



The Eskom Transmission Development Plan (TDP) 2021 - 2030

20 October 2020





Keynote address

By: Segomoco Scheppers Group Executive: Transmission

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Setting-the-scene

By: Jacob Machinjike General Manager: Grid Planning

Overview and purpose of the TDP Public Forum



The objective of the presentation is to:

- Contextualise the planning timelines relating to the demand forecast and generation patterns
- Share assumptions and results from the Transmission Development Plan 2021 – 2030
- Share information and results relating to the integration of IRP 2019 and address the future network requirements
- Share information on the estimated Transmission Capital Investment Requirements for the period 2021 – 2030
- More importantly, to solicit comments and inputs to improve on the Transmission Plans

Basis of the TDP 2020



The TDP 2020 was formulated to address the following

- Attain Grid Code compliance by resolving both substation and line violations (N-1) to ensure network sustainability
- Determine new network infrastructure requirements to sustain and allow for future demand growth

- Determine network infrastructure requirements to integrate new generation (Eskom and IPPs)
- Consider asset replacement requirements to ensure reliability of supply and network optimisation

The Different Plans



Integrated Resource Plan (IRP)

- The Department of Mineral Resources and Energy is accountable for the Country's Electricity Plan, which is the Integrated Resource Plan (IRP)
- The Integrated Resource Plan (IRP) is intended to drive all new generation capacity developments
- 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-year 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

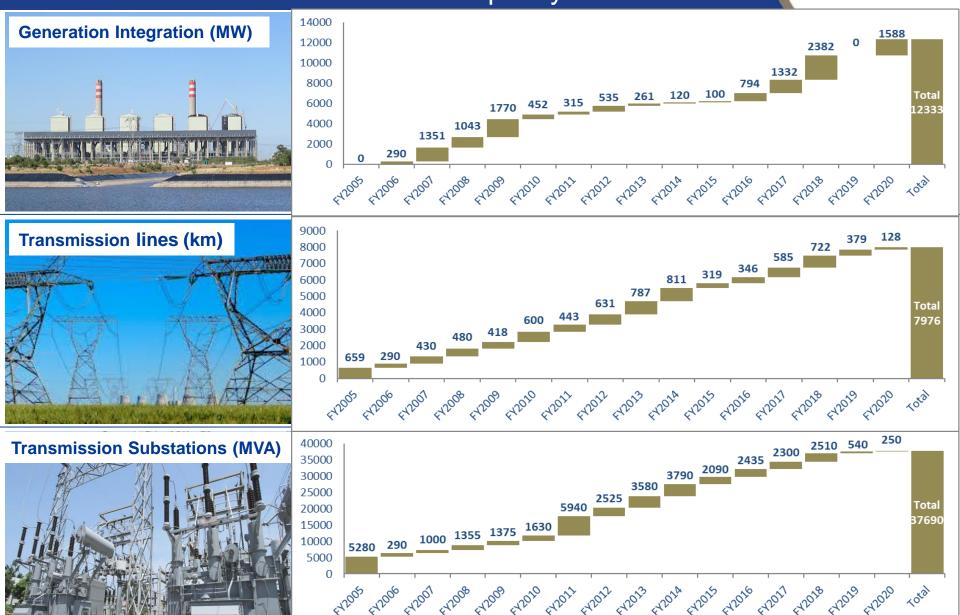




Recent Transmission Network Expansion Successes

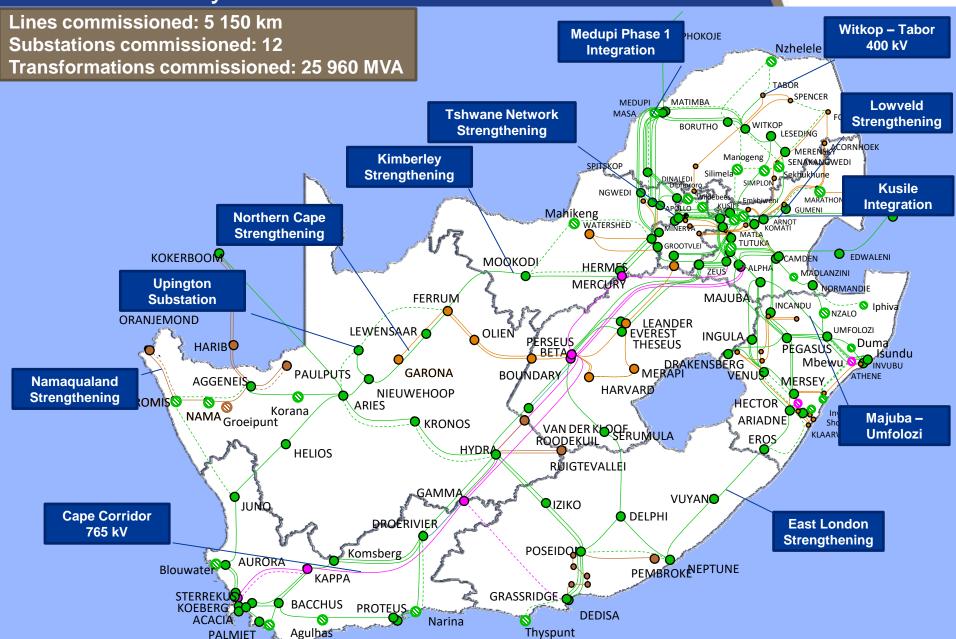
Historical investments in the Eskom power system: 12.3 GW of generation, ~ 7976 km of transmission lines, and ~37.7 GVA of transformation capacity





Major Transmission expansion projects completed in the last 10 years





DMRE IPP programme overview – September 2020



Peakers	REIPP	REIPP	REIPP	REIPP	REIPP	Small	Coal
	BW1	BW2	BW3&3.5	BW4	BW4B	1-5	Baseload
2 projects	28 projects	19 projects	23 projects	13 projects	13 projects	20 projects	2 projects
1200 MW	1436 MW	1054 MW	1656 MW	1121 MW	1084 MW	MW TBD	864 MW
All projects connected	All projects connected	All projects connected.	22 projects connected, 1 project in execution phase	13 projects of projects in exphase	connected, 13 xecution	Projects in RFP stage	Projects in Budget Quotation stage

8415 MW from 120 individual projects (The capacity for individual Smalls REIPP project TBD)

84 projects totalling 6112 MW have been commissioned, of which 4912 MW is from RE Sources

- Eskom has committed Capital costs to enable the integration of successful bidders (Bid Window 1 4B, including Small REIPPs) into the National Grid.
- Going forward Grid capacity for future REIPP is restricted due to network limitations

Pinotage Substation – commissioned July 2020 Photo Credits – Grant Duncan Smith (http://www.subiaco.co.za)







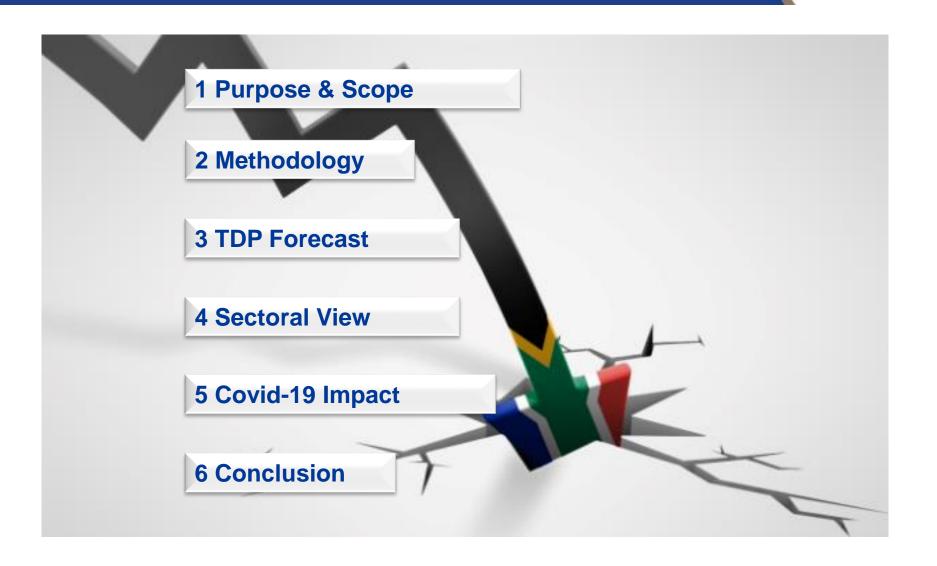


The TDP 2021 - 2030 Assumptions on the Demand Forecast

Presented by: Al'Louise van Deventer

Senior Manager: Forecasting and Research





Purpose and Scope



- □ The purpose of the Transmission demand forecast is to provide an overview of the national grid electricity demand in South Africa that serves as input to the Eskom Transmission Development Plan
- □ The scope of the presentation is the Eskom demand forecast methodology, the actual demand forecast and the COVID-19 impact on demand and the forecast



Transmission National Demand Forecast Methodology





- 1. Scenario Scoping of National Transmission Scenarios
- Scoping of future network scenarios in South Africa (IRP, NDP input)
- ❖ Nodal Model Built





2. Market Intelligence

- Sectoral information gathering
- Investment pledges
- Customer quotations



3. Base Demand Analysis

- Actual data analysis
- Network Topology verification
- Nodal point load actuals



4. Top Down Forecasting

- Balancing of Top down forecast
- Bus bar point load forecasts



5. Alignment and Validation

- Internal alignment with Distribution bottom up forecast
- Alignment with other Eskom forecasts
- ❖ Validation of forecasts with external forecasts (IRP, ISEP, CSIR)

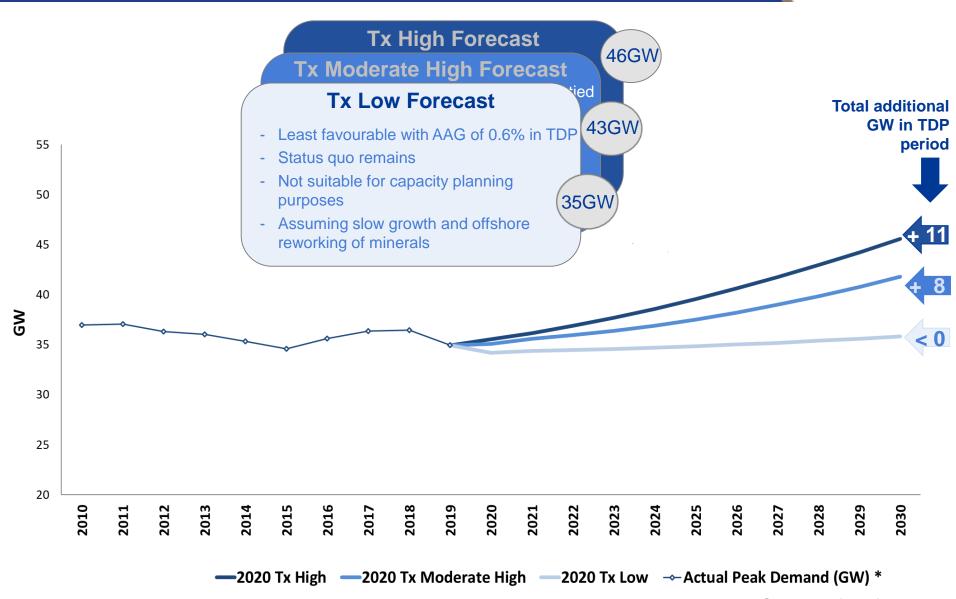


6. Implementation of Forecast

- Written Annual Report produced
- Final provincial forecasts produced as input to TDP planning process

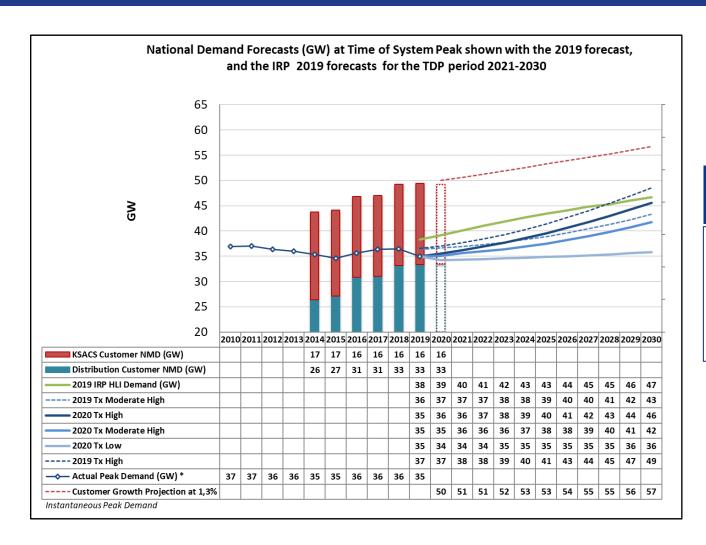
Transmission national demand forecast 2021 – 2030





Transmission national TOSP demand forecast 2021 – 2030 with Customer NMD's and IRP 2019

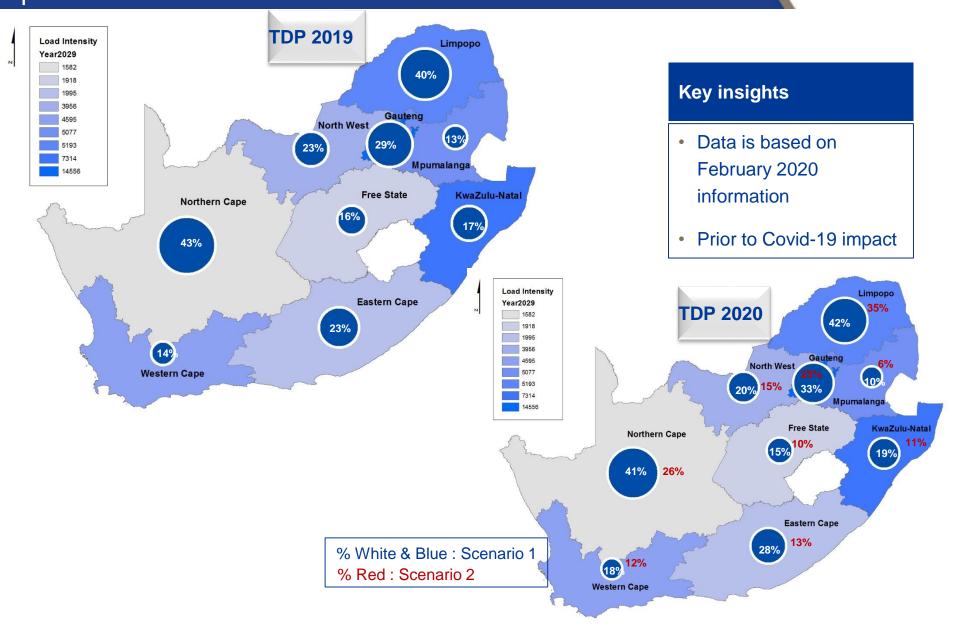




- Comparative with 2019
- Forecast reduced based on declining economic activity prior to COVID-19

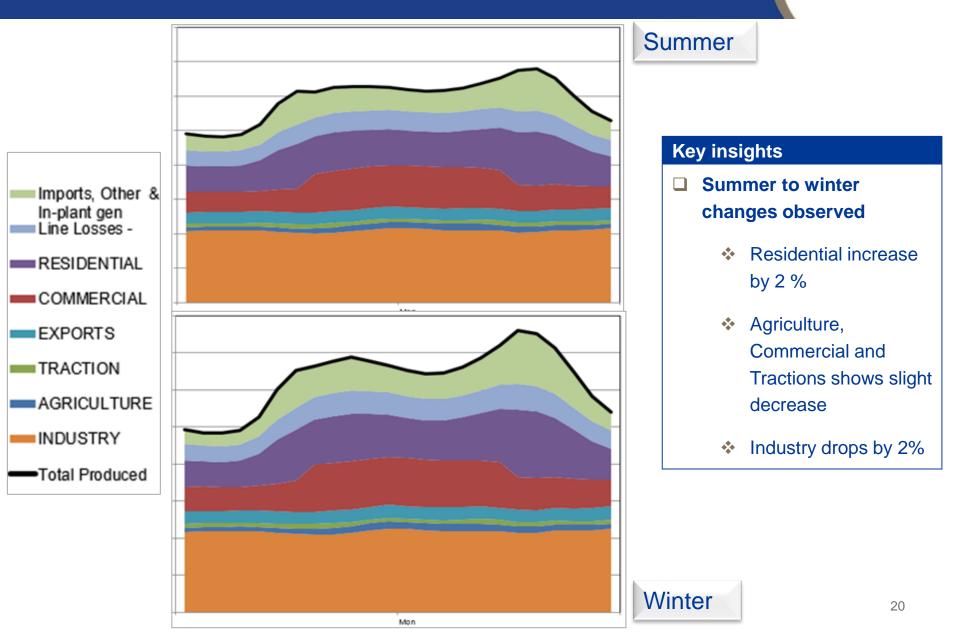
Provincial total Load Growth TDP 2019 VS TDP 2020 Transmission high growth: Total percentage growth per province





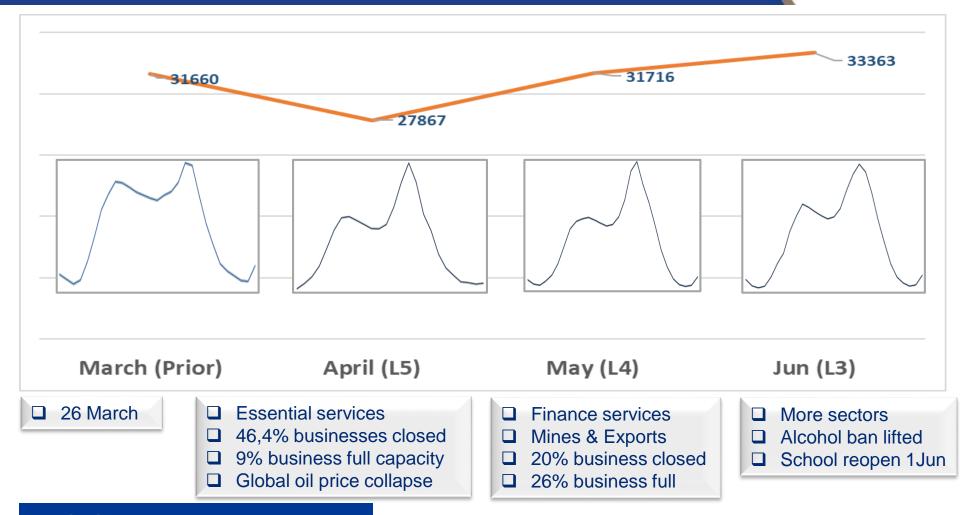
Typical Monday for Summer and Winter sectoral comparisons





Timeline for Covid-19 – for March till June 2020 Impact on demand and the economy





- June increase predominantly weather
- Typical V shape recovery

Regional Demand levels due to Covid-19 impact

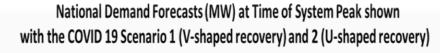


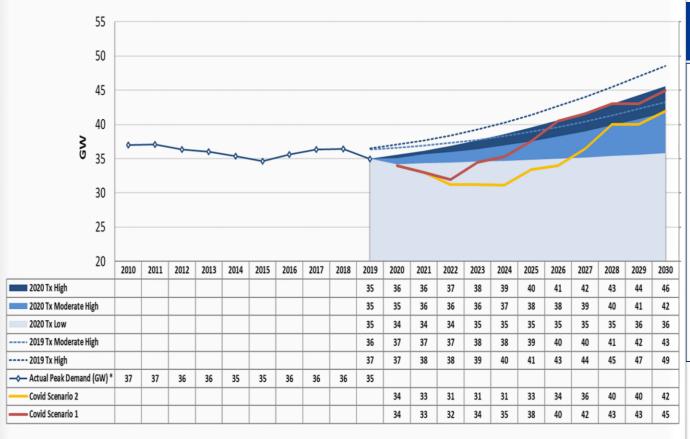
Regional Actual Demand due to Covid-19 Impact as per Lockdown Levels												\ OF9/	
Lockdown Level	Actuals 2020	EC	FS	GP	KZN	LP	MP	NW	NC	WC	National Peak		> 95% 96%-98%
L5 start	March											pue	91% - 95%
L5	April									88	90		80% - 90%
L4	May											Z	70% - 79%
L3	June							85	84	86		% of	< 70%

- Three provinces show 3 different type of recoveries as lockdown levels ease
- NW dominant sector is gold and platinum mining has typical increase
- NC dominant sector is diamond, iron ore and manganese mines shows decline and then increase
- WC dominant sector is agriculture shows increase and then reduction

COVID-19 Transmission national demand forecast 2021–2030







- Assume Cyclic phenomena.
- 2 possible Scenarios to simulate COVID-19 forecast effect:
- V- shaped forecast dip anticipated, growth return after 2 years.
- U-shaped return, growth return after 5 years. April demand reductions is 12 %

Conclusion



- For the TDP period the data used was as in February 2020 prior to COVID- 19 which started in Mach 2020 The demand forecast is trending downward due to contractions in the economy prior to COVID-19 The COVID-19 impact is potentially only a delay in demand returning by up to two years starting 2021 The national demand impact is clearly showing the contraction in electricity consumption and the economic impact and it is following the Covid-19 recovery curve scenarios. The sectoral contributions to the daily load profiles prior and during the lockdown levels impact has not been considered for the compilation of this TDP even though the impact has been studied. In the short term analysis regional impact for 3 regional demand recoveries for NW, NC and Western Cape has been noted as distinct. One of the key observations from a demand recovery perspective is the distinction within a sector e.g mining Other future focus areas for consideration in the demand forecast for the TDP, is the demand shift across various sectors such as commercial, industry and residential due to the work from home policy implemented by most companies.
- ☐ Consumer impact and the increase of distributed generation is another area where more analysis is needed



