The Eskom Transmission Development Plan (TDP) 2023 - 2032

27 October 2022

08:30 - 09:00	**Join MS Teams Live Event**	**All**
09:00 - 09:05	Opening and welcome	**Popi Njapha** Chief Engineer: Grid Planning
09:05 - 09:15	Keynote address	**Segomoco Scheppers** Managing Director: Transmission
09:15 - 09:30	TDP 2022 Overview / Setting the Scene	**Makoanyane Theku** Senior Manager: Customers and Grid Connection
09:30 - 10:00	Transmission Demand Assumptions, Analysis and Impact of Renewables	**Ronald Marais** Senior Manager: Strategic Grid Planning
10:00 - 10:15	System Operations Implications on Ancillary Services	**Siju Joseph** Manager: Ancillary Services
10:15 - 10:30	Grid Assets Refurbishment Plans	**Calvin Govindasamy** Chief Engineer: Asset Investment Planning
10:30 - 10:40	***Comfort Break***	**All**
10:40 - 11:50	Provincial Development Plans (Northern & Southern Grids)	**Caroleen Naidoo / Thokozani Bengani** Chief Engineer: Grid Planning
11:50 - 12:00	TDP 2022 Summary	**Leslie Naidoo** Senior Manager: Grid Planning
12:00 - 12:10	***Comfort Break***	**All**
12:10 - 12:20	TDP Delivery Interventions	**Prince Moyo** General Manager: Asset Management
12:20 - 12:30	TDP Project Schemes in Execution	**Naresh Singh** General Manager: Transmission Projects Delivery
12:30 – 13:00	General discussion (Q&A) and Closure	All

Keynote Address

Segomoco Scheppers
Managing Director: Transmission

Setting-the-scene

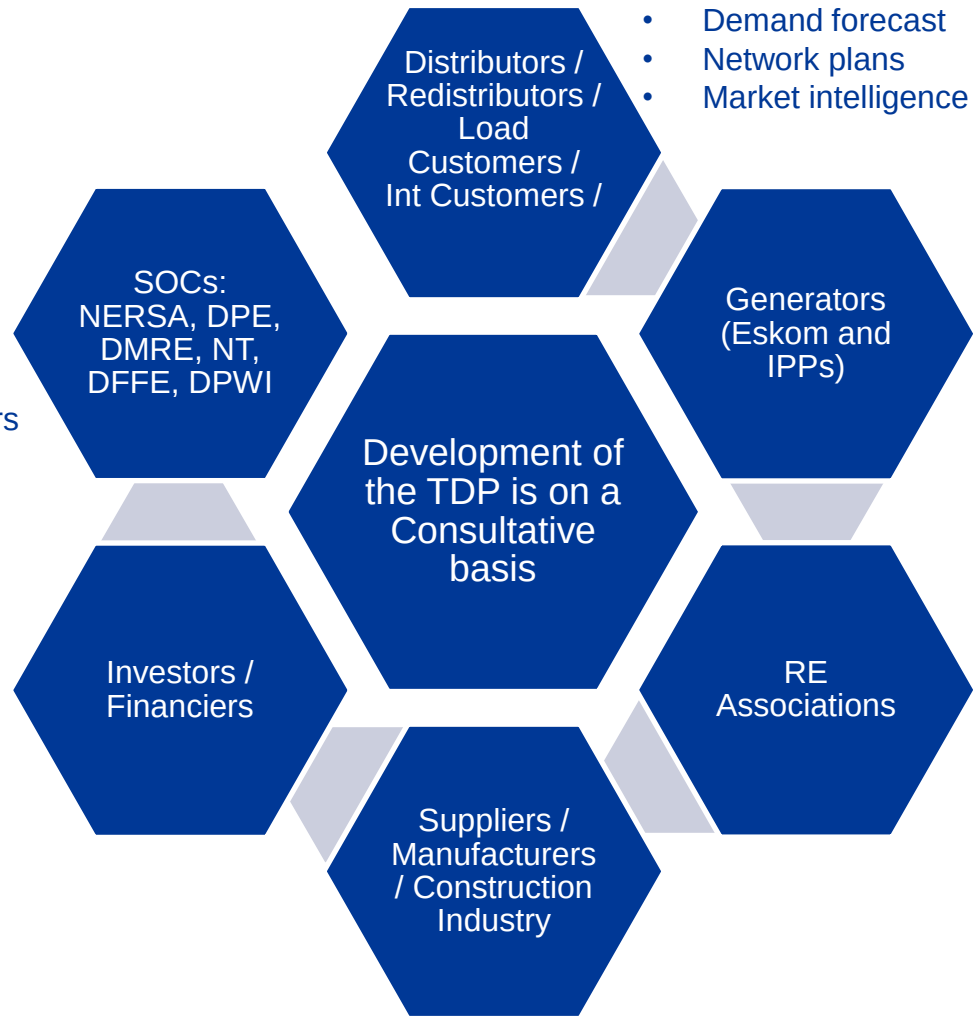
Makoanyane Theku
Senior Manager: Customers & Grid Connection

Background to the TDP 2022

- The TDP is a Transmission **licence** requirement that emanates from the **Grid Code** which states that "The *NTC* shall annually publish a minimum five-year-ahead *TS* development plan by end October, indicating the major capital investments planned *(but not necessarily approved)*."

- The **key change** from last year's TDP 2021 is associated with the **new generation capacity assumptions**. While the TDP 2021 focused predominantly on the Integrated Resource Plan (IRP) 2019 for these assumptions, the TDP 2022, apart from the IRP 2019, also factored in the following:
  - Eskom's 2035 Corporate Strategy,
  - Connection applications received through the various DMRE procurement programmes,
  - Information obtained through consultations with RE associations, as well as,
  - Applications received from the non-DMRE integration programmes

Background to the TDP (consultative process)



- Demand forecast
- Network plans
- Market intelligence

- Generation forecast
- Future aspirations

- Understanding the RE plans for the Country
- Alignment of plans
- Addressing technical matters ~ inverter based technologies

- Industry capacity assessment
- Sharing of TDP build requirements

- Project funding opportunities

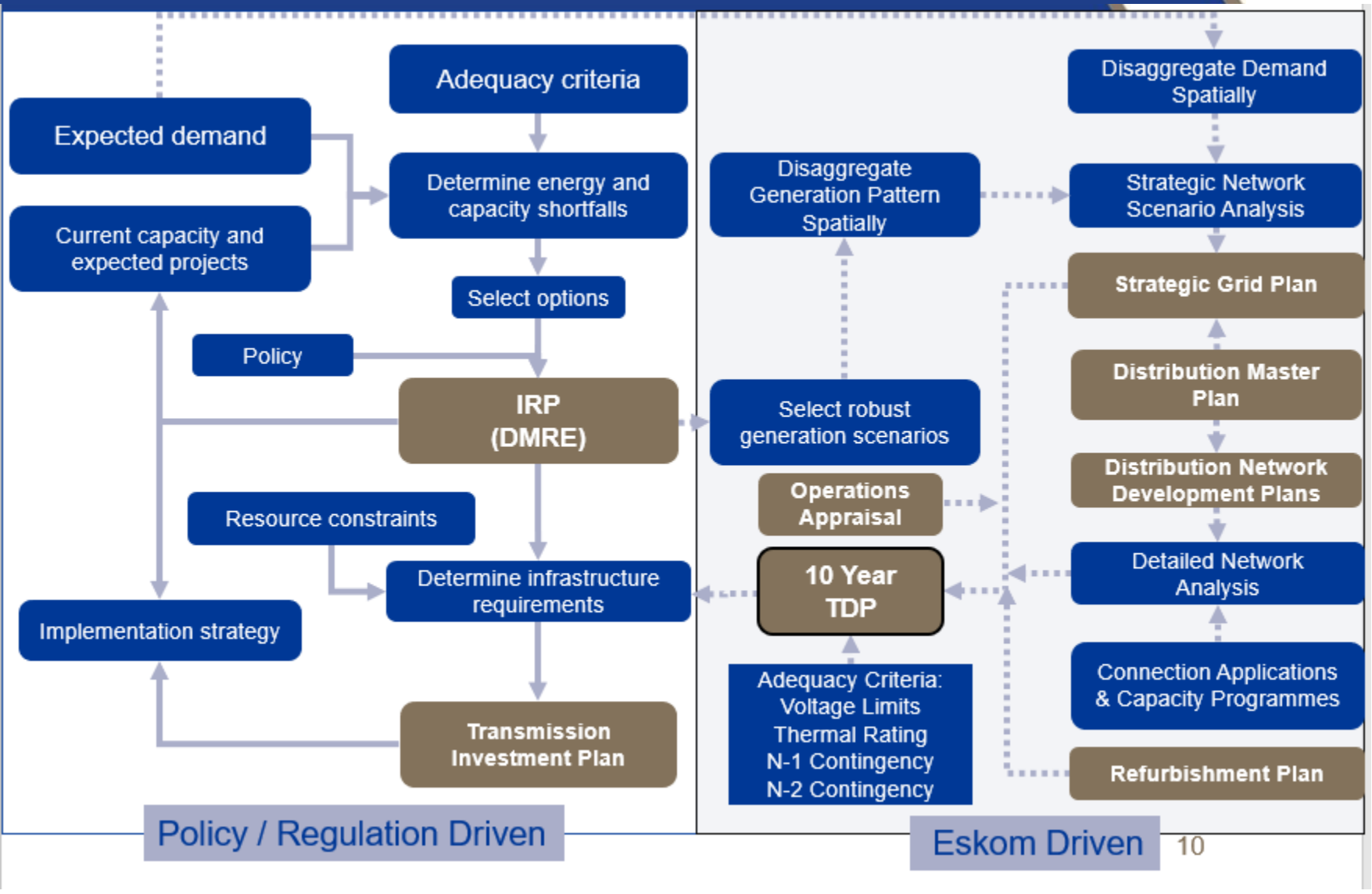
- Policy alignment and compliance
- Alignment of plans with Country aspirations
- Assistance with e.g. Servitudes, PFMA, industry capacity matters etc.

Overview and purpose of the TDP Public Forum

The purpose of the presentation is to:

- Contextualise the planning timelines relating to the demand forecast and generation patterns
- Share information and results relating to the integration of new generation capacity and address the future network requirements
- Share assumptions and results from the Transmission Development Plan 2023 – 2032 for both the capacity expansion and refurbishment portfolios
- Share information on the initiatives undertaken to implement the TDP, as well as challenges experienced on projects in execution
- More importantly, to solicit comments and inputs to improve on the Transmission Plans

Planning for the integrated power system



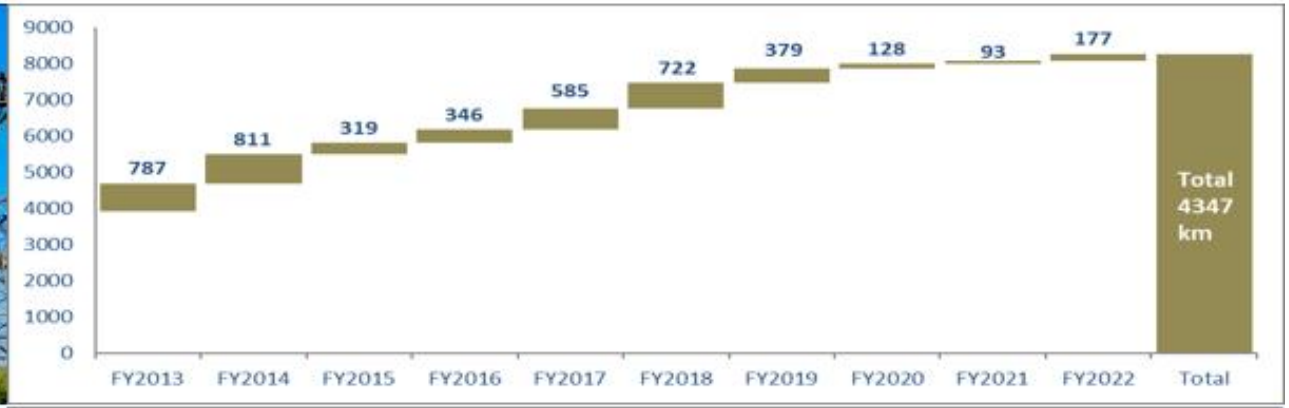
Recent Transmission Network Expansion Successes

Historical investments in the Eskom power system: 8.1 GW of generation, ~ 4347 km of transmission lines, and ~19 GVA of transformation capacity

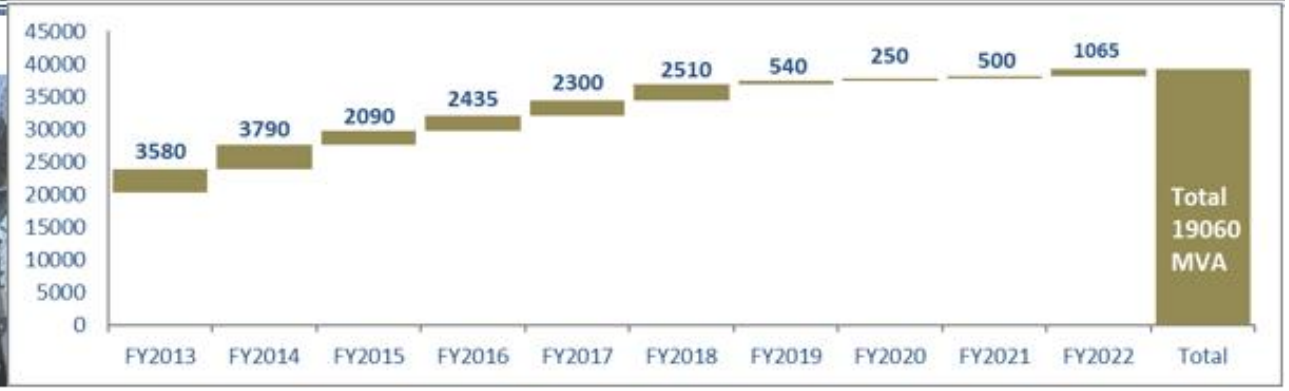
Eskom

Generation Integration (MW)

Transmission lines (km)



Transmission Substations (MVA)



DMRE IPP programme overview – end Sept 2022

Peakers	REIPP BW1	REIPP BW2	REIPP BW3&3.5	REIPP BW4&4B	RMIPPP	REIPP BW5	REIPP BW6++
2 projects 1005 MW	28 projects 1415 MW	19 projects 1033 MW	18 projects 1628 MW	26 projects 2205 MW	11 projects ~2000 MW	25 projects ~2583 MW	TBA projects ~5200 MW
All projects connected	All projects connected	All projects connected.	17 projects connected, 1 project in execution phase	25 projects connected, and 1 in execution phase	11 preferred bidders. 3 Projects currently in construction (150MW - PV with BESS)	25 preferred bidders. 3 PPAs signed so far. FC expected by Dec 22/Jan 23 for these projects	BW6 bid submissions received, to be evaluated. Storage, Gas proposals in planning phase

Up to BW5: ~12 GW from ~ 129 individual projects

91 projects totalling 7110 MW have been commissioned, of which 6105 MW is from RE Sources

- Eskom has committed Capital to enable the integration of successful bidders (Bid Windows 1 – 5) to the National Grid.
- Beyond BW5, the Transmission network capacity in the Western, Eastern and Northern Cape regions is severely constrained / limited and would require substantial strengthening at local and corridor level to provide additional network capacity to integrate the RE plants to the system.

