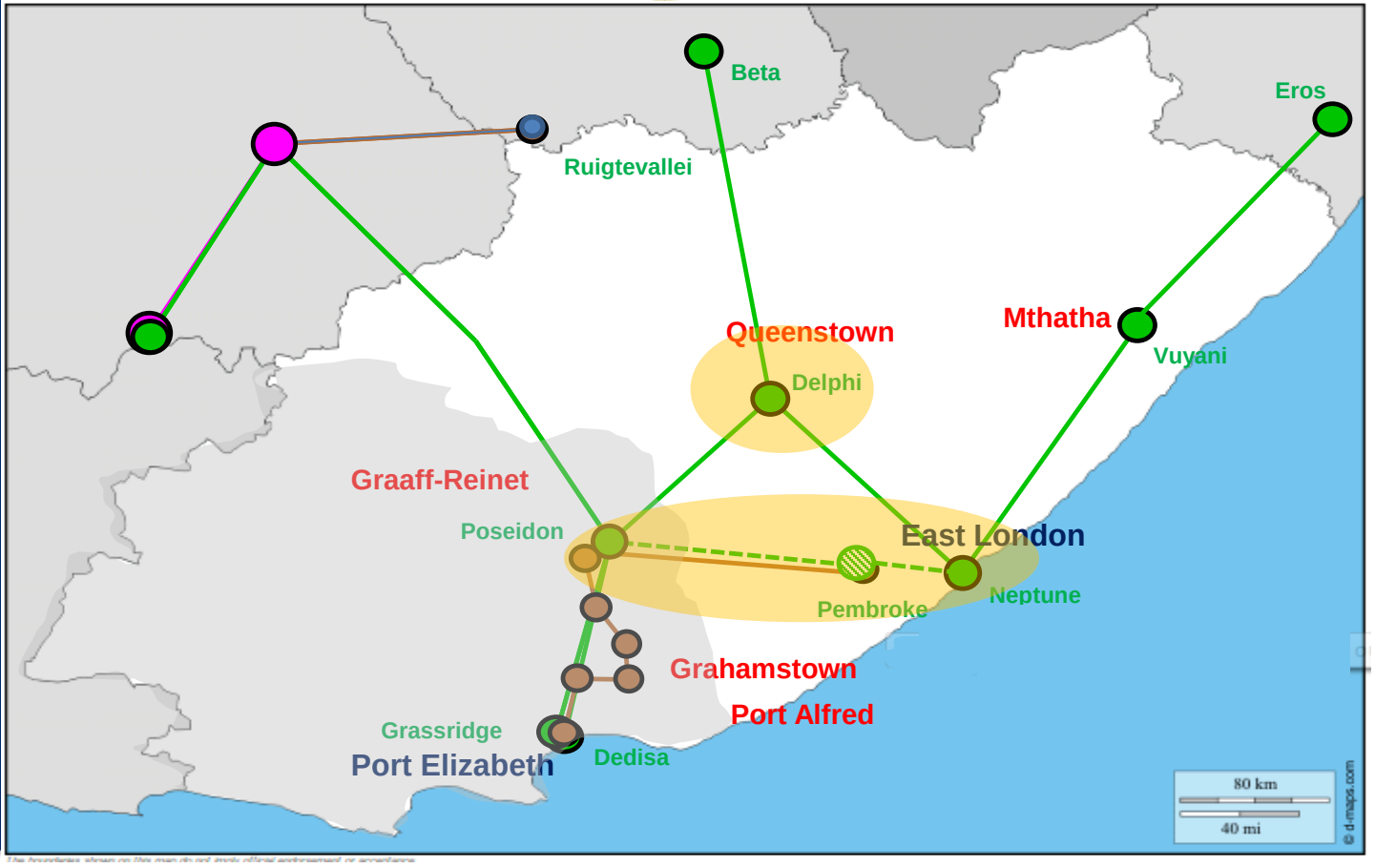
- Eros – Vuyani line, Vuyani substation and Vuyani – Neptune line
- Poseidon 500 MVA 400/132 kV transformer
- Grassridge – Dedisa 132 kV line
- ~ 1300 MW RE in the province and 300 MW DOE OCGT generation at Dedisa

NETWORK DEVELOPMENT PLAN

Key projects in the East London CLN

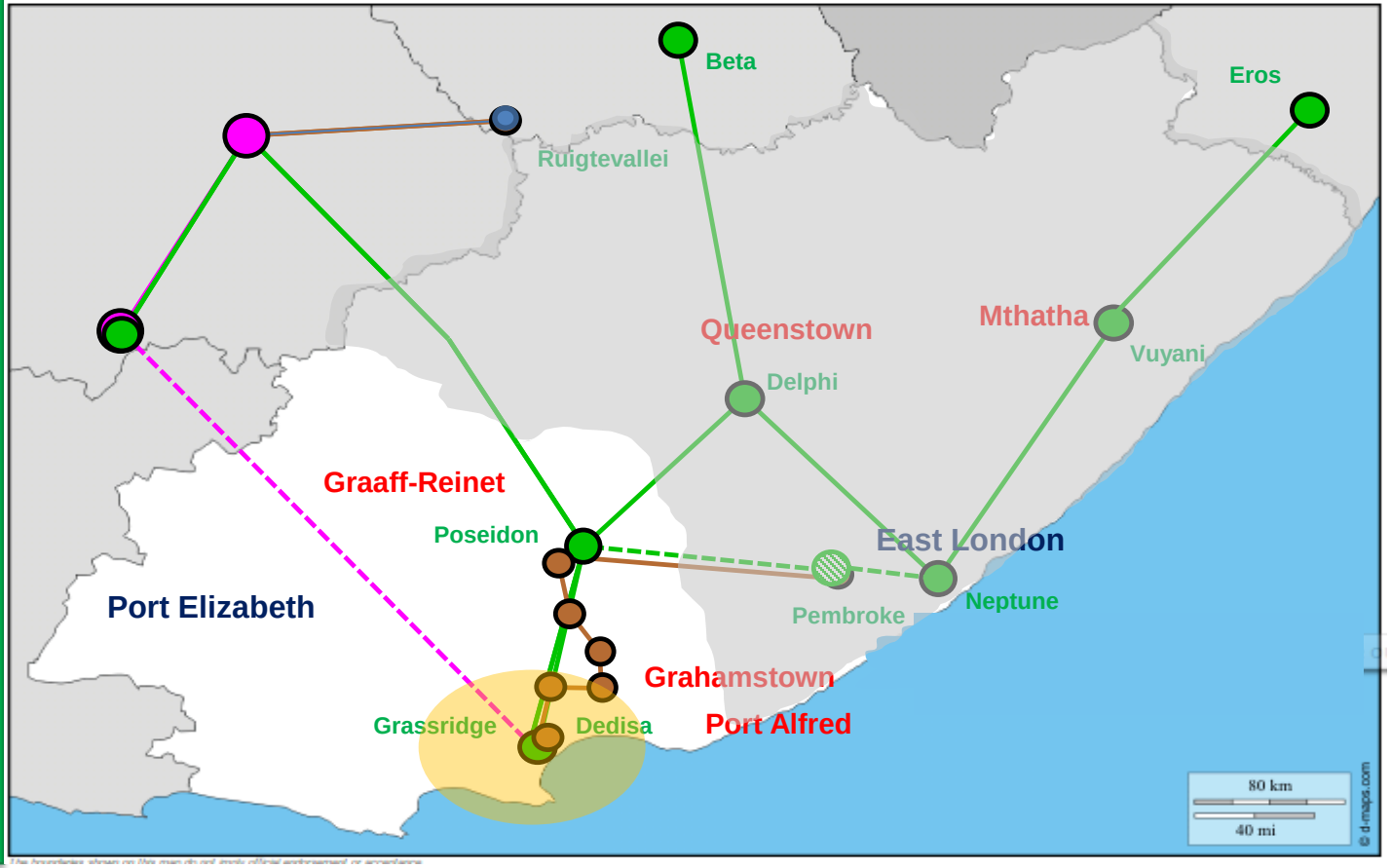
- 400 kV at Pembroke substation:
  - Neptune – Pembroke 400 kV line
  - Poseidon – Pembroke 400 kV line

- Delphi substation:
  - 1st 500 MVA transformer
  - 100 Mvar 400 kV capacitor bank

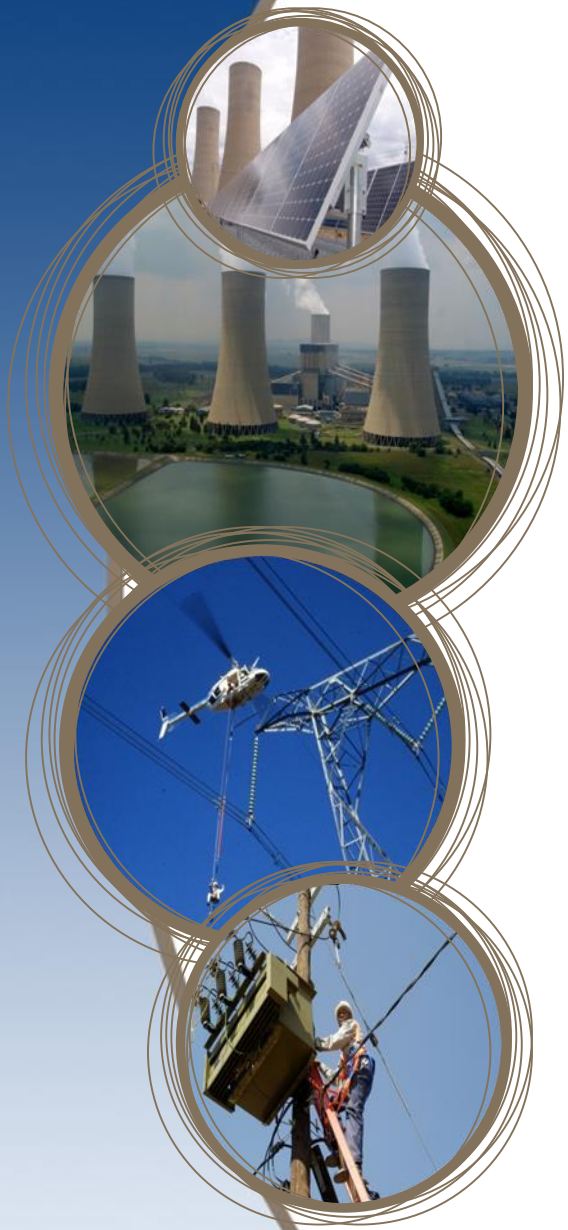


Key Projects in the PE CLN

- **Dedisa and Grassridge**
  - **3rd 500 MVA transformers and**
  - **100 Mvar 400 kV capacitor banks**
- **Gamma- Grassridge 1st 765 kV line**



Questions?