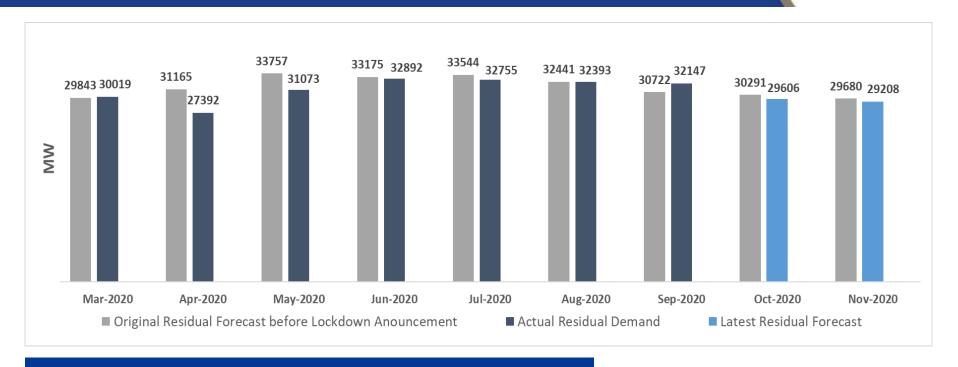


Thank You



Monthly peak demand as projected in February 2020 versus actual demand for 2020 with Covid-19 Impact





- Monthly comparison –Actual vs the forecast of February 2020
- April demand reductions is 12 %
- May demand reduction is 8%
- June & July influenced by cold
- September showed strong recovery after and moving to L1

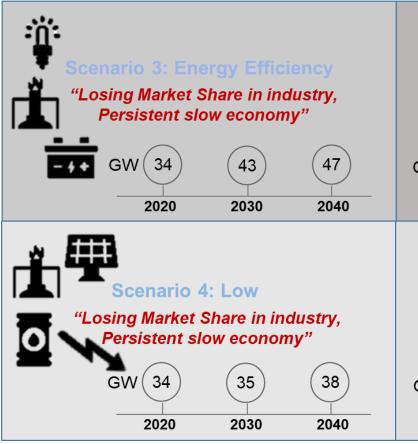
Transmission national demand forecast scenarios 2021 – 2030

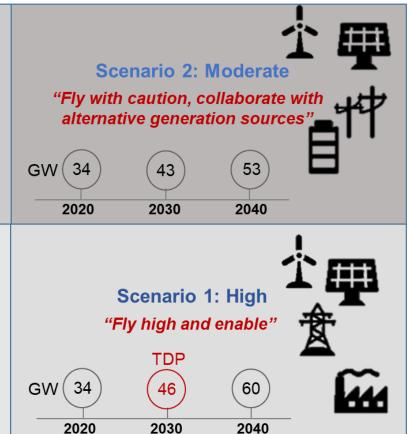


High

Technological innovation Energy Efficiency

Low





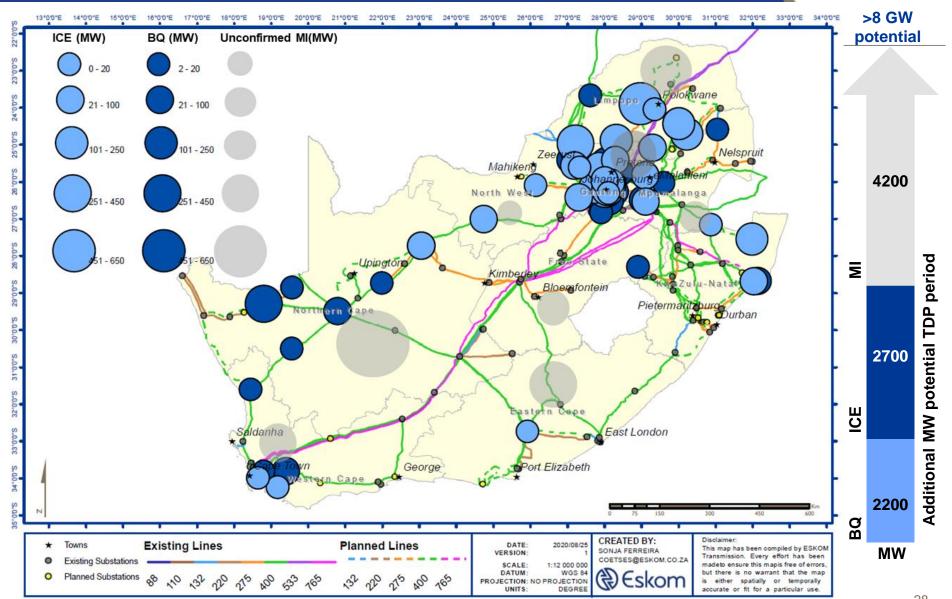
Low

Grid Connectivity

High

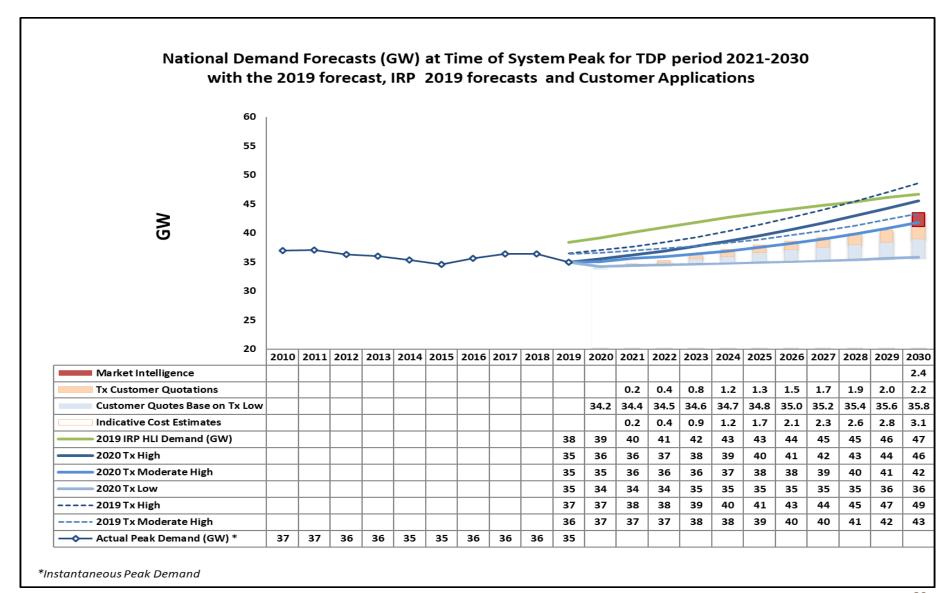
Demand Drivers and spatial allocation of demand potential





Transmission national TOSP demand forecast 2021 – 2030





Transmission national demand forecast scenarios 2021 – 2030



Technological innovation Energy Efficiency

High

Low

Scenario 3: Tx Medium (Energy Efficient) "Sharing the energy supply market"

- Medium to high grid deflection, low grid tied connections
- · AAG of 1,4% demand for TDP period
- Rising trends in energy efficiency.
 Decreasing in Energy intensity
- · Increase in battery storage and RES use
- Uncertainty on Economic energy intensity going forward

Scenario 2: Tx Moderate High "Fly with caution, enable, collaborate with off arid solutions"

- · Low to medium grid deflection, high grid tied
- Assumes return and growth of high energy intensive industries reliant on sustainable grid connection
- · AAG of 2% demand for TDP period, 2,5 GDP
- · Quantitatively based on past trends
- · Suitable for medium ranges planning

43GW

Scenario 4: Tx Low

"Losing Market Share in the industry, persistent slow economy"

- Least favourable with AAG of 0.6% in TDP
- Status quo remains. Further decrease in demand can be expected
- Not suitable for growth enabling capacity planning purposes
- Export of mined minerals and international processing of minerals will lead to less energy needed and less local GDP growth



39**G**W

Scenario 1: Tx High "Fly high and Enable"

- Inline with NDP economic growth,>3,5% AAG in GDP
- · AAG of 2,8 % demand for TDP period
- Optimistic growth scenario
- Suitable for strategic long term planning with a target saturation network of 65 GW by 2045
- High investment in development from local and international investors

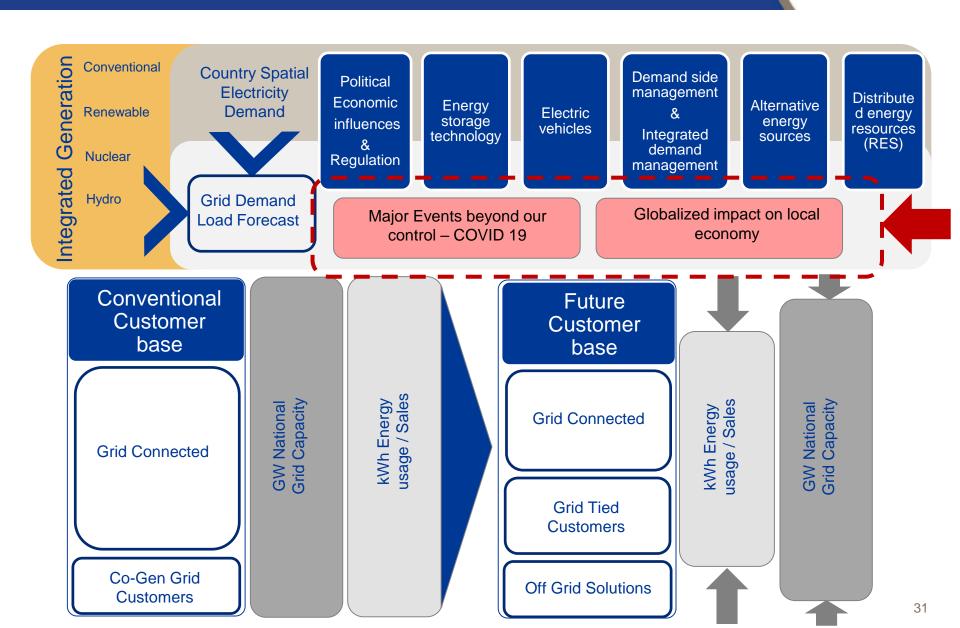
46GW

High

Grid Connectivity

An evolving power sector and change in forecast landscape

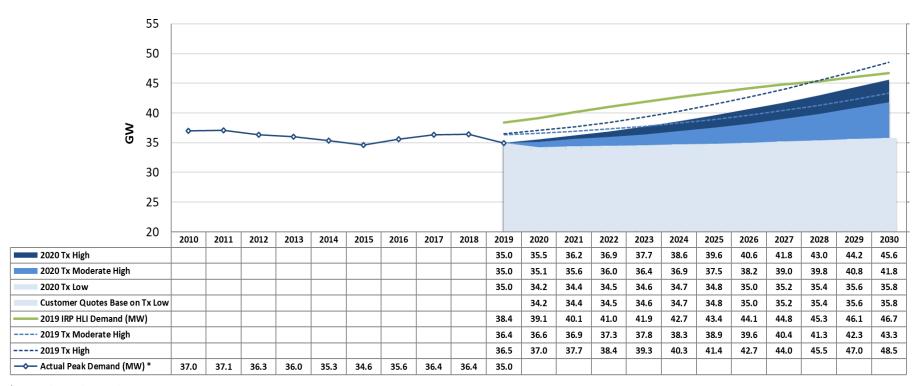




Transmission national TOSP demand forecast 2021 – 2030



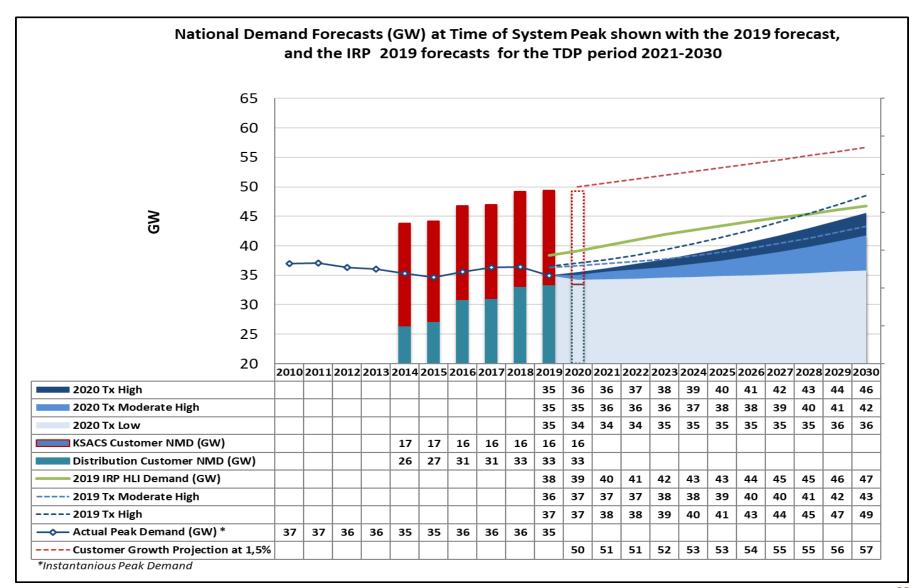
National Demand Forecasts (GW) at Time of System Peak shown with the 2019 forecast, and the IRP 2019 forecasts for the TDP period 2021-2030



^{*}Instantanious Peak Demand

Transmission national TOSP demand forecast 2021 – 2030 with Customer NMD's and IRP 2019













The TDP 2021 - 2030

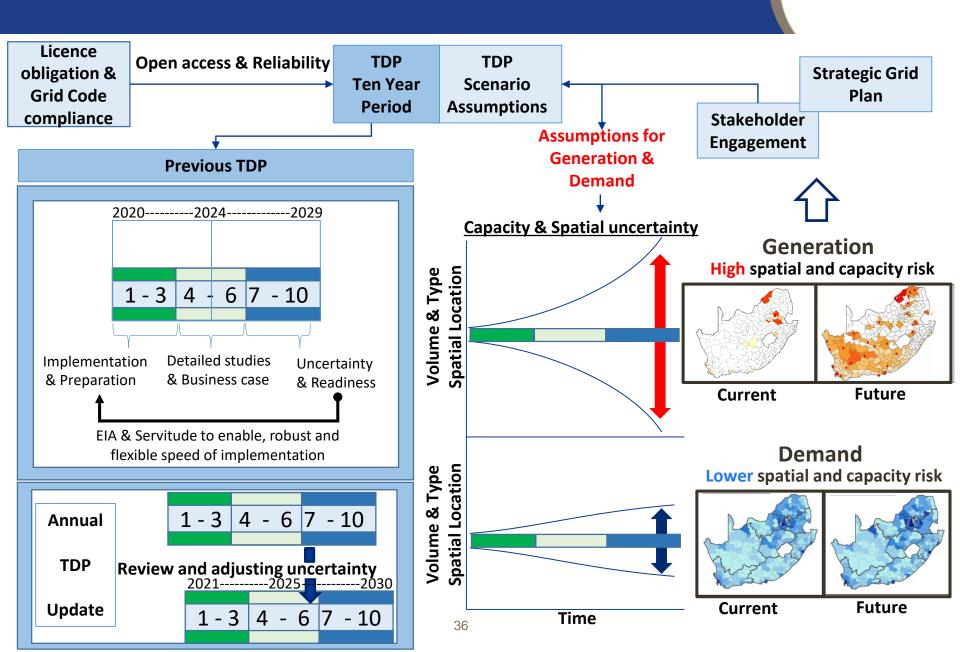
Assumptions on the Generation Forecast & Planning for the IRP2019

Presented by: Ronald Marais

Senior Manager: Strategic Grid Planning

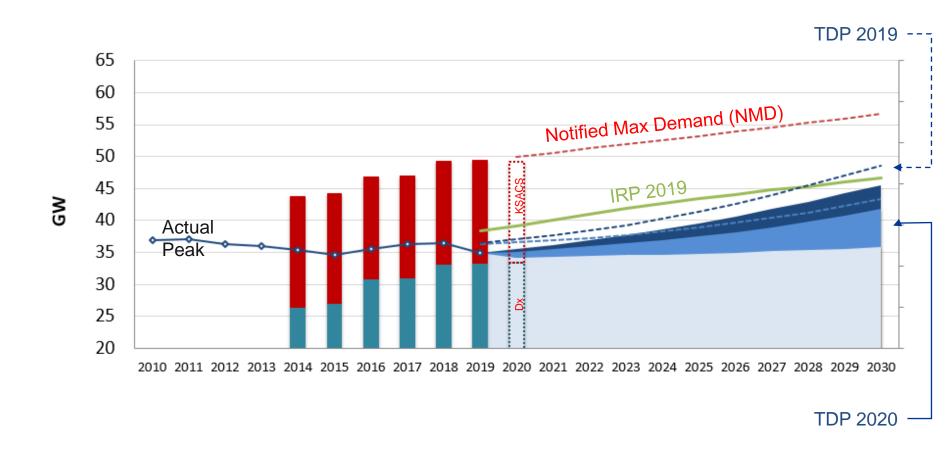
TDP process overview





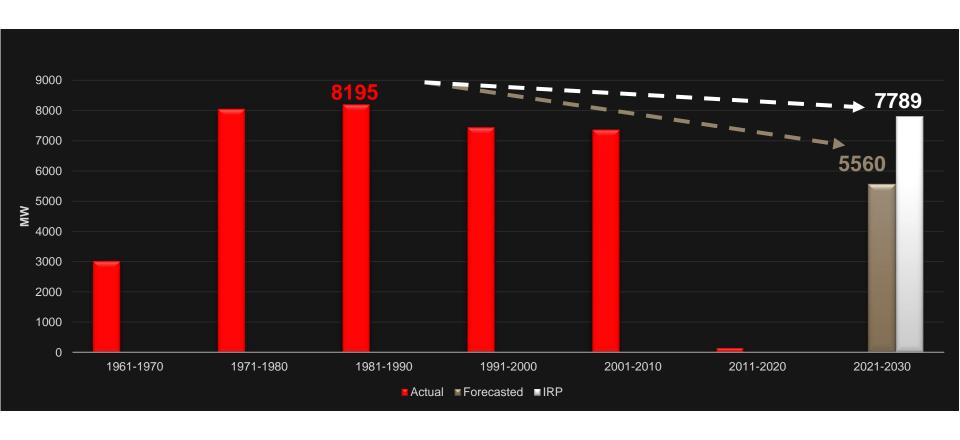
National demand forecast at time of system peak





Change in peak demand per decade





Generation comparison: IRP2019 vs IRP2018



	Draft IRP 2018						IRP 2019							
	Coal	Storage	PV	Wind	Gas	Total	Coal	Storage	PV	Wind	Gas	Total	Delta	
2020	1433		114	300		1847	1433		114	300		1847	0	
2021	1433		300	818		2551	1433		300	818		2551	0	
2022	711		400			1111	711	513	1400	1600		4224	3113	
2023	500					500	750		1000	1600		3350	2850	0.0.004
2024	500					500				1600	1000	2600	2100	−9.8 GW
2025			670	200		870			1000	1600		2600	1730	
2026			1000	1500	2250	4750				1600		1600	-3150	
2027			1000	1600	1200	3800	750			1600	2000	4350	550	
2028			1000	1600	1800	4400			1000	1600		2600	-1800	
2029			1000	1600	2850	5450		1575	1000	1600		4175	-1275	
2030			1000	1600		2600			1000	1600		2600	0	
Totals:	4577		6484	9218	8100	28379	5077	2088	6814	15518	3000	32497	4118	
New c	New capacity required by 2025 ~ 1870 MW New additional capacity required by 2025 ~ 9793 MW													
Committed capacity														
	New additional capacity													

Summary of differences between the IRP2019 and IRP2018:









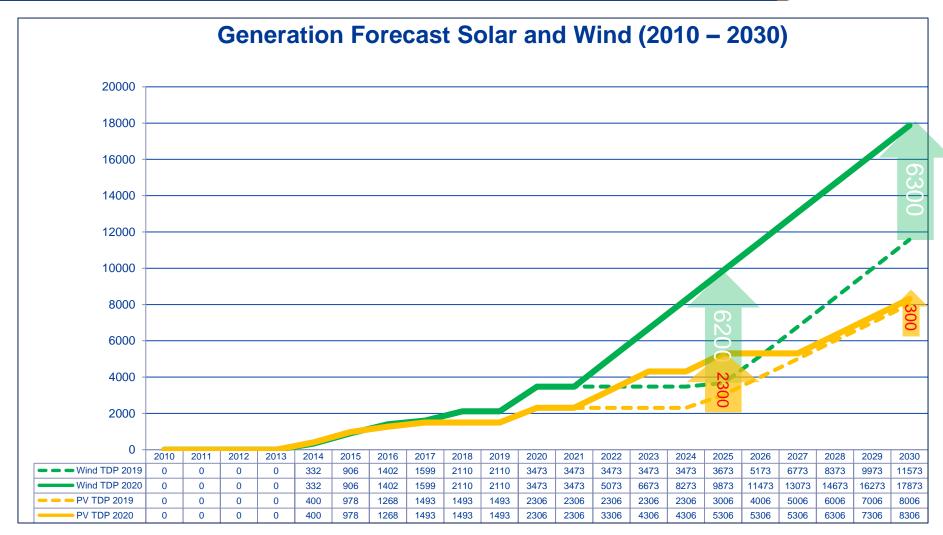






Wind and PV generation comparison at a glance





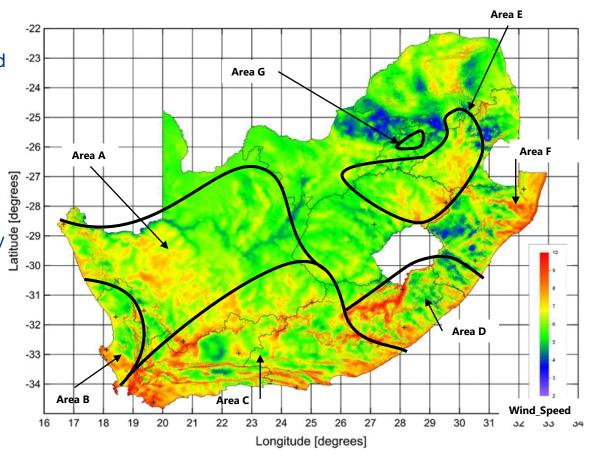




Importance of wind resource location



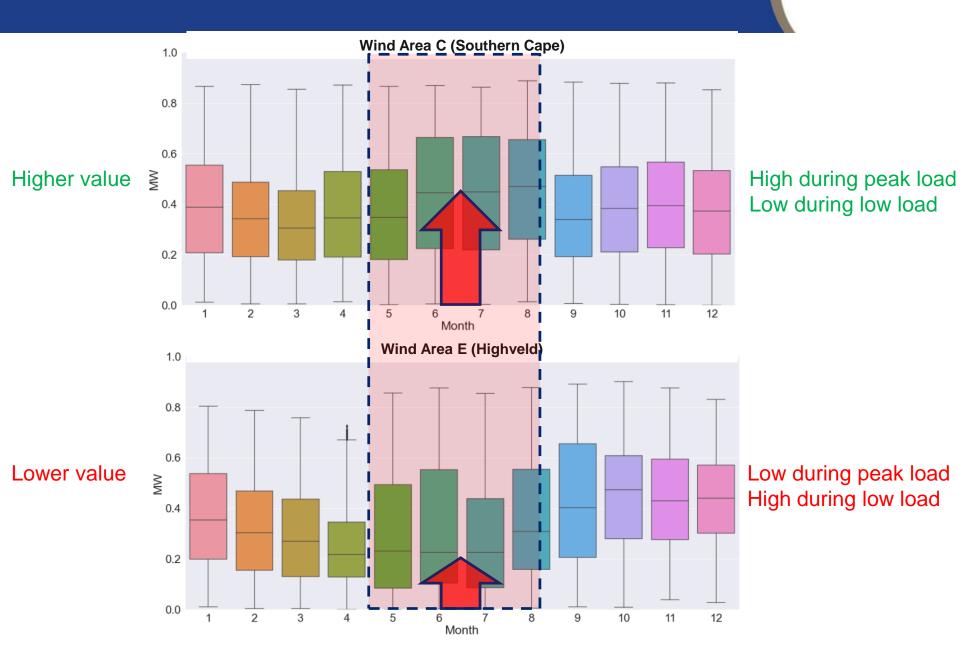
- Environmental limitations restrict build options
- Impacts the transmission network expansion & augmentation
- Wind profiles in individual areas and cumulative profiles impact the corridor development, system stability and power system requirements.
- IRP selects combination of profiles to minimise overall system costs



Credible resource location and profiles are required for Transmission expansion, security and reliability studies.