Today's Programme:

Apart from the usual TDP assumptions and provincial plans that we normally share at the public forum, today's presentation also includes:

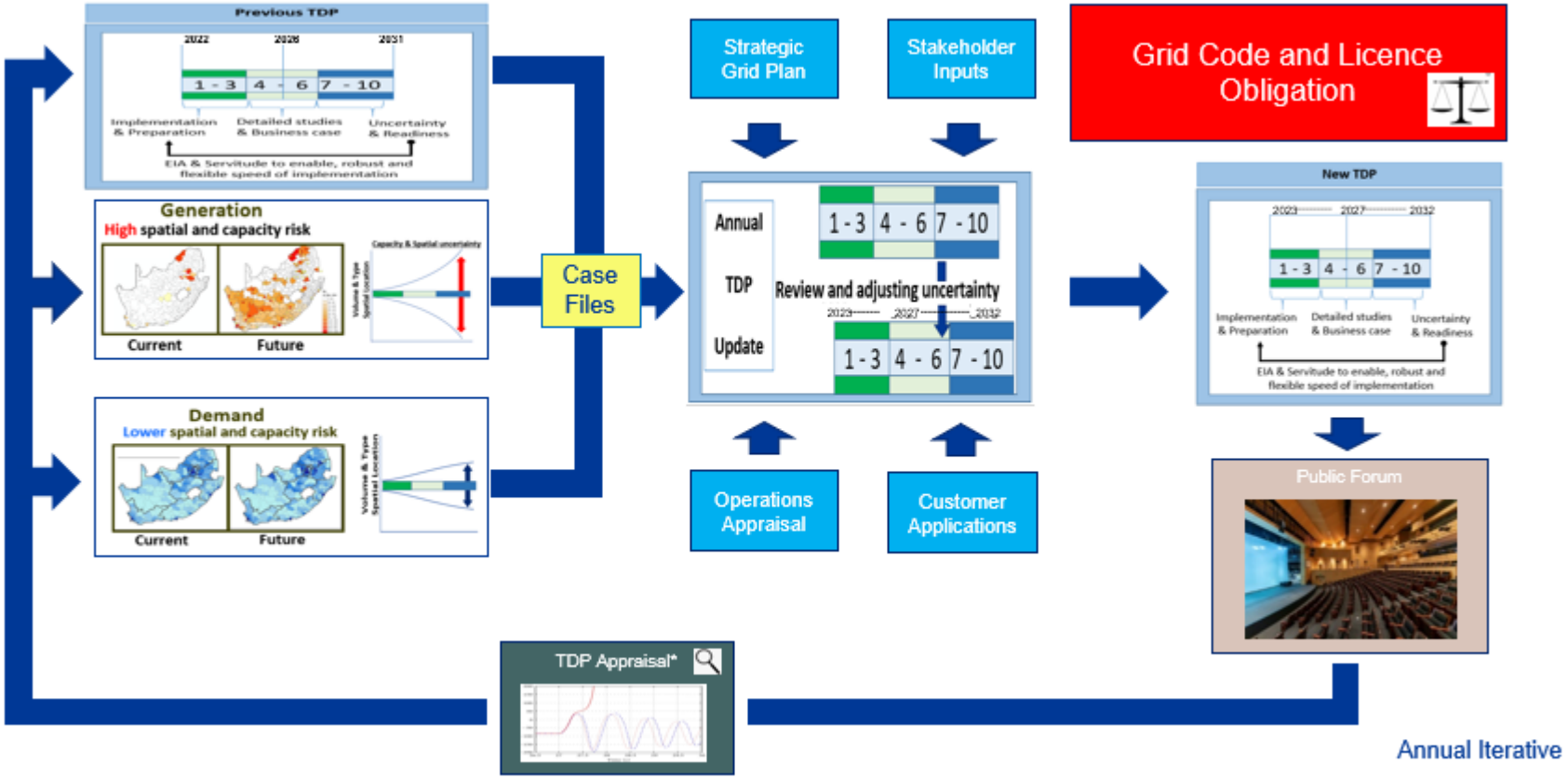
1) Implications to ancillary services by our System Operator
2) Initiatives undertaken to deliver on the TDP implementation
3) Experiences related to projects in execution

I hope you find today's engagements fruitful and we look forward to your feedback!!

The TDP 2023 - 2032 Assumptions on the Demand and Generation Forecast

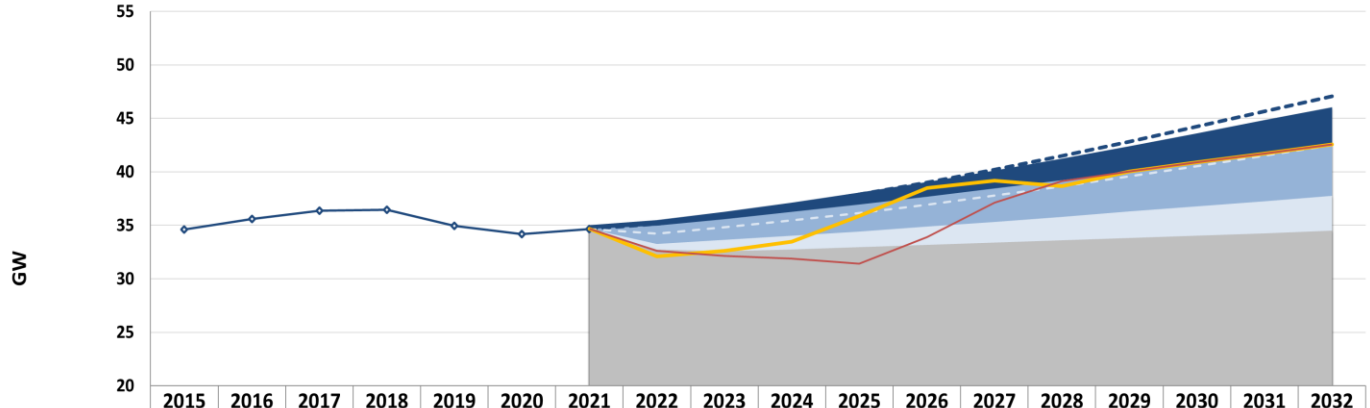
Ronald Marais
Senior Manager: Strategic Grid Planning

TDP process overview



Transmission national demand forecast

National Demand Forecasts (GW) at Time of System Peak shown with the 2022 forecast, for the TDP period 2023 -2032 with six scenarios, Tx High, Tx Moderate, Tx Medium EE, Tx Low and Constrained 1 & 2

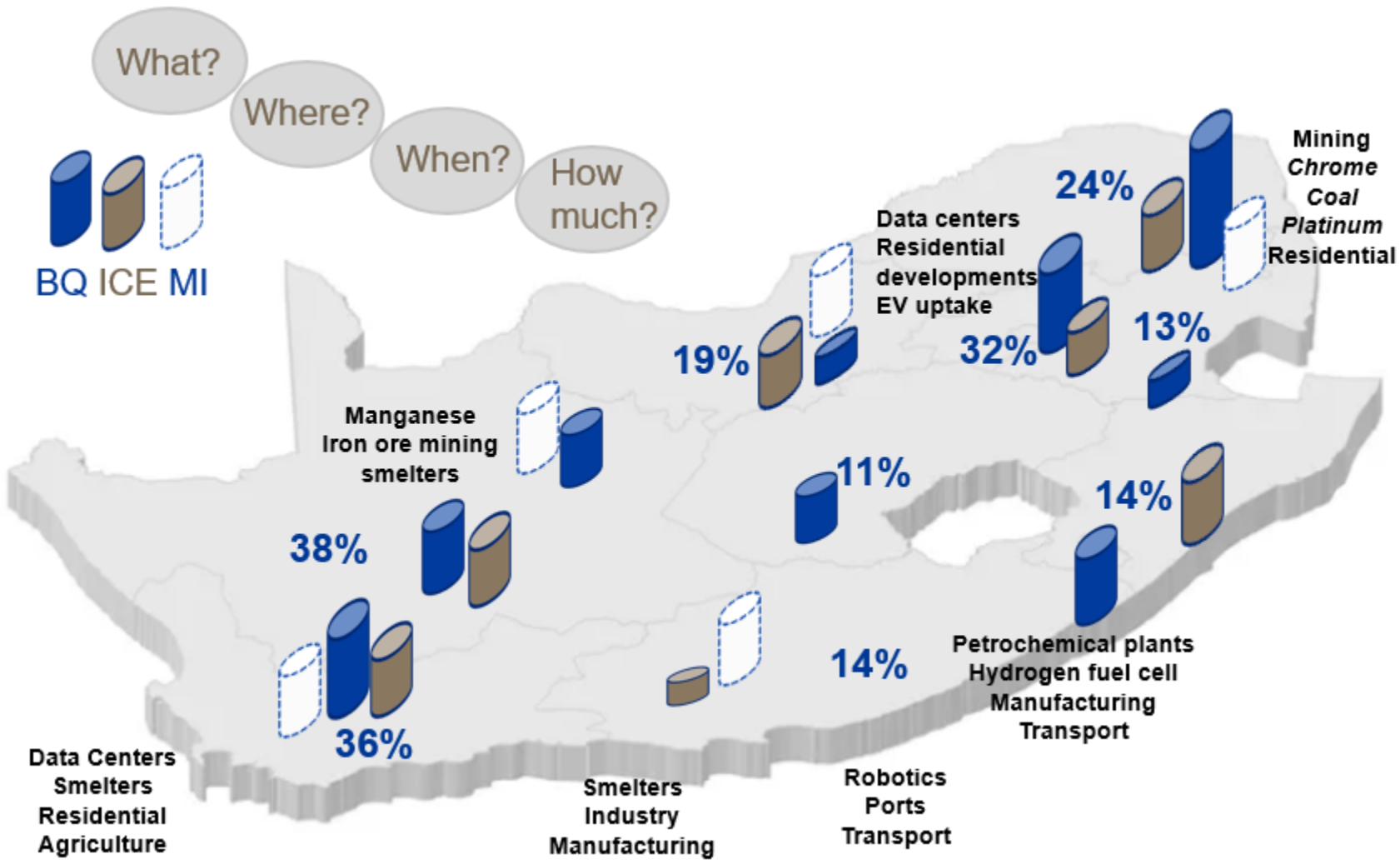


*Instantanious Peak Demand

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2022 Tx High							35	35	36	37	38	39	40	41	42	44	45	46
2022 Tx Moderate High							35	35	36	36	37	38	38	39	40	41	42	43
2022 Tx Medium EE / EI							35	33	34	34	34	35	35	36	36	37	37	38
2022 Tx Low							35	33	33	33	33	33	33	34	34	34	34	34
2021 Tx High							35	35	36	37	38	39	40	41	43	44	46	47
2021 Tx Moderate High							35	34	35	35	36	37	38	39	40	41	42	43
Actual Peak Demand (GW) *	34.6	35.6	36.4	36.4	35.0	34.2	34.7											
Constrained Scenario 1							35	32	33	33	36	38	39	39	40	41	42	43
Constrained Scenario 2							35	33	32	32	31	34	37	39	40	41	42	43

- The forecast has been revised down due to lack of gen capacity, Covid-19 effects, and sustained economic downturn
- The Tx Moderate High Forecast will be used for planning purposes
- Because of previous higher forecasts projects affected by load will be reprioritized
- **Generation has become the primary driver of infrastructure development henceforth**

Provincial allocation of demand potential



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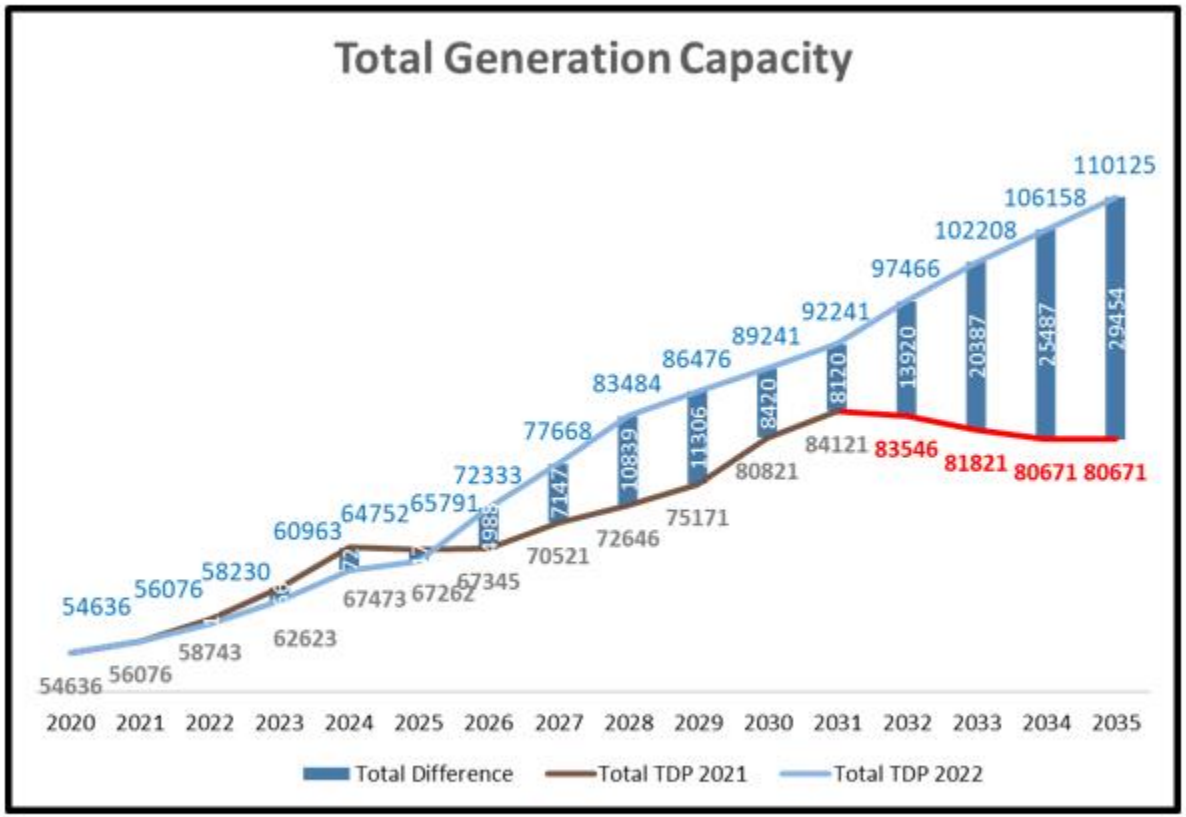
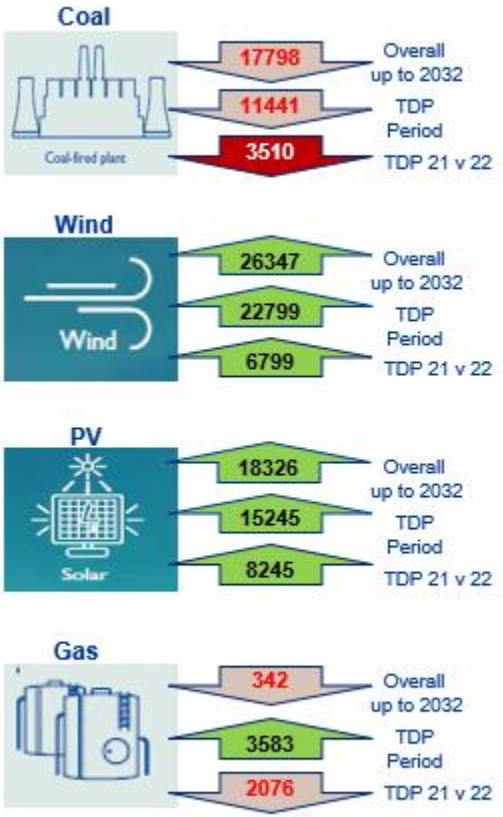
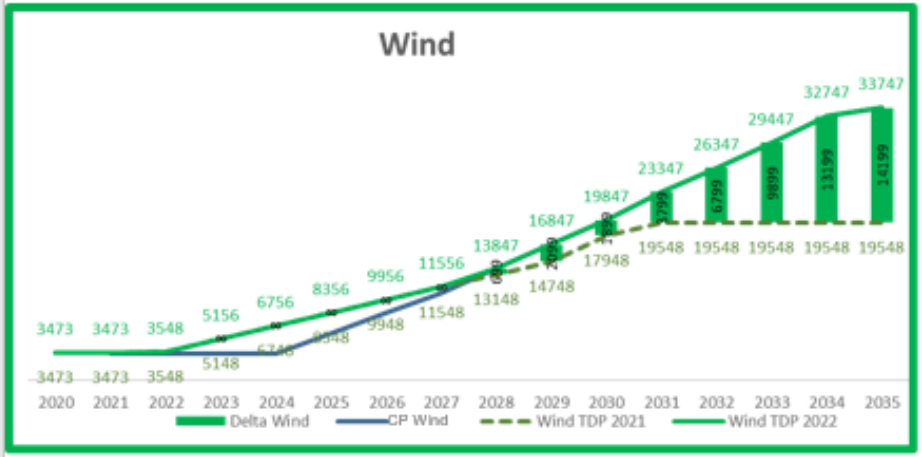
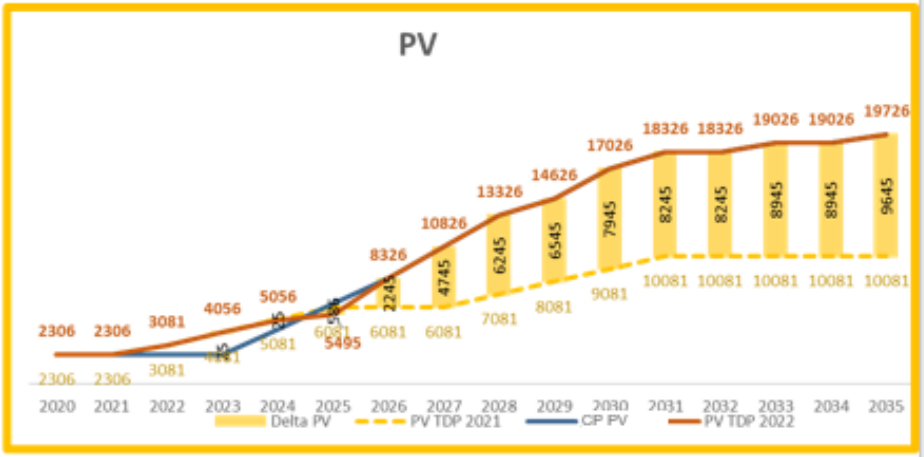
Generation capacity forecast