Western Cape Province

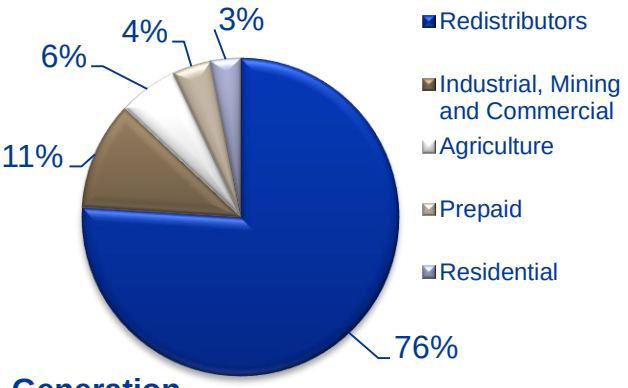
TDP 2019 - 2028

Presented by: Ahmed Hansa

Western Cape Province Profile

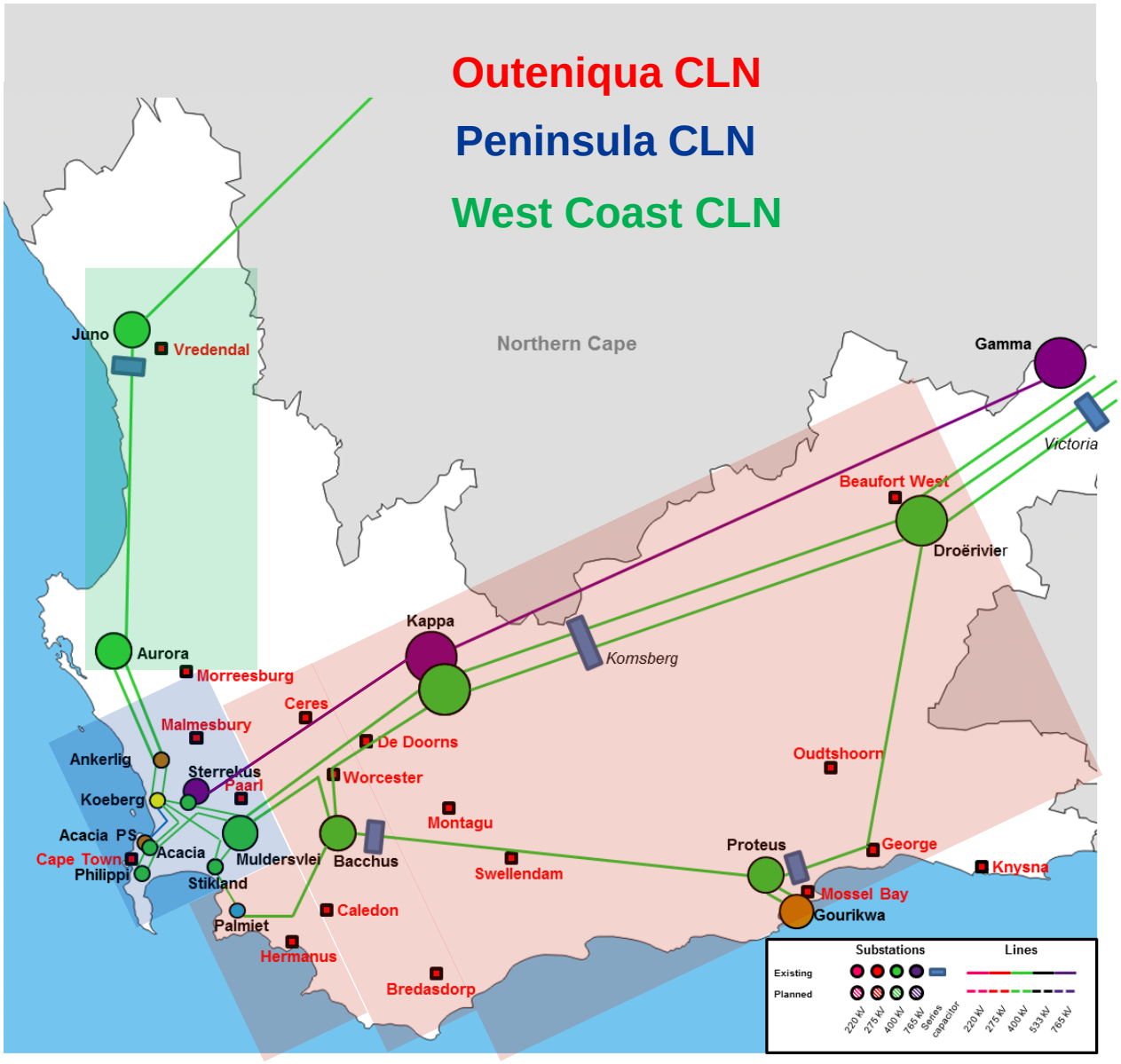
Load

- **Peak load of 3930 MW: 26th June 2017**



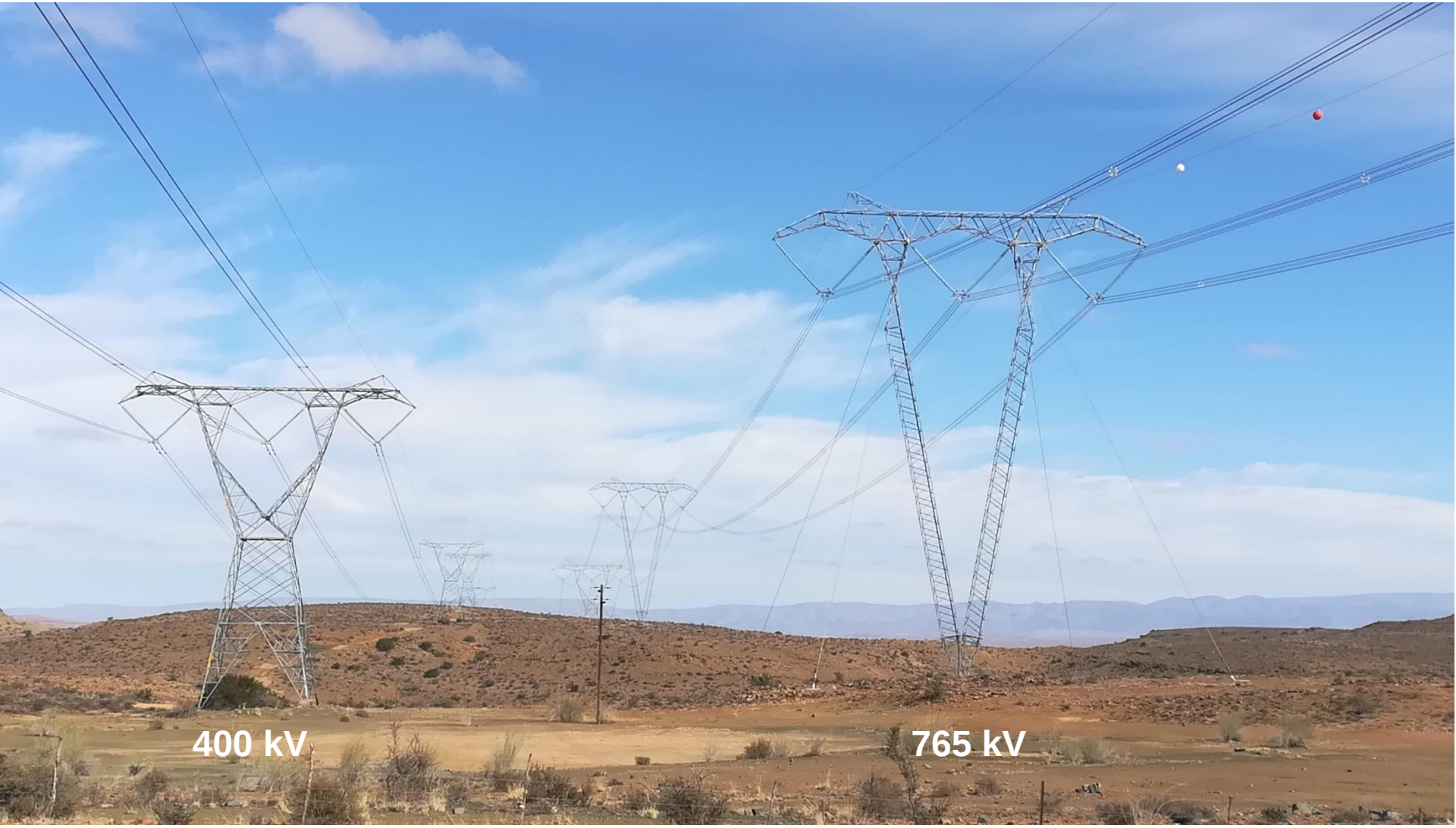
Generation

Type		Name	Output
Base Load	Nuclear	Koeberg	1860 MW
Peaking	Gas	Acacia	171 MW
		Ankerlig	1332 MW
		Gourikwa	740 MW
	Pumped Storage	Palmiet	400 MW
Eskom Renewables	Wind	Sere	105 MW
Eskom Total			4608 MW
REIPPPP	PV	IPPs	134 MW
	Wind	IPPs	316 MW
REIPPPP Total			450 MW
City of Cape Town Total			258 MW



COMPLETED PROJECTS

1st 765 kV line to the Cape (~1400 km)



132 kV 72 Mvar Capacitor Banks

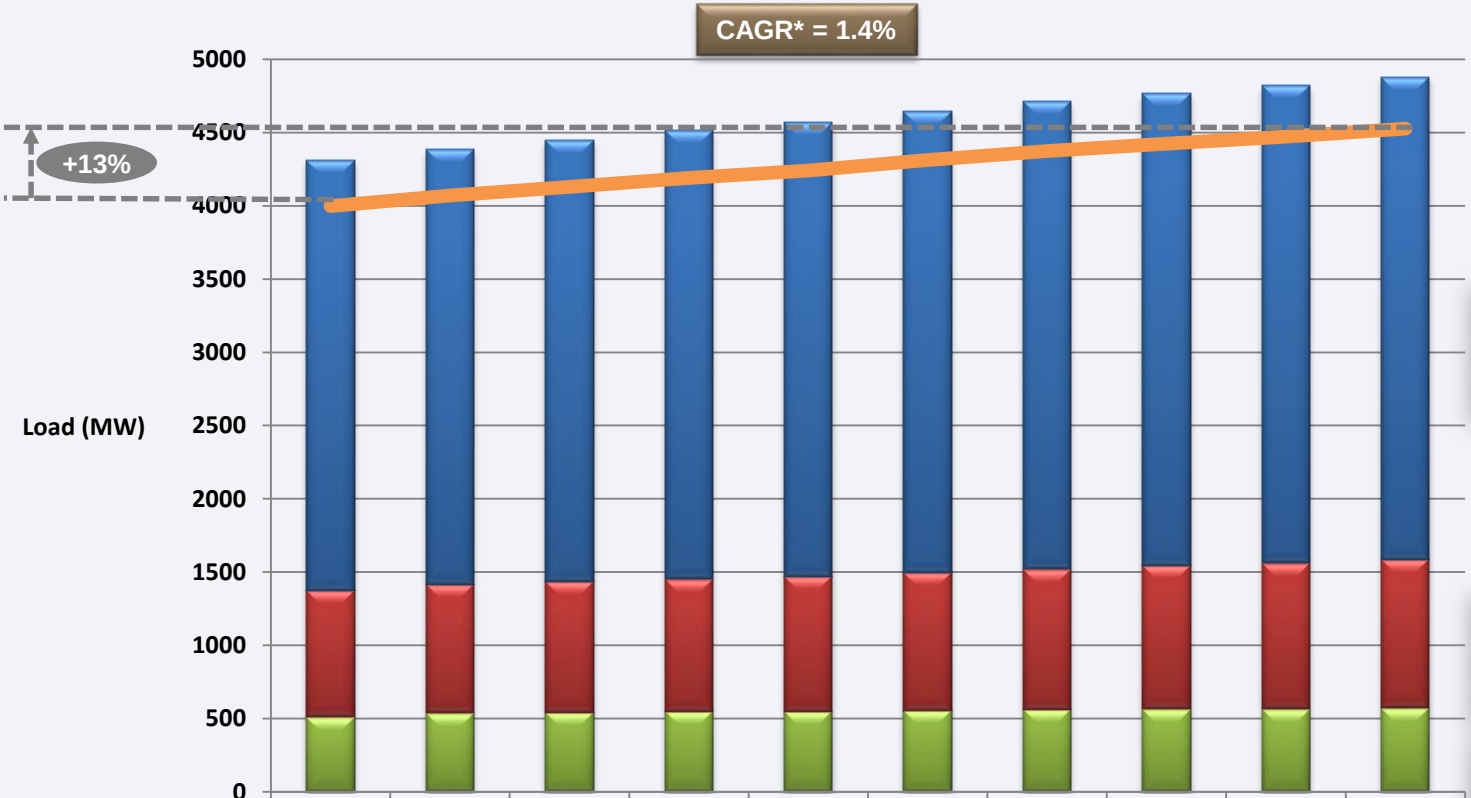
3rd 500 MVA transformer and FCLRs at Muldersvlei Substation

CHALLENGES

Encroachments on Philippi-Erica Servitude

LOAD FORECAST

Western Cape Load Forecast



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Peninsula	2934	2968	3016	3062	3098	3148	3192	3224	3257	3296
Outeniqua	863	877	891	905	920	945	959	980	996	1011
West Coast	511	539	543	547	550	554	562	565	568	573
Provincial Peak	3999	4070	4130	4190	4240	4312	4374	4424	4472	4527

Residential, commercial and light industrial load growth

Natural load growth and residential developments

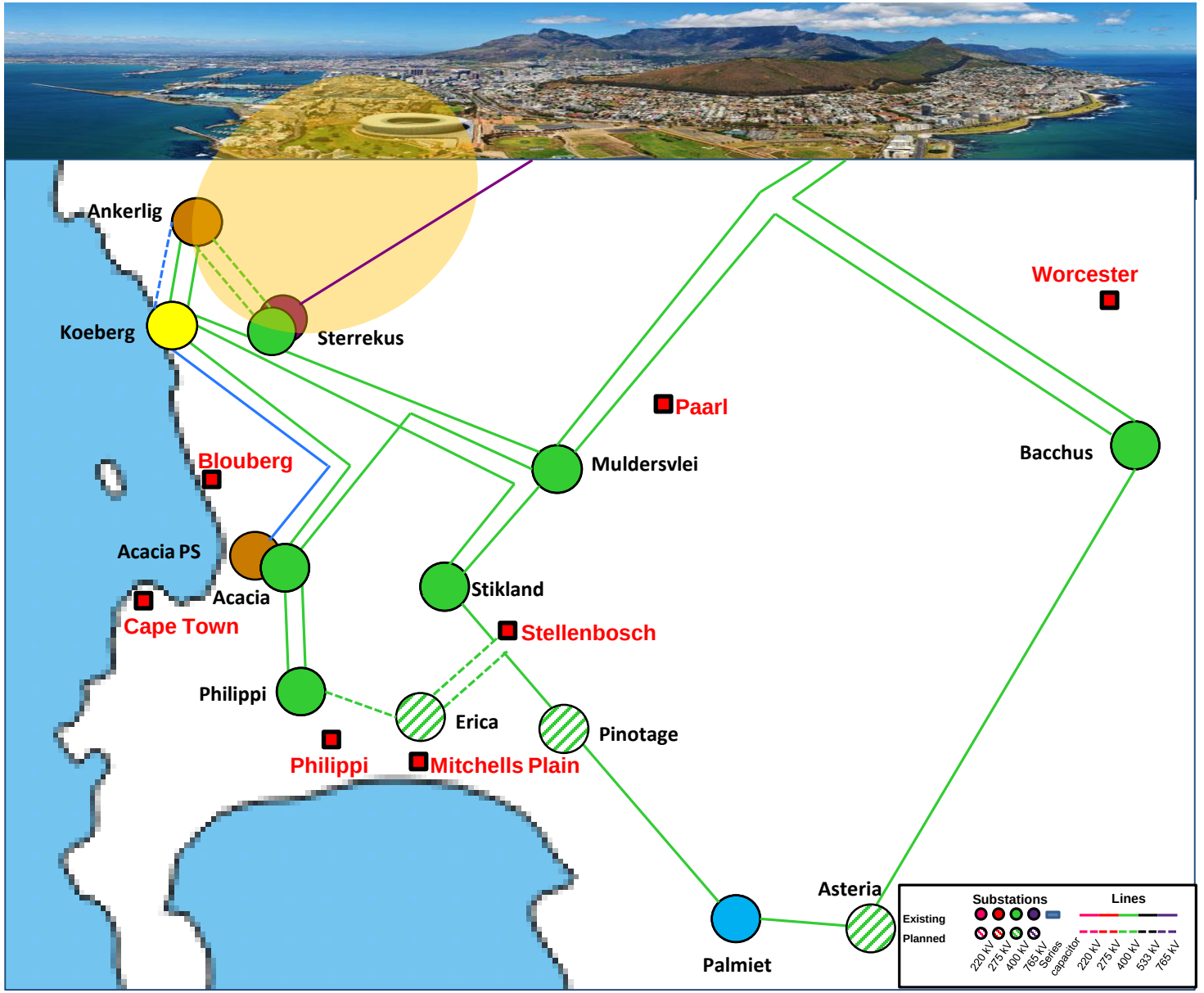
Load growth due to the Saldanha Bay IDZ

* Compound Annual Growth Rate

NETWORK DEVELOPMENT PLAN

Developments in the Peninsula CLN

- Ankerlig – Sterrekus 1st and 2nd 400 kV lines
- Relocate Koeberg offsite supply to Ankerlig
- Koeberg – Acacia 2nd 400 kV line
- Erica Substation
- Pinotage Substation