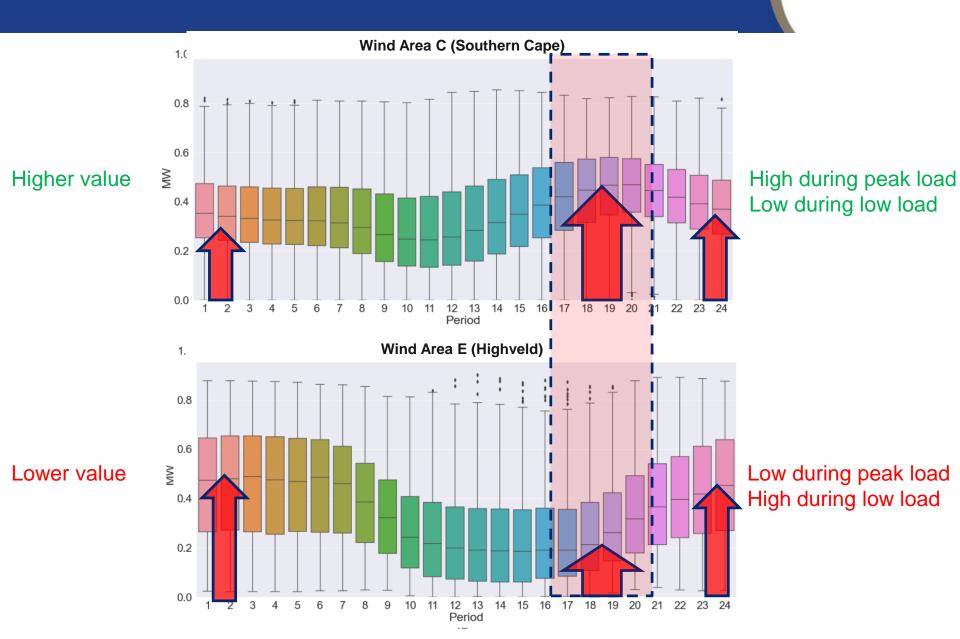
Importance of seasonal wind profiles





Importance of hourly wind profiles

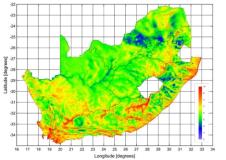




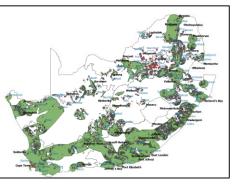
Wind area optimisation



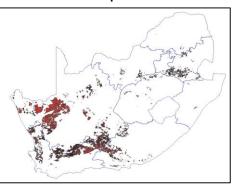


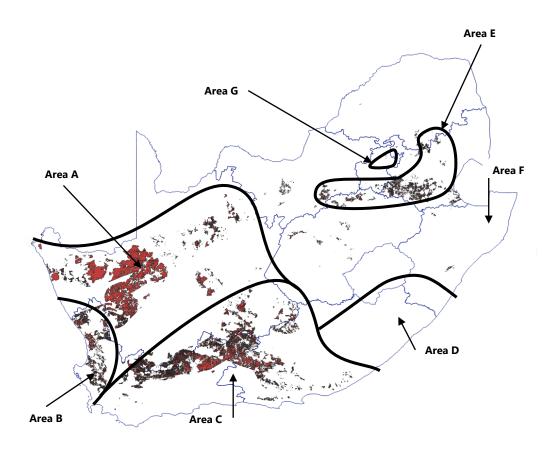


Viable Areas



Multi criteria Optimised Areas

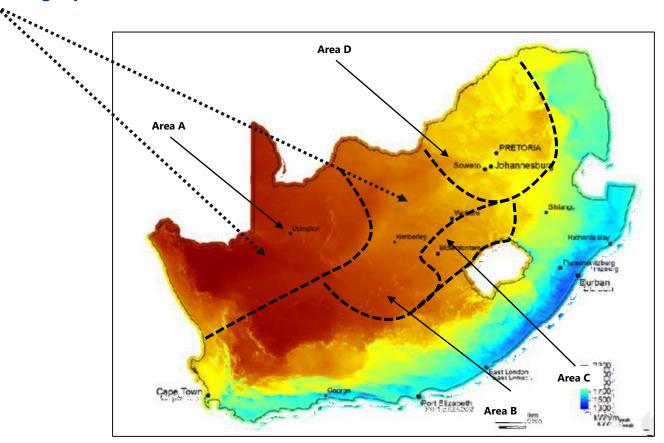




Dominant solar location: Significance of solar radiation yield

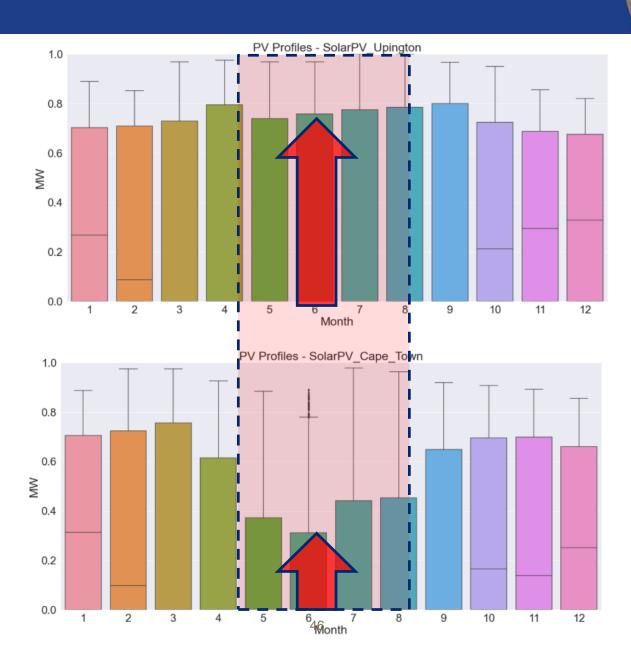


Orange to dark red are high yield areas



Seasonal solar profiles



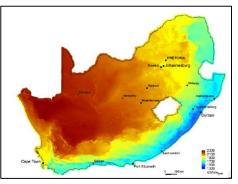


Dominant solar location:

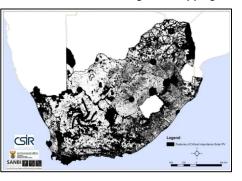
Alignment to credible resources areas



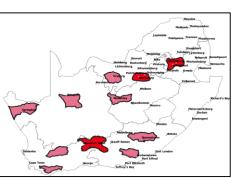
Solar Radiation

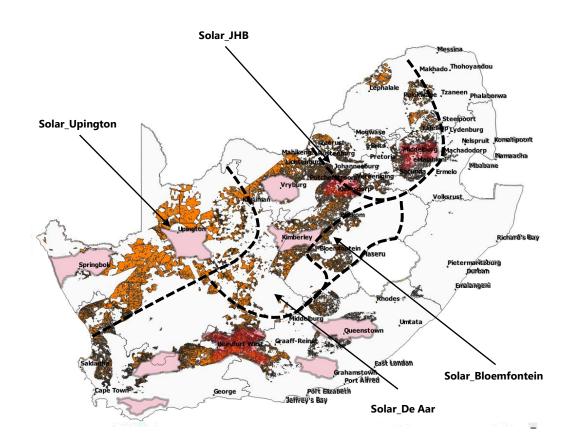


Critical success factors Negative Mapping



Renewable Energy Development Zones (REDZ)





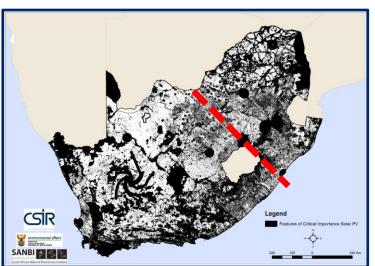
Environmentally acceptable Wind & Solar resources

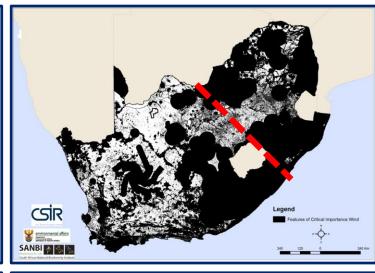


Solar

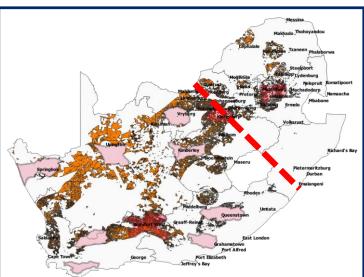
Wind

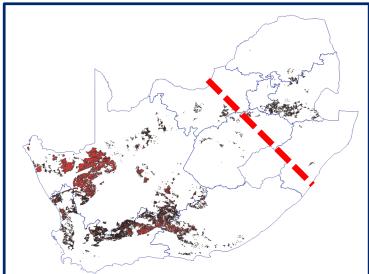
Features of Critical Importance and associated buffers for negative mapping





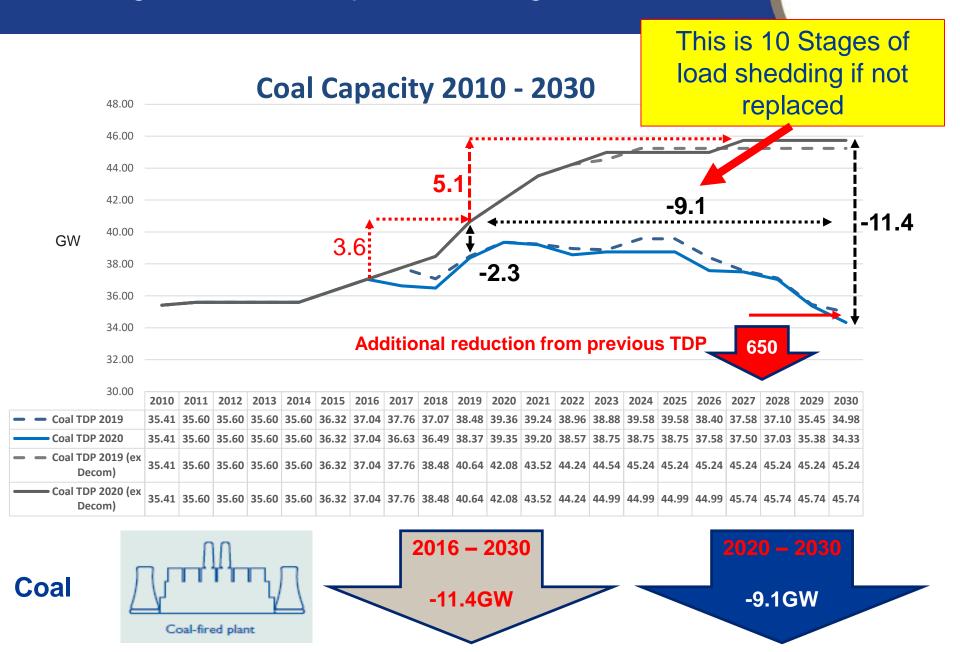
Strategic Environmental Assessment -Remaining area buffers





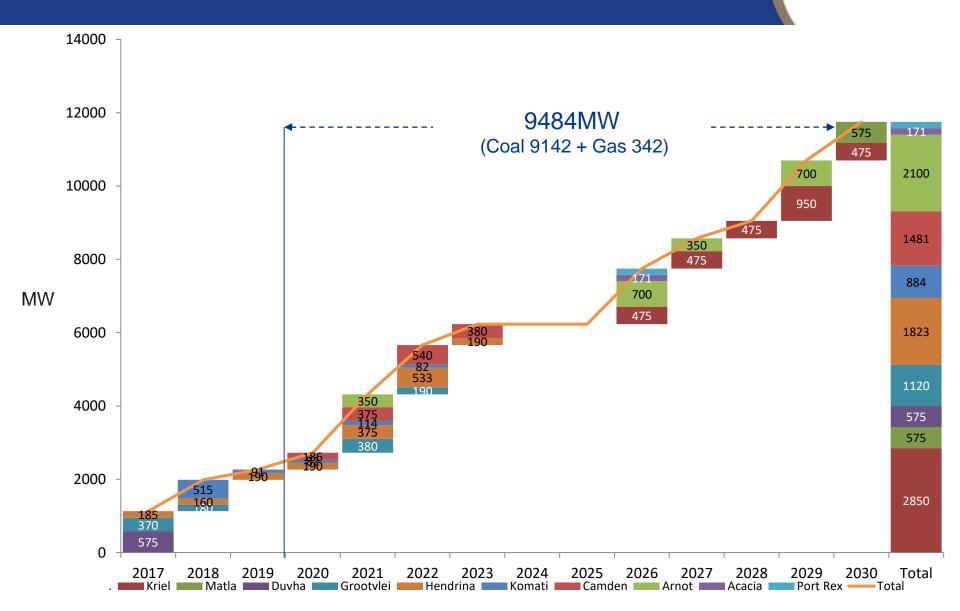
Coal generation comparison at a glance





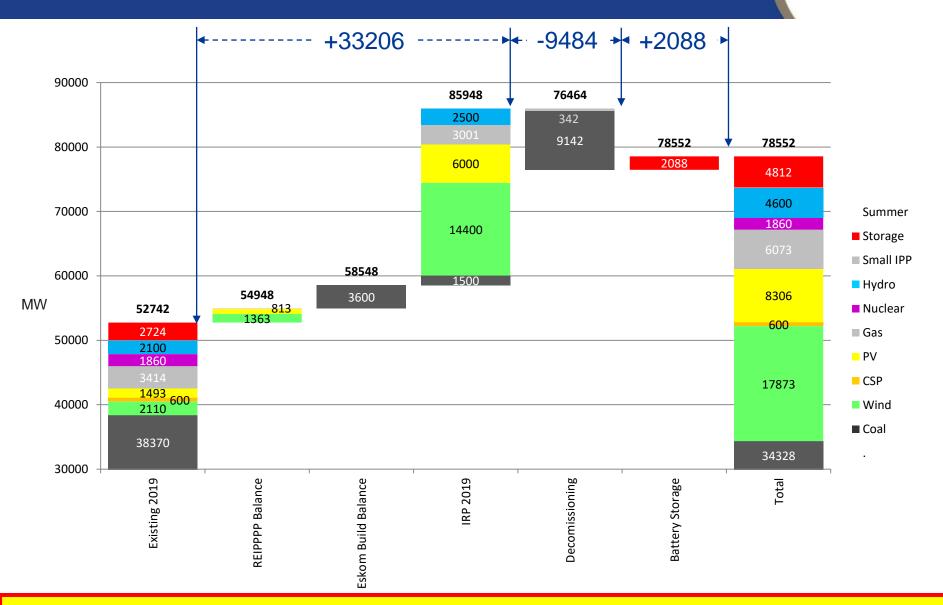
Annual and total decommissioning





Generation build-up graph

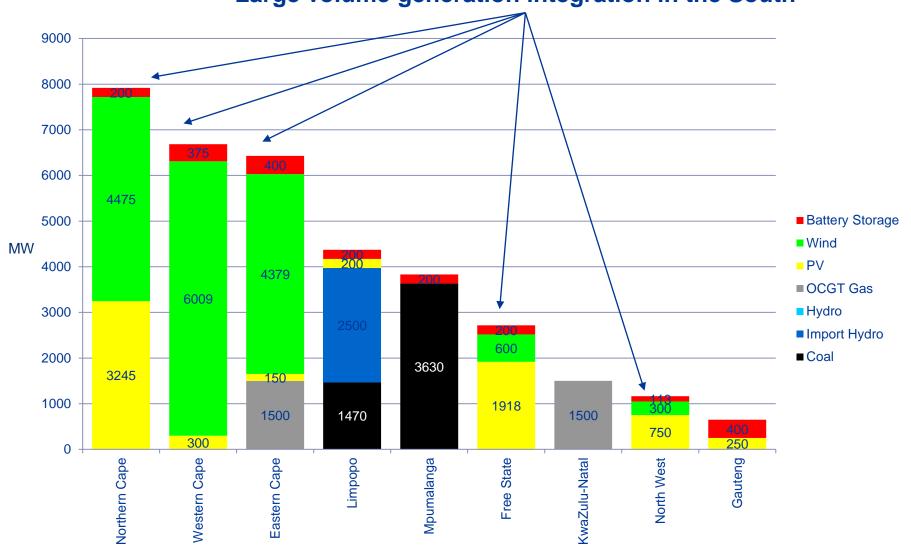




Provincial allocations

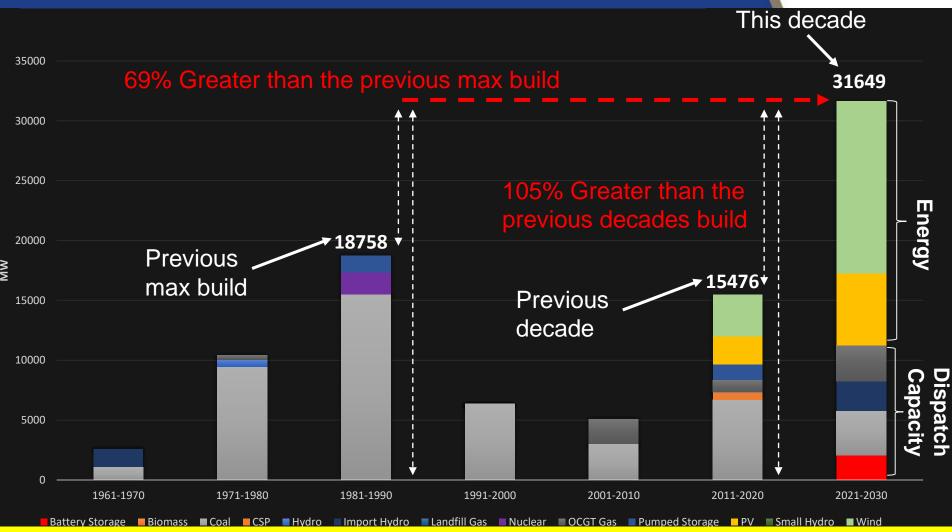






Generation build per Decade



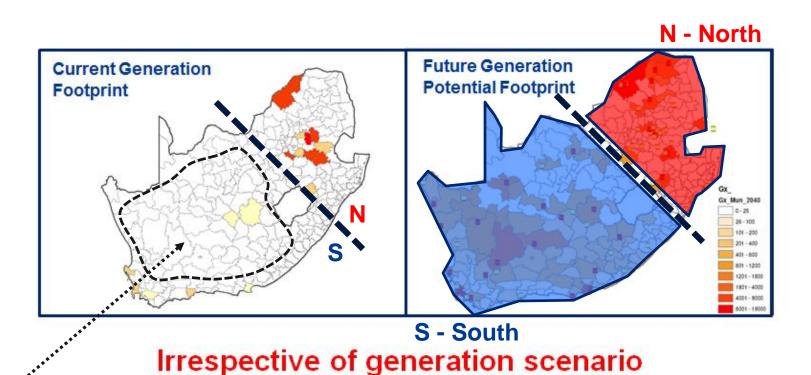


Existing generation fleet replacement with both **new energy** (Wind & Solar) and **new capacity** (back up gas, batteries etc.) is **required irrespective of load growth.**

Transmission expansions are critical to create access for these new energy sources and new capacity location. Load growth plays a significantly lower role but is still important.