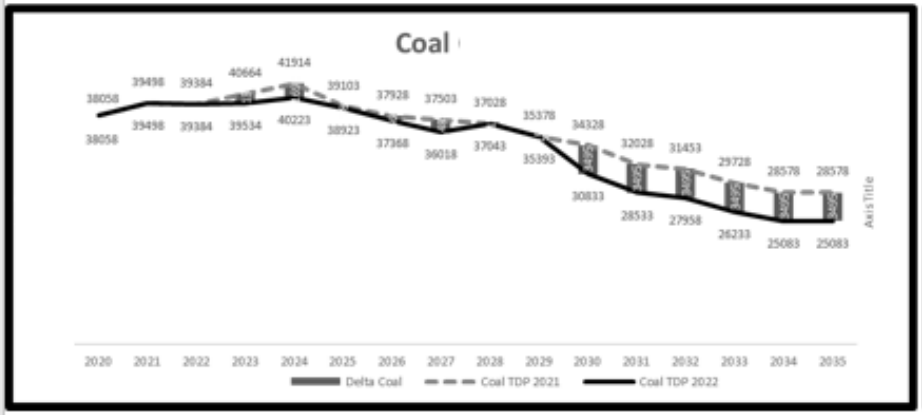


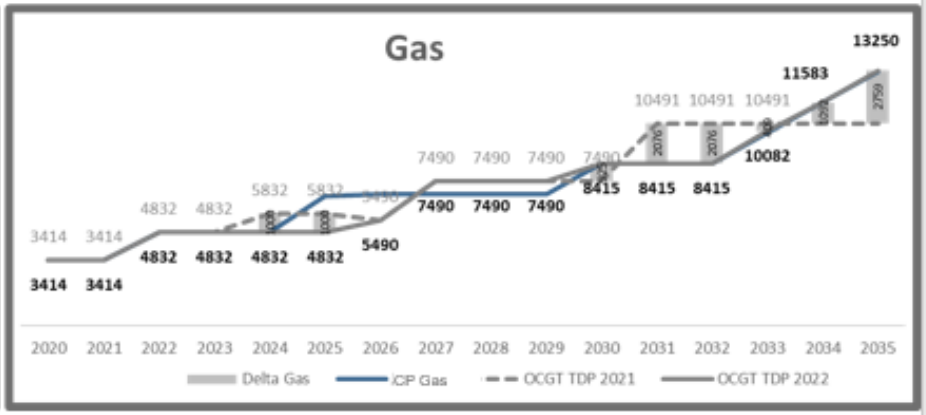


Generation comparisons (TDP 2021 vs TDP 2022)