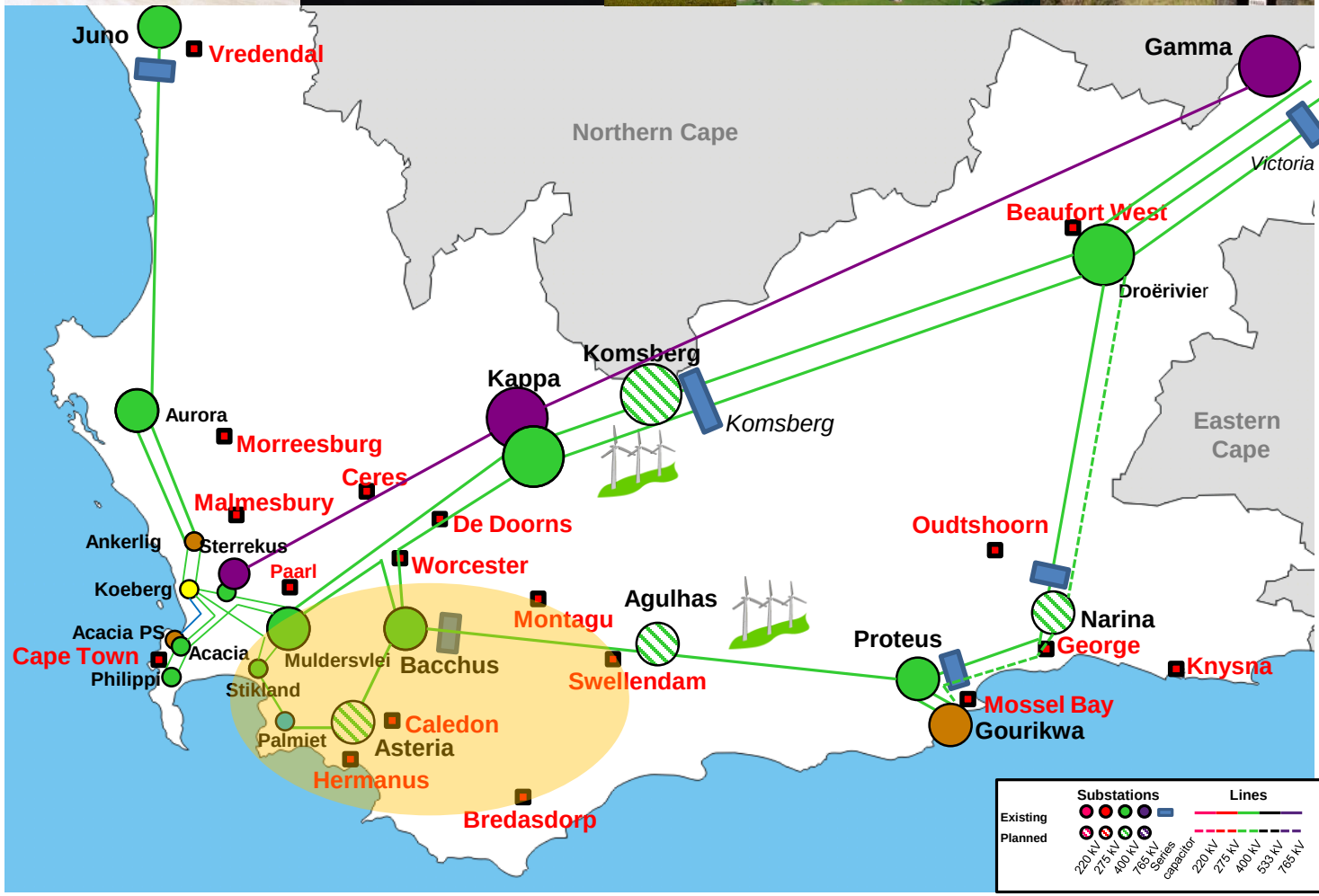


Pinotage Substation – Under Construction

Photo Credits – Google Earth and Grant Duncan Smith (http://www.subiaco.co.za)

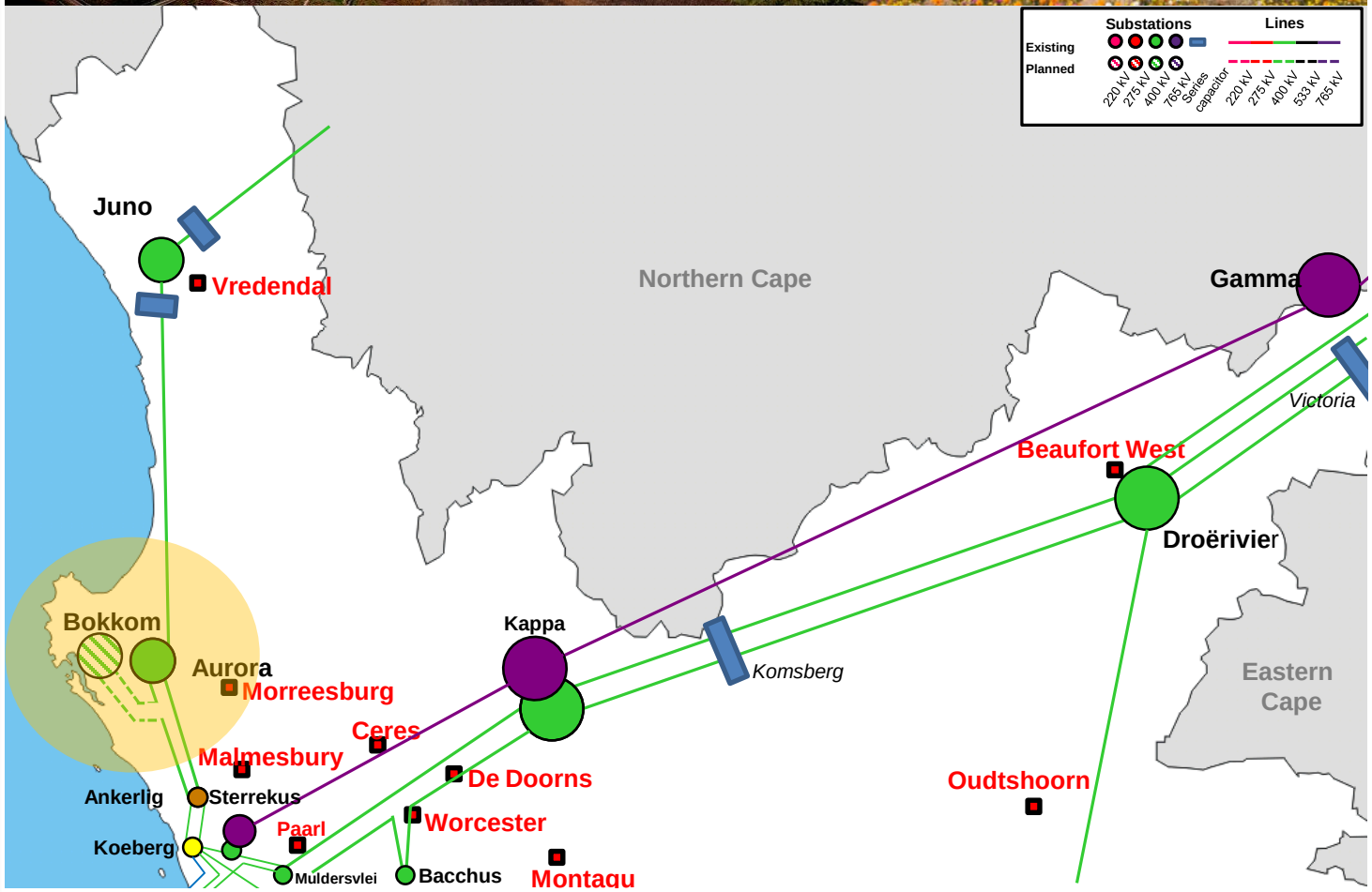
Developments in the Outeniqua CLN

- Asteria Substation
- Agulhas Substation
- Kappa 400/132 kV transformation
- Komsberg 400/132 kV Substation
- Narina Substation
- Gourikwa – Narina – Droërivier 400 kV line – Strategic EIA



Developments in the West Coast CLN

- Aurora transformation upgrade
- Bokkom Substation (Phase 1)
- Juno transformation upgrade
- PCB series cap phase out plan



Questions?

Eskom Transmission Refurbishment Plan 2019 - 2028

Presented by: Atha Scott

Content

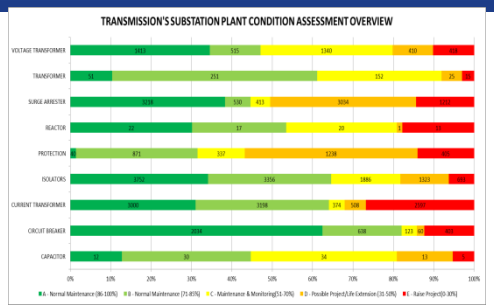
- **Tx Mandate and Framework**
- **Asset Replacement Process**
- **Criteria for Development**
- **Network Sustainability**
- **10 Year Refurbishment Capital Plan**
- **Asset Condition and Replacement Plan**
- **Network Status**
- **Conclusion**

Tx Mandate and Framework

- South African Grid Code stipulates that Transmission is responsible for the renewal, optimisation, reconfiguration and decommissioning of existing assets to ensure sustainability of the network.
- Eskom is supporting an Asset Management approach and alignment to ISO 55000
- Transmission Refurbishment deliverables/focus areas:
  - Asset Replacement of aging equipment (CTs, VTs, Surge Arresters, H.V. Circuit Breakers and Power Transformers)
  - Replacement of substation batteries and electronic components for protection and control systems, corroded conductors etc. (these not repairable)
  - Targeted Asset Performance Improvements (lines and substation equipment)
  - Physical security improvements and surveillance and monitoring at our key assets and sites
  - Strategic and operational spares holding (to reduce SML<1 and MI risk)
  - Compliance (Regulatory, OHSAct, NKP Act, Environmental etc.)
- Asset Purchases (Production Equipment)
  - Specialised equipment for: live-line work; fault location systems, and online condition monitoring, etc.

Asset Replacement Process

Engineering Asset Appraisal Reports for *HV & Secondary Plant* Updates

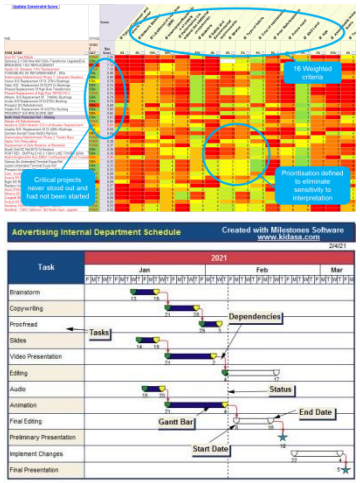


Engineering Assessment

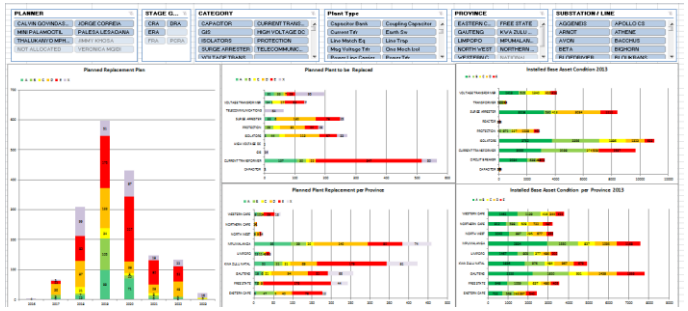
SAP PM

SAP Plant Maintenance

TCP



SURS / Decommissioned Assets



Asset Replace Timeline

FRA
ERA
DRA
CRA
PCRA

- Location
- Plant Item
- Condition
- Timeline

Asset replacement based on Planned Projects

Refurbishment Plan Development

Asset Condition Assessment, Criticality and Risk (AHI)

Develop Business Case

Project Review, Prioritisation and Approval

Develop Unconstrained Plan

Publish Refurbishment Plan

Technology Appraisal Reports and LCMP (Strategy)

Grid Operation and Maintenance

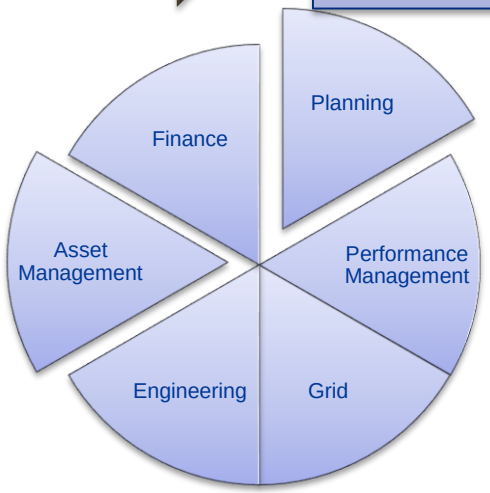
Performance Management

Asset Health Assessment Index

Asset Investment Planning

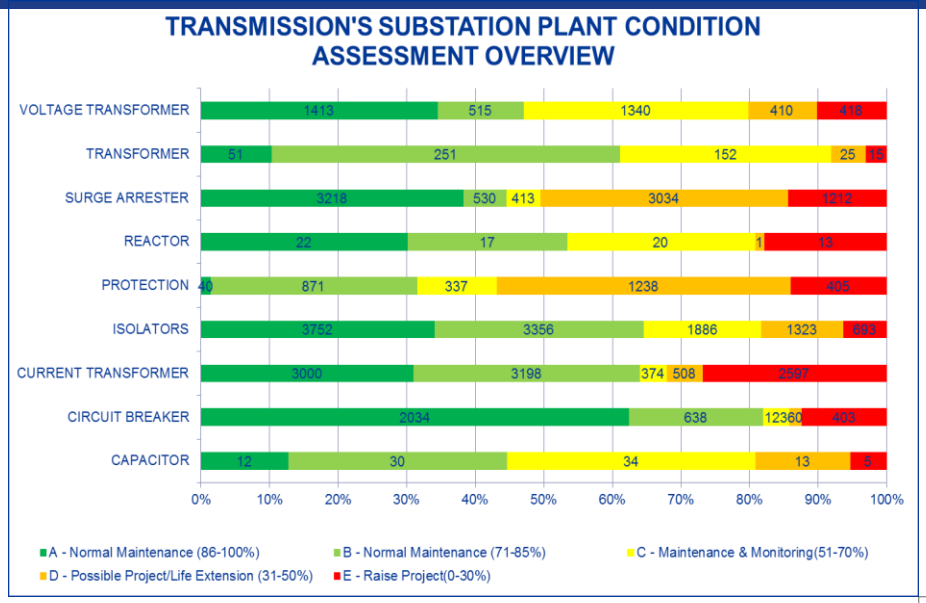
Improvement Strategy, Tools and Systems

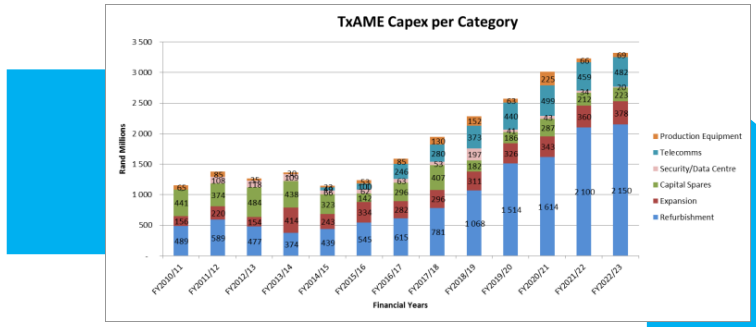
Criteria for successful development:
- Structured AM approach
- Participation and Buy-in
- Accurate Data
- Accurate Tools for Estimation and Definition