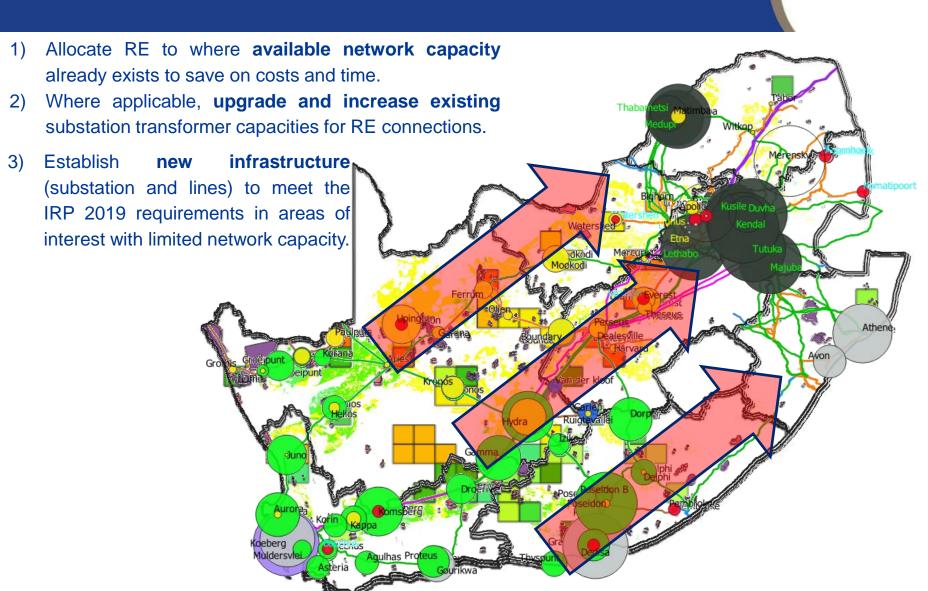
Change in Generation Spatial Footprint



Limited load hence limited Tx and Dx network.

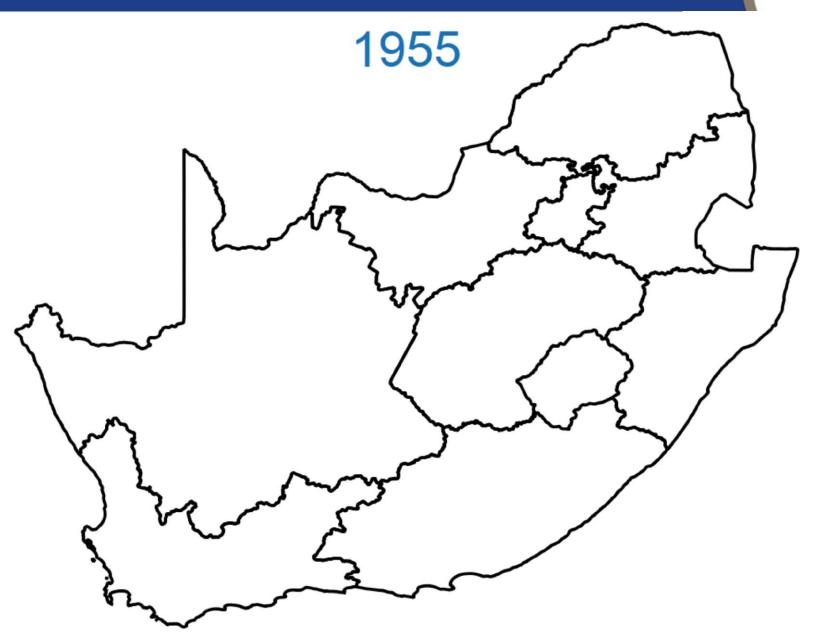
Spatial Allocation Considerations





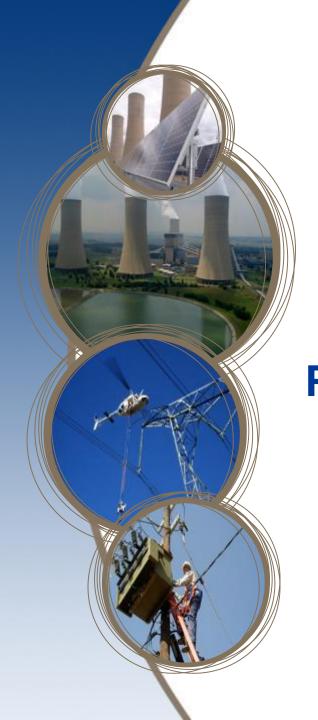
Evolution of Generation Capacity













TDP 2020 Provincial Development Plans

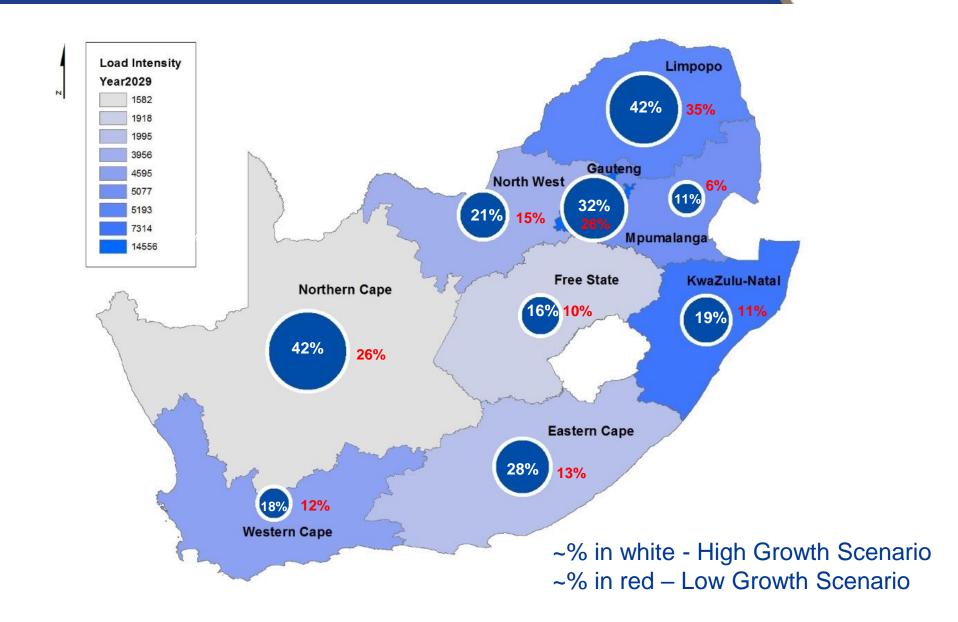
Compiled by : Grid Planning Chief Engineers

Presented by : Popi Queen Melato

October 2019

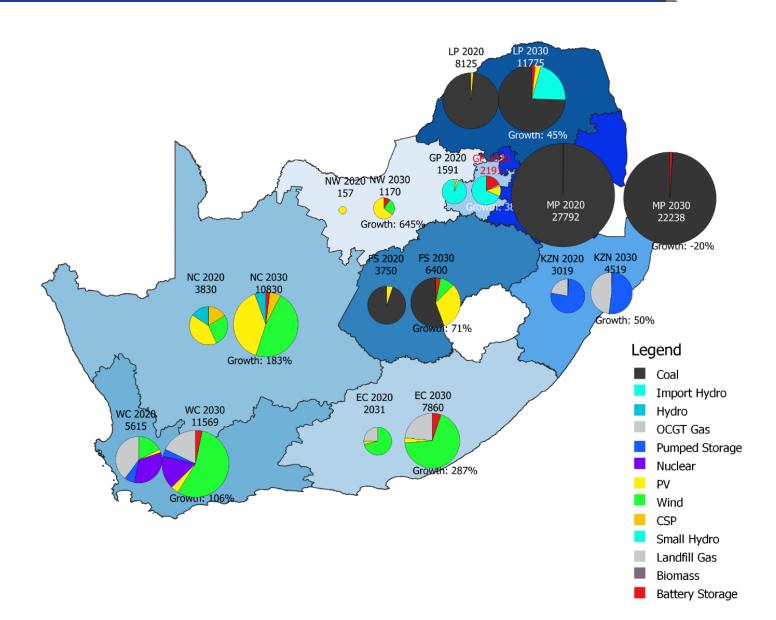
Provincial demand growth over the TDP period

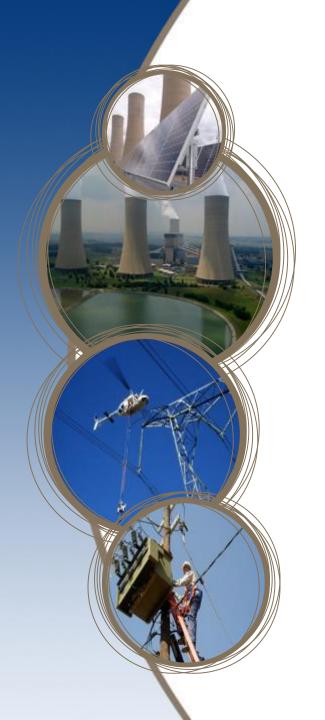




Provincial generation forecast over the TDP period







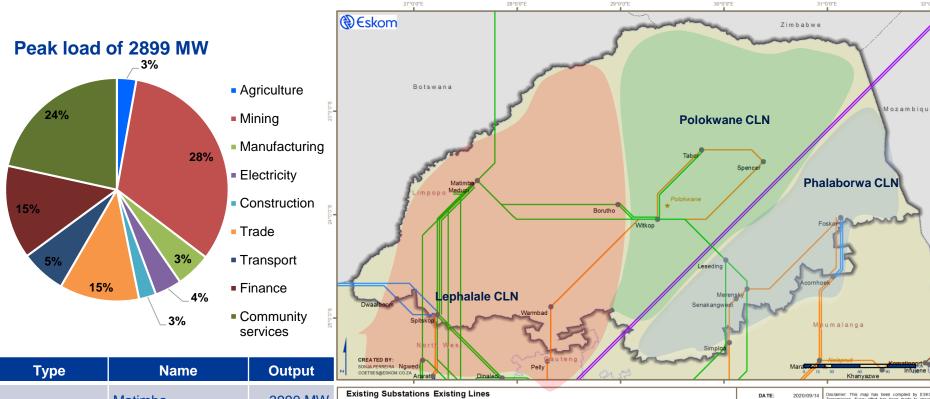


Limpopo Province

By: Caroleen Naidoo Chief Engineer

Limpopo Province Profile





88 16 13 10 10 10 10 10 10 10 10

Туре	Name	Output		
Coal Boso Load	Matimba	3990 MW		
Coal Base Load	Medupi	2382 MW		
	Witkop PV	30 MW		
Renewables	Soutpan PV	28 MW		
Tronomables	Villa Nora PV	60 MW		
Total Installed Go	6490 MW			

Limpopo Province Load Forecast (2021 – 2030)



Phalaborwa Load Growth Drivers:

- Electrification
- Agriculture
- Chrome Mining

Polokwane Load Growth Drivers:

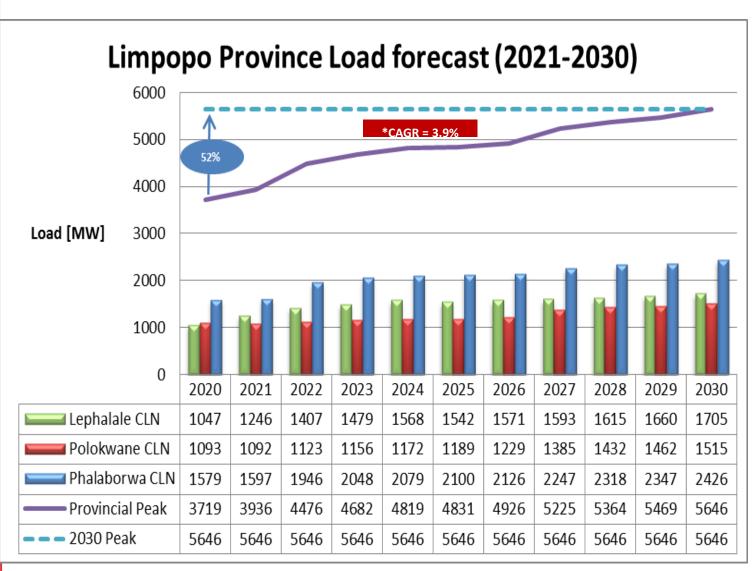
- Electrification
- Agriculture
- Diamond and Coal Mining

Load Reduction:

 Caused by an NMD reduction by Silicon Smelters.

Lephalale Load Growth Drivers:

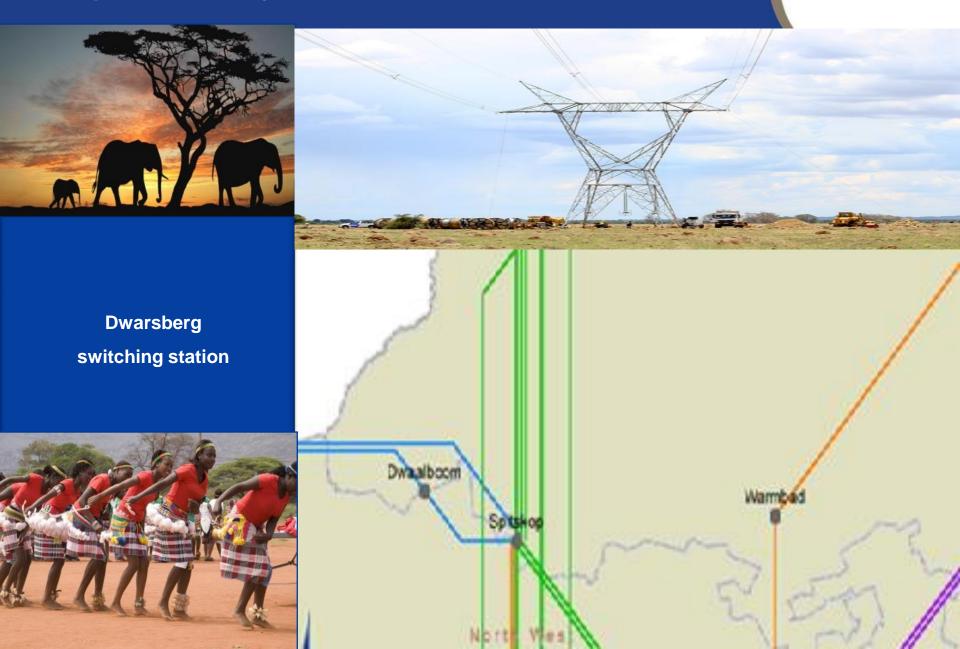
- Electrification
- Commercial and light industrial load growth
- Platinum and Coal Mining



^{*} Compound Annual Growth Rate

Completed Projects



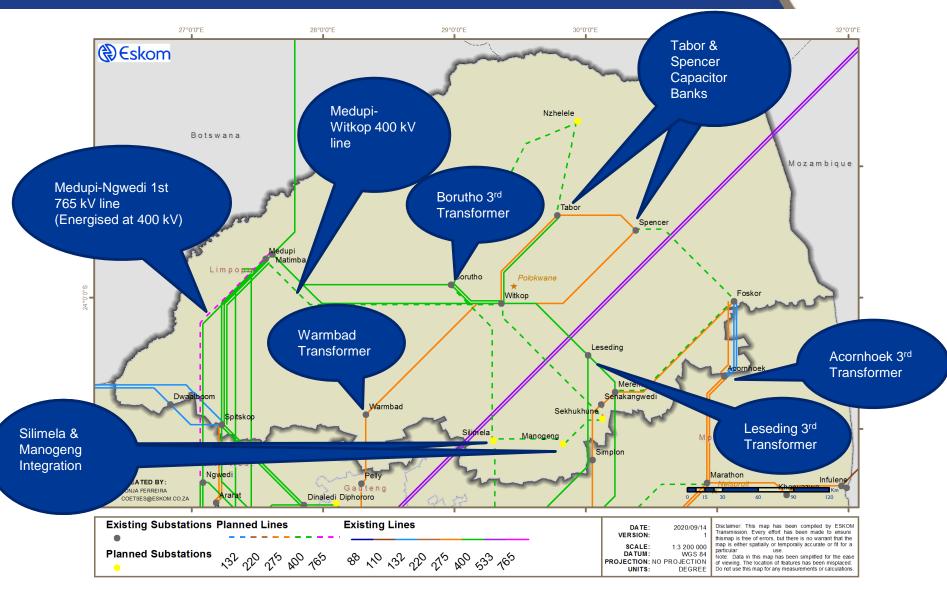






Developments from 2021 - 2025

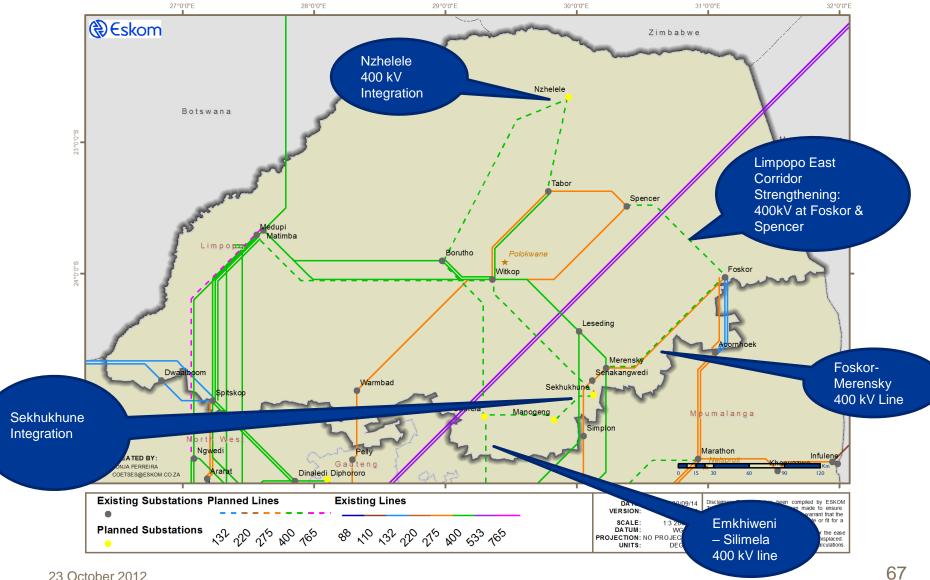


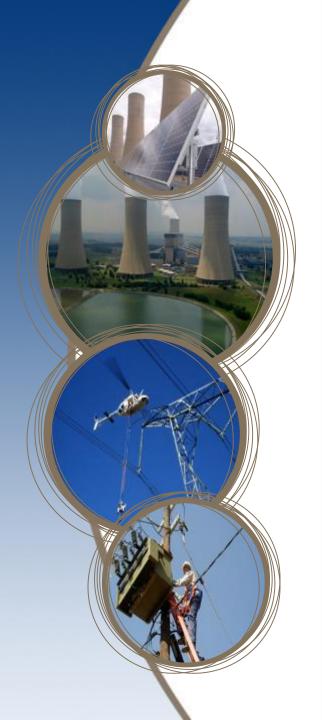


23 October 2012 66

Developments from 2026 - 2030







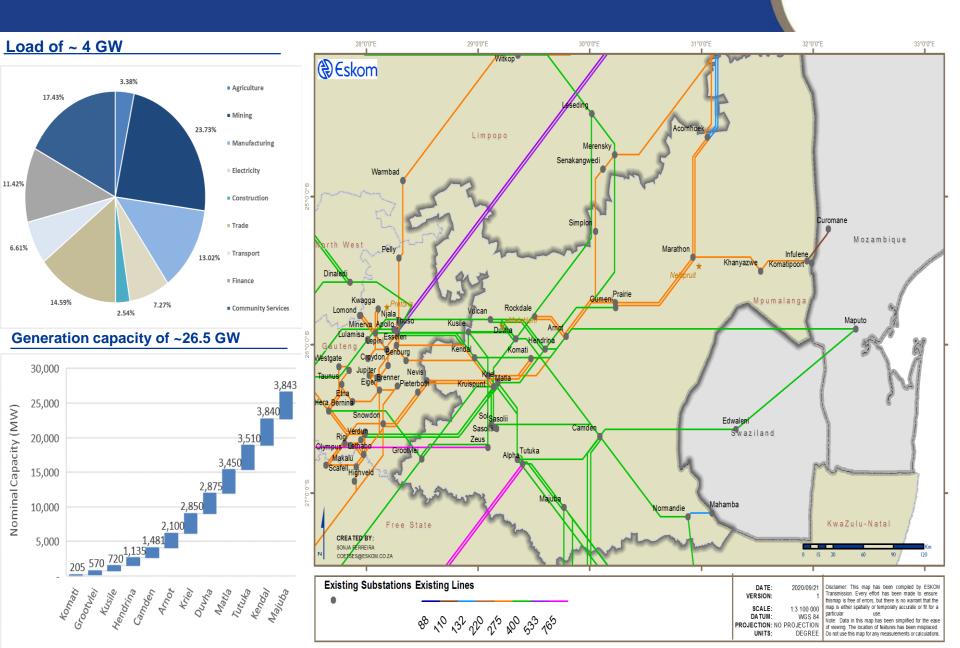


Mpumalanga Province

By: Kabir Singh Chief Engineer

Mpumalanga province profile





Completed projects for grid reliability



Sol 5th 400/132 kV 500 MVA transformer



- For execution of:
- The fault level mitigation-FCLR's
- Refurbishment and upgrade of terminal equipment
- To be redeployed to the new Wonderkrag S/S

Normandie 2nd 400/132 kV 250 MVA transformer



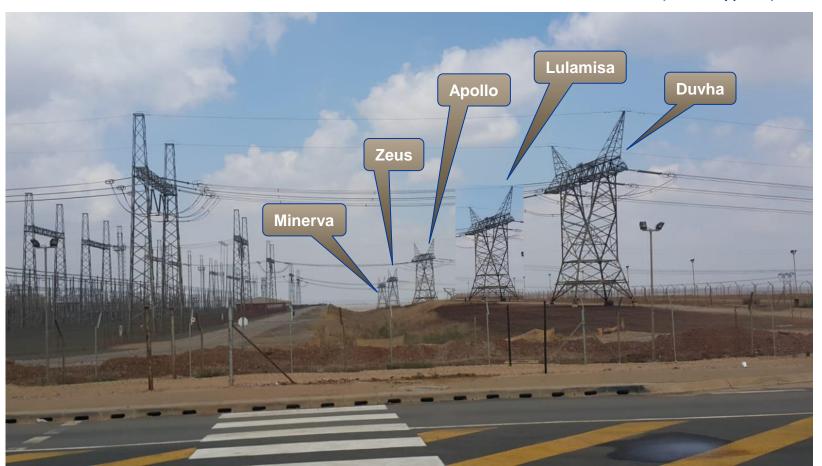
- N-1 requirement
- Improved reliability of supply to Swaziland