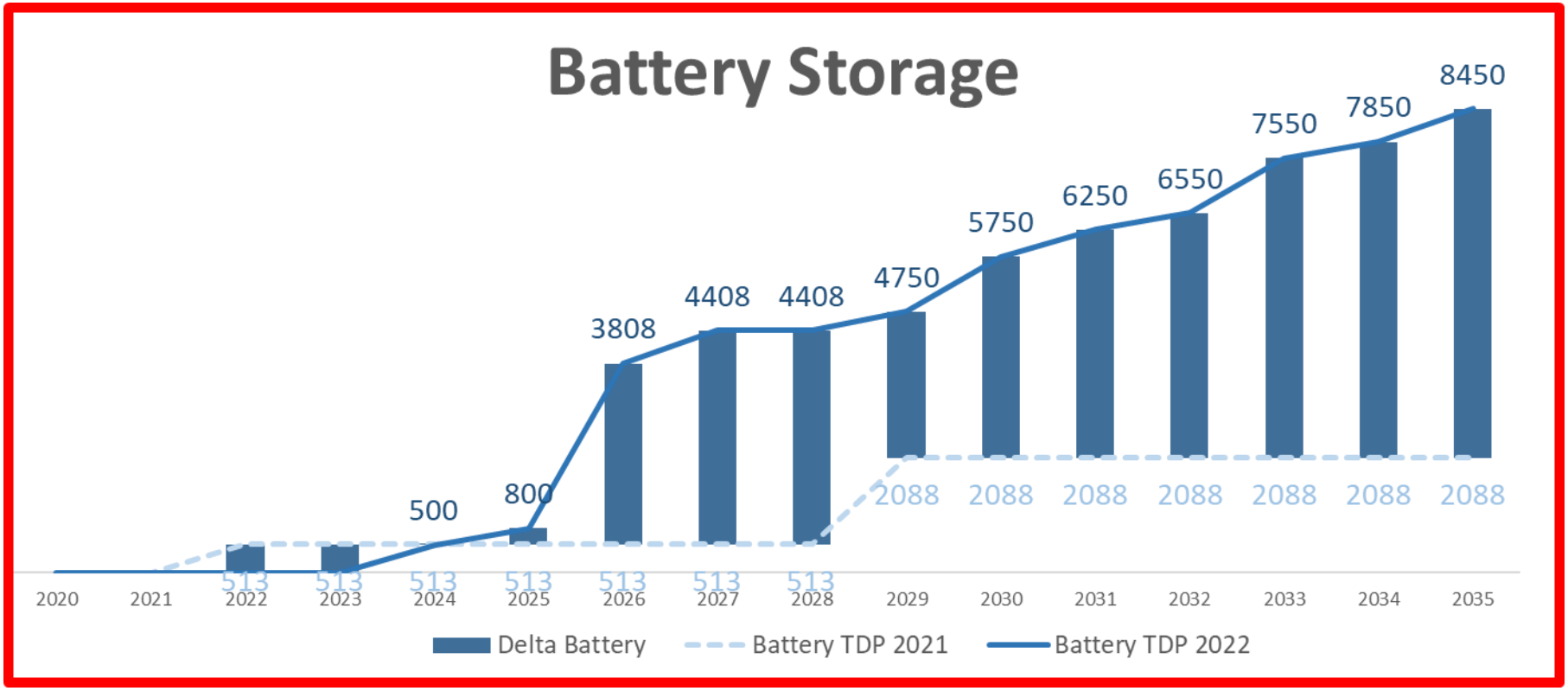




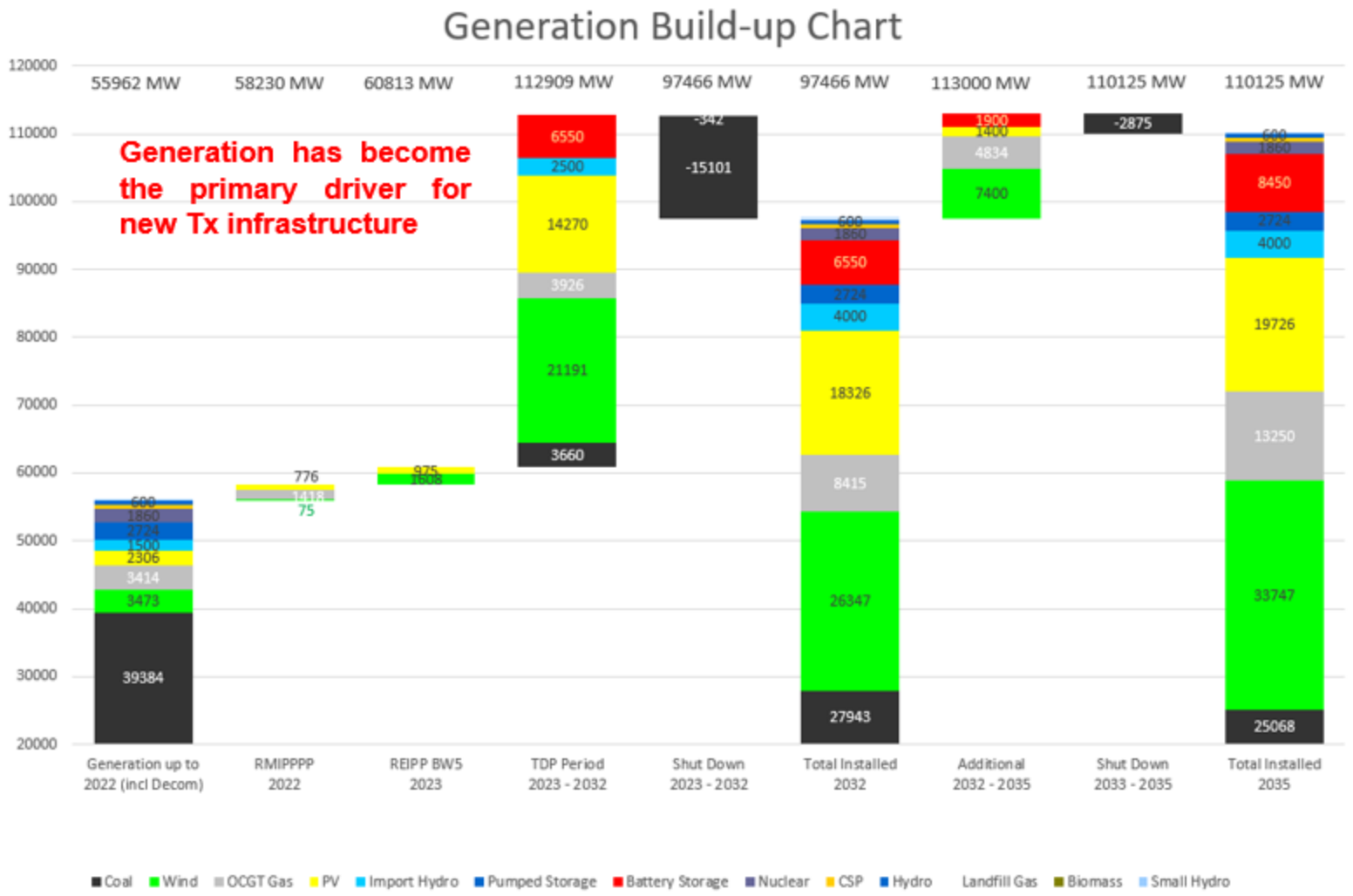


CP – Corporate Plan 2035

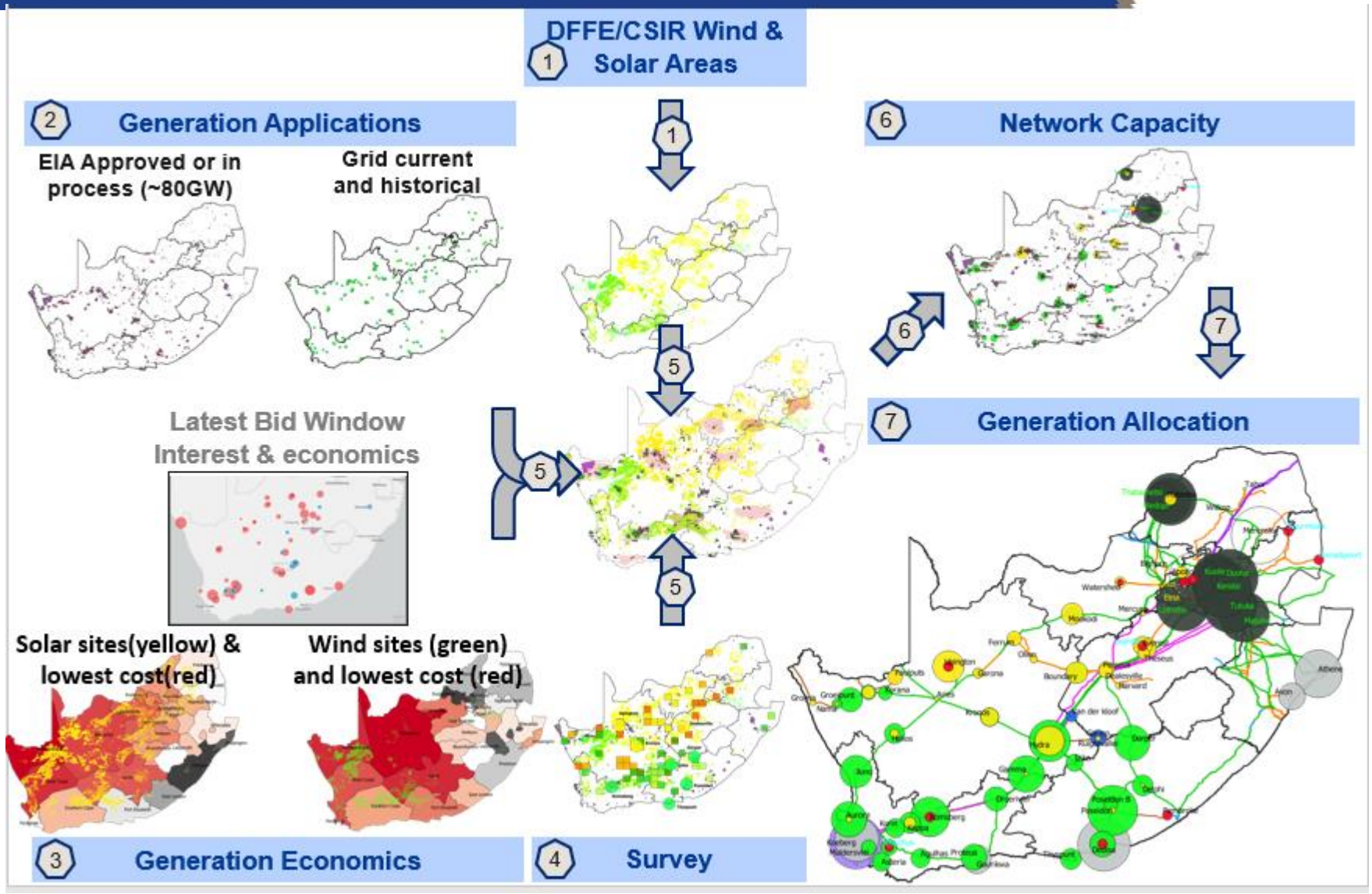
Generation comparison: Storage



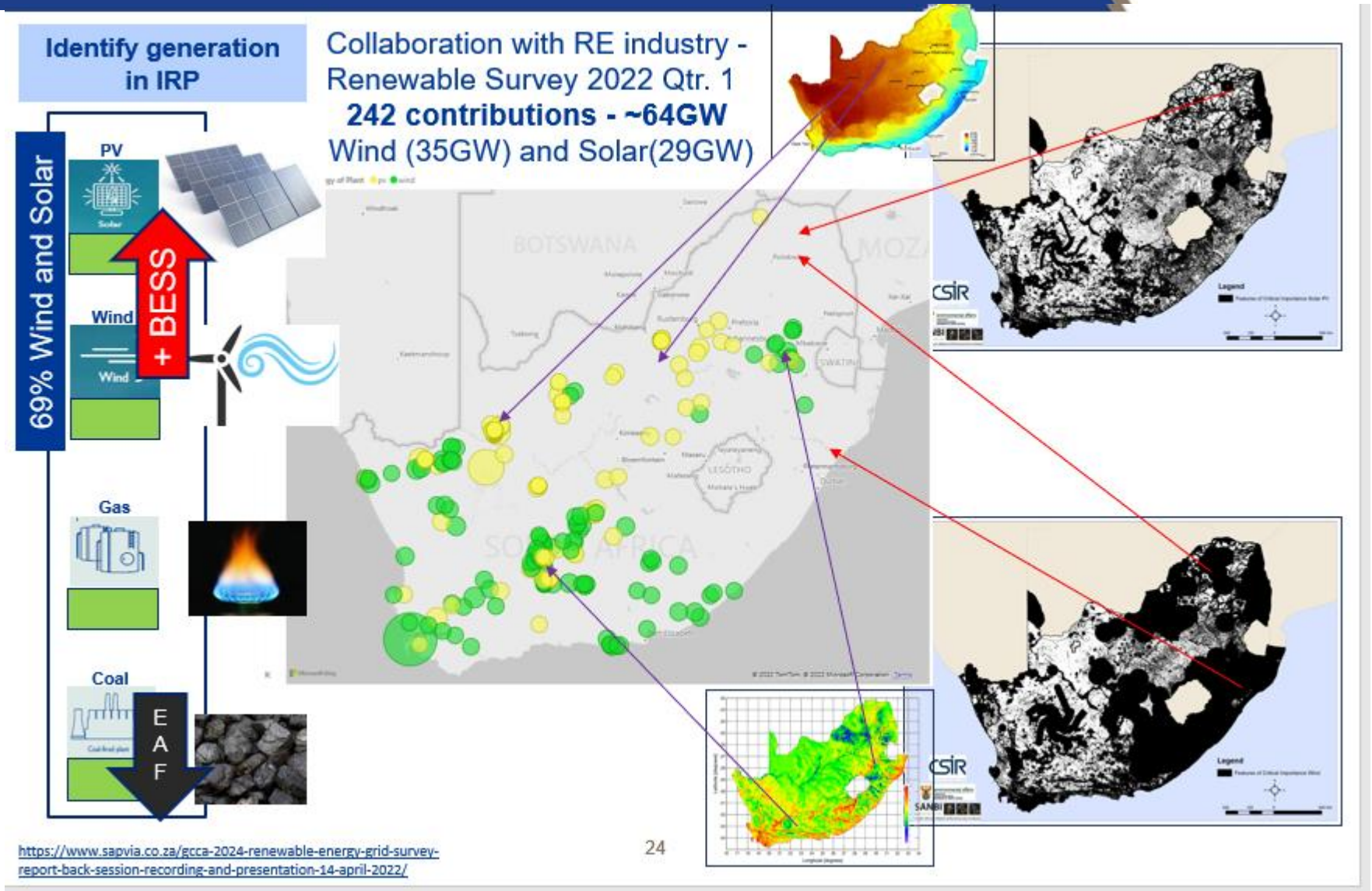
Generation build-up graph



How do we know where to build?
Generation spatial allocation

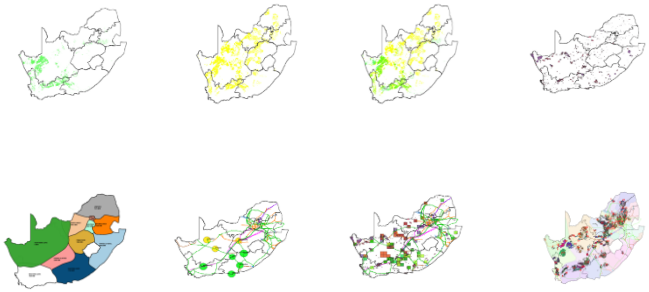


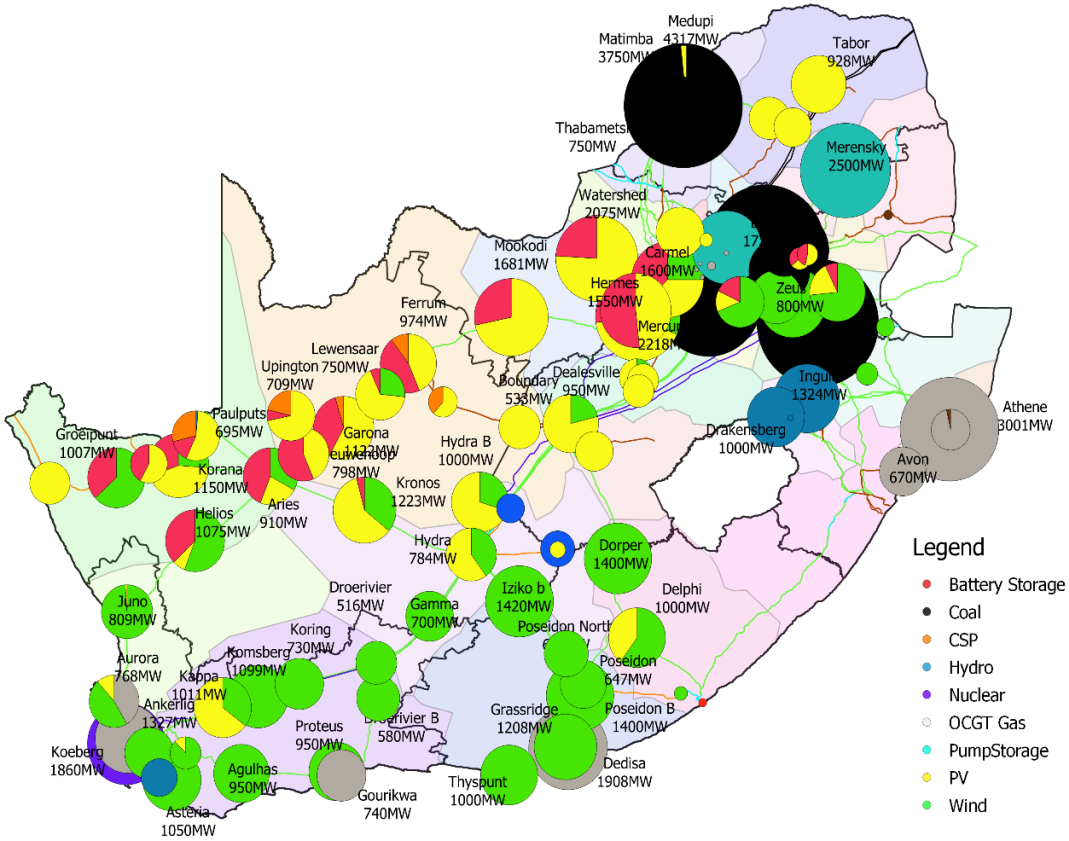
IRP renewables and market interest



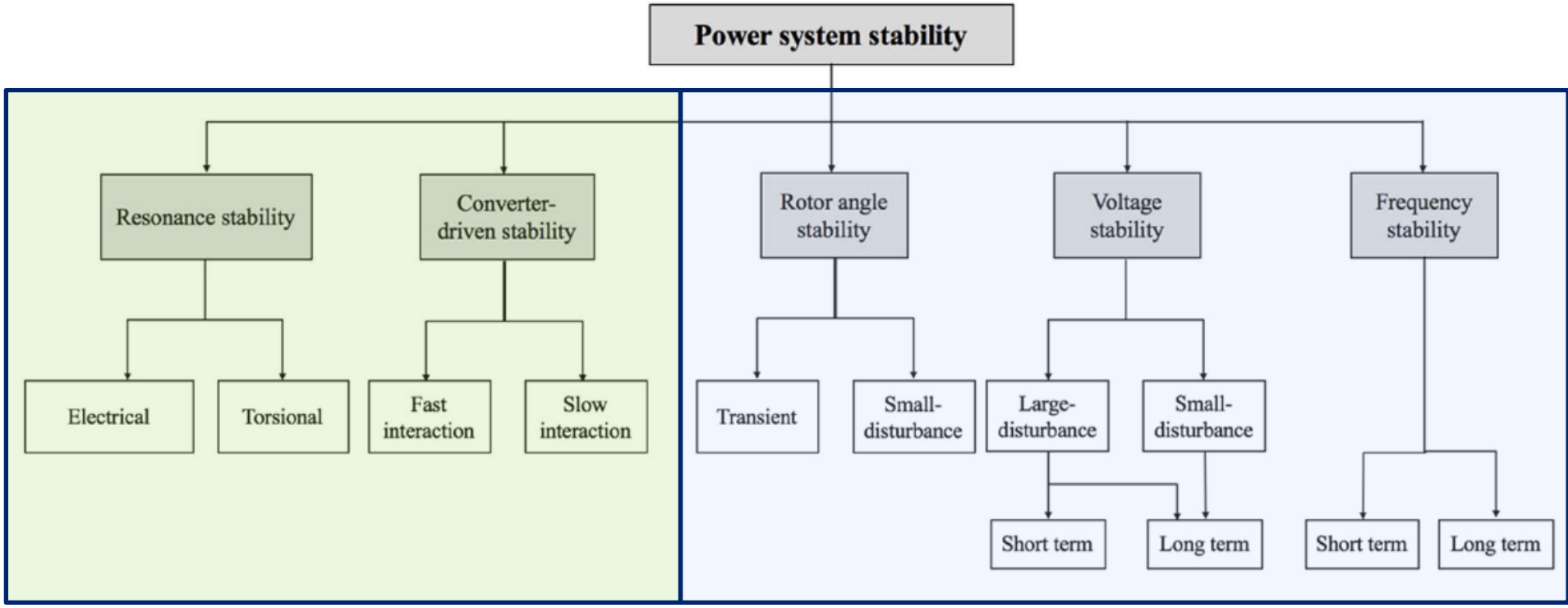
Spatial considerations

- The allocation of Renewables took into consideration the following:
  - CSIR view on RE potential adjusted for sensitive areas
  - Maximum PV potential in a 60km radius
  - EIA applications in the past few years from DEA
  - Grid Planning applications processed thus far
  - Proximity to major corridors and network
    - Relocations for earlier years due to network constraints
  - GCCA 2024 Post-BW5
  - Strengthening projects in the WC and NC



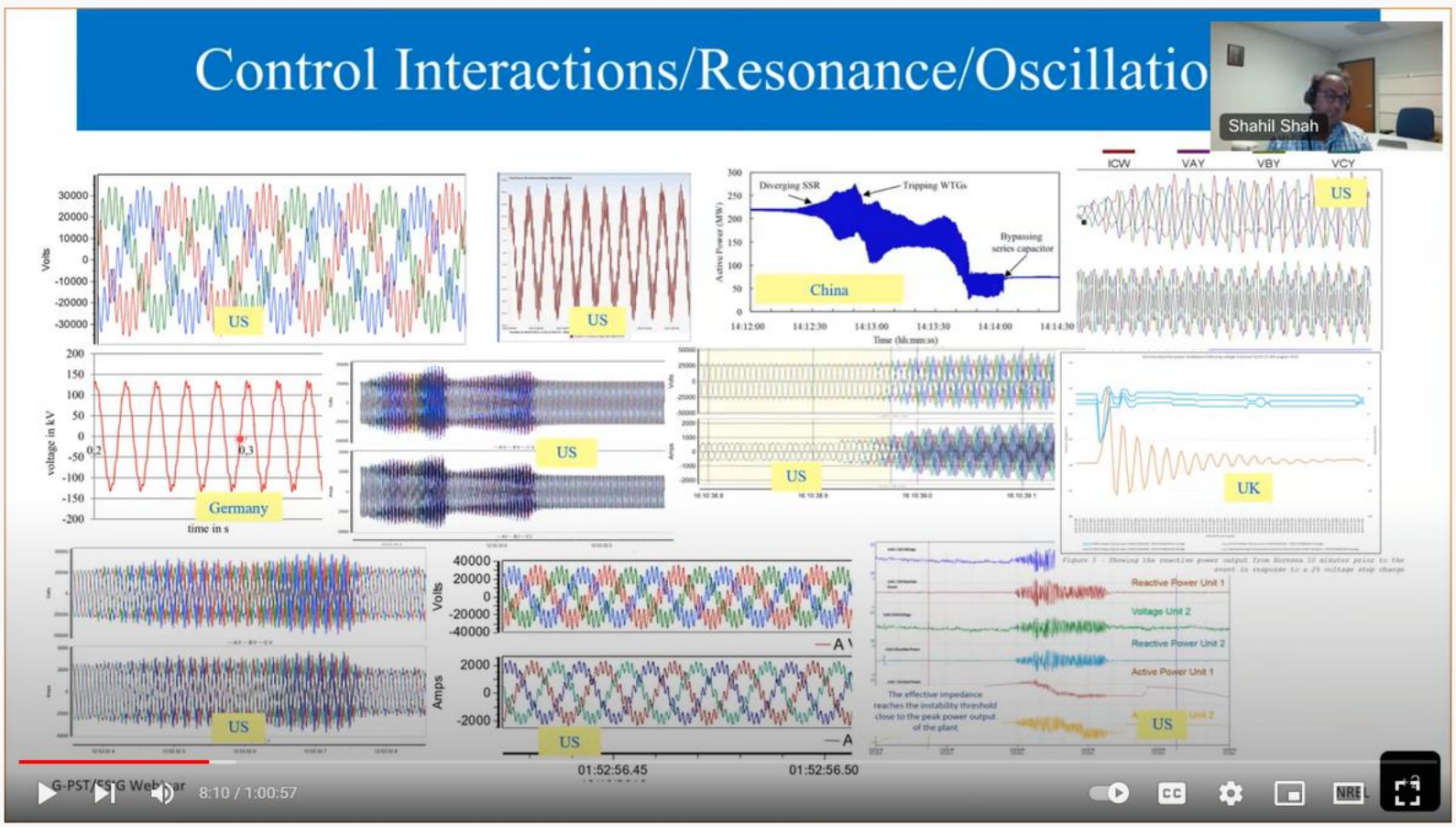


Grid stability is more than balancing supply and demand…



Inverter grid interaction has required two additional stability considerations

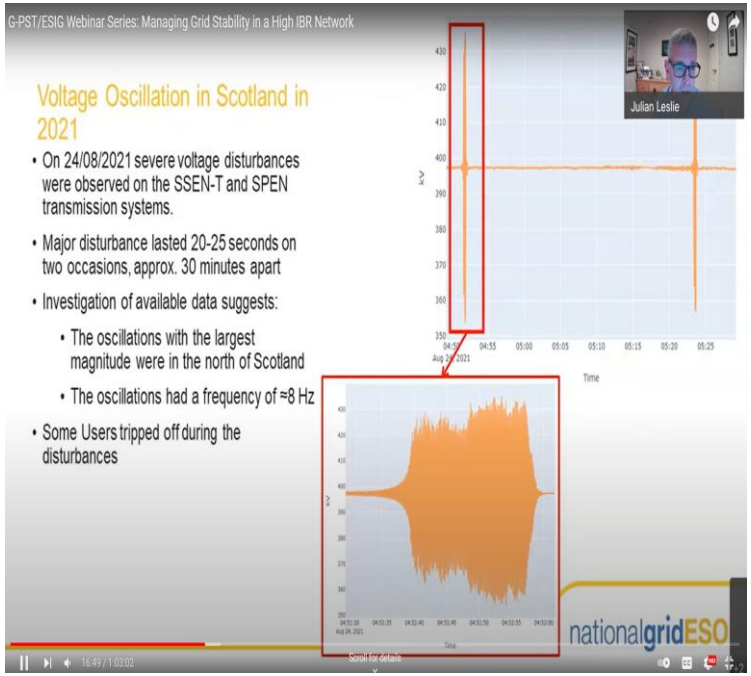
International grid stability inverter control interactions / resonance / oscillation



https://www.youtube.com/watch?v=_XA5PpK0LAY&t=488s

Unforeseen challenges in Scotland

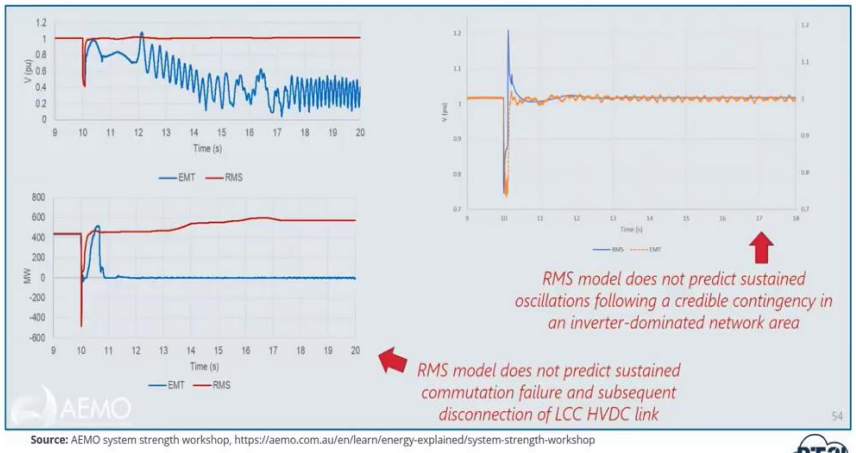
- **Similarity to the South Africa System**



https://www.youtube.com/watch?v=OyGCB3FV5Pw&t=1252s

- System strength “short circuit” is declining over the entire system
- Unlike South Africa the inertia in Great Britain remains high (as was in this event)
- Low synchronous generation with high inverter penetration - System oscillations were observed by the system operator for an extended period.
- Various generation plant tripped (correctly) from the oscillation wide impact
- ROOT CAUSE UNKNOWN - Short term more synchronous generation online
- Finding the root cause requires developing more detailed EMT model.
- Identified need to update the Grid Code for improved modeling requirements

AEMO (Australia) – Large islanded network high penetration



Source: AEMO system strength workshop, https://aemo.com.au/en/learn/energy-explained/system-strength-workshop

https://www.youtube.com/watch?v=U5sgMMj1Ico&t=146s

High penetration requires high resolution of modeling to observe system stability and inverter interaction

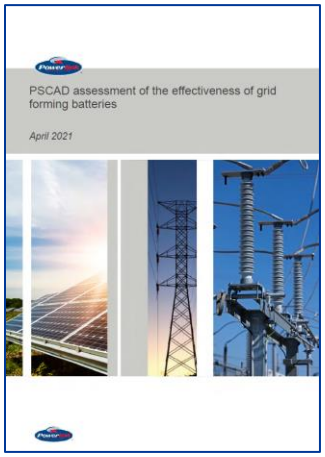
- Current transient analysis tools (RMS) are failing in high penetration inverter dominant networks.
- Under fault conditions the “RMS tend to overestimate how well things are going to be”
- RMS show system will return to a stable condition the EMT shows network will collapse.
- Greater congruence between the EMT and infield measurements.
- Analysis must shift to EMT models
- EMT needs the real source code compiled into the EMT, to better represent the interaction with the system and other inverter
- Cannot evaluate independently of other plant

No silver bullet…

- Technology Advancements – Grid-Forming Inverter NREL and ARENA perspective

Present	1–3 years	3–6 years	>6 years
•Early trends in grid-forming applications •Identify research challenges in: •Voltage control •Frequency control •System protection •System recovery •Modeling and simulation.	•Solve research challenges •Develop grid-forming hardware, software, and controls •Develop grid-forming-based grid controls •Lab testing and evaluation •Identify grid-forming integration challenges for demonstration.	•Microgrids to island grids grid-forming demonstration •Solve system integration challenges •Demonstration in weak grids/bulk grid •Demonstrate grid-forming grid controls •Draft standards.	•Establish technical standards for grid-forming •Standardize grid-forming inverter models •Begin adaptation of grid-forming inverters for standard operation in bulk grids.

https://www.nrel.gov/docs/fy21osti/73476.pdf



- However, similar to any dynamic device (including synchronous condensers) **they are not a 'silver bullet'** and to be effective, there are a range of factors which need to be carefully considered.
- The thoughtful deployment **of grid forming batteries alongside other technologies will be critical to managing the transition to renewables.**

https://arena.gov.au/knowledge-bank/pscad-assessment-of-the-effectiveness-of-grid-forming-batteries/

- Grid-Forming Inverters are critical to high penetration weak grids like South Africa
- Still under development by many manufacturers
- No international standards exist
- Manufacturers have their own interpretation of a Grid-Forming inverters

Acceleration connection capacity

Collaboration is key to enable grid capacity

Activities underway

- **Inter governmental initiatives**
- **Provincial**
- **Renewable association**
- **International collaboration**

Questions?