Stakeholders

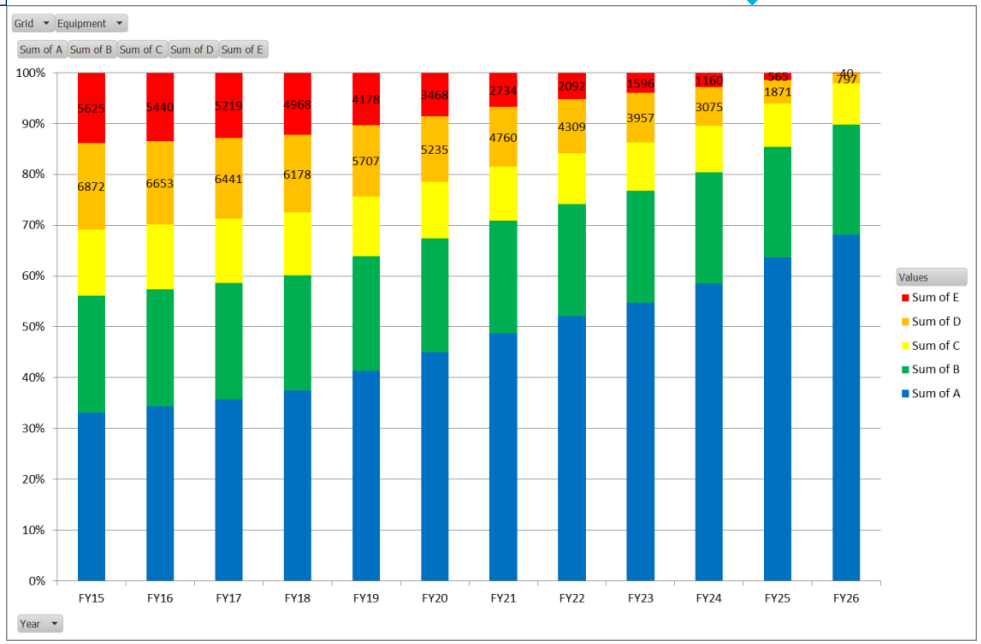
10 Year Asset Renewal Plan Objective





Plan Semi-constrained to reflect bottle necks in the Capital Plan value chain

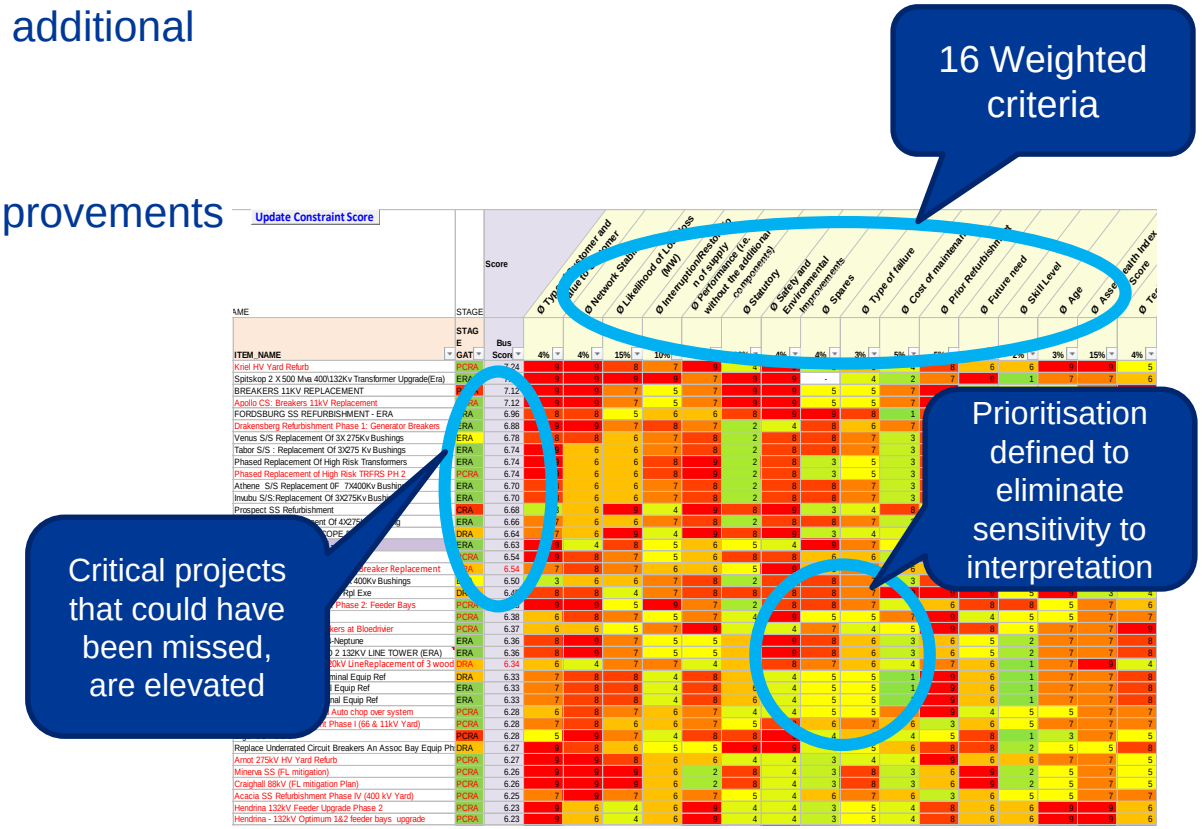
- Starting point: assets identified based on condition rolled up per bay.
- Rolled up into substation
- Phased using criticality, importance and impact
- Generated projects to cost and enter into plan



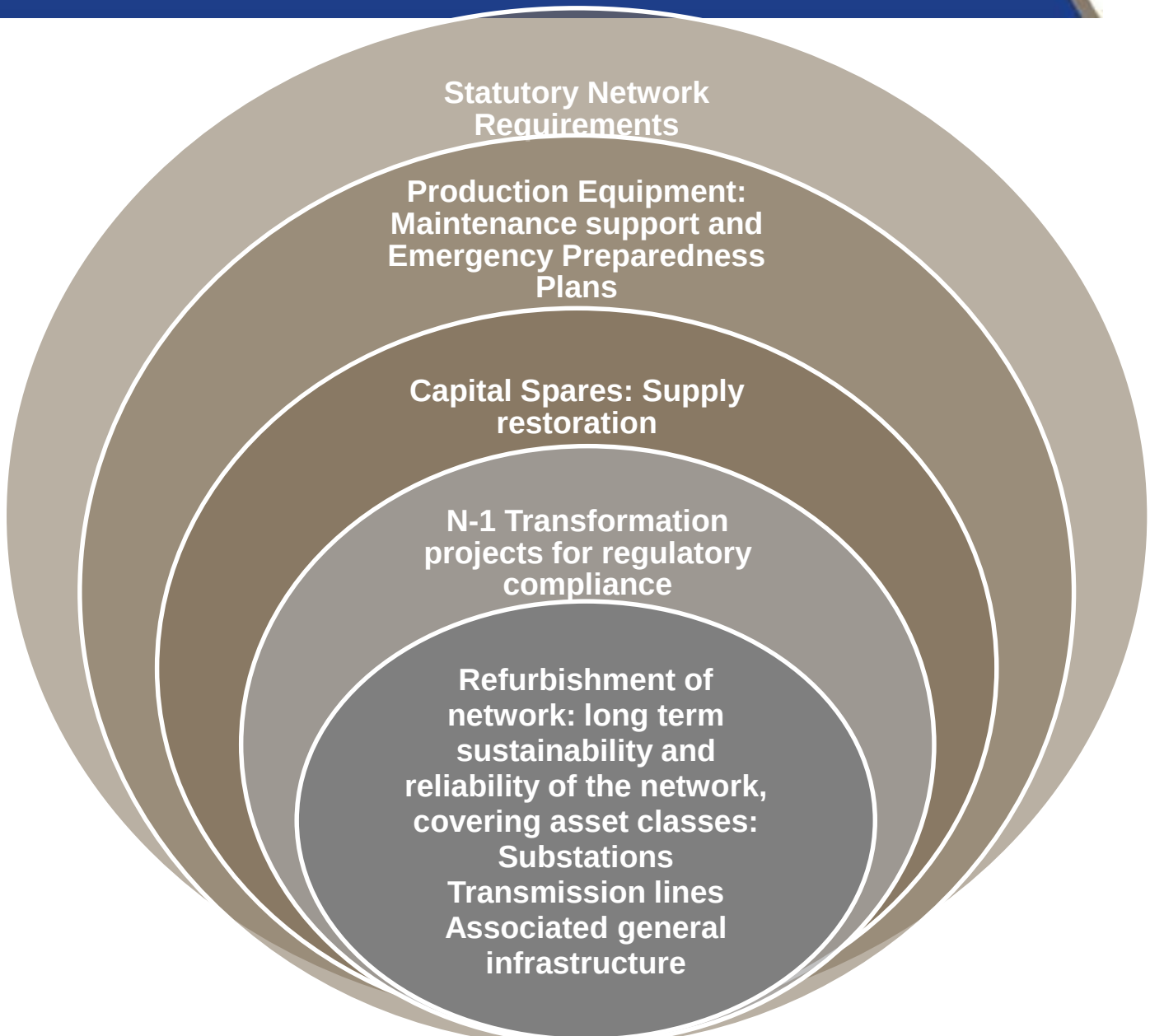
Prioritisation and Optimisation

Criteria matrix

- Type of Customer and Value to Customer
- Network Stability
- Likelihood of Load loss (MW)
- Interruption/Restoration of supply
- Performance (i.e. without the additional components)
- Statutory
- Safety and Environmental Improvements
- Spares
- Type of failure
- Cost of maintenance
- Prior Refurbishment
- Future need
- Skill Level
- Age
- Asset Health Index Score
- Technology



Network Sustainability Framework

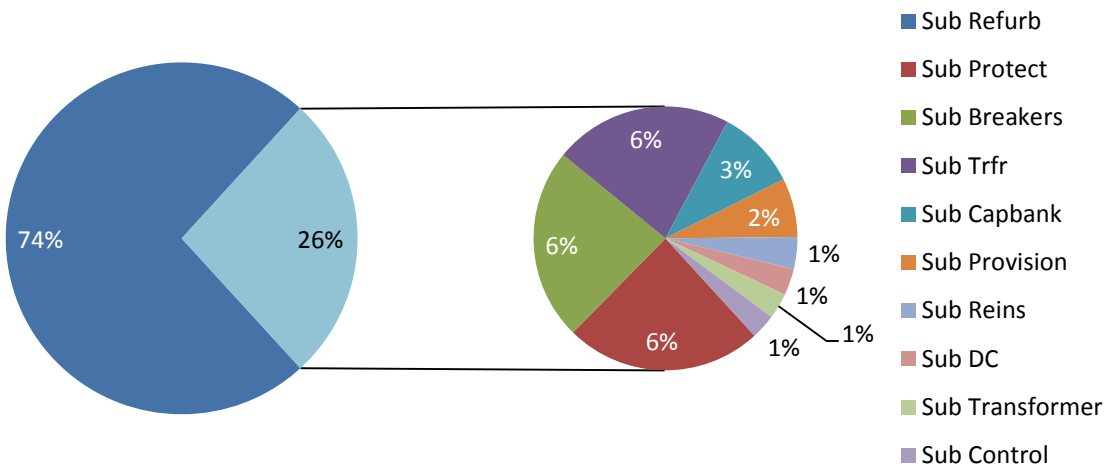


Sustainability Key Priorities/Focus areas

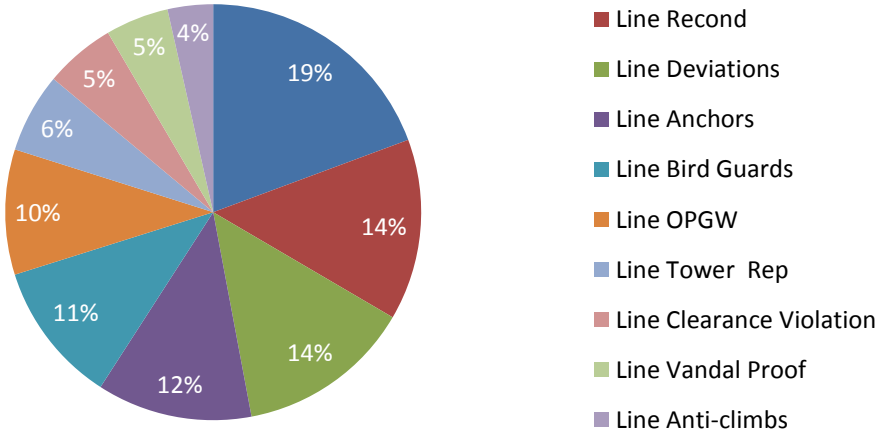
- **Improvement in Line Performance**
- **Implementation of Energy and Operational Efficiency Programmes**
- **Implementable Asset Investment Plan**
  - Integration in existing network
  - Optimal outage Management
  - Adequate Project Execution Planning
  - Appropriate Resourcing
- **Management of Safety and Environmental requirements**
- **Ensuring an appropriate level of Strategic and Critical Spares**
- **Data Management**
- **Effective EPP's (Emergency Preparedness Programmes)**