Completed projects of the Kusile transmission integration



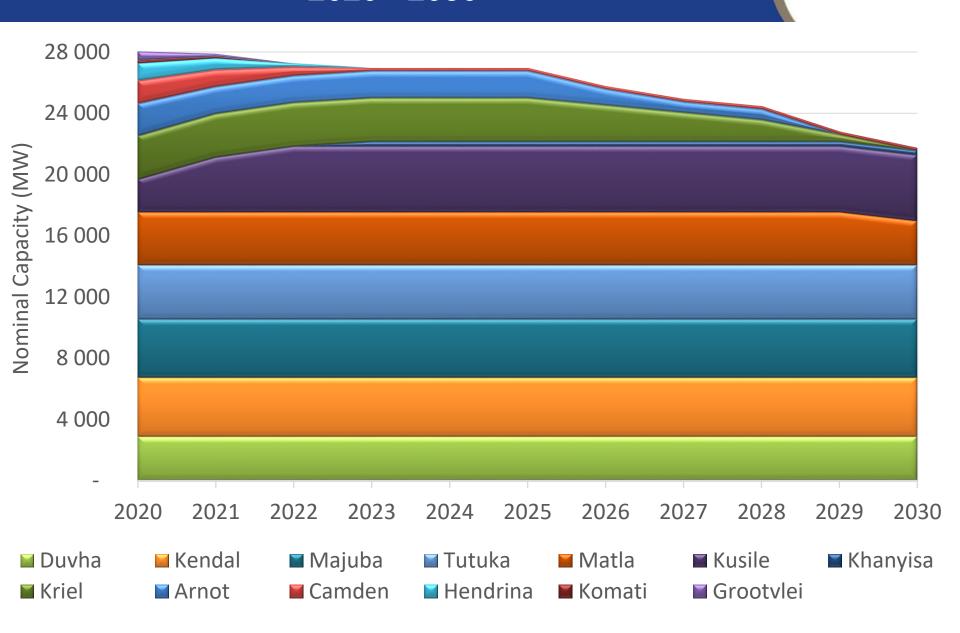
- Kusile 400 kV Yard
- Kendal-Apollo loop-in to Kusile
- Kusile-Zeus 400 kV line
- 2nd Kendal-Zeus 400 kV line

- Loop the Kendal-Duvha line to form Kendal-Arnot
- Loop the Duvha-Kendal line to form Duvha-Vulcan 2
- Duvha-Minerva loop-in to Kusile
- Sol-Camden 400 kV line 1 & 2 (Zeus bypass)



Mpumalanga generation forecast 2020 - 2030





Generation Developments in Mpumalanga

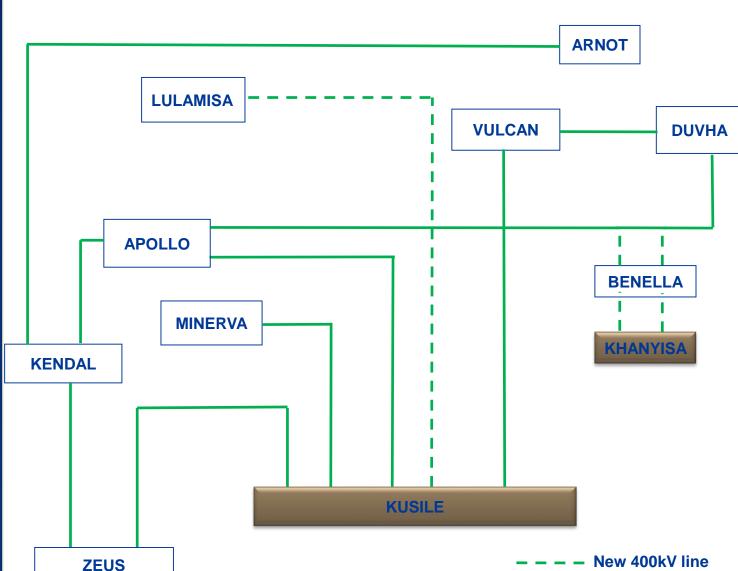


Kusile Integration

- · Kusile Duvha
- Kusile Minerva
- Kusile Apollo
- Kusile Zeus
- Kendal Zeus
- Kusile Lulamisa

Khanyisa IPP Integration

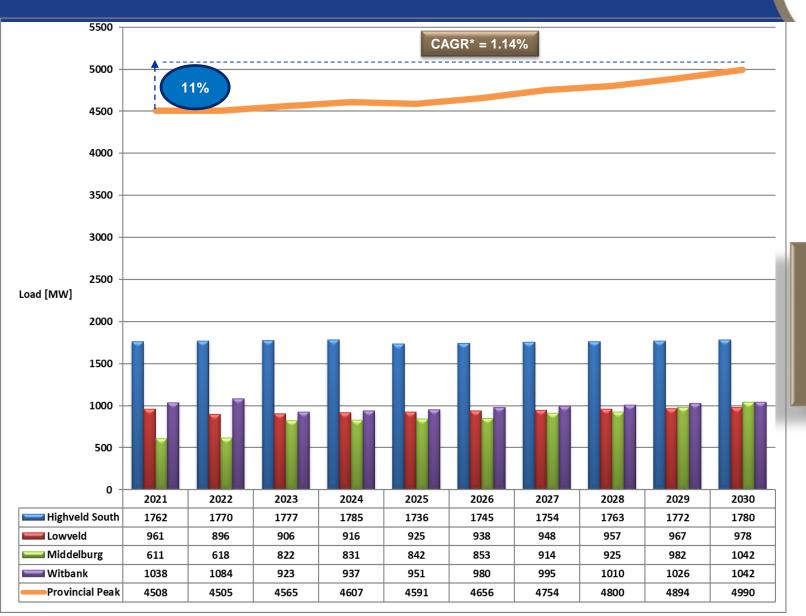
 Duvha-Apollo 400 kV loopin to Benella Sw/S





Mpumalanga Load Forecast 2021 - 2030





Key Growth
Drivers
Residential
Commercial
Tourism
Mining
Industrial
development

^{*} Compound Annual Growth Rate

Strengthening developments in Mpumalanga



of viewing. The location of features has been misplaced. Do not use this map for any measurements or calculations

Wonderkrag integration

- N-1 compliance
- Safety compliance
- Creating spare capacity
- Fault level mitigation

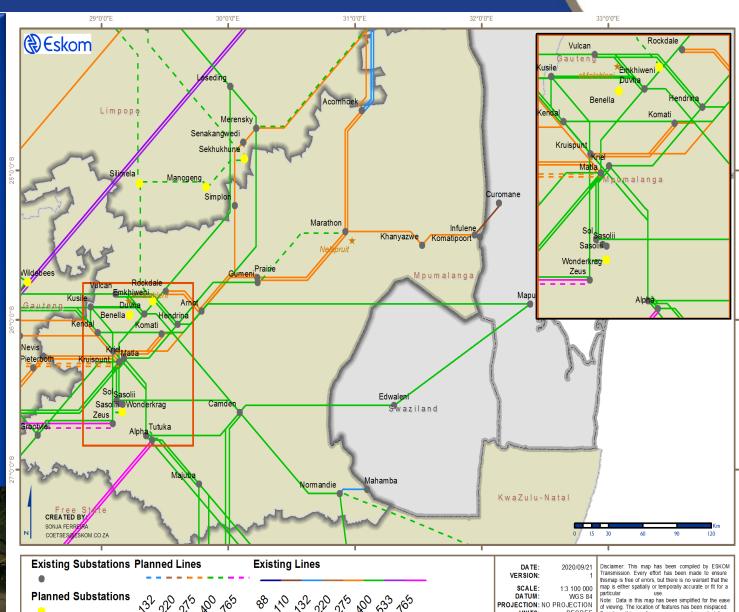
Emkhiweni integration

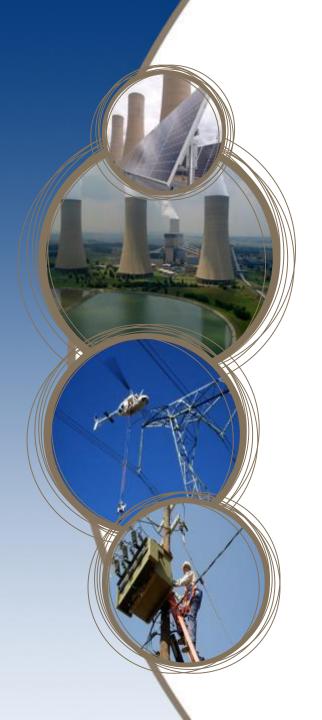
- N-1 Compliance
- Safety related to burning grounds
- Creating spare capacity

Marathon 400 kV integration

- N-1 compliance
- · Creating spare capacity
- Increased cross-border transfer capability









Gauteng Province

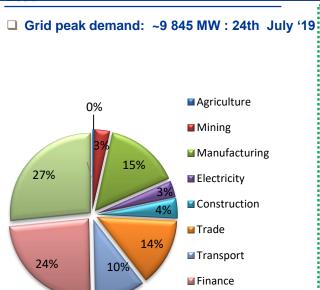
By: Thamsanqa Ngcobo Chief Technologist

Gauteng Province Profile

■ Community

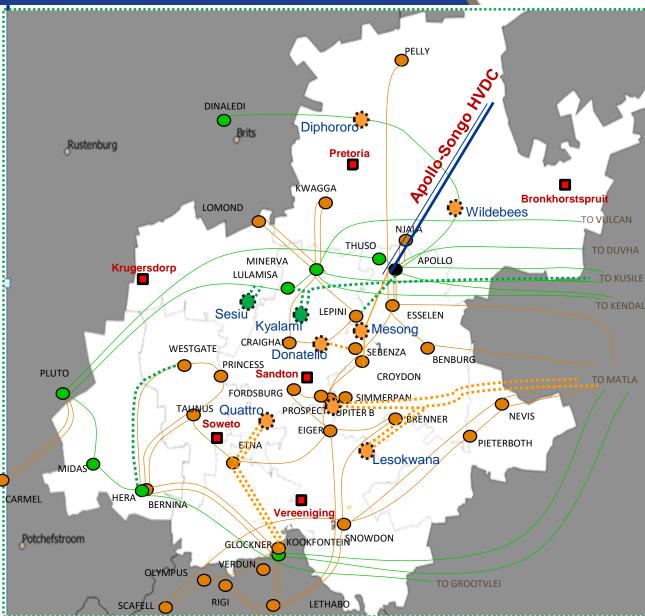
services





Generation

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



Gauteng Projects in Execution



Benburg Ext. 3rd 250 MVA 275/132 kV Transformer

Supports network reliability in the East Rand



Gauteng Projects in Execution



Sisimuka 88 kV Busbar

- 1st phase of converting Simmerpan to a 275/88 kV sub
- supplies growth in Germiston area



Gauteng Projects in Execution



Lepini Ext. 275 kV 2x150 MVar Capacitors

supports the Minerva-Lepini – Craighall 275 kV ring which supplies the northern suburbs



Gauteng Load Forecast



Gauteng Load Forecast (2021-2030)



Growth drivers:

- Residential,
- Commercial, &
- Light industrial

Growth Nodes:

- Northern Suburbs
- West Rand
- East Rand
- Tshwane

^{*} Compound Annual Growth Rate

Developments in the JHB East & South Area



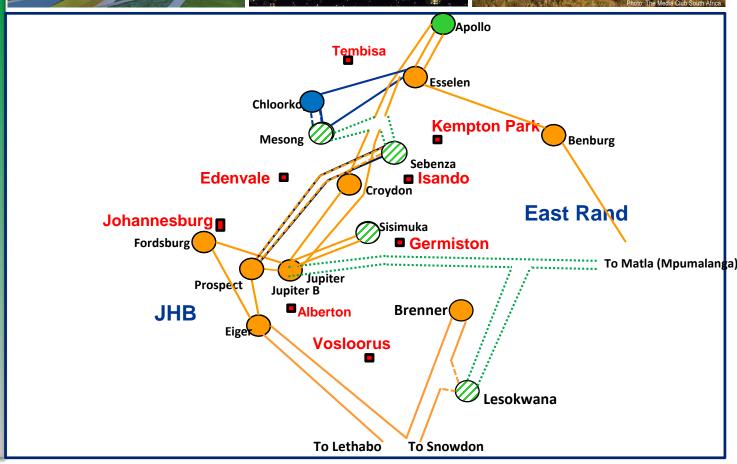


- Mesong Substation
- Jupiter B integration
- SisimukaSubstation
- Lesokwana
 Substation







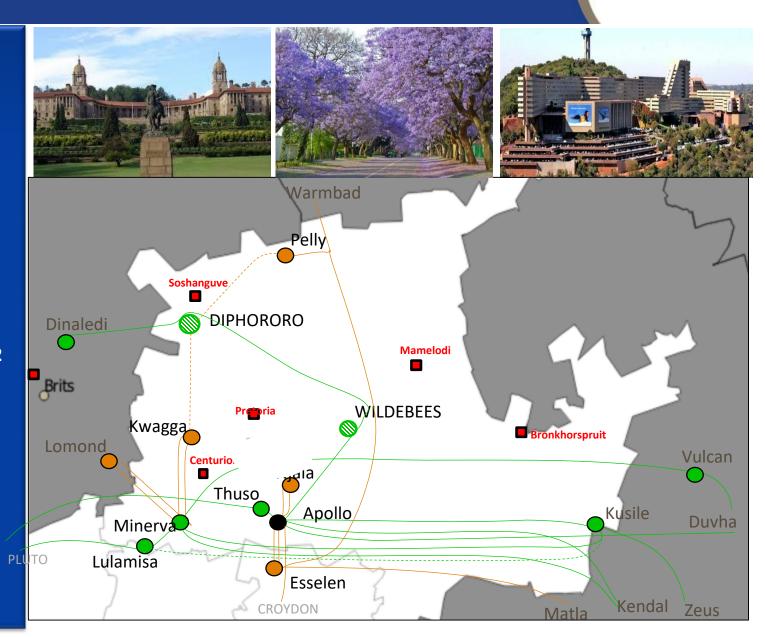


Developments in the Tshwane Area



Key Projects

- Wildebees integration
- Diphororo Phase 1
- Diphororo Phase 2



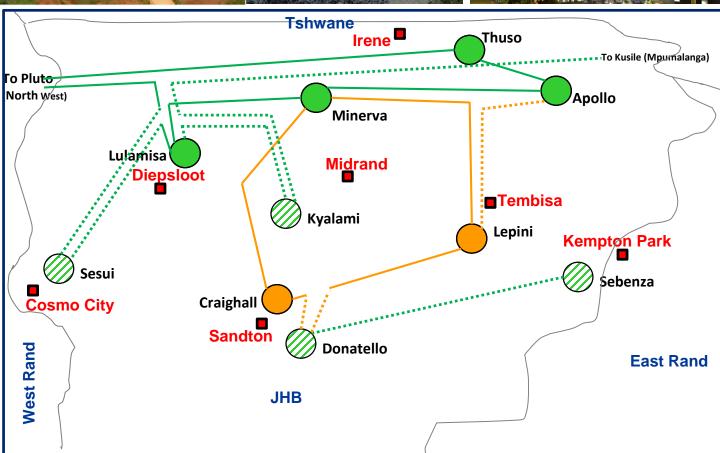
Developments in the JHB North Area



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

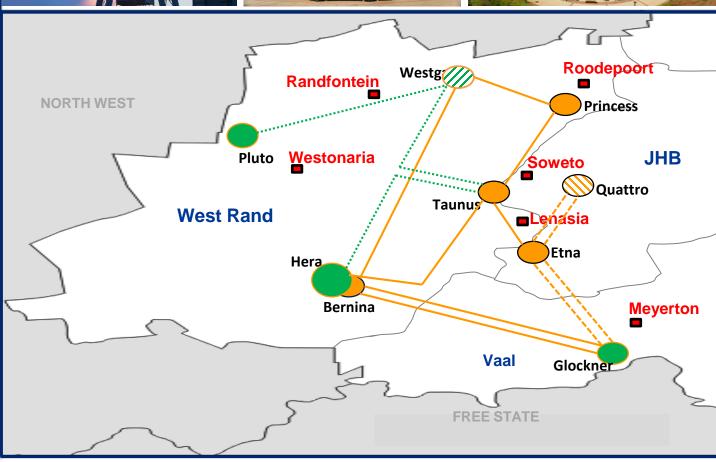


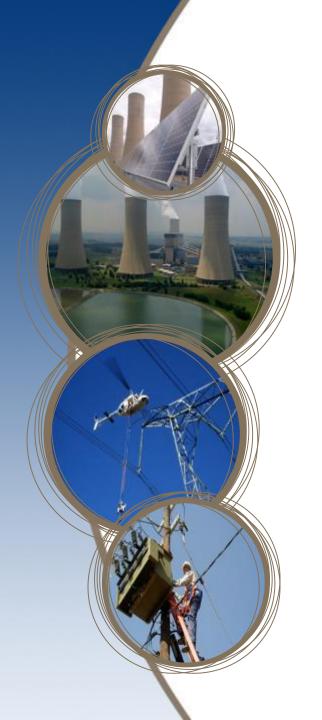
Key Projects

- Vaal Strengthening Phase 2
- SowetoStrengthening
- West randStrengtheningPhase 1 & 2











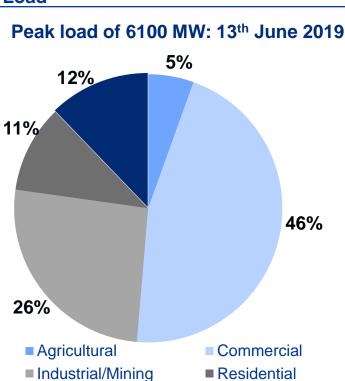
KwaZulu-Natal Province

By: Thokozani Bengani Chief Engineer

KwaZulu-Natal Province Profile



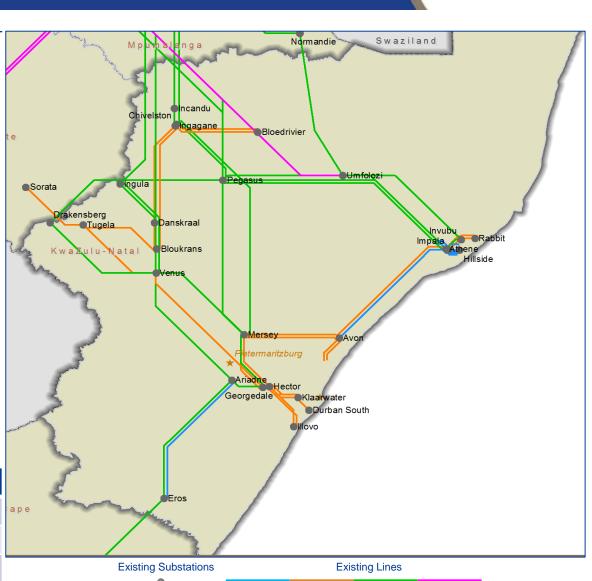
Load



Generation

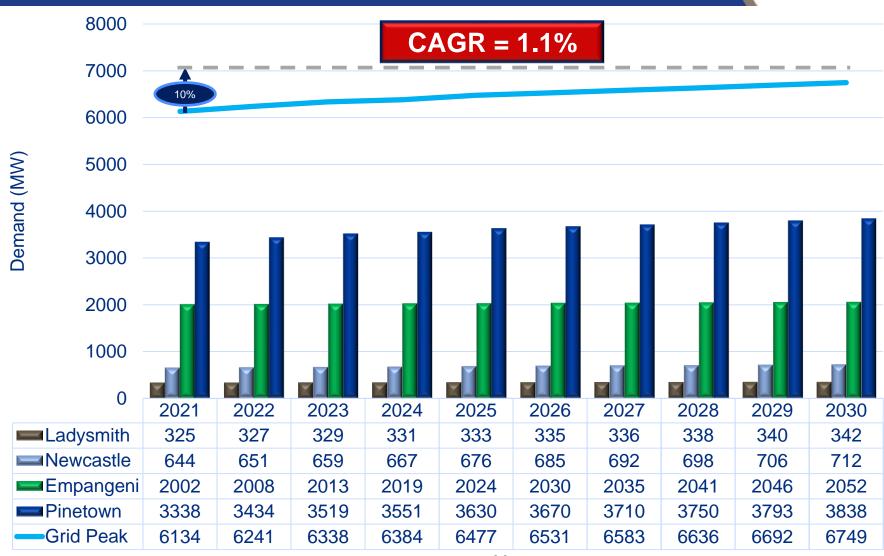
■ Logistics

Тур	е	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

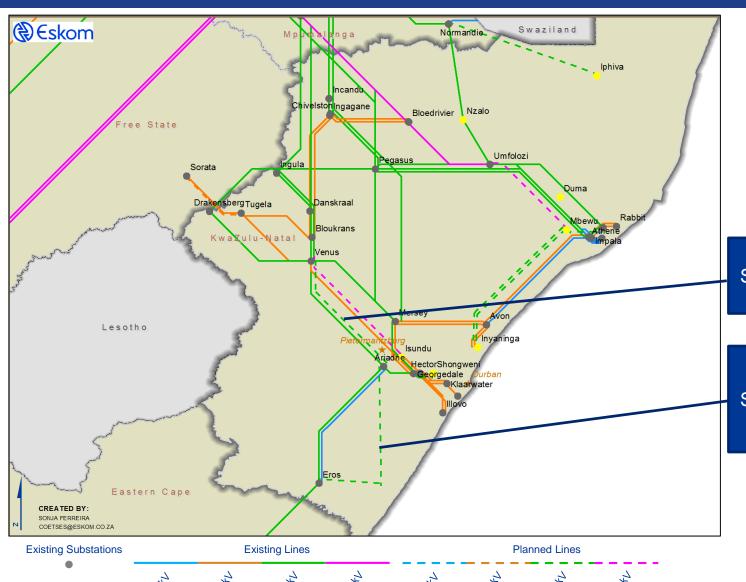




Year

KwaZulu-Natal 2020 – 2025 Transmission Plans





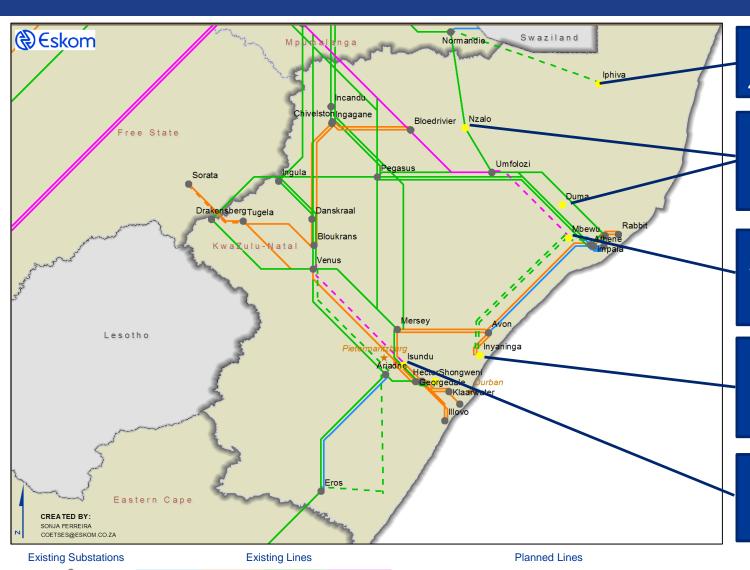
Planned Substations

Pinetown
Strengthening: AriadneVenus 400 kV Line 2

South Coast Strengthening: Ariadne-Eros 400 kV Line 2

KwaZulu-Natal 2026 – 2030 Transmission Plans





Planned Substations

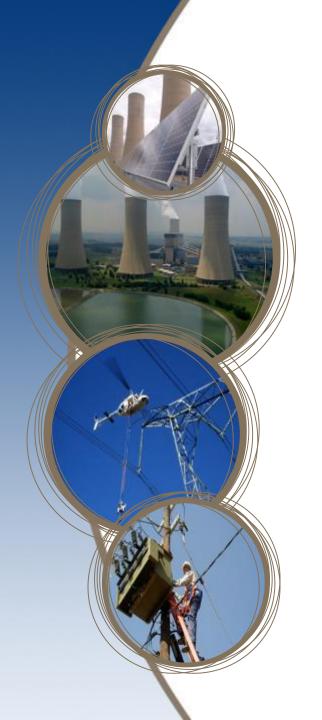
Northern KZN
Strengthening: Iphiva
400/132 kV Substation