Transmission System Operations Ancillary Services Implications

Siju Joseph
Manager: Transmission System Operator
Ancillary Services

Ancillary services (AS) overview

(AS) Grid Code Definition

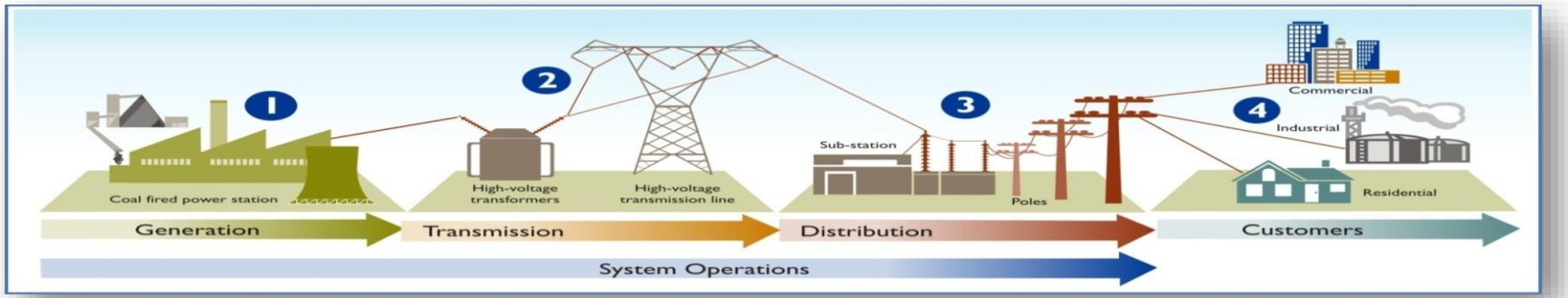
- Services supplied to the *NTC* by *generators*, *distributors* or *end-use customers*, necessary for the reliable and secure transport of power from *generators* to *distributors* and other *customers.*

Why and what services?

- The *System Operator* shall be responsible for the provision of all short-term reliability services for the *IPS*. These include restoration, the balancing of supply and demand, the provision of quality voltages and the management of the real-time technical risk.

How will this be done?

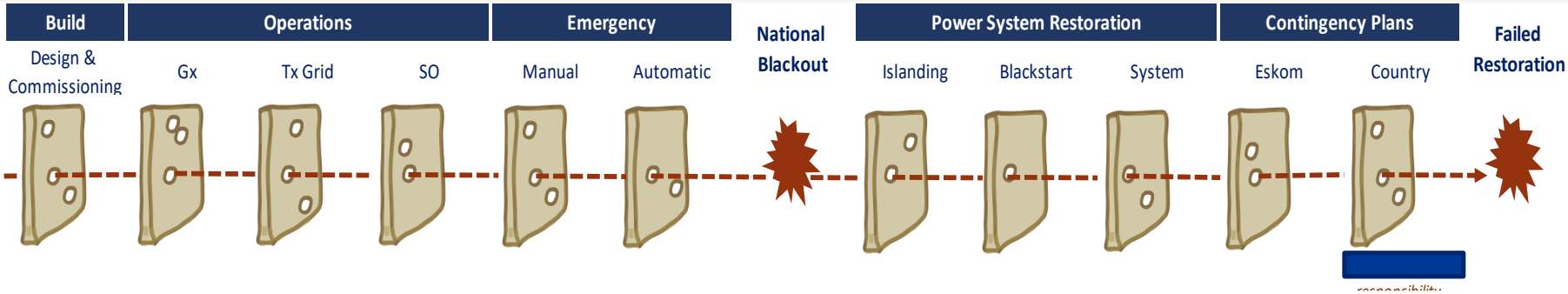
- The *System Operator* shall be responsible for procuring the required *ancillary services* as described in this section in accordance with the license and market rules. It shall state opportunities for the provision of *ancillary services.*



The services

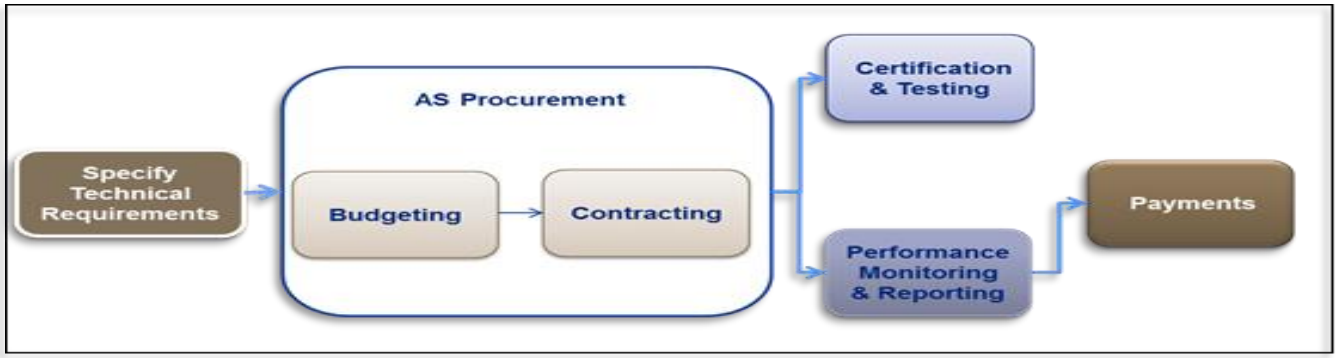
- **System reserves** to combat generation/load contingencies and forecast errors. These include instantaneous, regulating, ten-minute, supplemental and emergency reserves

- **Reactive power and voltage control** to maximise system security and reduce network losses,
- **Constrained generation** to compensate those generators dispatched out of the merit order and suffer financial loss due to lack of related market rules dealing with transmission constraints and units in strategic positions.
- **System restoration** services to expedite system restoration resulting from regional and system-wide interruption of supply. These include Black-start, Islanding and in future self-start facilities



Current processes

PROCESS	WHY?	WHAT IT ENTAILS
Specify AS Tech requirements (ASTR)	Required by the Grid Code	• Studies using simulation tools to ensure reliable system • Documenting requirements • Publish requirements on the external site.
AS procurement	Budgeting: to ensure amount is within MYPD	• Costing of services • Agree with service provider on costs to be paid
	Contracting: To ensure there is a legal binding to the provision	• Determine levels of service from each provider • Compile ASA in conjunction with provider
Certification and testing	To ensure that services agreed can be provided by the agent	• Each service needs to be certified to ensure capability • Testing ensures that the provider can do what is required
Performance monitoring	• To ensure that the services are performing consistently • For payment purpose	• Weekly performance reports • Monthly performance report • Regular interactions with agents to monitor performance
Payments	Payments as agreed in the ASA/PPA	• Derive payments from the monthly performance • Explain deviances • Compile reports



Ancillary Services Technical Requirements (ASTR)

- The first step in securing ancillary services for the year ahead is to specify the technical requirements of the services to be procured (ASTR)"
- this document is published annually on the Eskom website. **(Ancillary Services - Technical Requirements – Eskom)**

RESERVES REQUIREMENTS

Reserve	Season	Period	2022/23 MW	2023/24 MW	2024/25 MW	2025/26 MW	2026/27 MW
Instantaneous	Summer	Peak	650	650	650	650	650
		Off peak	850	850	850	850	850
	Winter	Peak	650	650	650	650	650
		Off peak	850	850	850	850	850
Regulating	Summer	Peak	530	545	560	575	600
		Off peak	530	545	560	575	600
	Winter	Peak	530	545	560	575	600
		Off peak	530	545	560	575	600
Ten minute	Summer	Peak	1020	1005	990	975	950
		Off peak	820	805	790	775	750
	Winter	Peak	1020	1005	990	975	950
		Off peak	820	805	790	775	750
Operating	Summer/ Winter	Peak/ Offpeak	2200	2200	2200	2200	2200
Emergency			1400	1300	1200	1100	1000
Supplemental			200	300	400	500	600
Total			**3800**	**3800**	**3800**	**3800**	**3800**

OTHER SERVICES IN THE ASTR

- The other services stipulated in the ASTR include;
  - Voltage Control
  - Black-start
  - Islanding
  - Constrained generation

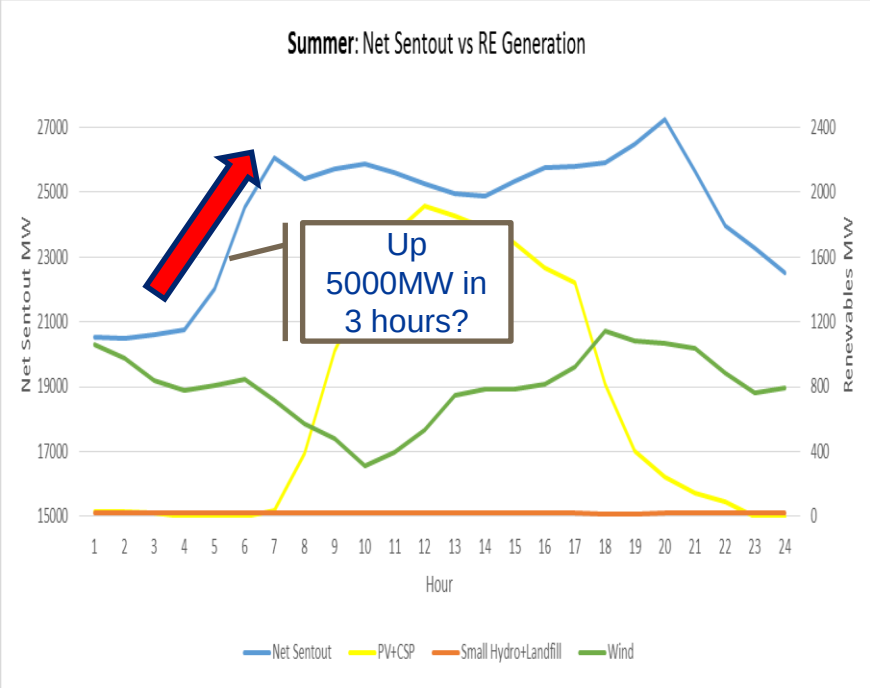
The future of ancillary services

- The aggressive plans on reduction of greenhouse gases will have a **major impact** on the day to day running of the integrated power system
- The impact will be seen mainly on **ancillary services** and will include issues such as:
  - transient stability,
  - curtailment of VRE
  - system strength and
  - Flexibility
- In a system with very high RE penetration the system will need units that provide;

  Faster load **ramps**

  Reliable mingen

  More frequent **start-ups and shutdowns**



- The AS team has already **initiated exploratory studies** to add the following as new ancillary services
  - fast frequency reserves,
  - self-start capability and
  - Inertia

Current and future providers of ancillary services

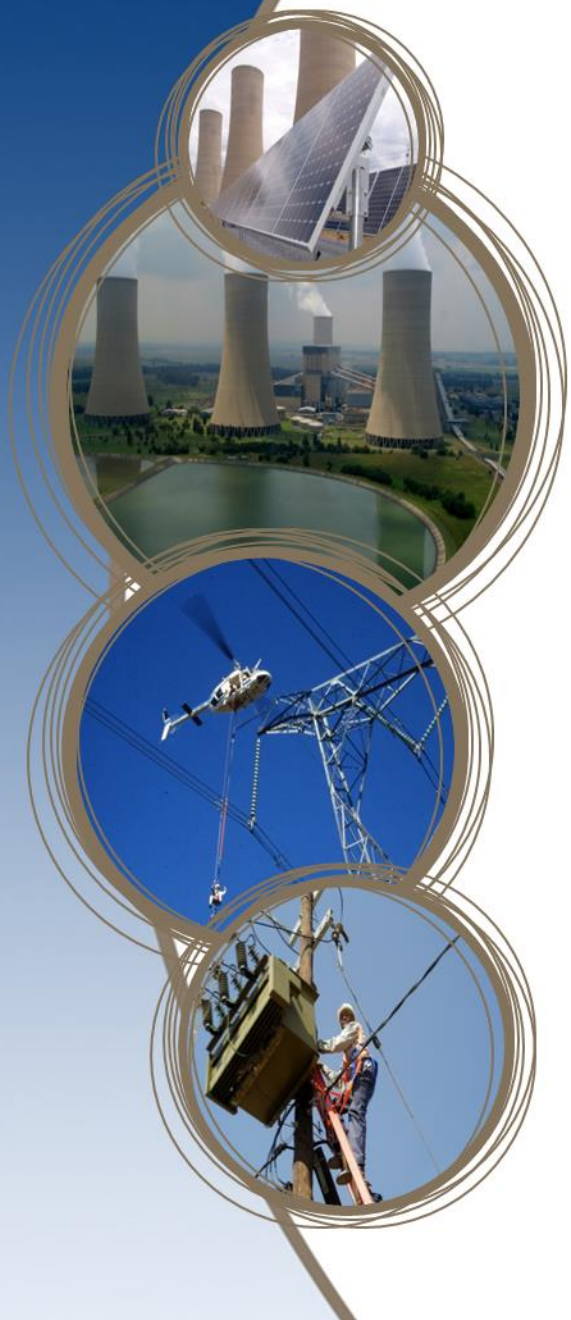
CURRENT PROVIDERS

- Currently, most of the services are procured from Eskom Generation
- The SO also has a robust Demand Response Program that provides some of the much needed Instantaneous and Supplemental Reserves

FUTURE PROVIDERS

- The SO is actively involved in stipulating services required from IPP programs such as
  - The RMIPPP,
  - The BW6 REIPPP,
  - The Energy Storage Program.
  - The Eskom BESS program
- The SO is looking forward to discussions with other possible providers
- The envisaged Market Operator program will also greatly impact the future of Ancillary Services

Questions?



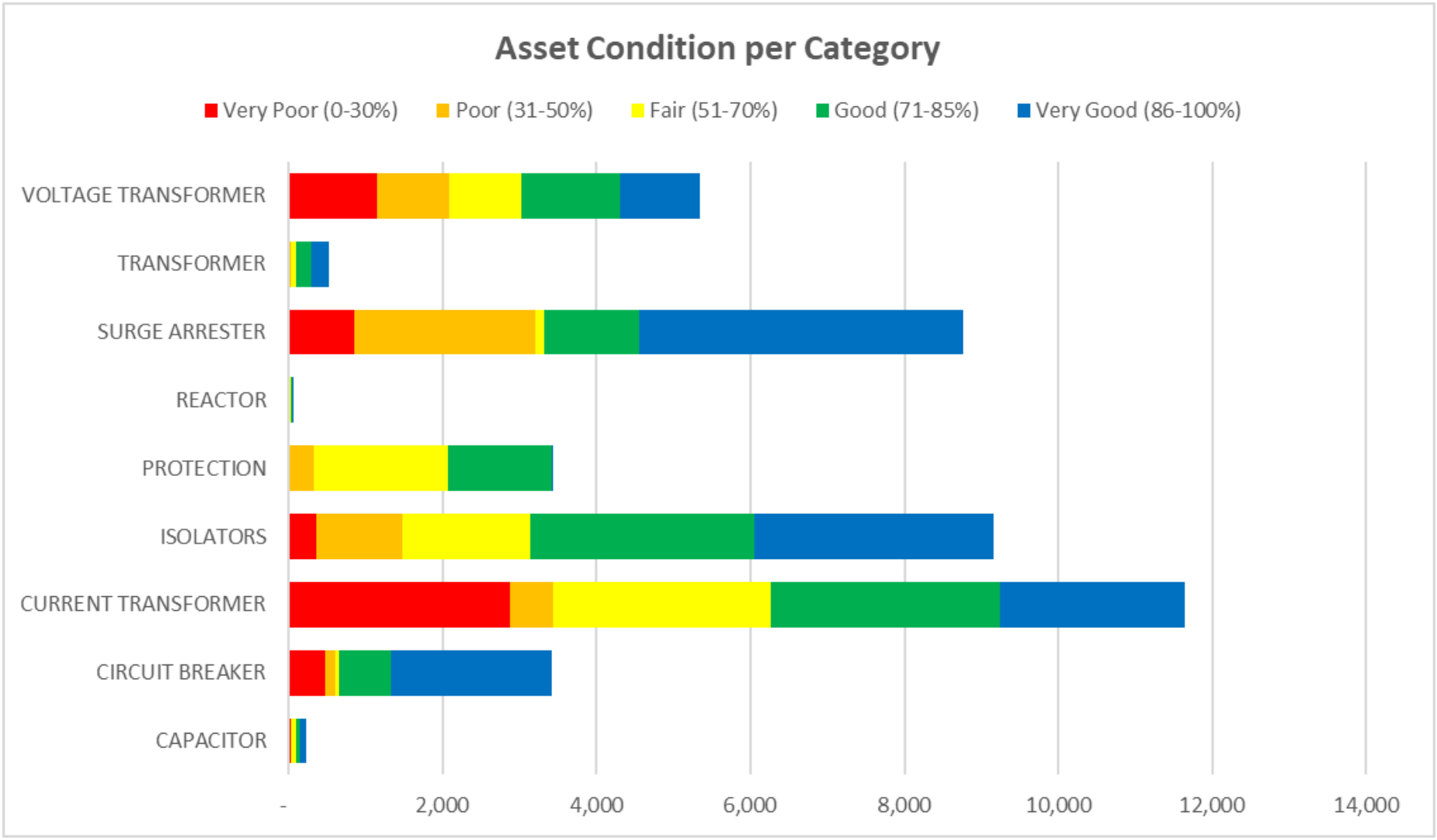
Summary of the Transmission Refurbishment Plans FY2023 – FY2032