Major Spend Categories

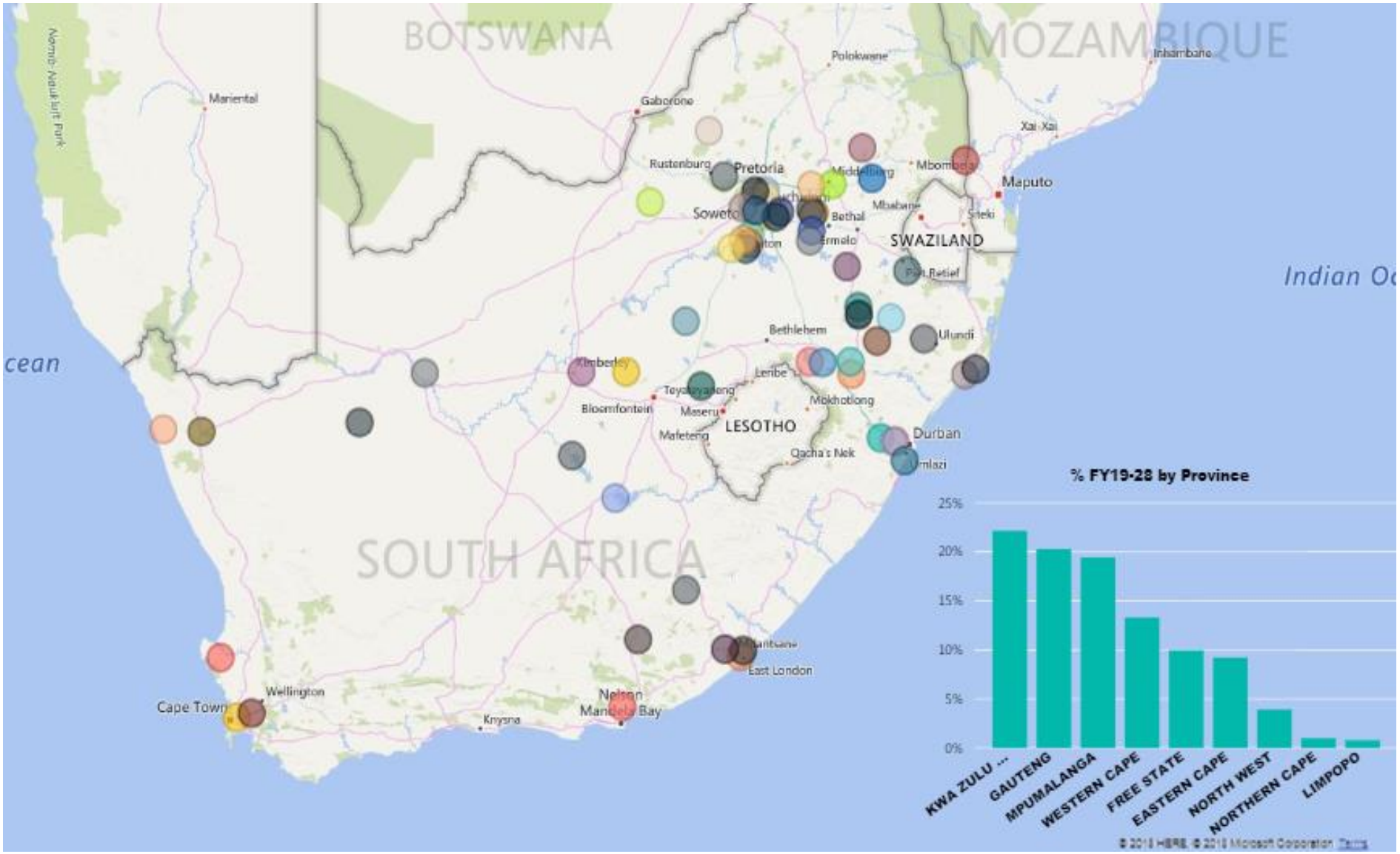
Substation type projects FY19-28



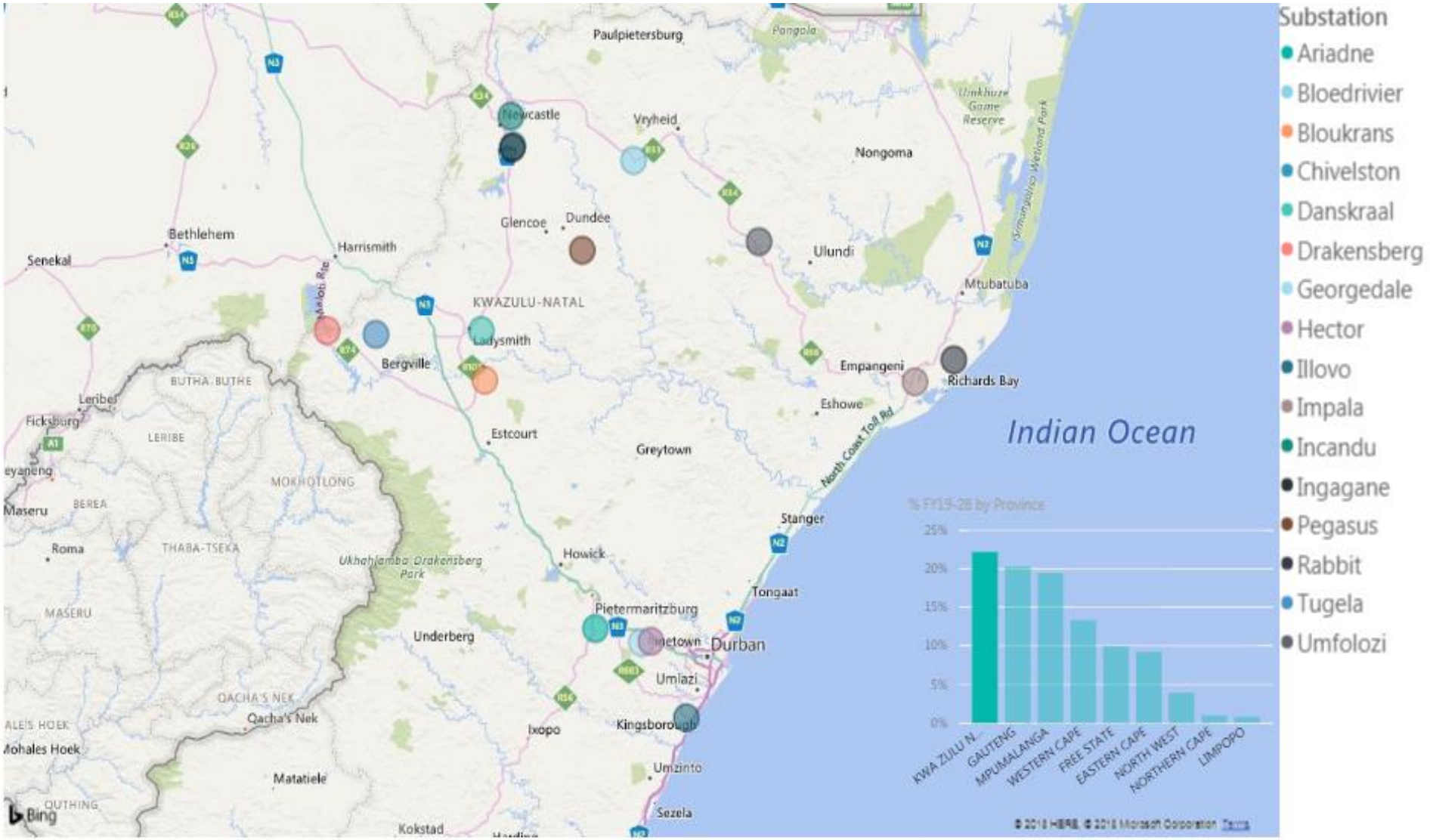
Line type projects FY19-28



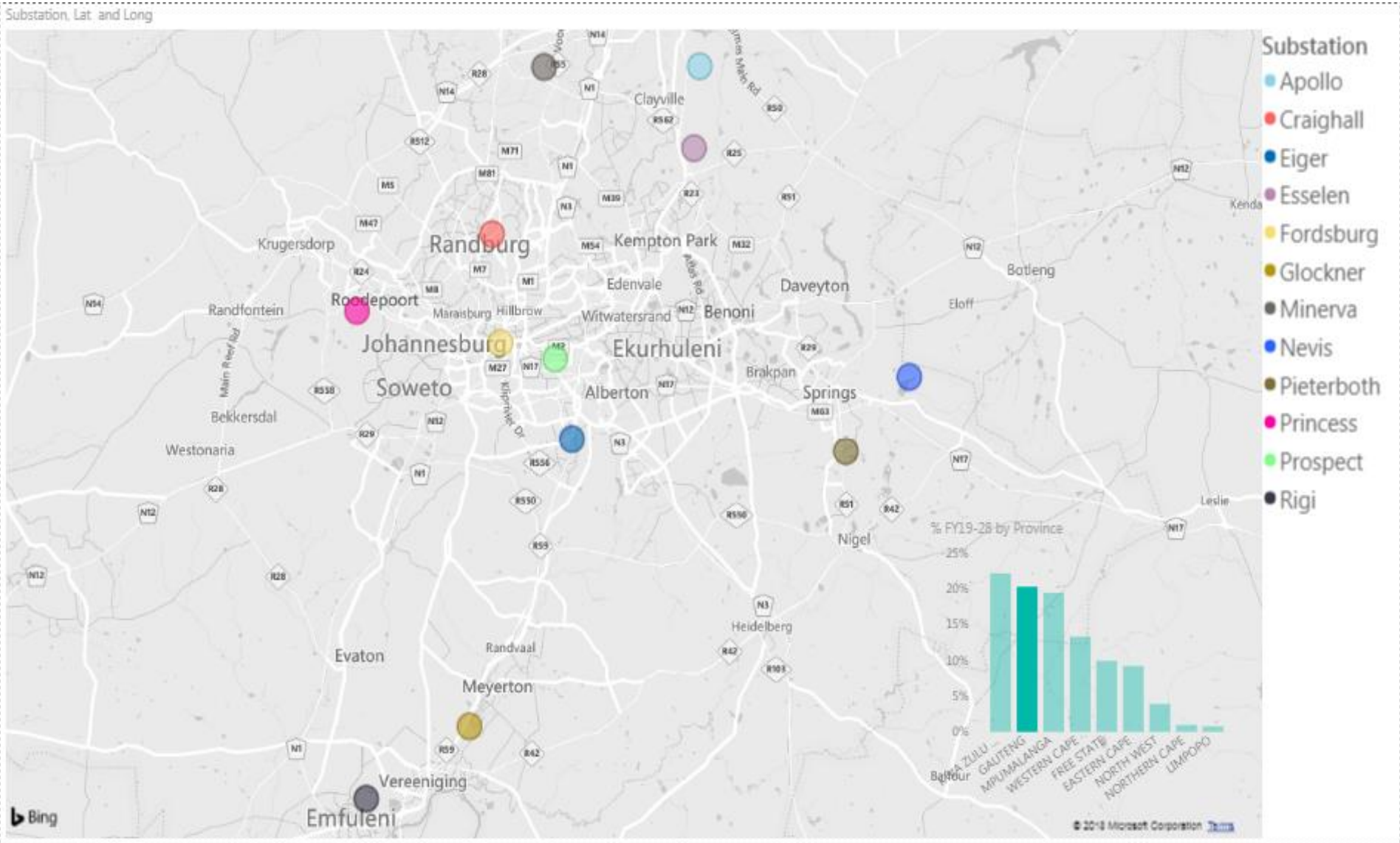
10 Yr Major SS Refurbishments



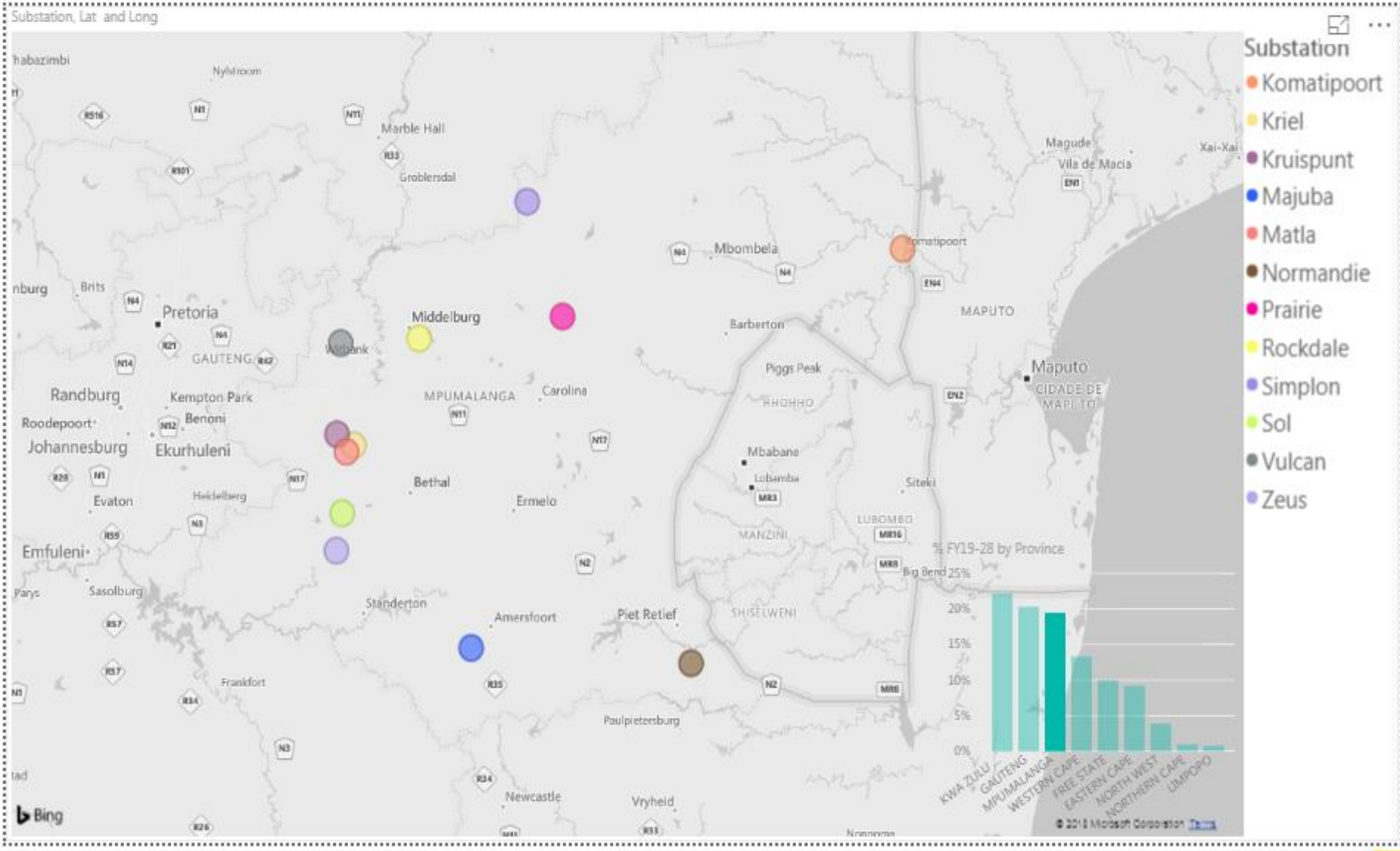
10 Yr Major SS Refurbishment: KZN



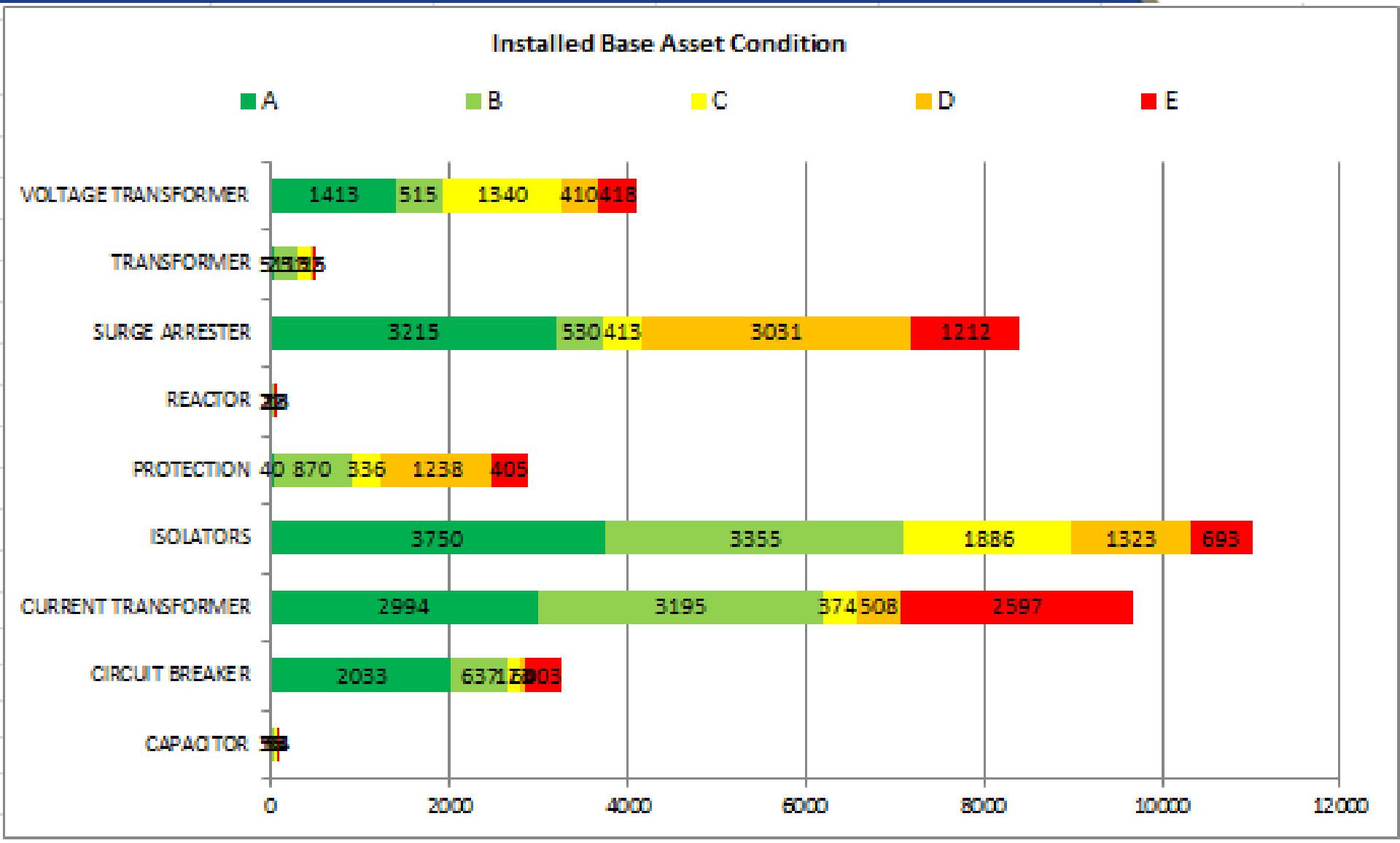
10 Yr Major SS Refurbishment: Gauteng



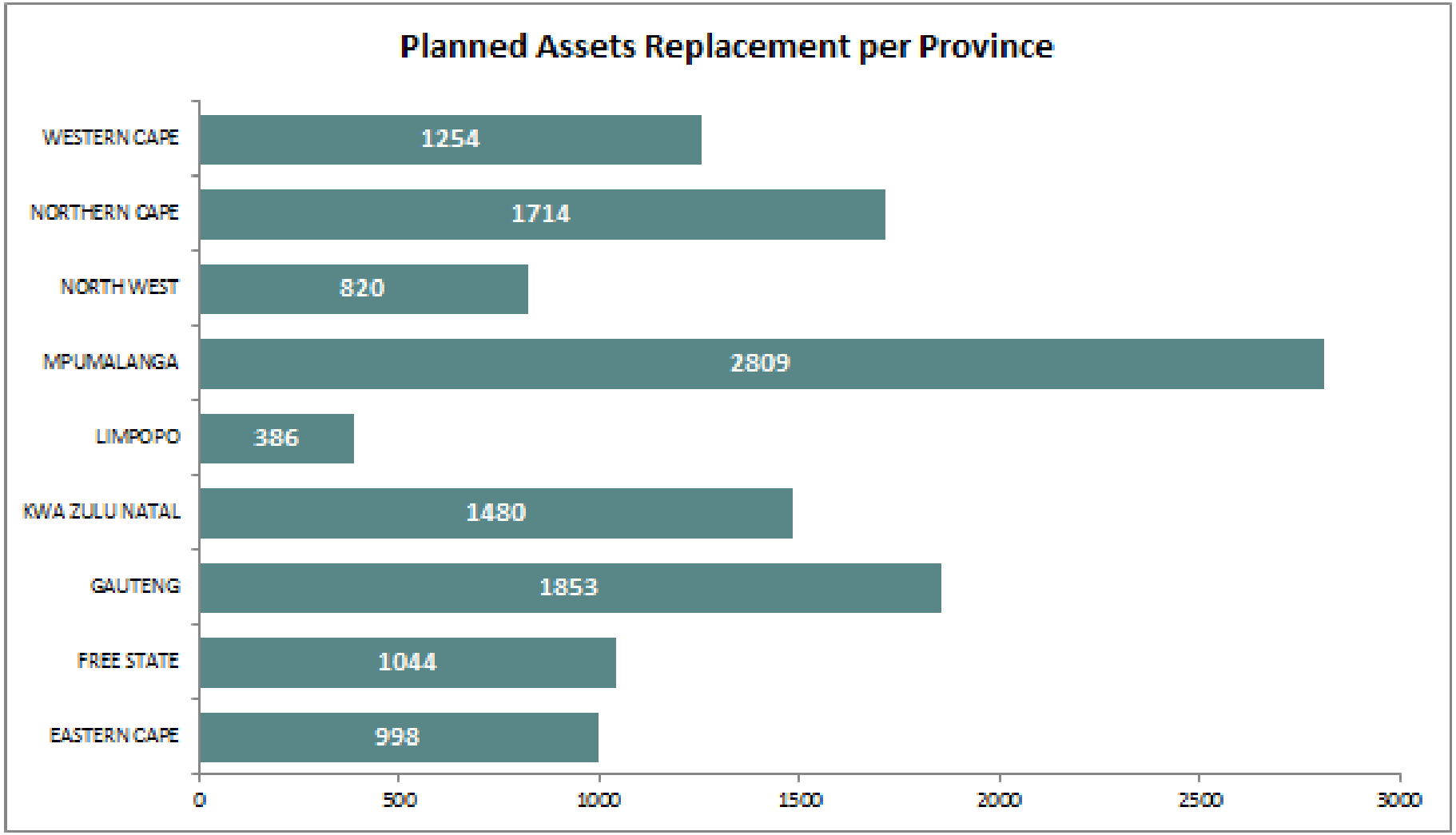
10 Yr Major SS Refurbishment: Mpumalanga



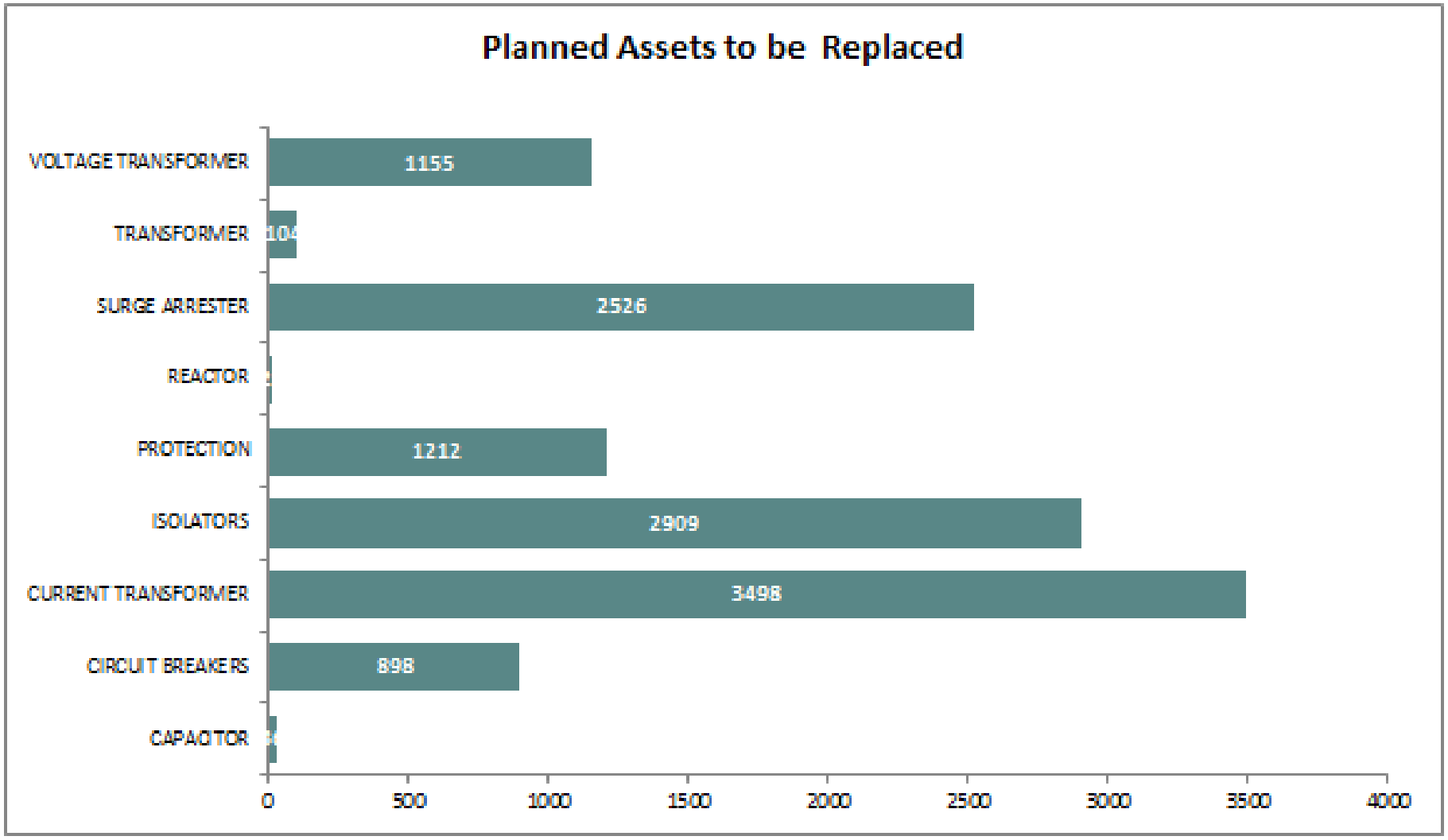
Asset Condition per Asset Category Based on Baseline Reports



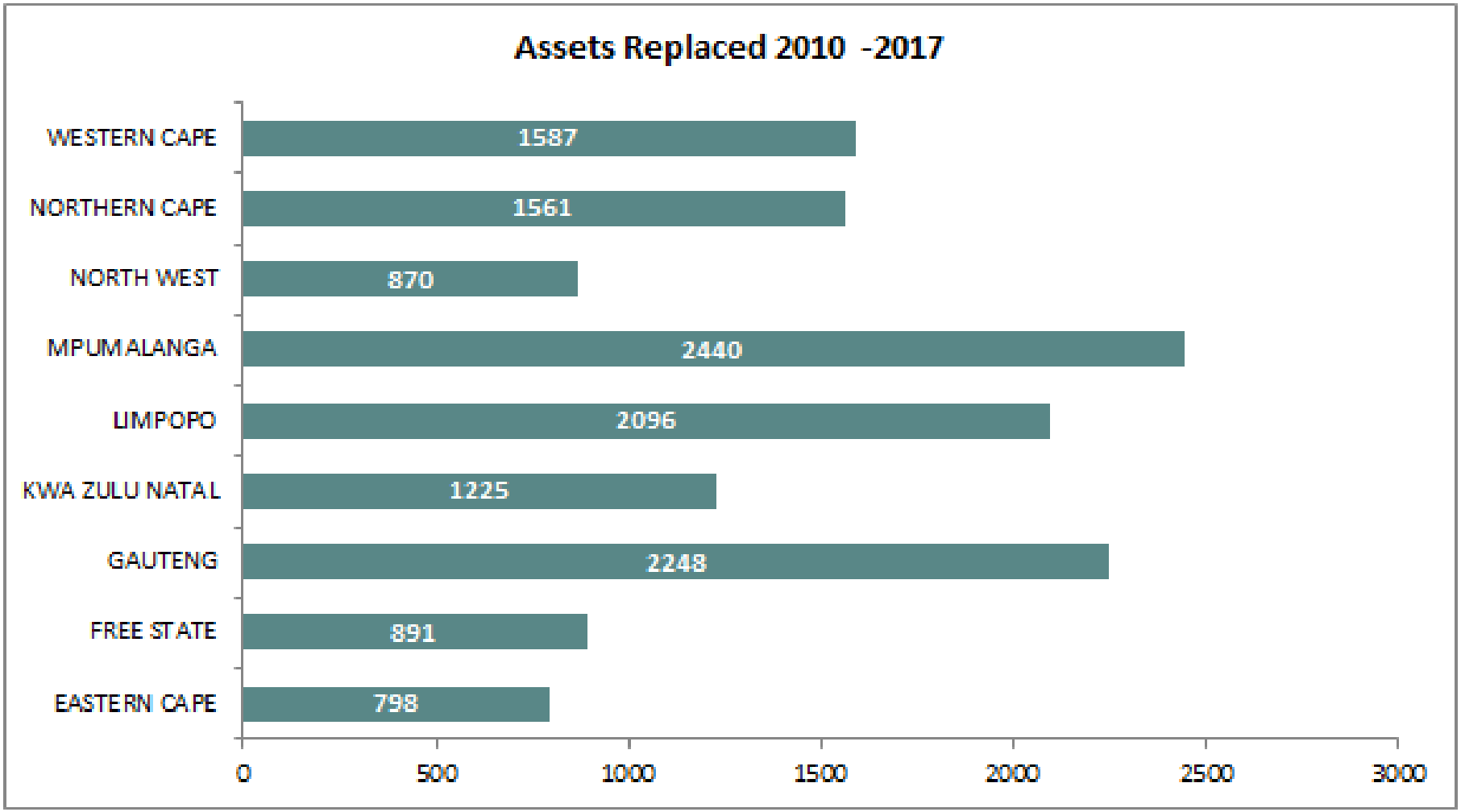
Planned Asset Replacements per Province 10 Year Refurbishment Plan (FY19–28)



Planned Asset Replacements per Category 10 Year Refurbishment Plan (FY19–28)



Assets Replaced 2010 - 2017



Network Status

Tx Asset	Performance and Condition	Focus Areas
Tx Line Assets	Tx Line Assets are approximately **midlife and performance** is trending near target levels with mostly **bird** related faults impacting on performance. The assessment reports indicate that the asset **condition is generally good** with specific types of refurbishments required at present	• Bird Guard projects (Delayed due to Legal case) • Coastal areas tower member and guyed anchor replacements • Line re-insulation & hardware replacements • Clearance violations (non - age related) • Vandalism and Anti-climb
Breakers	Assessment reports indicate that the asset **performance and condition is generally good** and trending near target levels. There are a number of assets **in poor and very poor** condition and they **are being packed into major substation refurbishment** projects.(systematic replacement approach)	• High risk breakers have been identified and have been prioritized in once-off projects to deal with specific risk. • Failures are managed via spares where stock levels are as per policy and are being successfully maintained at present.
Protection	Protection assets **performance is generally good** and are trending within target levels	• With the new protection scheme contracts and their associated implementation requirements, we are assessing the implementation strategies inline with the required rate of replacement and develop appropriate solutions. • The Protection Refurbishment is currently a high focus area.