Ermelo-Richards Bay
Coal line
Strengthening: Duma
& Nzalo Substations

Empangeni Strengthening: Mbewu 400 kV Switching Station

eThekwini Strengthening: Inyaninga 400/132 kV Substation

Pinetown
Strengthening: Isundu
400 kV Switching
Station





Free State Province

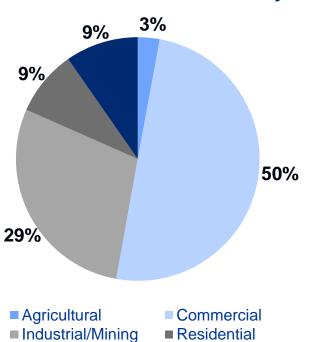
By: Thokozani Bengani Chief Engineer

Free State Province Profile



Load

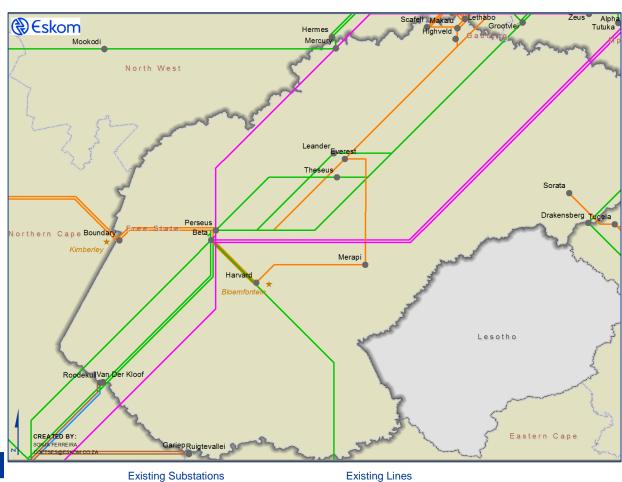
Peak load of 1499 MW: 08th July 2019



Generation

■ Logistics

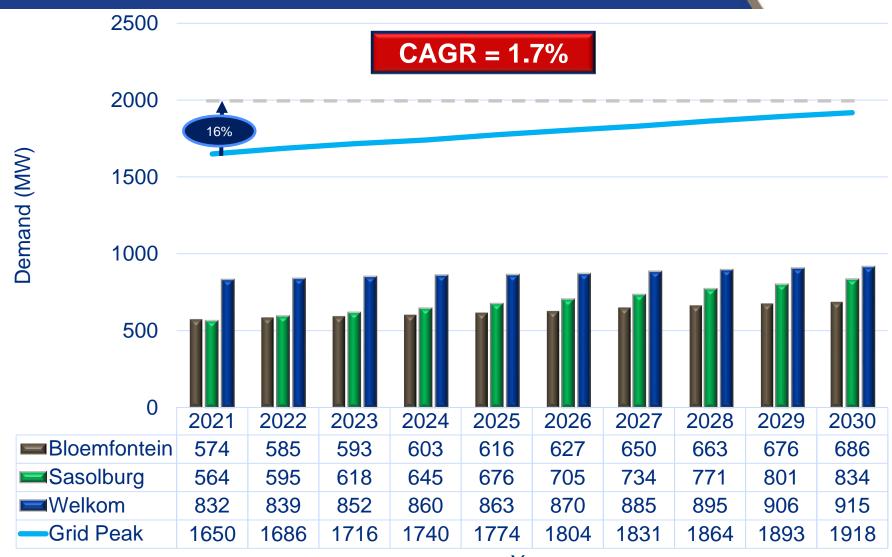
Ту	ре	Name	Output
Base	Coal	Lethabo	3558 MW
IPP	Hydro	IPPs	4.4 MW
	PV	IPPs	199 MW
Total Installed Generation		3761 MW	



82 A

Free State Load Forecast

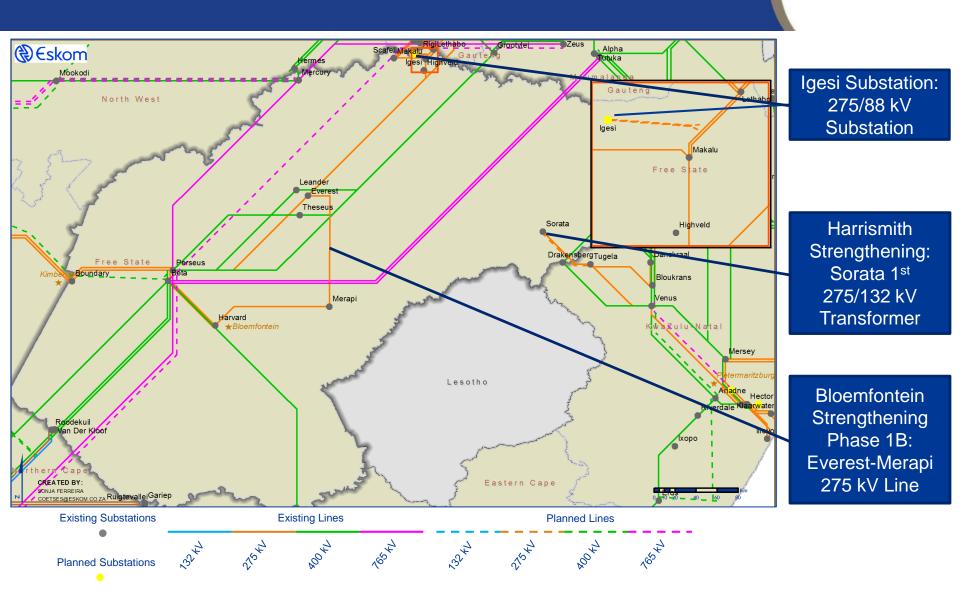




Year

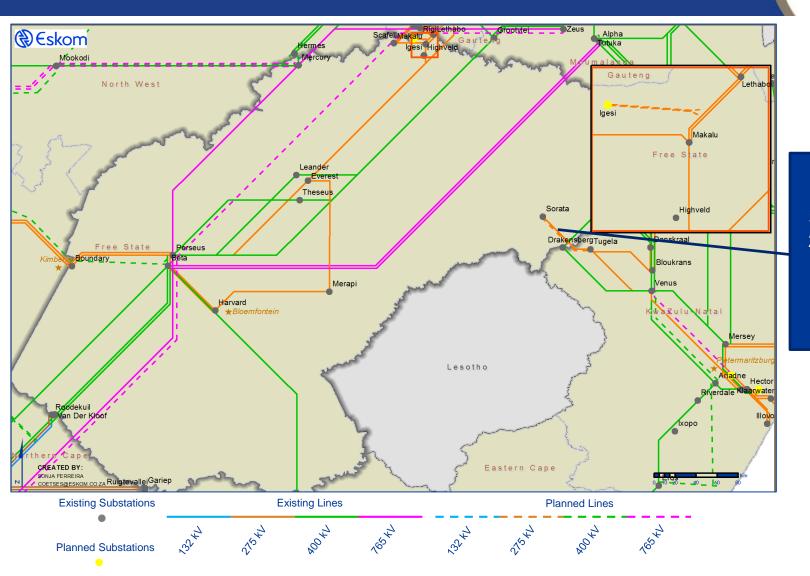
Free State 2020 – 2025 Transmission Plans



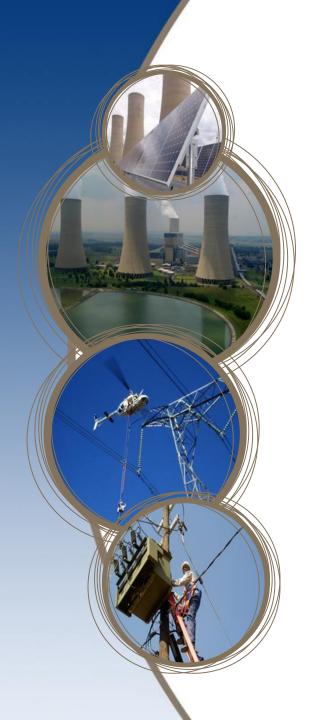


Free State 2026 – 2030 Transmission Plans





Sorata
Strengthening:
2nd 275/132 kV
Transformer &
Tugela-Sorata
275 kV Line 2





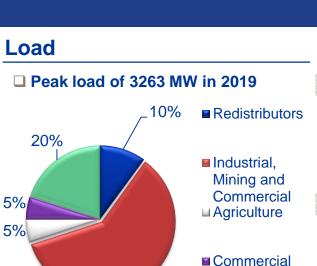
North West Province

By: Popi Queen Melato Chief Engineer

North West Province Profile

■ Residential





60%

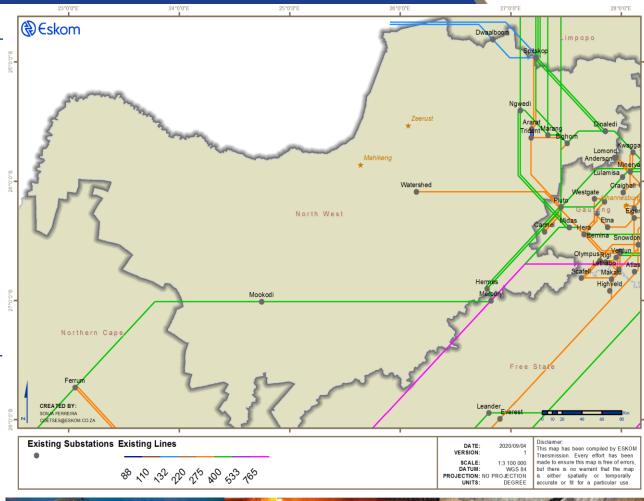


Rustenburg

Carletonville

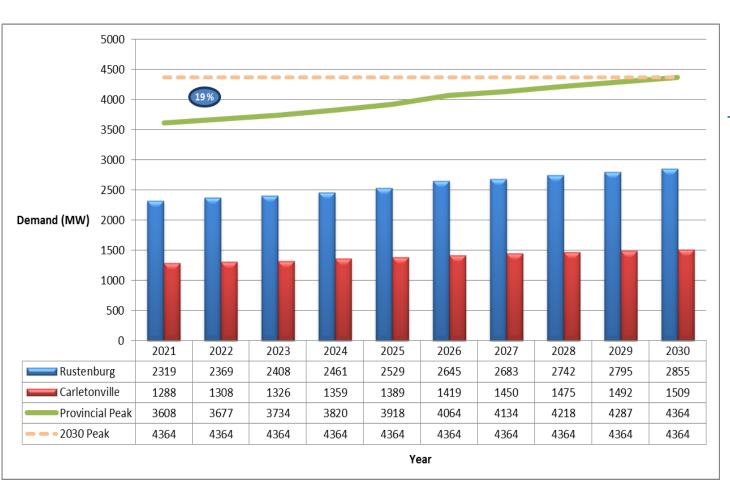
Generation





North West Province Load Forecast





Load Drivers

Rustenburg CLN

- Natural load growth
- Mining applications
- Load shifts from neighbouring provinces

Carletonville CLN

- Natural load growth
- Electrification
- Bulk supply applications
- Load shifts from neighbouring provinces

^{*}Compound Annual Growth Rate

Renewable Energy in North West Province



Renewable Energy Projections:

- Approximately 1 GW
 10 year horizon
- Mookodi substation 825 MW
 - Approved 75 MW Waterloo Solar Park
 - 450 MW PV
 - 300 MW Wind
- Watershed substation 225 MW
 - Approved 75 MW Zeerust Solar Park
 - 150 MW PV
- Bighorn substation 7 MW
 - Existing 7 MW RustMo1 PV

Alternate Energy:

- Watershed substation
 - 113 MW BESS



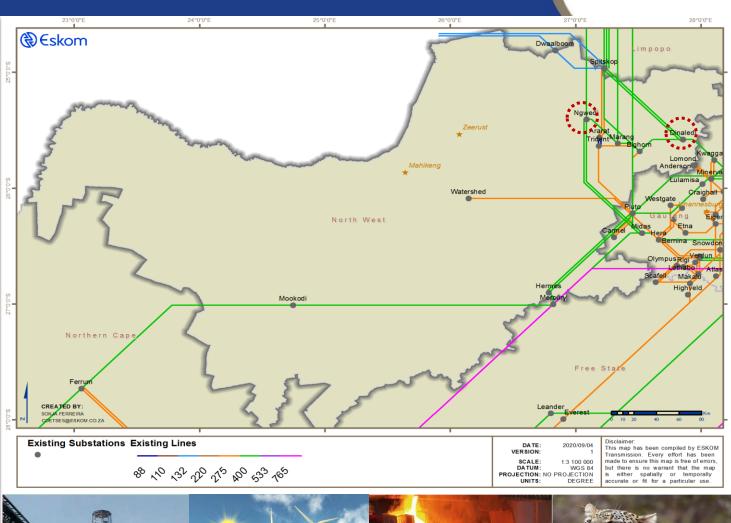




Completed Projects



- Dinaledi 3rd transformer
- Ngwedi substation integration
- 1x Medupi Ngwedi 400 kV lines

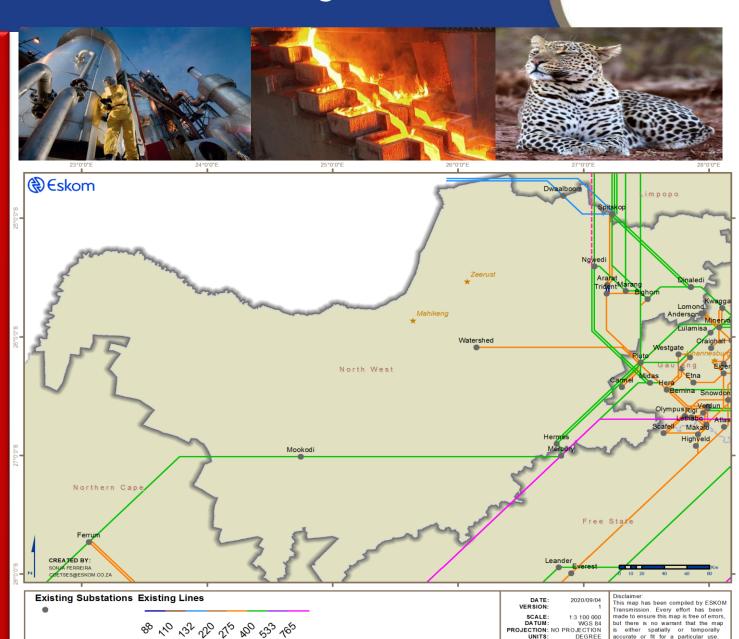




Developments in the Rustenburg CLN



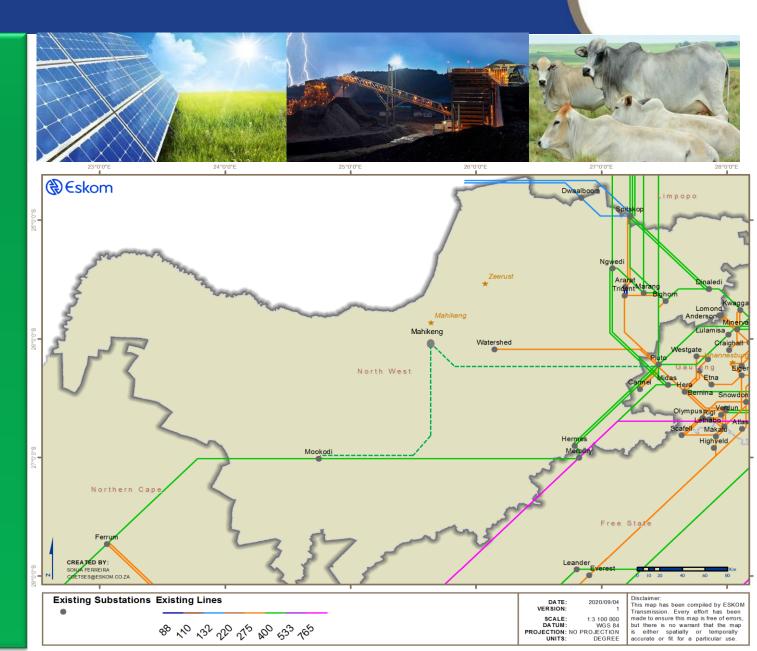
- 1x Medupi Ngwedi
 400 kV line
 (1x 765 kV design)
 - near Mogwase in 2021
- Rustenburg Reactive
 Compensation
 (Bighorn, Marang and Dinaledi) in 2028
- Bighorn Extension –
 near Marikana in 2030

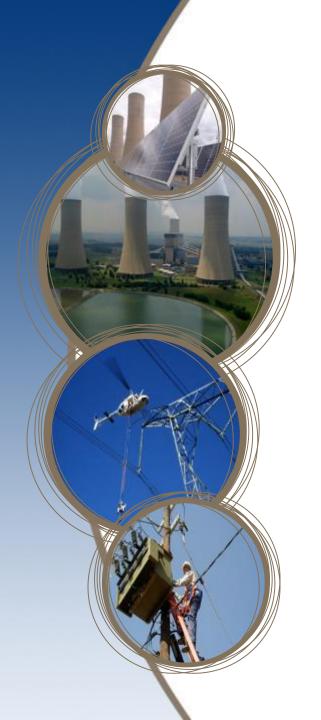


Developments in the Carletonville CLN



- WatershedStrengthening in2021
- Mookodi first 500
 MVA 400/132 kV
 transformer in 2025
- Pluto Mahikeng400 kV line in 2028
- Mahikeng substation in 2028
- Mookodi Mahikeng
 400 kV lines in 2030