Calvin Govindasamy
Chief Engineer: Asset Investment Planning

Introduction

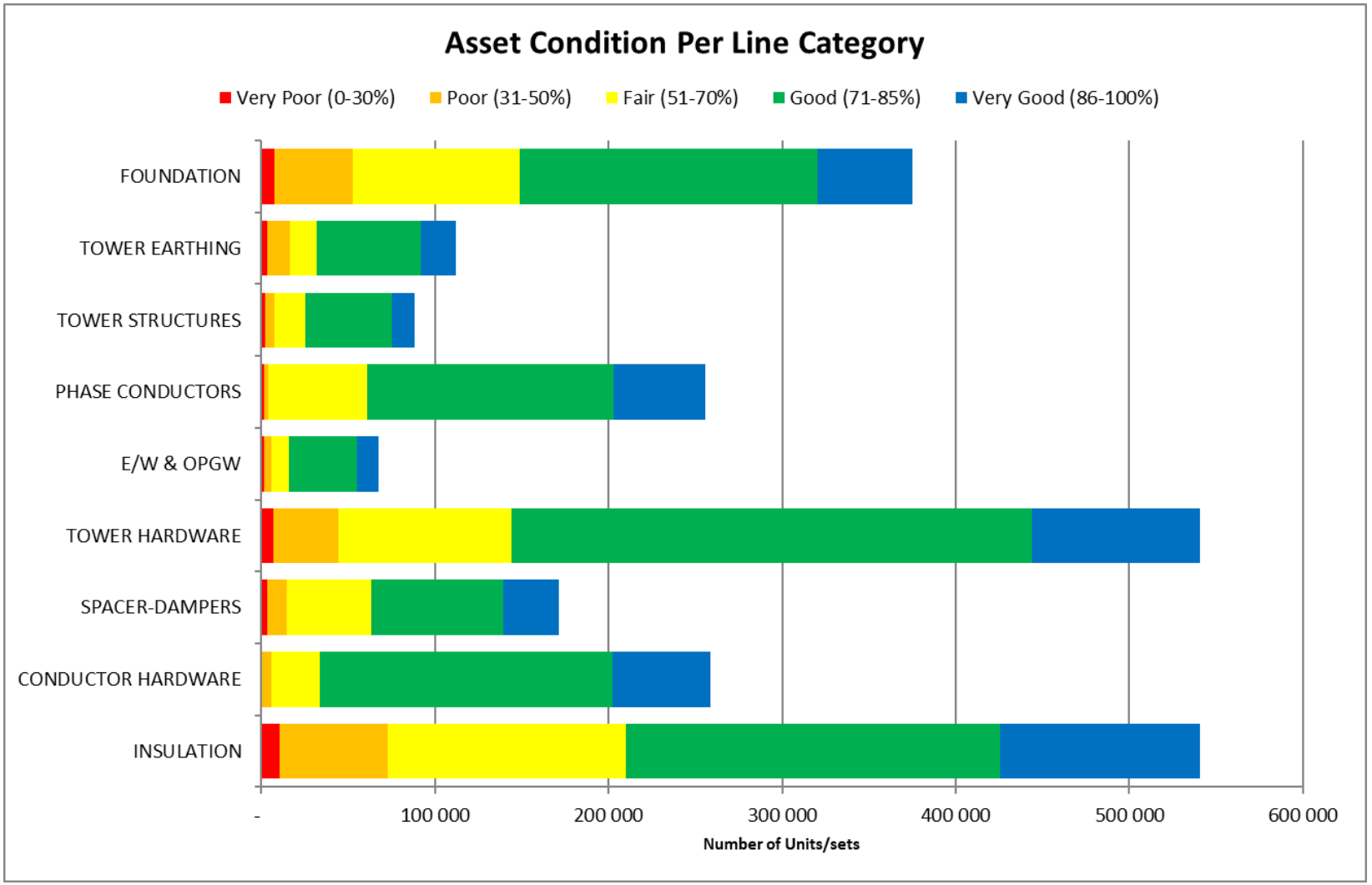
- The Asset Management Section is focused on the existing network assets (or the installed base of assets), and to sustain that existing network infrastructure at desired performance levels.
- This is done by removing risks from the network through the replacement of poor condition assets, with consideration of network constraints.
- Asset Management is further responsible for the development of the Refurbishment Plan by identifying refurbishment requirements in terms of capital investments that would ensure that the network conforms to the required reliability and statutory standards.
- The purpose of the presentation is to give an overview of the status of the existing network assets and the planned investments to address replacement of the required equipment.

Substation Asset Condition Assessment:
(Main Asset Classes per condition category)



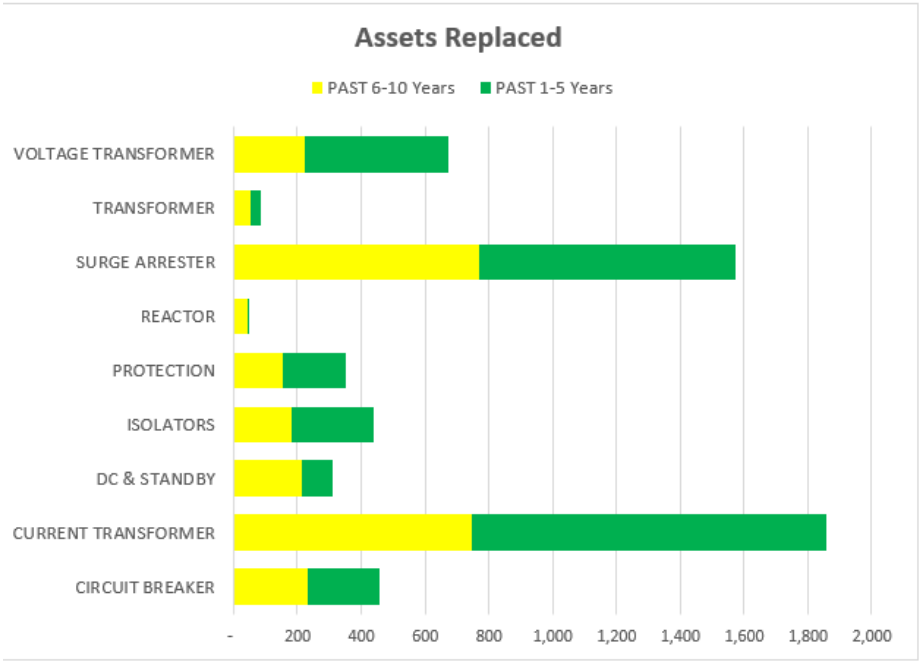
National View

Overhead Lines Asset Condition Assessment:
(Main Asset Classes per condition category)



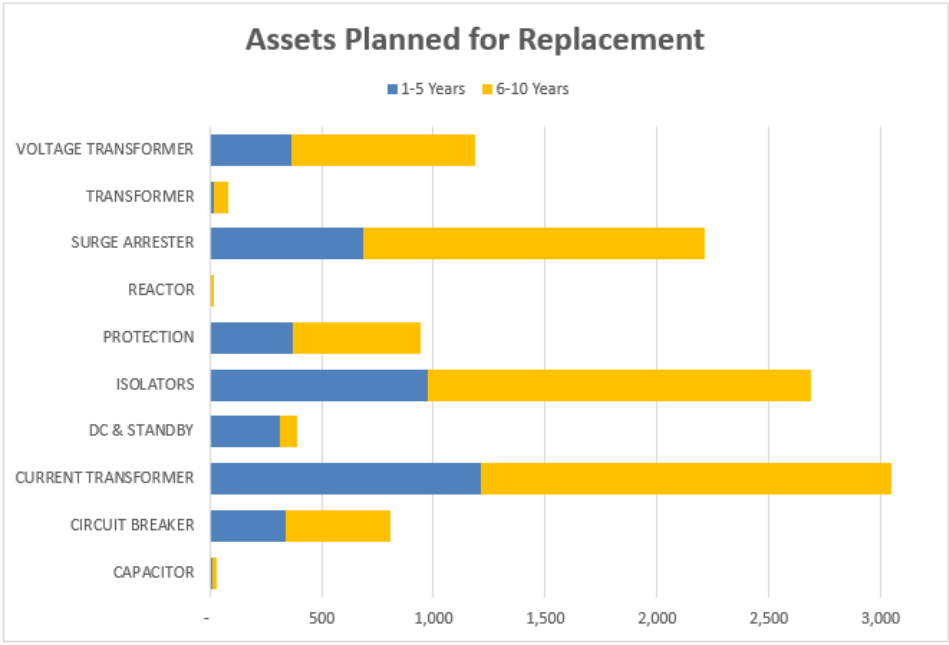
National View

Assets replaced and planned for replacement

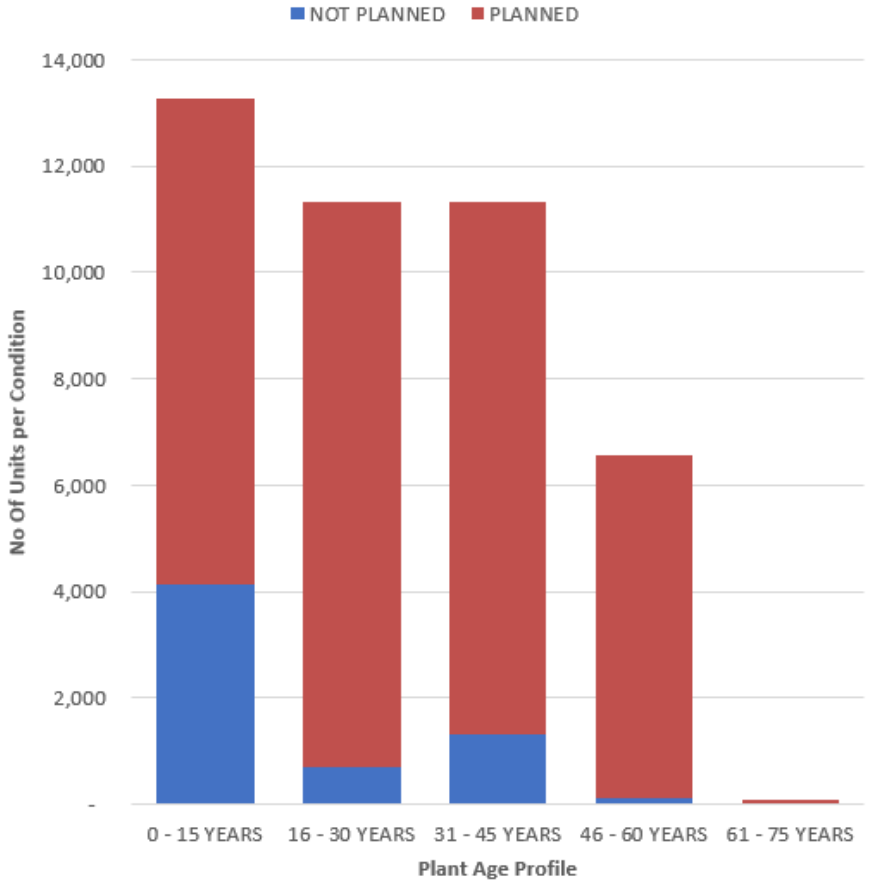


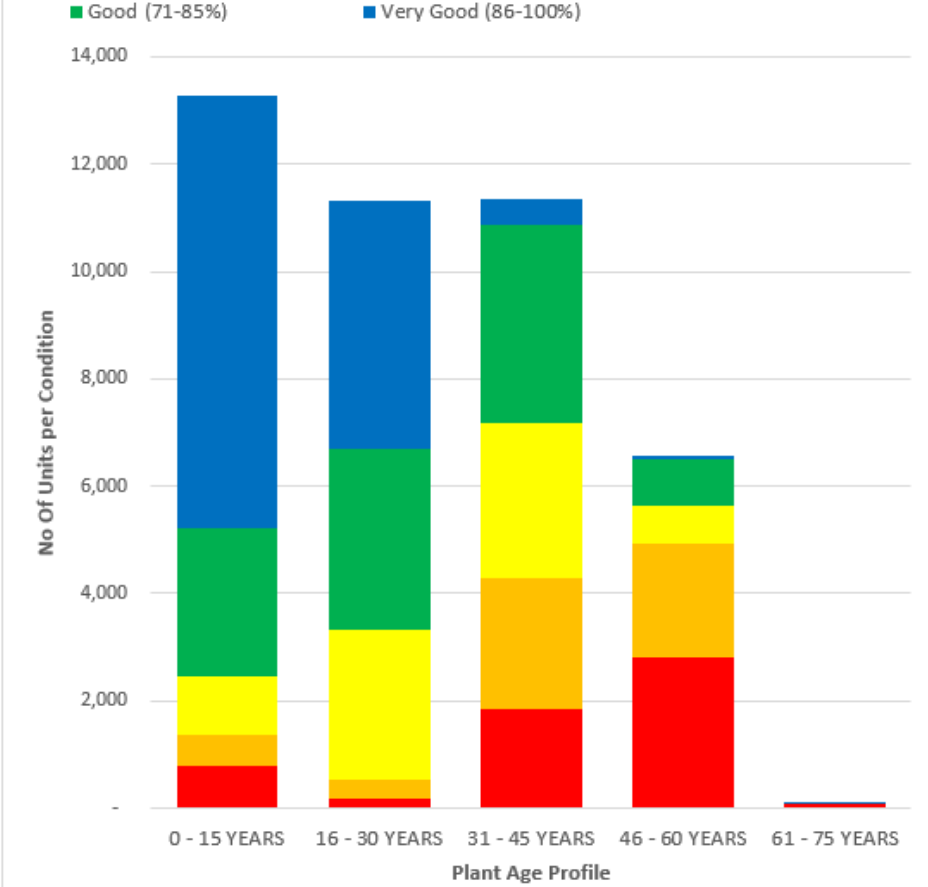
CATEGORY	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
CIRCUIT BREAKER	53	55	55	41	29	41	48	37	40	57	456
CURRENT TRANSFORMER	115	105	195	191	141	231	225	236	202	216	1,857
DC & STANDBY	33	70	29	62	22	19	41	5	5	24	310
ISOLATORS	59	22	35	40	24	31	34	43	57	94	439
PROTECTION	29	20	38	36	31	51	26	37	40	42	350
REACTOR	7	6	21	6	3	1	2	1	2	1	50
SURGE ARRESTER	63	125	192	276	112	122	190	200	134	158	1,572
TRANSFORMER	6	11	13	15	9	13	8	4	4	4	87
VOLTAGE TRANSFORMER	37	47	55	44	39	76	81	135	59	100	673
Grand Total	**402**	**461**	**633**	**711**	**410**	**585**	**655**	**698**	**543**	**696**	**5,794**

CATEGORY	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Grand Total
CAPACITOR	1	3	1	5	2		4	6	2	4	28
CIRCUIT BREAKER	26	102	81	86	43	37	98	83	77	174	807
CURRENT TRANSFORMER	99	325	351	142	292	165	336	462	367	511	3,050
DC & STANDBY	62	183	40	14	11	13	8	45	8	5	389
ISOLATORS	90	302	269	150	165	79	268	464	263	642	2,692
PROTECTION	29	118	100	43	80	55	101	161	76	182	945
REACTOR						2	3	7	2	2	16
SURGE ARRESTER	45	201	192	74	173	163	243	334	242	549	2,216
TRANSFORMER	5	2	5		4	4	11	17	13	20	81
VOLTAGE TRANSFORMER	45	118	45	41	115	51	147	198	135	291	1,186
Grand Total	**402**	**1,354**	**1,084**	**555**	**885**	**569**	**1,219**	**1,777**	**1,185**	**2,380**	**11,410**



Substation Asset Condition Assessment and Plan





Refurbishment Plan Focus Areas

Some of the major focus areas of the Refurbishment Plan are:

1. **Operational Risks:**

   - **HV Plant Assets:**
     - High-Risk Transformers and Reactors are addressed in a phased approach based on network risk.
     - Insulation flashover mitigation by re-insulation or surface coating at highly polluted areas
     - Reducing network risk due to problematic instrument transformers and surge arrestors that have degraded and reached end-of-life. These are addressed as targeted replacements.
     - Circuit Breakers: Application requiring technological advancements and improved functionality

   - **Protection Schemes:**
     - Protection schemes are being addressed as a priority focus area and will require an extended replacement programme.
     - Certain schemes need to be replaced due to obsolescence and the unavailability of spares
     - Application requiring technological advancements and improved functionality

   - **Fibre:**
     - Fibre Wrap (e.g. Adlash) installed on some line earth-wires have exceeded their expected lifespan and are now impacting on the line performance. These need to be replaced with Optical Ground Wire (OPGW) which generally is very costly and outage dependent.