Network Status

Tx Asset	Performance and Condition	Focus Areas
Transformers	Transformer **performance is trending well** and the asset class is an important focus area.	• High Risk Transformer initiatives are dealing with the exceptions and **poor and very poor units** whilst the substation refurbishments manage the replacement program. • Failures are managed via the **strategic spares policy** which has been successfully implemented and maintained.
Capacitors	Technical **performance is trending well** and the PCB (Polychlorinated Biphenyls) programs are supporting the replacement of aged units.	• PCB (Polychlorinated Biphenyls) programs
Reactors	Technical **performance is trending well** and the asset class is managed by the replacement program.	• 7 units have been included in the current 5yr plan.
Auxiliary Items	CTs technical **performance is trending well.** Spend on this asset class has been prioritized. Aux Transformers technical **performance trending near target levels**. Isolators, surge arrestors, VT's and Line traps technical **performance is trending near target levels.**	• **Priority assets** have been identified for urgent replacement and the balance of assets are to be managed through the replacement program.

Other H&S /Environmental Projects included in Plan

- **Health & Safety**
  - Line clearance corrections
  - Anti theft, anti climbs and vandal proofing
  - Aircraft warning spheres
  - Servitude gates
  - Substation earth-mat reviews
  - Substation security, perimeter fences and lighting and yards stoning
- **Environmental**
  - Bird anti-perching and diverters (line collisions)
  - Polychlorinated Biphenyls (PCB) phase out by 2026
  - Asbestos phase out by 2033
  - Energy efficient lighting and air conditioners

Conclusion

- The current 10 year Transmission refurbishment plan is a reflection of needs of the network, since it is based on asset condition assessments, asset criticality and network risks

- The prioritisation process that was employed in developing the portfolio of projects for the 10 year refurbishment plan, embodies the requirements and stipulations of the Grid Code

- The plan supports two key strategic imperatives of Eskom Holdings:
  - “Ensure the reliability and availability of power capacity to support South Africa’s economic growth ambitions.”
  - “Continue capturing efficiencies in operating and capital costs to achieve a sustainable tariff path for the economy.”

Thank You !

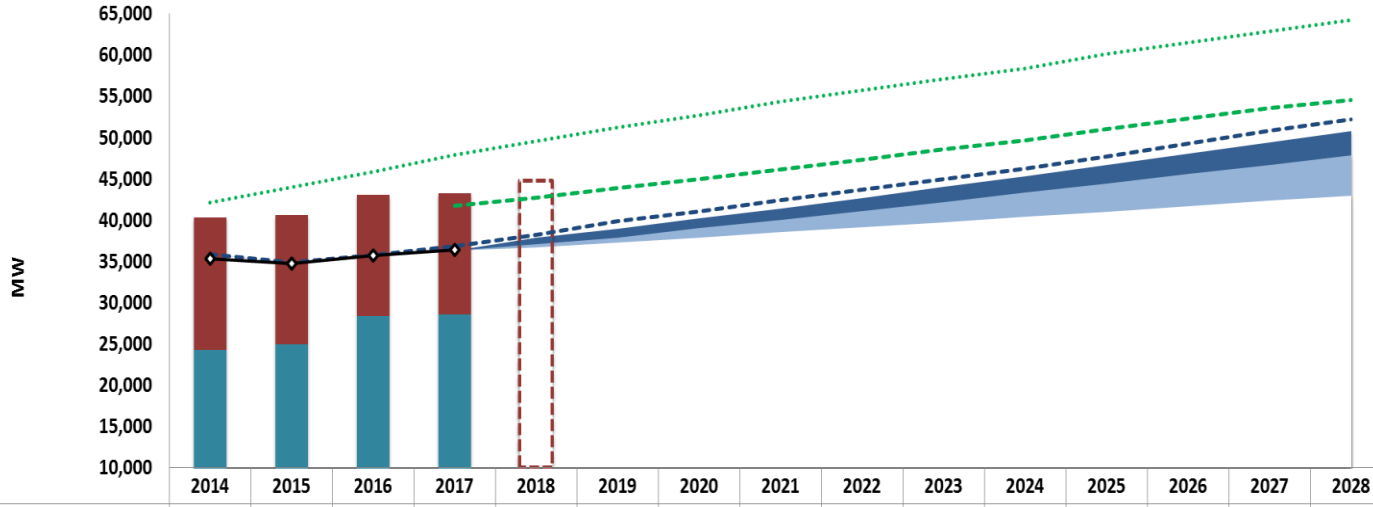
Transmission Development Plan 2019 – 2028

Summary and Capex Analysis

Presented by: Leslie Naidoo

RECAP:

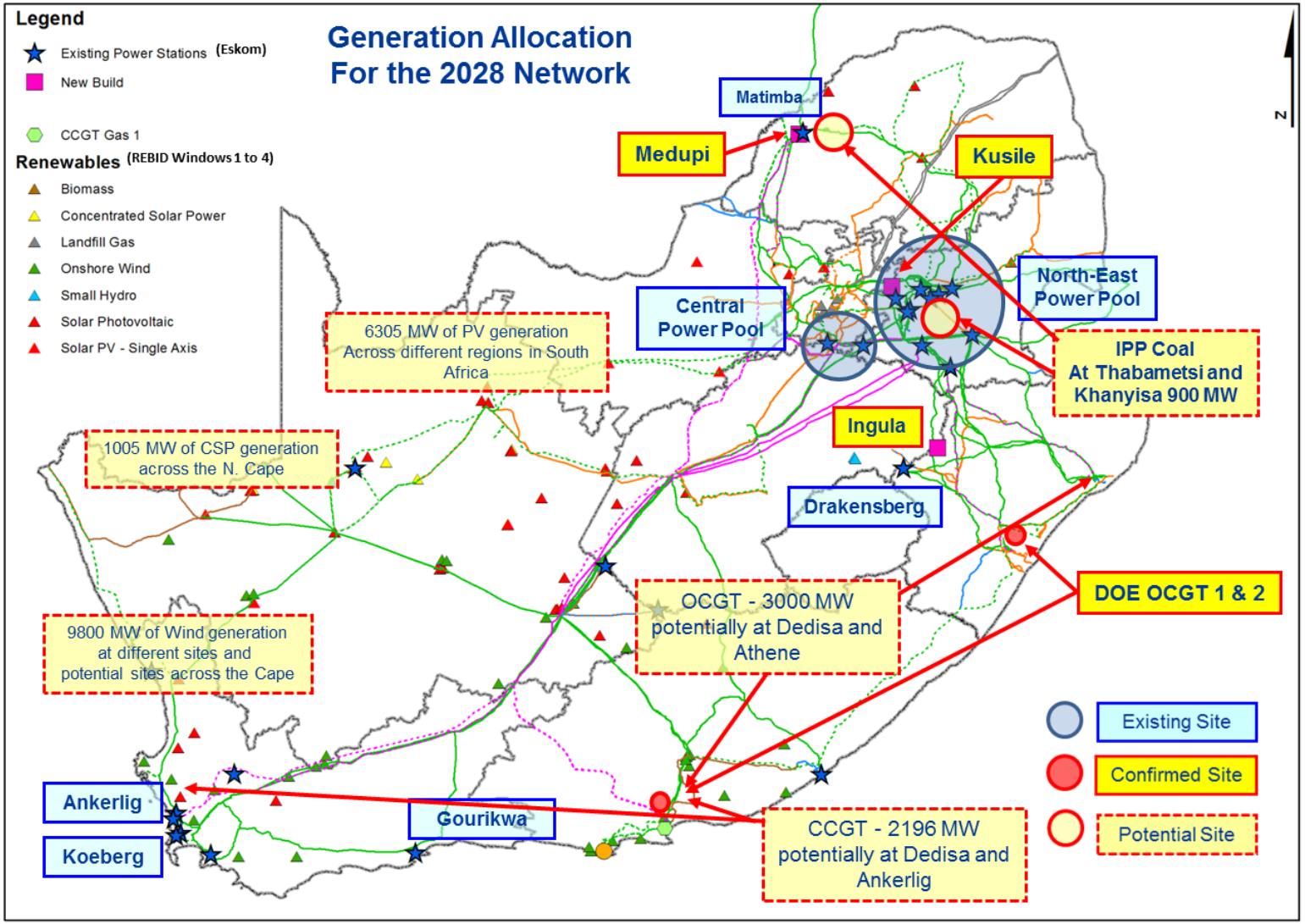
Demand Forecast:



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2018 TDP Demand - High(65GW by 2040)	35850	34850	35742	36303	37835	38973	40162	41398	42674	43981	45312	46660	48017	49376	50731
2018 TDP Demand Medium (58GW by 2040)	35850	34850	35742	36319	37115	37872	38993	40036	41111	42210	43325	44449	45574	46694	47802
2018 TDP Demand - Low (50GW by 2040)	35850	34850	35742	36331	36729	37312	37908	38517	39136	39764	40400	41041	41687	42336	42987
KSACS Customer NMD (MW)	15979	15673	14708	14691											
Distribution Customer NMD (MW)	24295	24943	28369	28549											
Projected Total Customer NMD (MW)					44772										
2017 TDP Demand (MW) - Transmission High	35850	34850	35742	36816	38245	39826	41051	42415	43708	44924	46255	47694	49232	50864	52182
2010 IRP Demand (MW)	42129	43994	45786	47870	49516	51233	52719	54326	55734	57097	58340	60150	61500	62850	64200
2016 Base Draft IRP Demand (MW)				41682	42702	43831	44916	46130	47336	48547	49656	51015	52307	53561	54567
Actual Peak Demand (MW) *Instantanious	35343	34695	35742	36359											

RECAP:

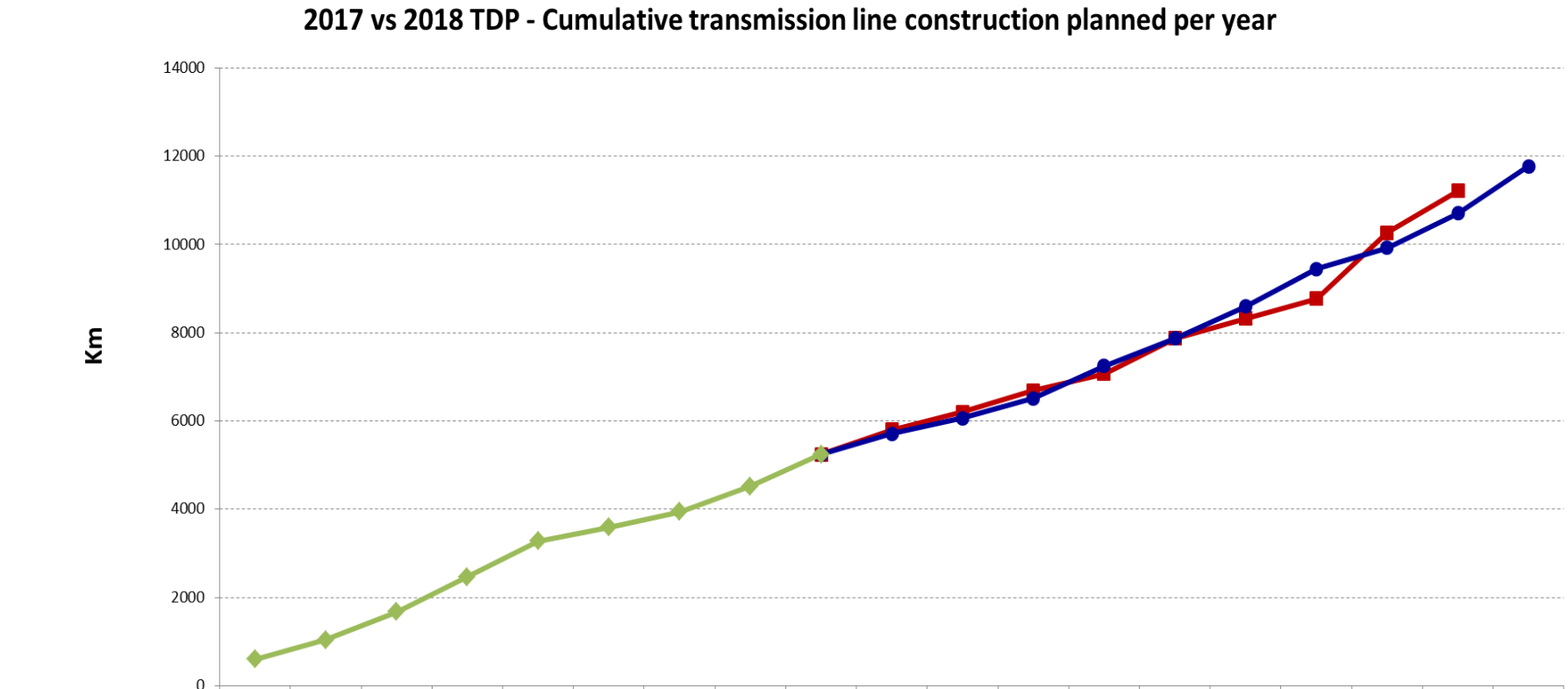
Generation Pattern:



Summary of Transmission Infrastructure Requirements over the TDP Period

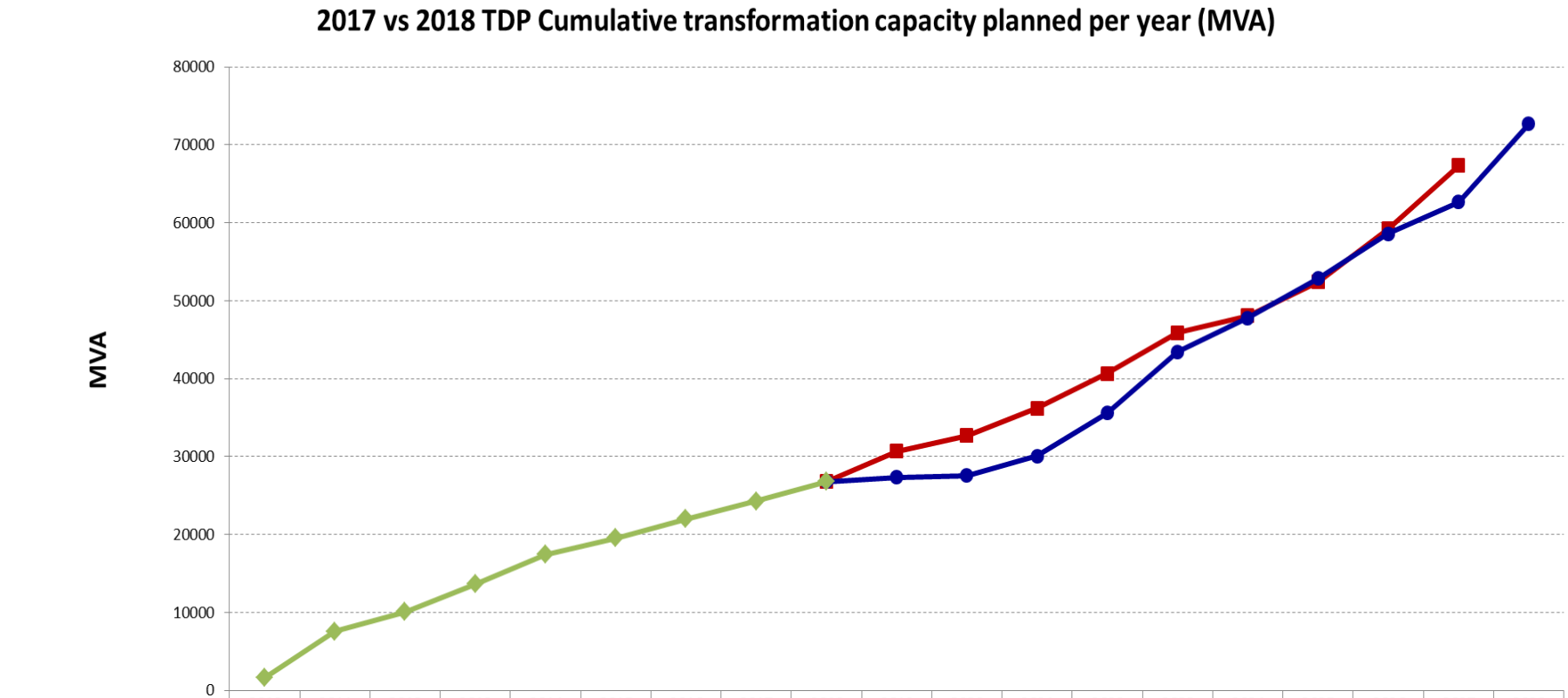
Transmission Assets: National View	New Assets expected in 2019 - 2023	New Assets expected in 2024 - 2028	Total New Assets
Power lines (km)			
765kV	98	300	398
400kV	2235	3422	5657
275kV	114	99	213
220kV	94	0	94
132kV	90	83	173
Total length (km)	2631	3904	6535
Transformers			
Number of units	43	72	115
Total capacity (MVA)	16630	29270	45900

Transmission expansion plan: Transmission lines



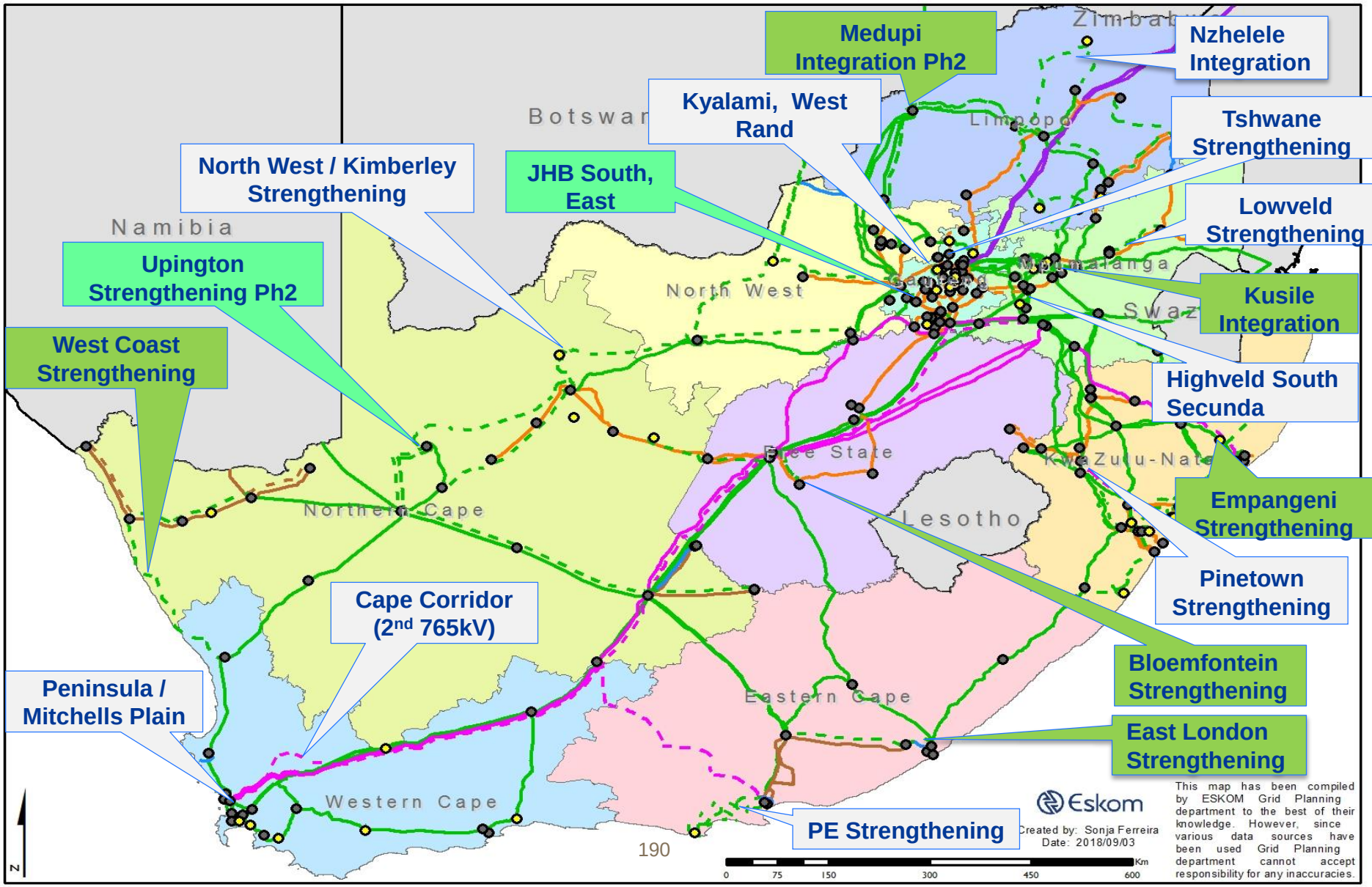
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2017 TDP									5239	5800	6194	6691	7071	7870	8320	8765	10261	11211	
2018 TDP									5239	5714	6063	6512	7241	7870	8589	9448	9927	10705	11774
Actual Built Cummulated	600	1043	1674	2461	3272	3591	3937	4522	5239										

Transmission expansion plan: Transformer capacity



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2017 TDP									26800	30715	32715	36215	40680	45875	48090	52405	59225	67355	
2018 TDP									26800	27340	27590	30090	35590	43430	47810	52840	58595	62660	72700
Actual Installed Cumulated	1630	7570	10095	13675	17465	19555	21990	24290	26800										

Major Projects planned in the TDP period



Transmission Capital Expenditure Drivers

1. Capacity Expansion and Network Strengthening:
   - Connection of new and anticipated customer loads and generation
   - N-1 Reliability Investments
   - Mitigation of Fault-level Exceedances (existing and anticipated)
   - Resolution of Quality of Supply excursions
   - Securing of Servitudes and Environmental Authorisations
   - Compliance (Regulatory, OHSAct, Environmental etc.)

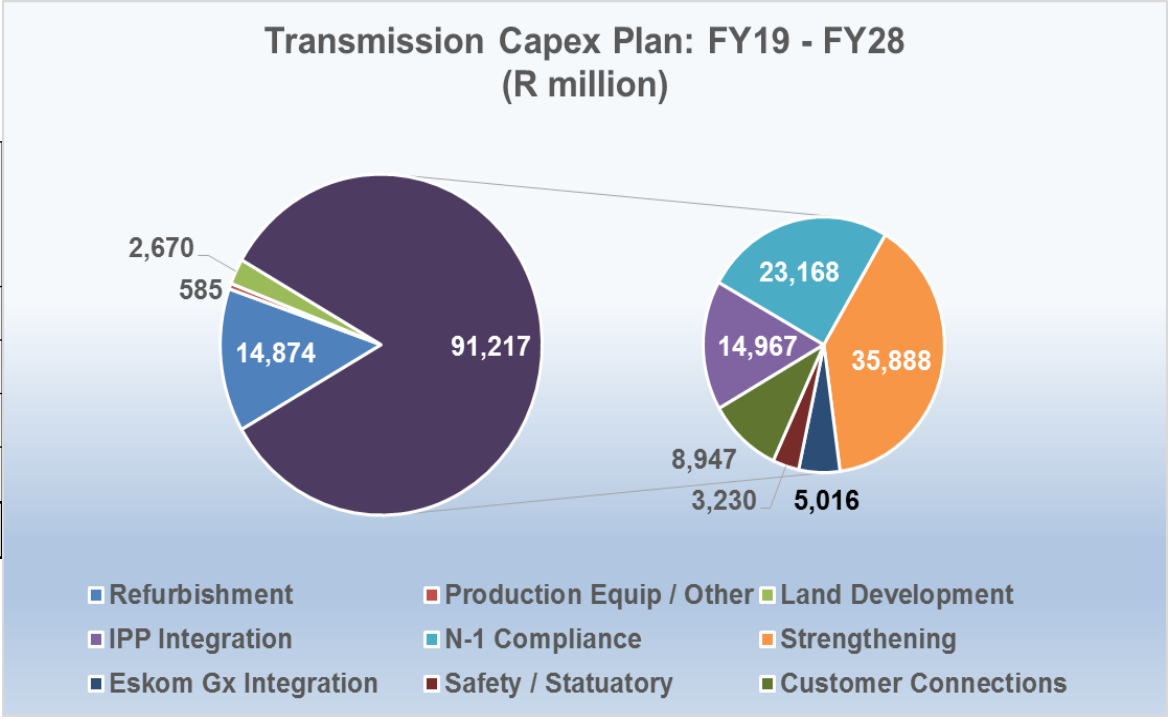
2. Refurbishment (i.e. Extension of Life of Existing Assets):
   - Refurbishment of aging equipment (CTs, VTs, Surge Arresters, H.V. Circuit Breakers and Power Transformers)
   - Replacement of substation batteries and electronic components for protection and control systems, corroded conductors etc. (these not repairable)
   - Targeted Asset Performance Improvements (lines and substation equipment)
   - Physical security improvements and surveillance and monitoring at our key assets and sites
   - Strategic and operational spares holding (to reduce SML<1 and MI risk)
   - Compliance (Regulatory, OHSAct, NKP Act, Environmental etc.)

3. Asset Purchases:
   - Specialised equipment for: live-line work; fault location systems, and online condition monitoring, etc.

Transmission 10 Year CAPEX Plan: FY2019-2028

Summary of Transmission Capex Plan (R Million): FY 2019 - FY 2028

Transmission Capex Category	Total: (FY19-28)
Capital Expansion	91,217
Refurbishment	14,874
EIA and Servitudes	2,670
Production Equipment / other	585
	109,346



Capex Observations

The total Transmission Capital Plan amounts to R109 billion over the TDP period 2019 – 2028 of which:

- R91.2 billion is required for reliability (N-1) projects, integration of committed generation (Medupi, Kusile, Ingula, IPPs up to Bid Window 4B) and connection of new loads onto the system
- R18 billion is required for EIA and Servitudes, refurbishment and production equipment

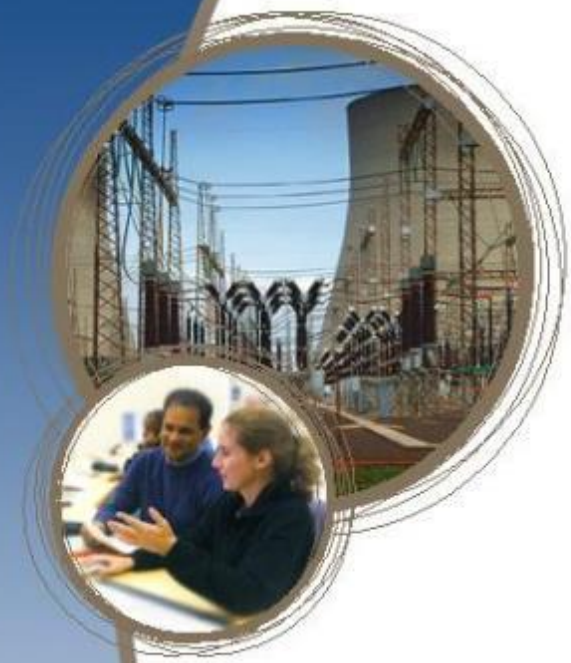
Risk to the TDP 2018

- Nersa's decision on Eskom's MYPD4 application may impact execution of the Transmission Development Plan
- The liquidity position of Eskom may impact the execution of the Transmission Development Plan.
- The location of future IPPs may also impact the roll-out of new network reinforcements.
- The time taken to acquire servitudes continues to be a challenge to the TDP roll out.
- The execution ability to accomplish the plan remains a challenge

Conclusions

- The demand forecast in the TDP assumptions compares favourably with all the forecasts (IRP and Eskom) and is therefore prudent
- The generation forecast assumptions will be sufficient to allow the 2018 TDP to meet the requirements of the IRP (Draft), and where necessary, sensitivity studies will be done to meet extreme conditions or stress test various scenarios
- We are confident that projects currently in construction will be completed in time
- We will continue engaging with our stakeholders to enable network access in anticipation of the Country's future demand and generation needs
- Investments in the Transmission infrastructure is a crucial enabler for economic growth and development

Questions?



Thank you