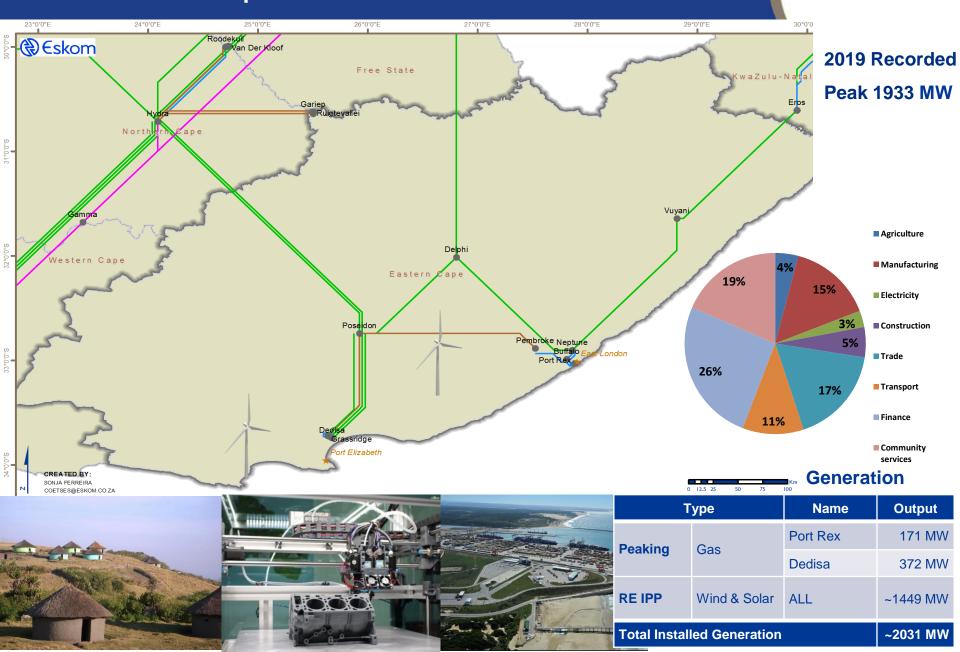


Easter Cape Province

By: Popi Queen Melato Chief Engineer

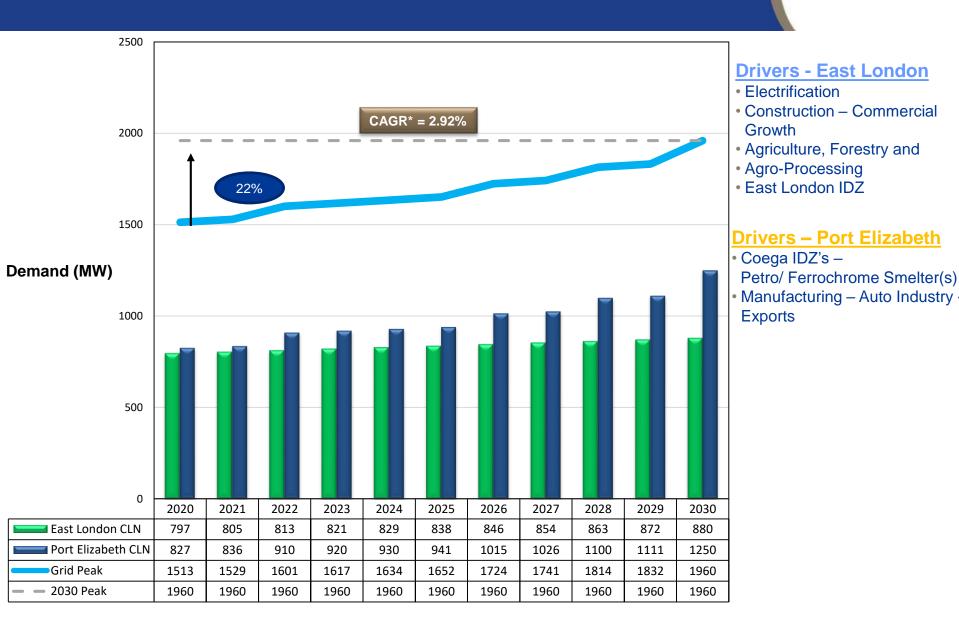
Eastern Cape Province Profile





Eastern Cape Province Load Forecast

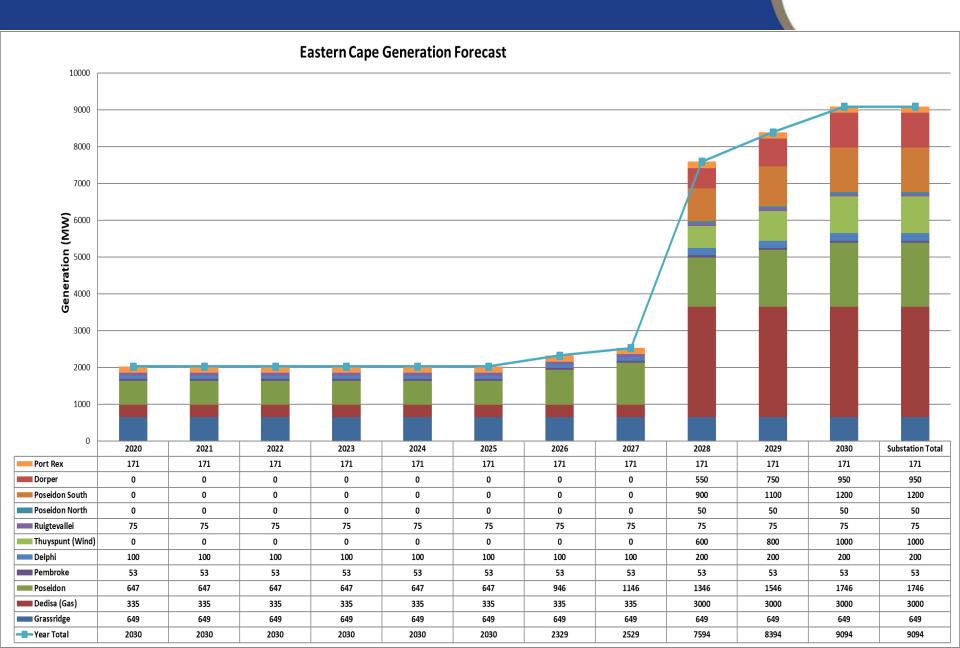




^{*} Compound Annual Growth Rate

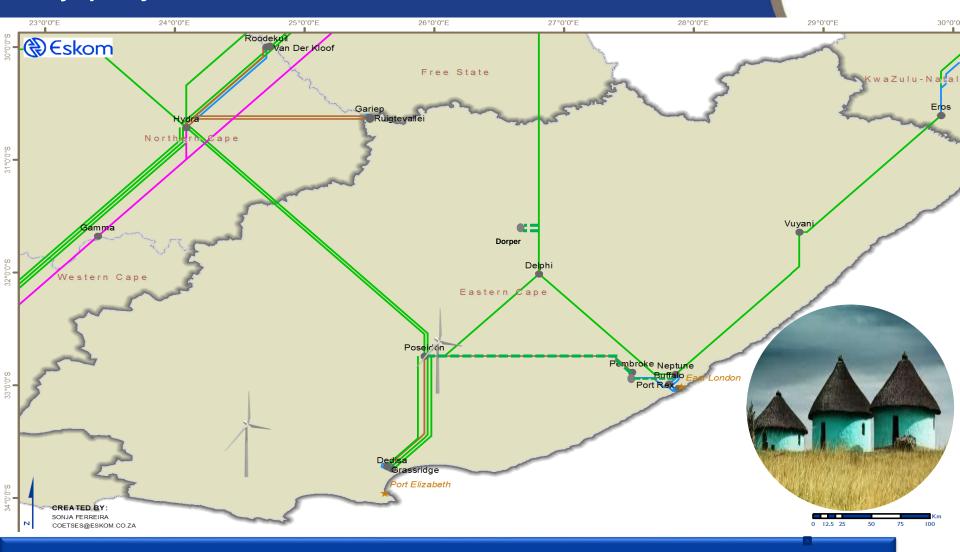
Eastern Cape Generation Forecast





Key projects in the East London area





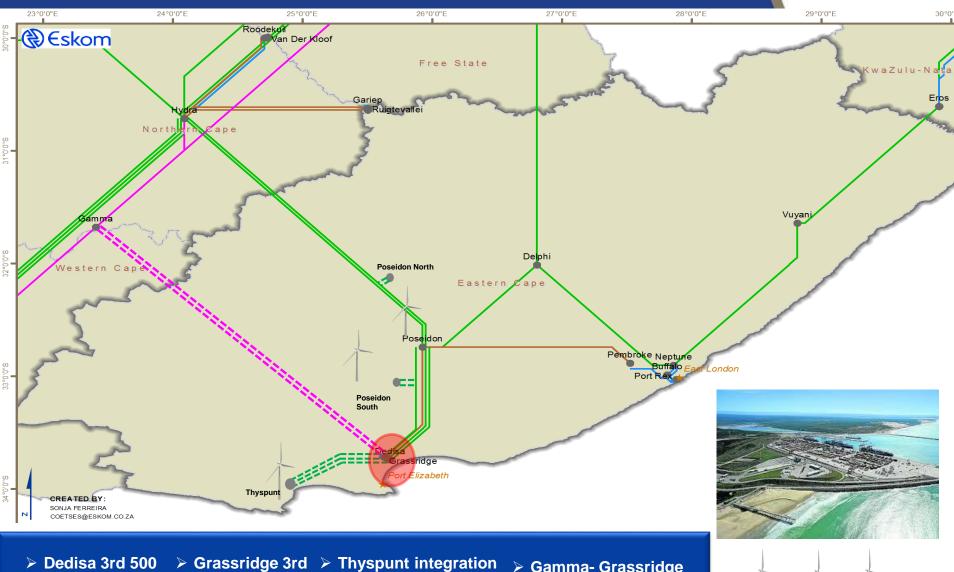
Pembroke 400 kV
Integration

Poseidon – Pembroke400 kV line

Dorper substation integration

Key Projects in the PE CLN





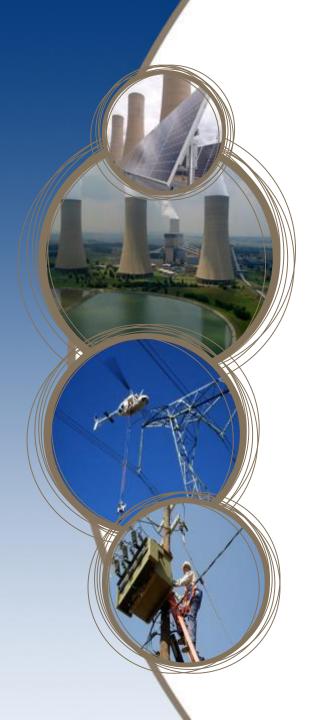
Dedisa 3rd 500MVA TRFR

· Grassridge 3rd →

500 MVA TRFR

Thyspunt integration for wind generation

Gamma- Grassridge2x 765 kV line





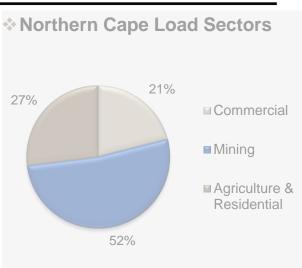
Northern Cape Province

By: Rashaad Tayob Senior Engineer

Northern Cape Province Profile

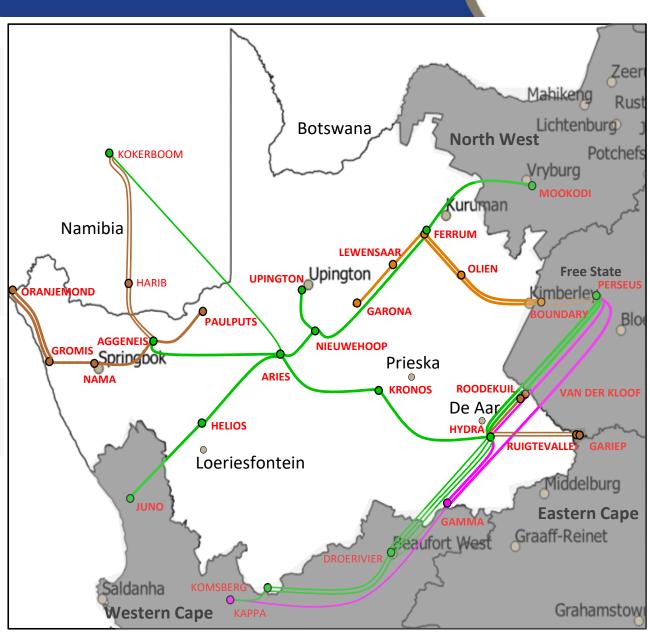






GENERATION

	Van der Kloof Gariep	240 MW 360 MW
	Eskom Total	600 MW
	PV	1580 MW
一人		
₩/ ↑↑	Wind	1040 MW
	Wind	1040 MW 600 MW



Northern Cape Province Load Forecast





^{*} Compound Annual Growth Rate

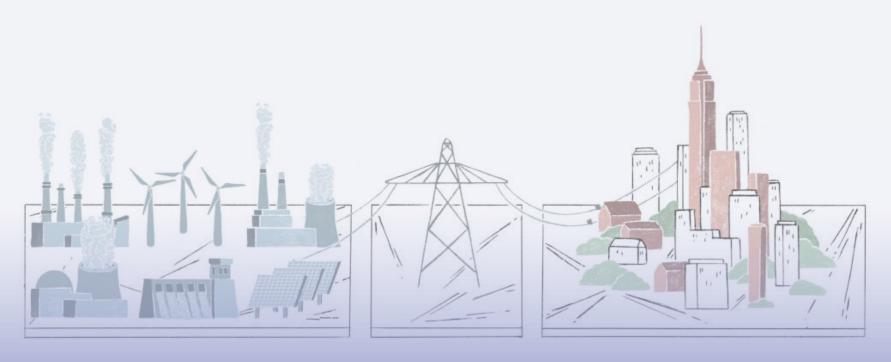
Northern Cape Province Generation Forecast







Transmission Development Plan



Northern Cape Integration Plans required for IRP 2019 (major schemes)



New Transmission Corridors:

- Aries Kronos 400 kV
- Kronos Hydra 400 kV
- Aggeneis Groeipunt 400 kV
- Ferrum Upington 400 kV
- Ferrum Mookodi 400 kV (via
- Mookodi Hermes 400 kV
- Aries Upington 400 kV
- Ferrum Beta 400 kV (via **Boundary**)
- Gromis Nama 400 kV
- Nama Groeipunt 400 kV
- Aries Umtu 765 kV

(initially Aries - Upington - Umtu 400 kV)

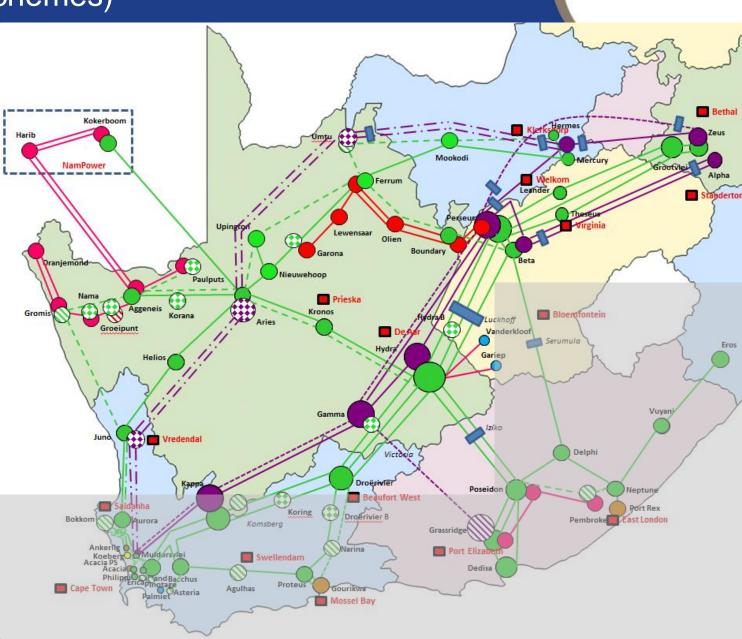
- Umtu Mercury 765 kV
- (initially Umtu Mookodi Mercury 400 kV)
- Gamma Perseus 2nd 765 kV
- Perseus Zeus 765 kV

New Substations:

- Groeipunt 220/132 kV
- Hydra B 400/132 kV
- Korana 400/132 kV
- Umtu 400/132 kV (initially operated as 400 kV switching station)

New Transformations:

- Groeipunt 400/132 kV
- Gamma 400/132 kV
- Garona 400/132 kV
- Nama 400/132 kV
- Aggeneis 400/132 kV
- Aries 400/132 kV
- Paulputs 400/132 kV
- Gamma 765/400 kV
- Gromis 400/132 kV
- Boundary 400/132 kV
- Aries 765/400 kV
- Umtu 765/400 kV



Strengthening Plans for the Namaqualand CLN



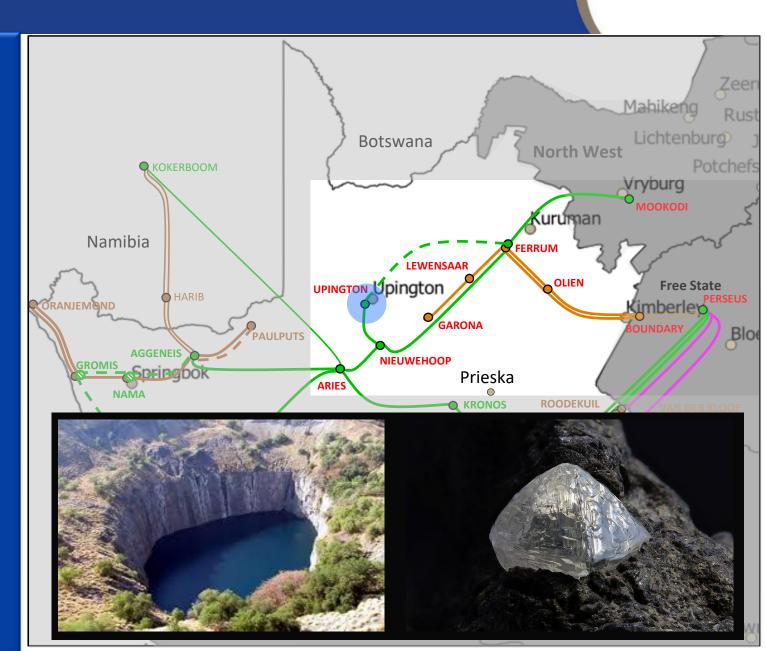
- Juno Gromis 400
 kV line & Gromis
 500 MVA 400/220
 kV transformer
- Nama 20 MVA 66/22 kV transformer
- Aries SVC device
- Helios 20 MVA 132/66 kV transformer
- Aggeneis –
 Paulputs 2nd 220
 kV line (built at 400 kV)



Strengthening Plans for the Kimberley CLN



- Upington 2nd 400/132 kV transformer
- Upington Ferrum 400 kV line

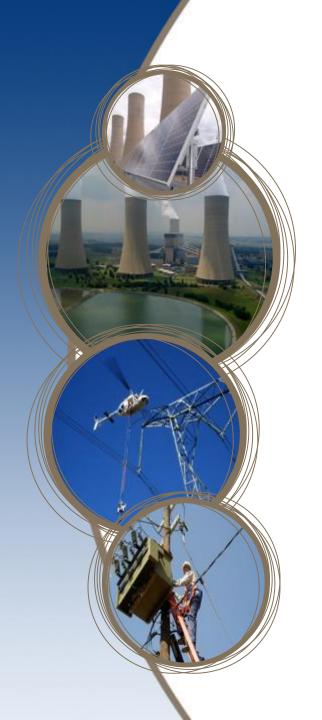


Strengthening Plans for the Karoo CLN



- Ruigtevallei 10
 MVA 132/22 kV
 transformer
- Derate Hydra Ruigtevallei 220 kV line to 132 kV
- Hydra Roodekuil132 kV linestrengthening







Western Cape Province

By: Ahmed Hansa Chief Engineer

Western Cape Province Profile



Transmission Network



- 400 kV: 2 783 km
- □ 765 kV: 546 km

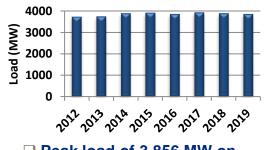


- 13 Substations
- 46 Transformers
- □ 15 045 MVA

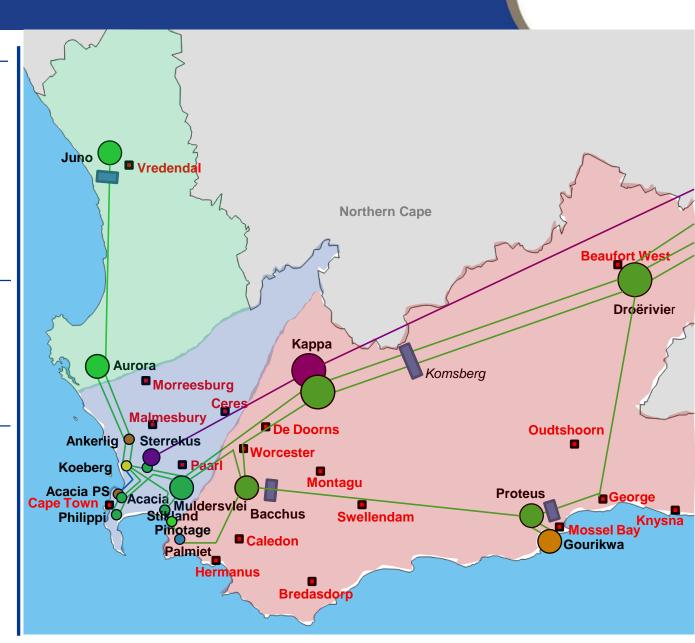
CLNs

- Outeniqua
- □ Peninsula
- West Coast

Load







Existing generating facilities in the Western Cape



Eskom P	ower Stations
Acacia	19 171 MW
Ankerlig	21 1 327 MW
Gourikwa	22 740 MW
Koeberg	3 1 830 MW
Sere	100 MW
Palmiet	400 MW
Total	4 568 MW

	RE IPP	S
PV		134 MW
Wind		316 MW
Total		450 MW

City of Cap	oe Town
Total*	258 MW



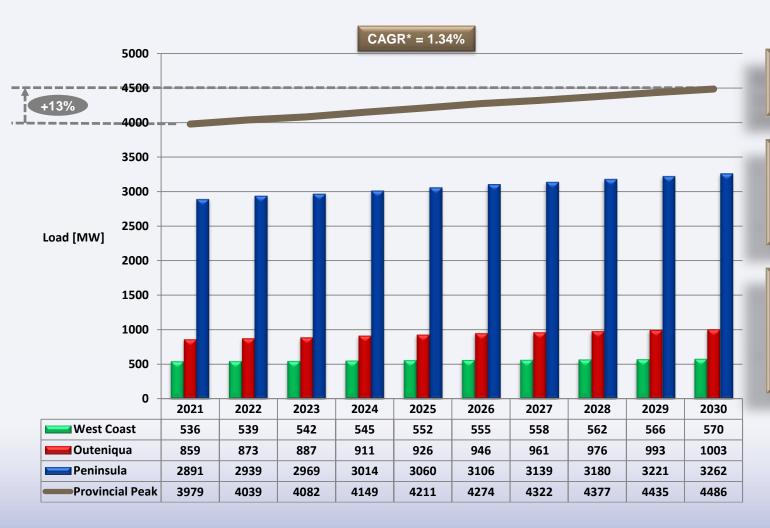
^{*}excludes small scale embedded generation (SSEG)