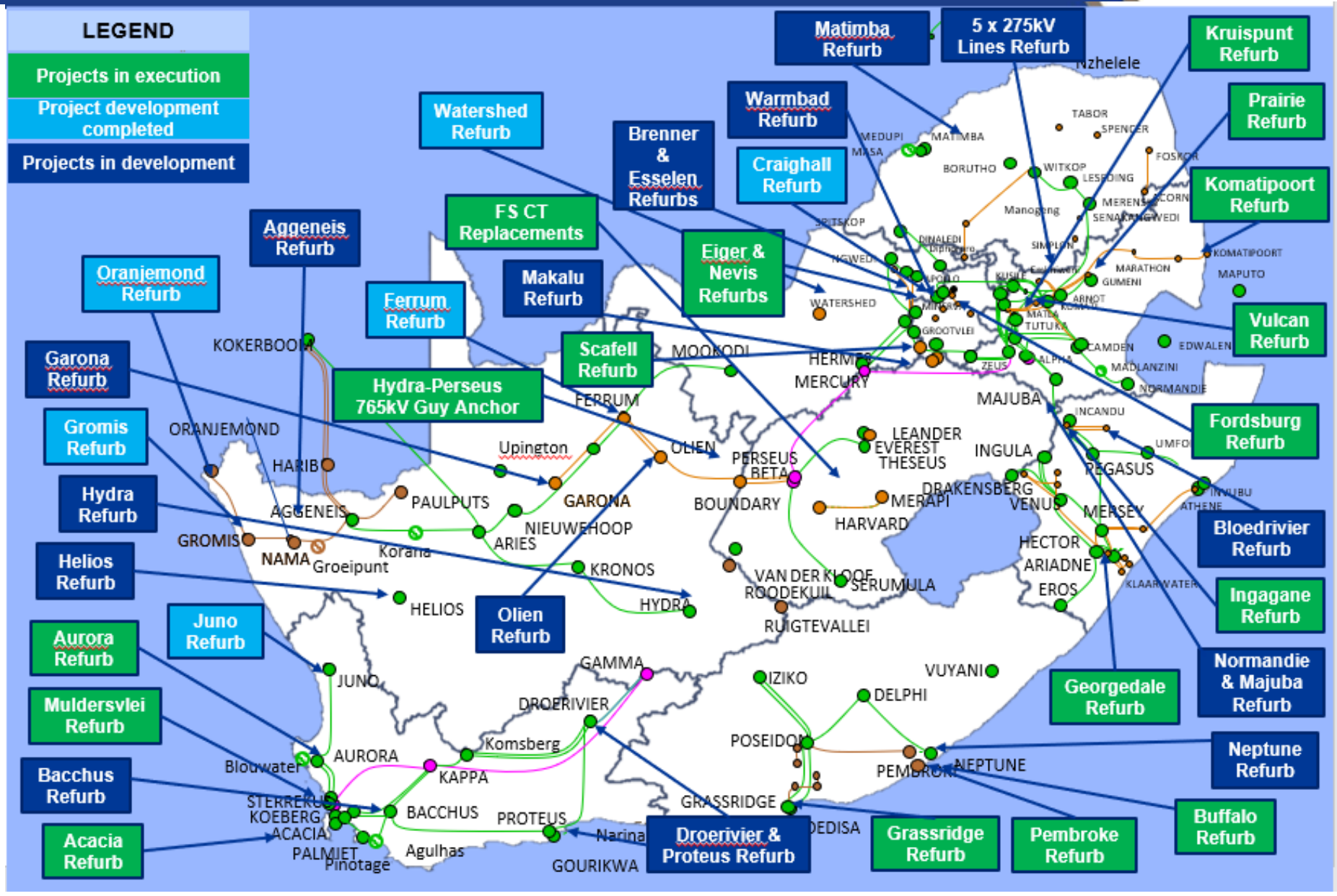
Refurbishment Plan Focus Areas…

- **Powerline Assets:**
  - Foundations: Several line foundation designs (built prior to 2004) allowed for bare steel to be in direct contact with the soil, which results in varied levels of degradation based on soil type and weather.
  - Insulation and Hardware: Spacer dampers exhibit a lower level of reliability due to the accelerated wear and tear on the conductor.
  - Line Insulation is the least reliable of the line components, being under-insulated brought about by changes in design standards, thus forming the bulk of the line asset replacements.

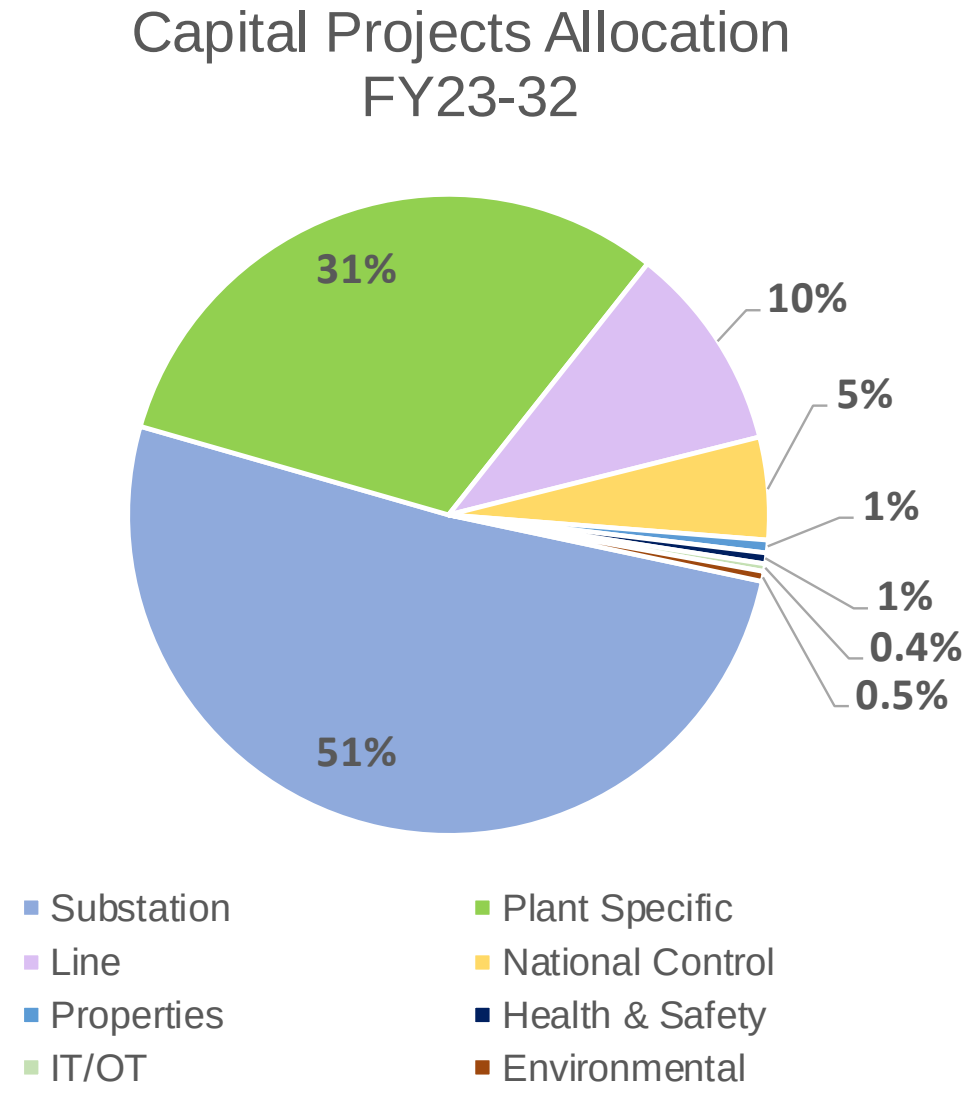
2. **Statutory Risks:**

- **Compliance Requirements:**
  - Fault-level exceedances related to equipment ratings
  - Environmental legislation in terms of Asbestos and PCB phase-out.
  - Adequacy of Oil Containment
- **Infrastructure Security:**
  - Addressing statutory fencing requirements for safety, operating and proximity to High Voltage
  - Security upgrades to address breaches and theft

Major Refurbishment Projects: FY2023 – FY2032



Capital projects allocation within the Refurbishment Plan



Conclusion

- Transmission has an adequate planning process to determine asset replacement requirements, which is aligned to Asset Management principles.
- The current portfolio of projects in the refurbishment plan, considers the risks to the network and embodies the requirements and stipulations of the Grid Code.
- The 10-year refurbishment plan is based on actual asset condition assessments, asset criticality, network risks and the undergone a robust prioritisation process.
- The plan is further flexible enough to accommodate emerging operational risks and current requirements in addition to the planned asset replacement program.
- In conclusion, the major refurbishment projects as displayed, are an indication that the refurbishment plan addresses requirements across the country.

Questions?

Transmission Development Plan (TDP) 2023 – 2032

Public Forum

TDP 2022

Provincial Development Plans

Compiled by: Grid Planning Chief Engineers

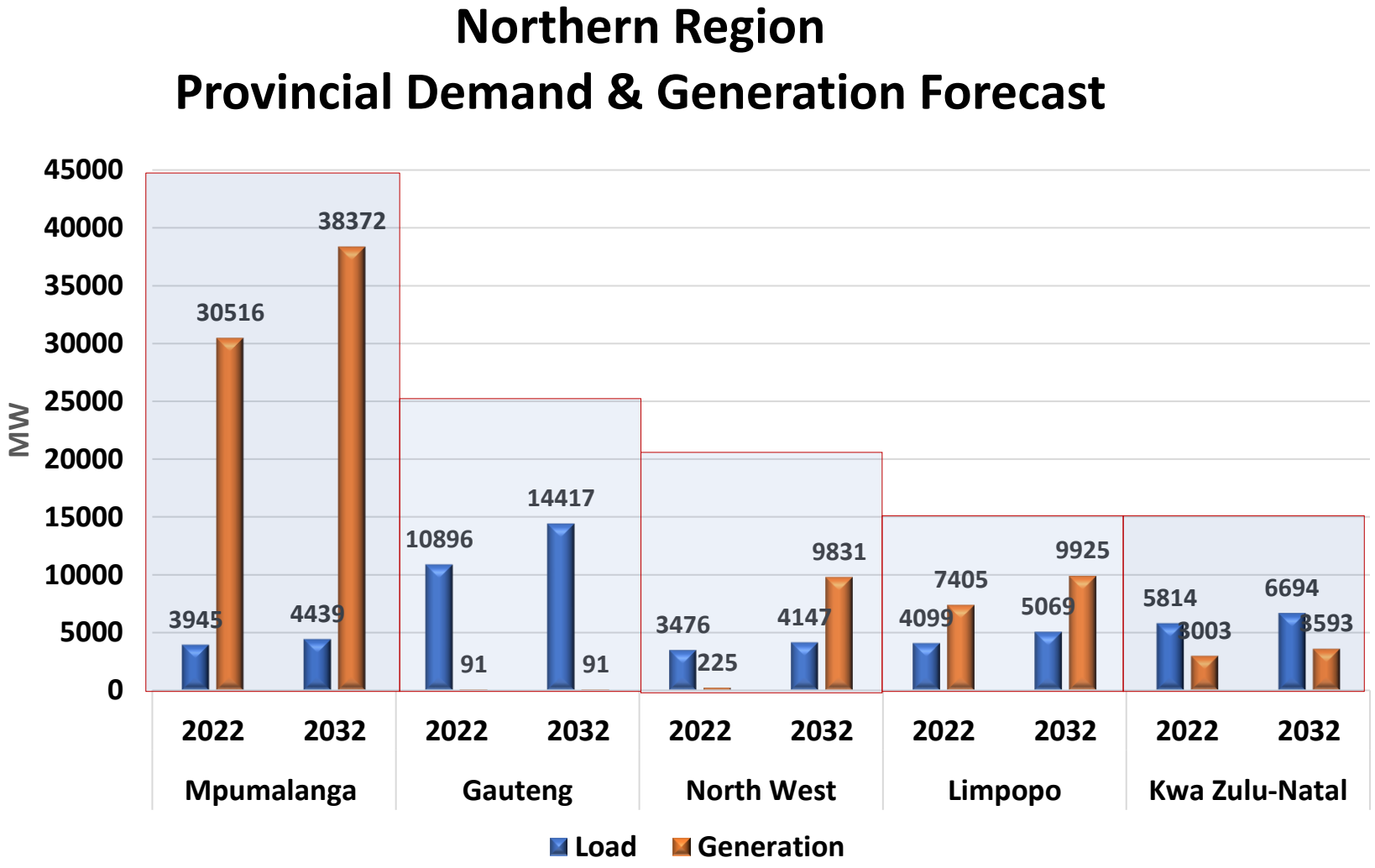
Presented by: Caroleen Naidoo / Thokozani Bengani

Transmission Development Plans: Northern Grids

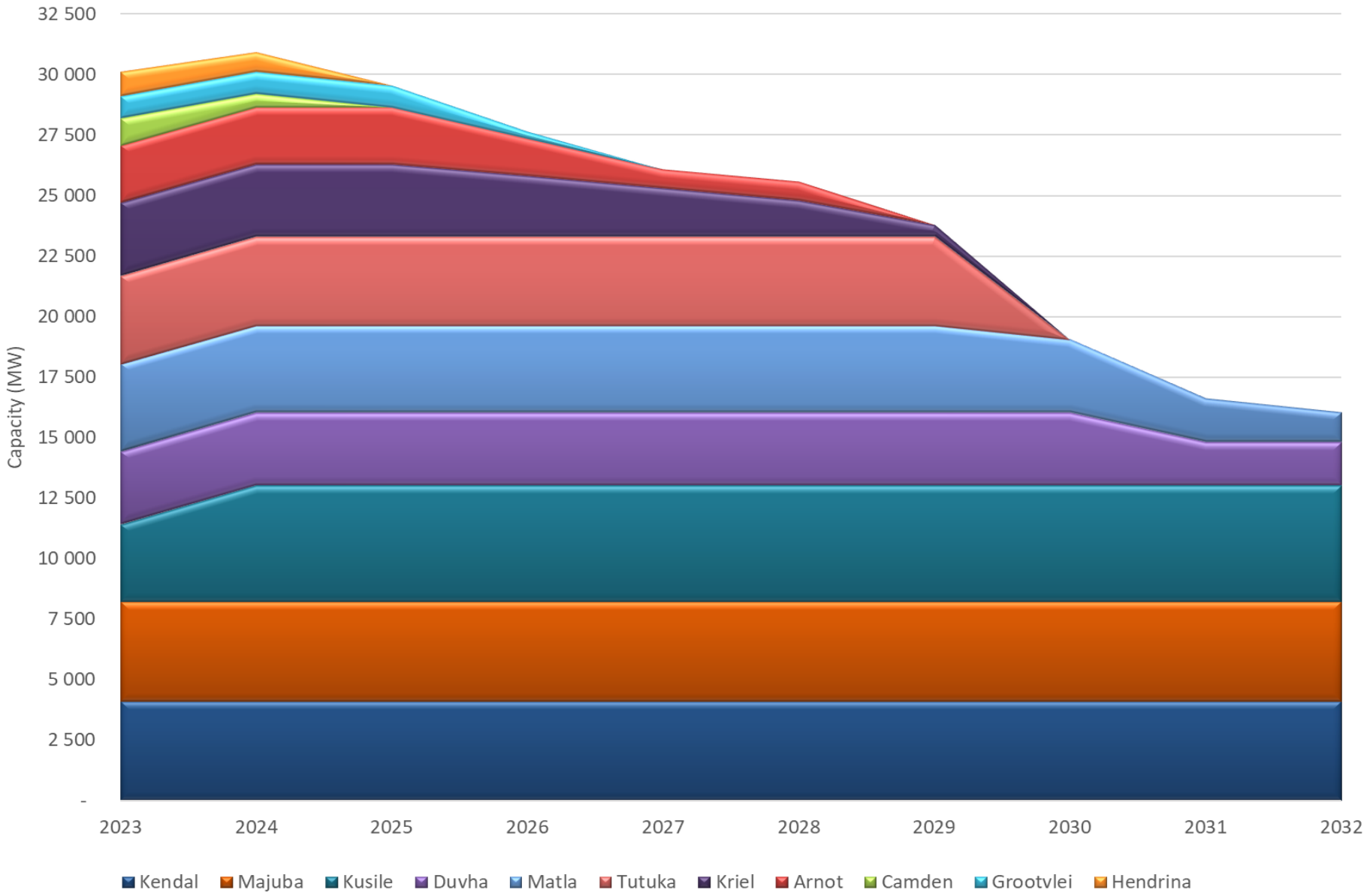
(Mpumalanga, Gauteng, North West, Limpopo and KwaZulu - Natal)