Western Cape Load Forecast





Residential, commercial and light industrial load growth

- Natural load growth and residential developments
- Reduction in demand at Mossgas
- Load growth due to the Saldanha Bay IDZ
- Reduction in demand at Saldanha Steel

^{*} Compound Annual Growth Rate

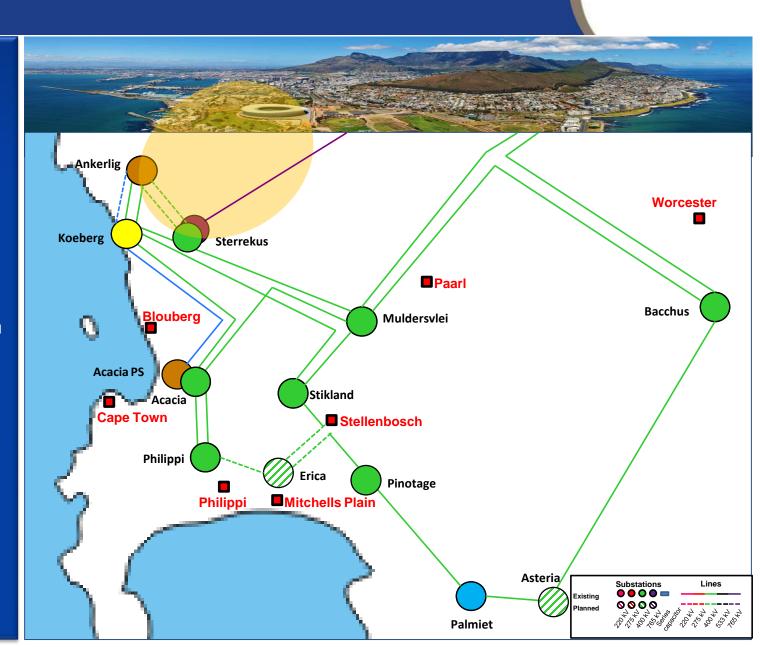




Developments in the Peninsula CLN



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



Pinotage Substation – commissioned July 2020 Photo Credits – Grant Duncan Smith (http://www.subiaco.co.za)

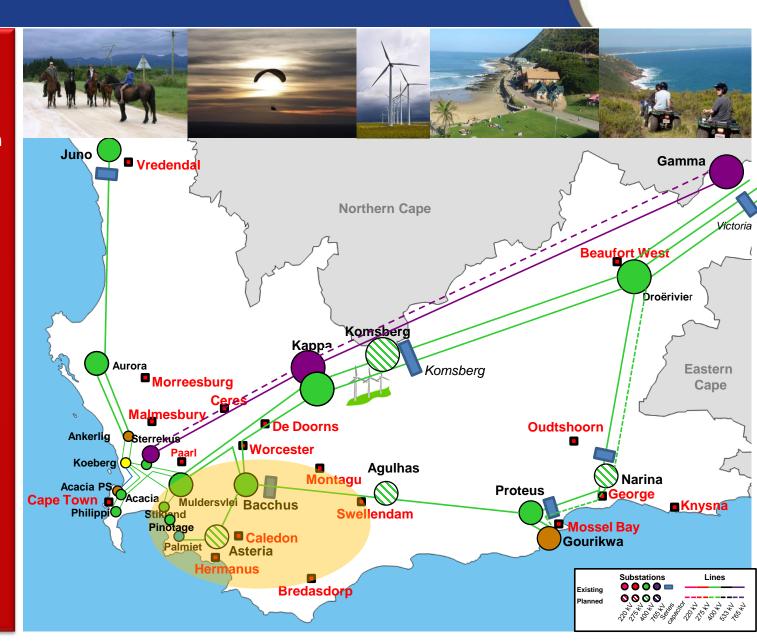




Developments in the Outeniqua CLN



- Asteria Substation
- Agulhas Substation
- Kappa 400/132 kV transformation
- Komsberg 400/132 kV Substation
- Narina Substation
- Gourikwa-Narina-Droërivier 400 kV line – Strategic EIA
- Cape Corridor Phase 4



Komsberg Substation – under construction (Photo Credits – Conco)

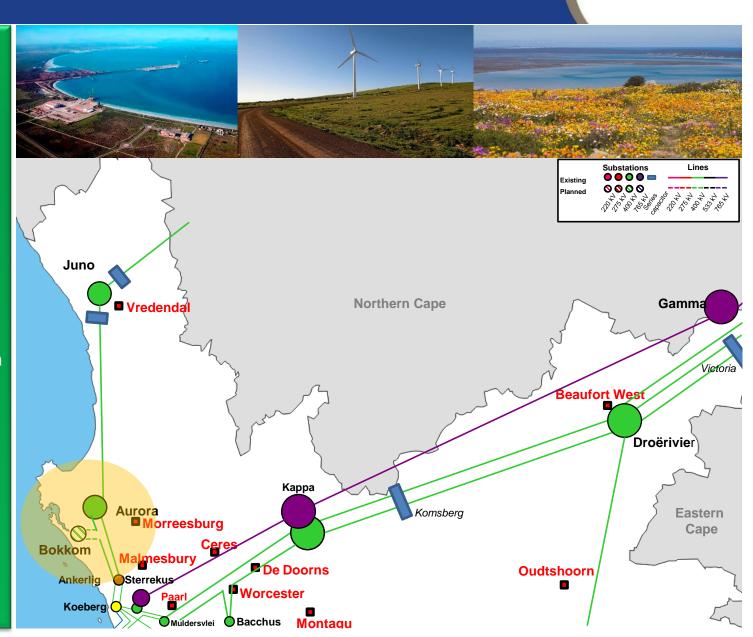




Developments in the West Coast CLN



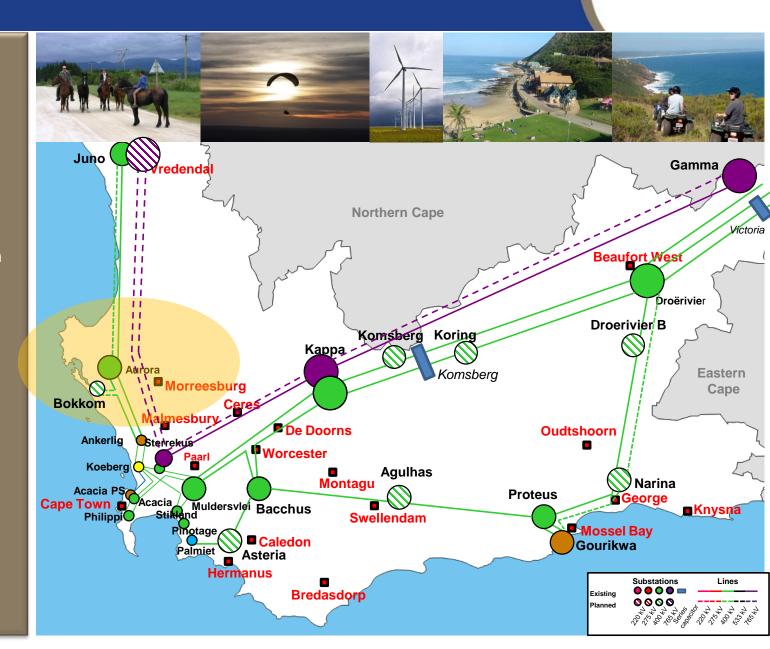
- Bokkom Substation (Phase 1)
- Aurora transformation upgrade
- Juno transformation upgrade
- PCB series cap phase out plan



Developments for future IPPs



- Aurora Juno 2nd
 400 kV line
- Cape CorridorPhase 5 and 6
- Koring Substation
- Droerivier B
 Substation







Thank you





Transmission Development Plan 2021 – 2030

Summary and Capex Analysis

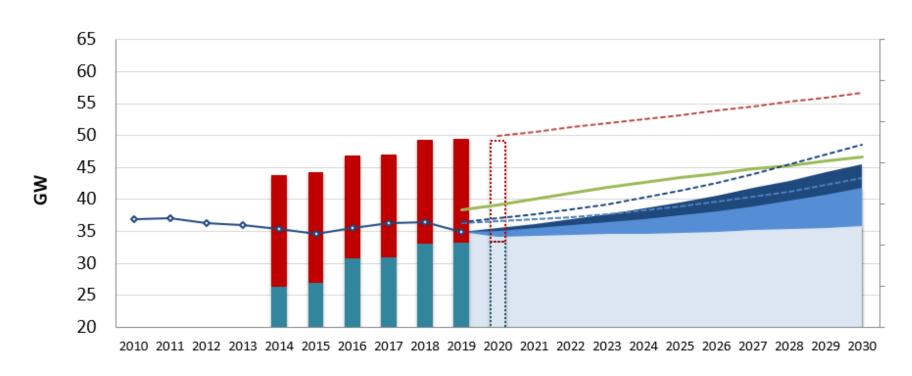
By: Leslie Naidoo

Senior Manager: Infrastructure Investment Planning

Recap: Assumptions on the demand forecast

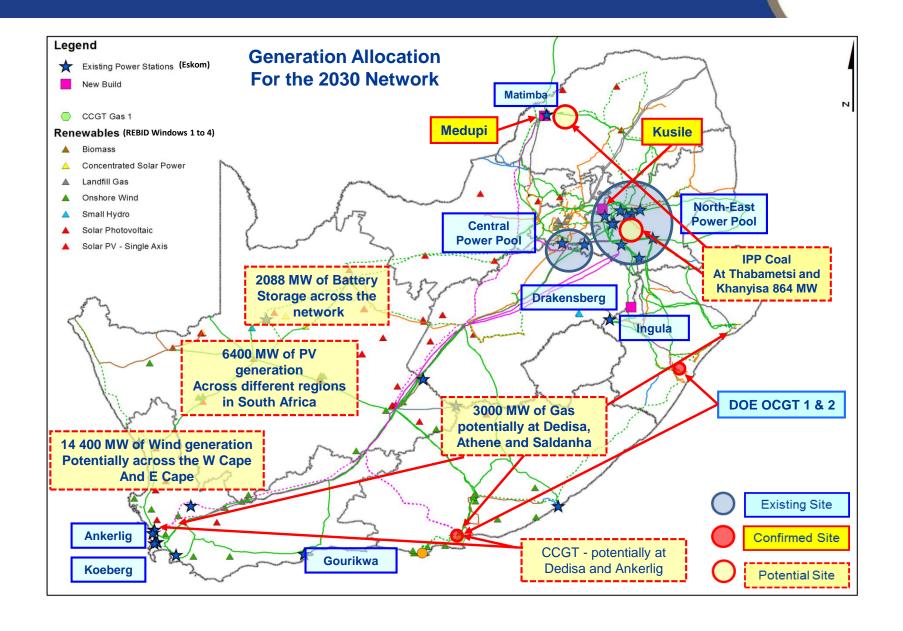


National Demand Forecasts (GW) at Time of System Peak shown with the 2019 forecast, and the IRP 2019 forecasts for the TDP period 2021-2030



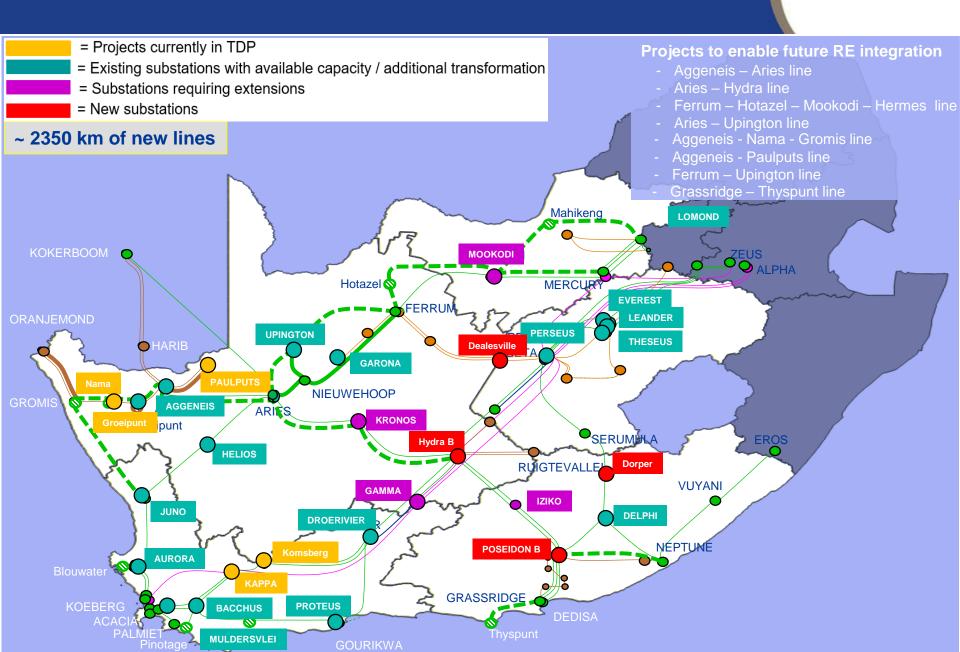
Recap: Assumptions on the Generation Pattern





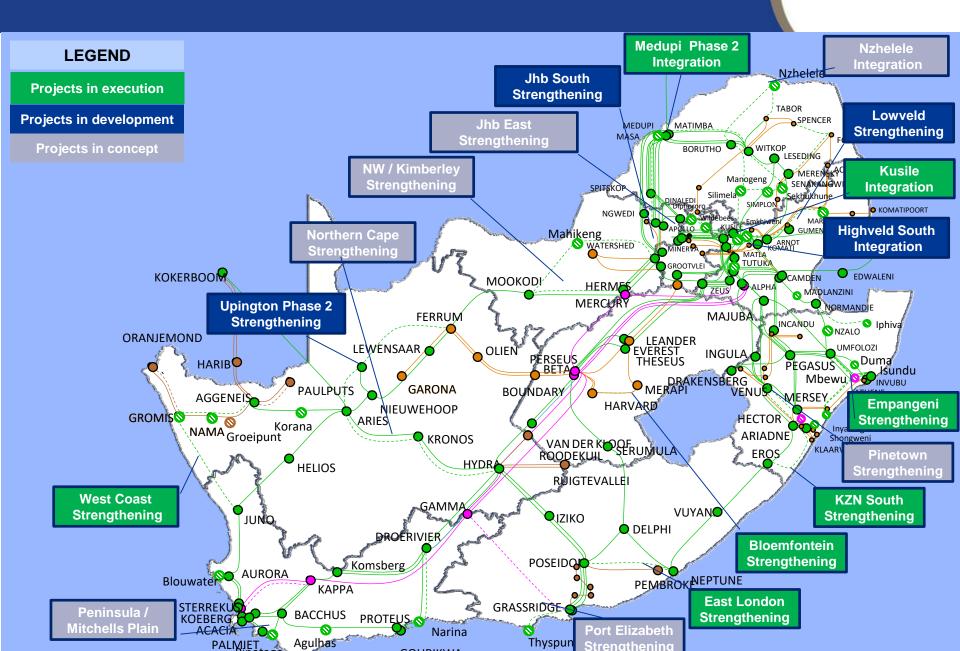
Transmission integration plans for the IRP 2019





Major Projects planned in the TDP period

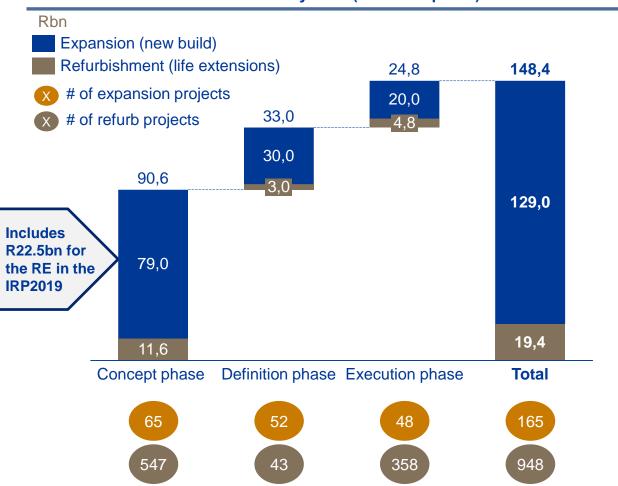




TDP 2020 Project Life Cycle Model (PLCM) summary







Challenges / Actions:

Key Challenges:

- Capex constraints
- Servitude acquisitions
- Supplier and construction capability

Actions taken:

- Prioritisation of the project portfolio
- Maximise of available capex
- Re-align the plan taking into consideration the key challenges
- **Developed a realistic and** achievable plan

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Summary of Transmission infrastructure requirements over the TDP period



Transmission Assets	New Assets expected	New Assets expected	Total New
Nationally	2021 - 2025	2026 - 2030	Assets
Power lines (km)			
765 kV	396	1592	1988
400 kV	4230	1966	6196
275 kV	63	9	72
Total length (km)	4689	3567	8256
Transformers			
Number of units	62	49	111
Total capacity (MVA)	29220	23655	52875



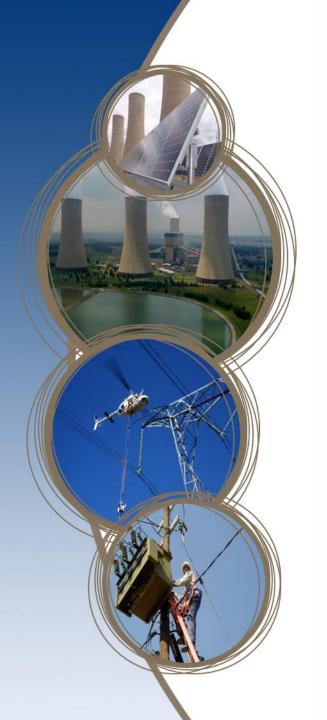
Based on the TDP network requirements for sustainability ~ R130bn

Transmission Assets	New Assets expected	New Assets expected	Total New
Nationally	2021 - 2025	2026 - 2030	Assets
Power lines (km)			
765 kV	76	762	838
400 kV	2609	2132	4741
275 kV	29	43	72
Total length (km)	2714	2937	5651
Transformers			
Number of units	31	52	83
Total capacity (MVA)	15010	26 585	41595



Based on the revised and "realistic" Plan

~ R87bn





TDP 2020 Capex Analysis

Transmission capital expenditure drivers



1. Capacity Expansion and Network Strengthening:

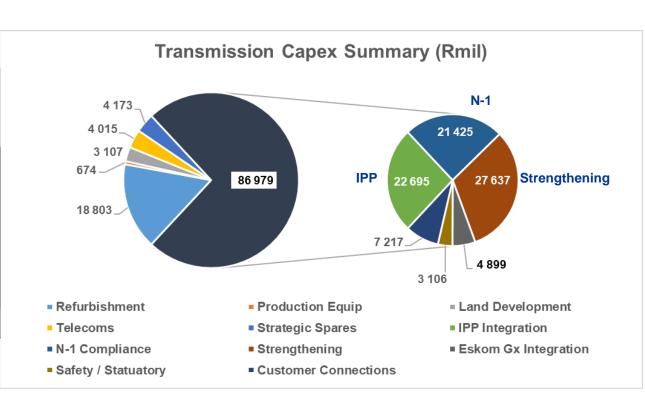
- Integration of new generation (~30GW) as per the IRP2019 in areas with limited networks
- Investments in "back-bone" strengthening to dispatch power to the major load centres
- Connection of committed customer loads (Accepted / issued Budget Quotes)
- Reliability Investments (N-1) for network sustainability
- Mitigation of Fault-level Exceedances (existing and anticipated)
- Securing of Servitudes and Environmental Authorisations
- Compliance (Regulatory, OHSAct, Environmental etc.)
- 2. Refurbishment (i.e. Extension of Life of Existing Assets): Implementation of the Transmission Sustainability Improvement Plan to address:
 - Maintenance "backlogs" due to outage challenges and increased failure rate of ageing plant
 - Refurbishment of ageing equipment (CTs, VTs, Surge Arresters, H.V. Circuit Breakers and Power Transformers, Protection and Control Systems)
 - Refurbishment of ageing and "obsolete" telecommunications infrastructure
 - Asset Performance Improvements (lines and substation equipment)
 - 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.)

Transmission 10 year CAPEX Plan: FY2021 - 2030



Summary of Transmission Capex Plan (R Million) FY 2021 – 2030 (after considering the key challenges faced)

Transmission Capex Categories (Rmil)	Total FY21- FY30
Capacity Expansion	86 979
Refurbishment	18 803
Production Equipment	674
EIA & Servitude	3 107
Telecoms	4 015
Strategic Spares	4 173
	117 751



Notes: 1) The TDP 2019 and MYPD4 was based on the draft IRP2018

2) The IRP2019 requires an accelerated execution plan especially in the next 5 years

Risk and challenges



- Future determinations on the MYPD applications may impact Eskom's revenue stream and hence the execution of the TDP.
- Eskom's liquidity position could result in further restrictions to capex allocations across all Division.
- Servitude acquisitions remains a huge challenge and we appeal for support to all concerned (Local and National Authorities, land owners, developer etc.) to come together to resolve this challenge
- Transmission's infrastructure for the IRP2019 to integrate ~ 30GW of new capacity would require an acceleration to the execution programme, hence placing huge demands on limited resources across the value chain (including suppliers and construction industry)
- Capex curtailment and deferments over the years places huge pressure on the Transmission build programme ito "back loading" as well as on the sustainability of supplier and construction industry

Closing remarks



- ➤ The success of the TDP 2020 requires a concerted effort by all role players including our stakeholders in Government, Customers, the various RE associations, as well as the supplier and construction industry across the value chain.
- ➤ In closing I wish to emphasize that our role in Transmission is to provide an open and transparent access to the power system.