Presented by: Caroleen Naidoo

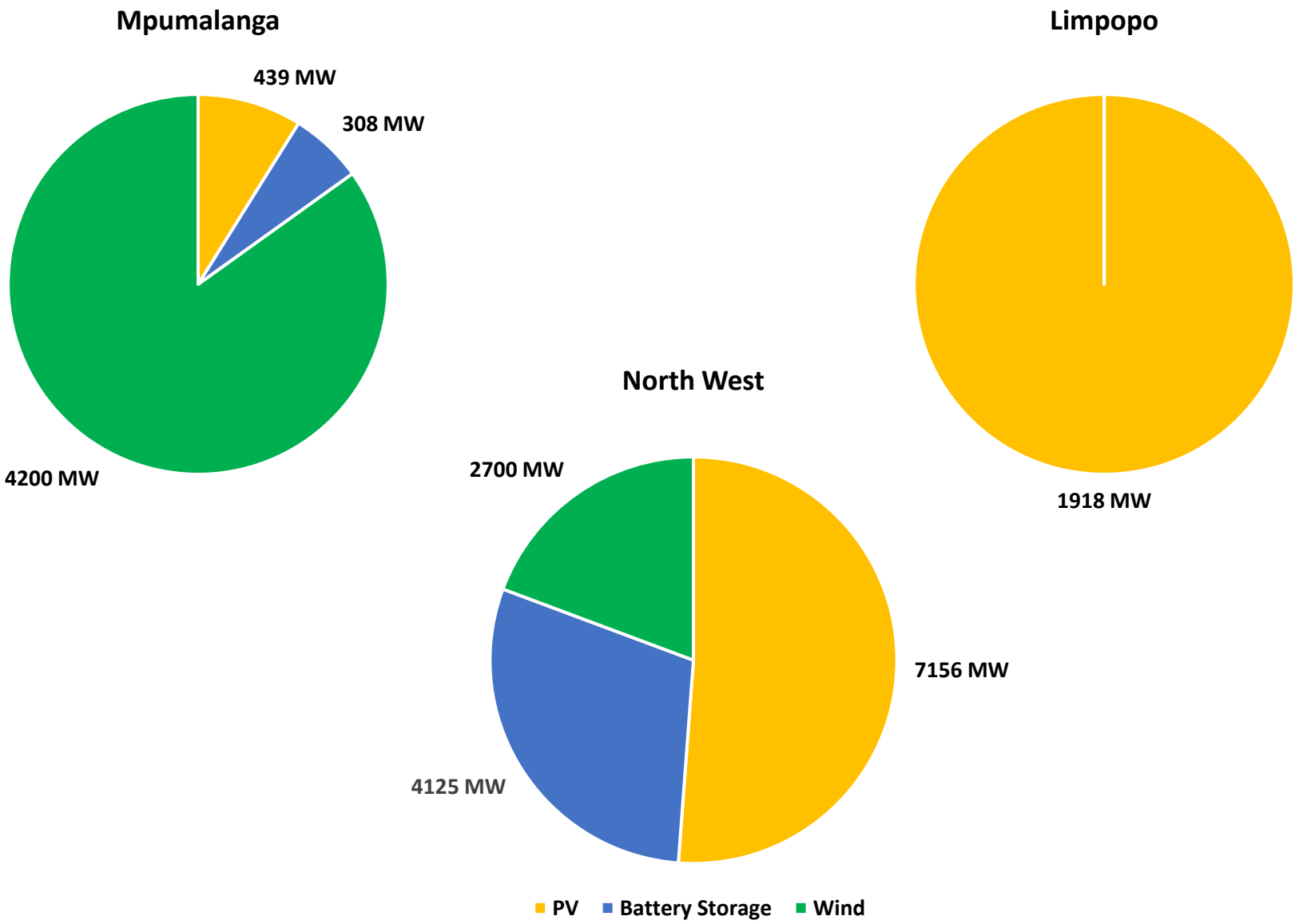
Provincial demand and generation forecast



Conventional generation forecast in MP



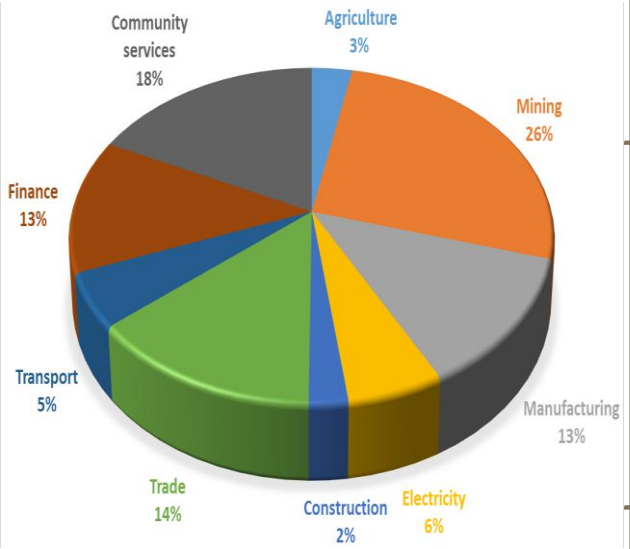
Provincial RE generation mix in 2032



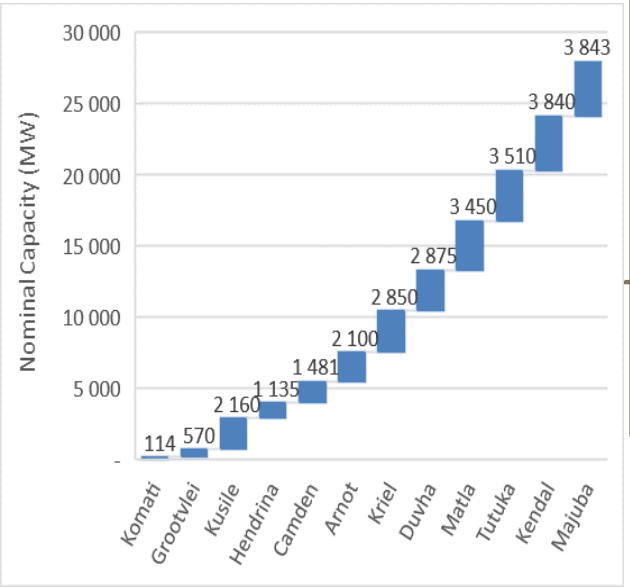
Mpumalanga

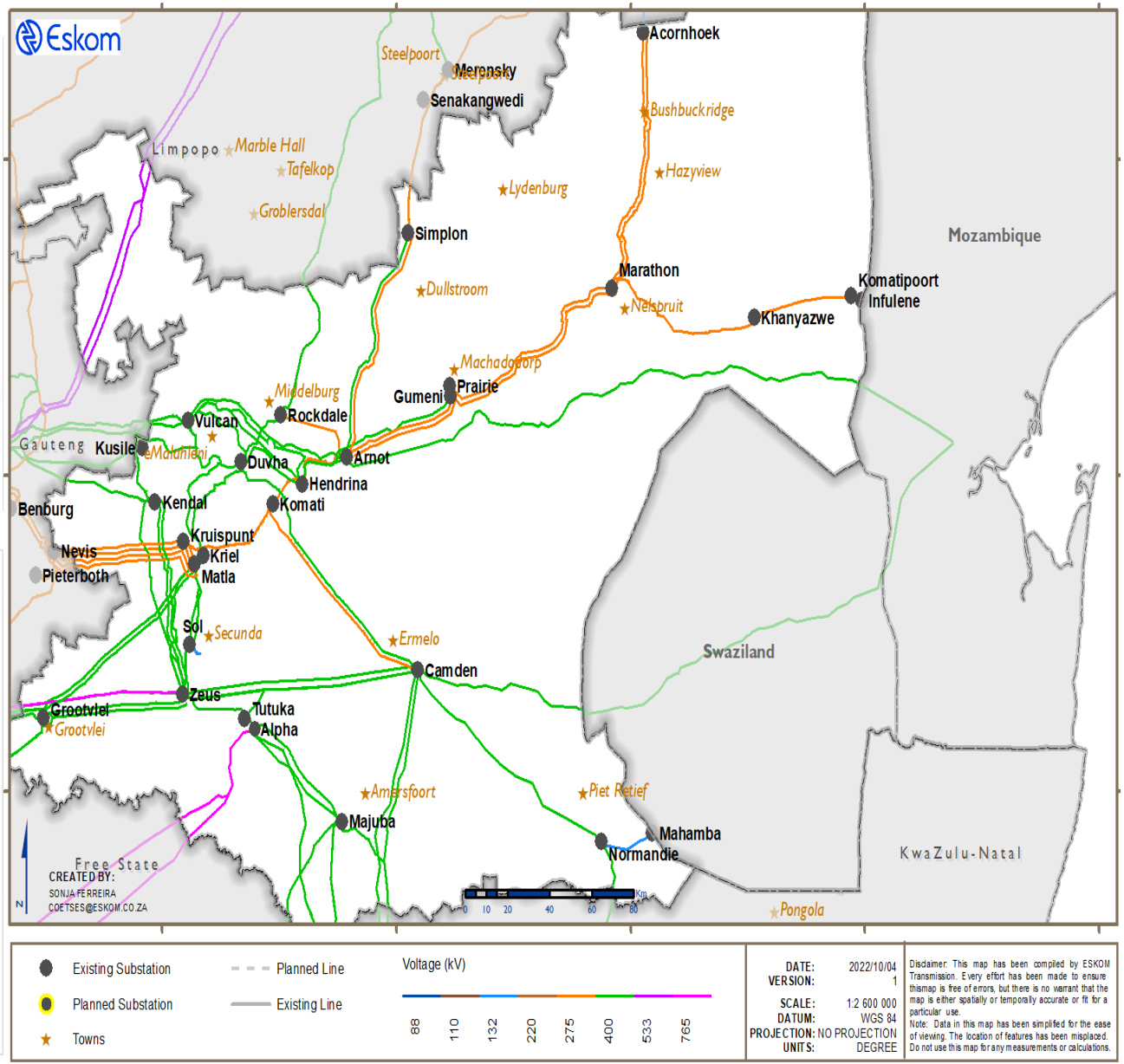
Mpumalanga province profile

Load of ~ 4 GW

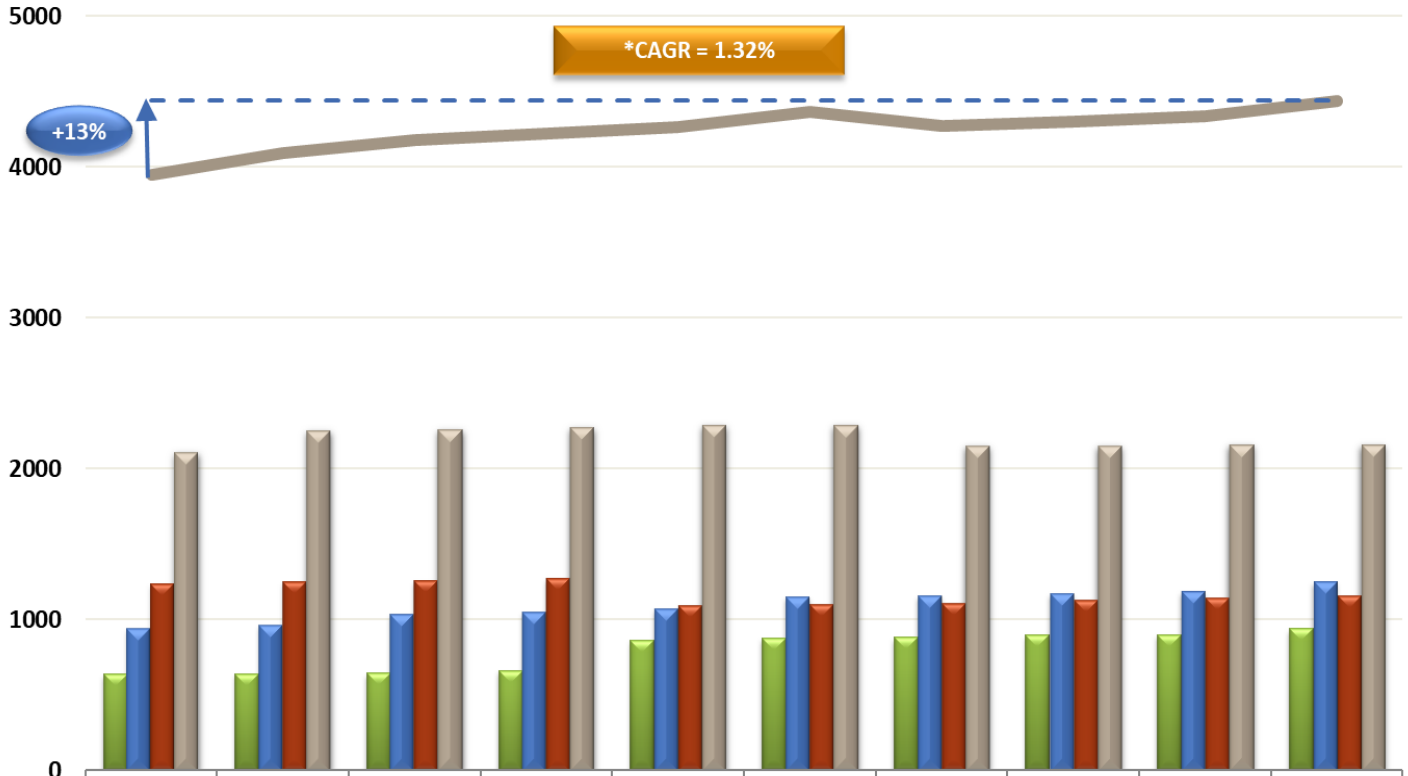


Generation capacity of ~28 GW





Mpumalanga Load Forecast

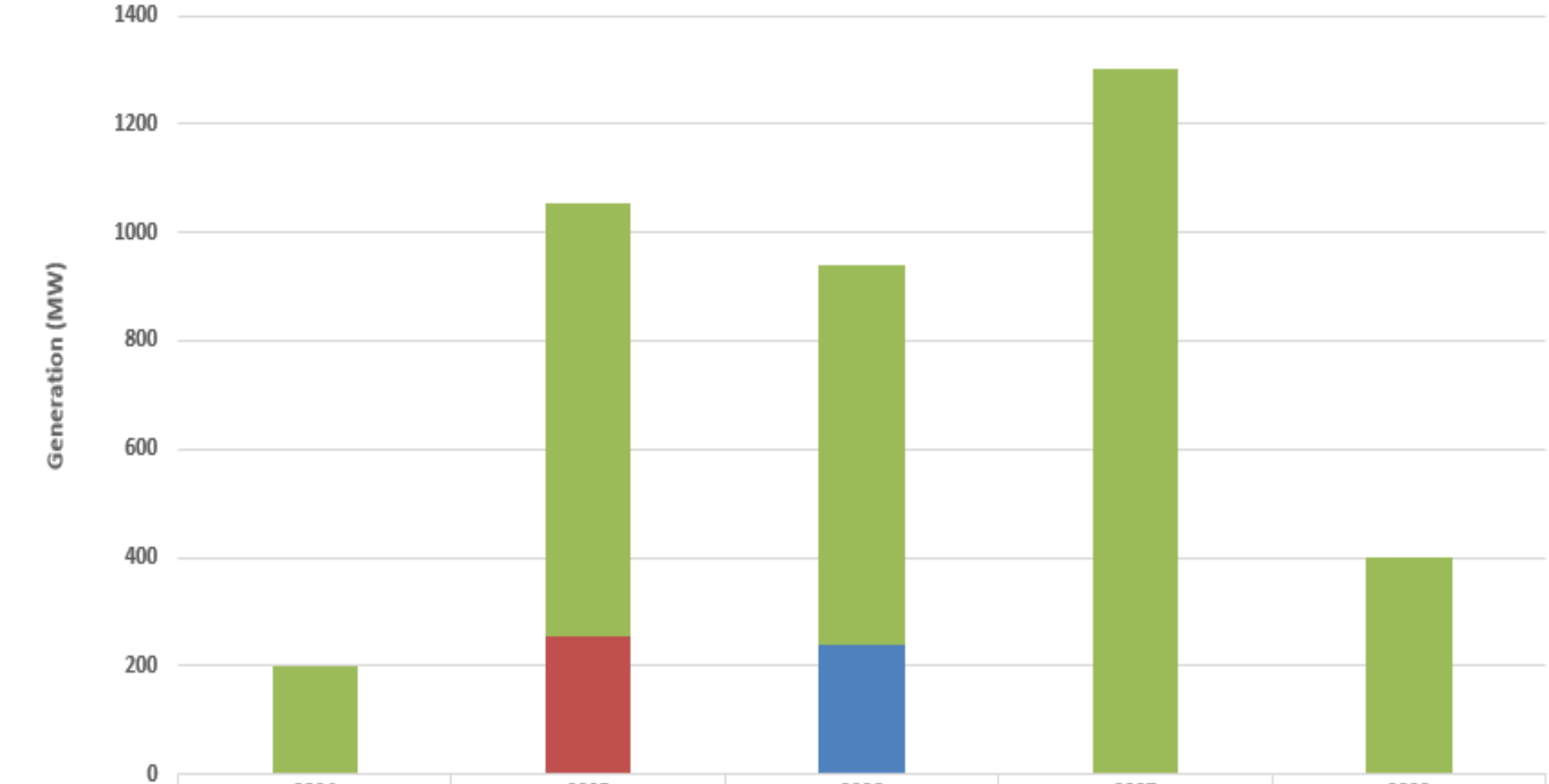


	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Middelburg	638	641	644	663	863	877	883	896	901	941
Lowveld	944	970	1042	1052	1076	1154	1164	1174	1186	1253
Witbank	1237	1254	1264	1274	1096	1104	1112	1129	1145	1162
Highveld South	2114	2254	2265	2276	2287	2293	2150	2153	2158	2157
Provincial Peak	3945	4095	4181	4221	4268	4362	4269	4302	4334	4439
2032 Peak	4439	4439	4439	4439	4439	4439	4439	4439	4439	4439

Key Growth Drivers
Residential
Commercial
Tourism
Mining
Industrial development

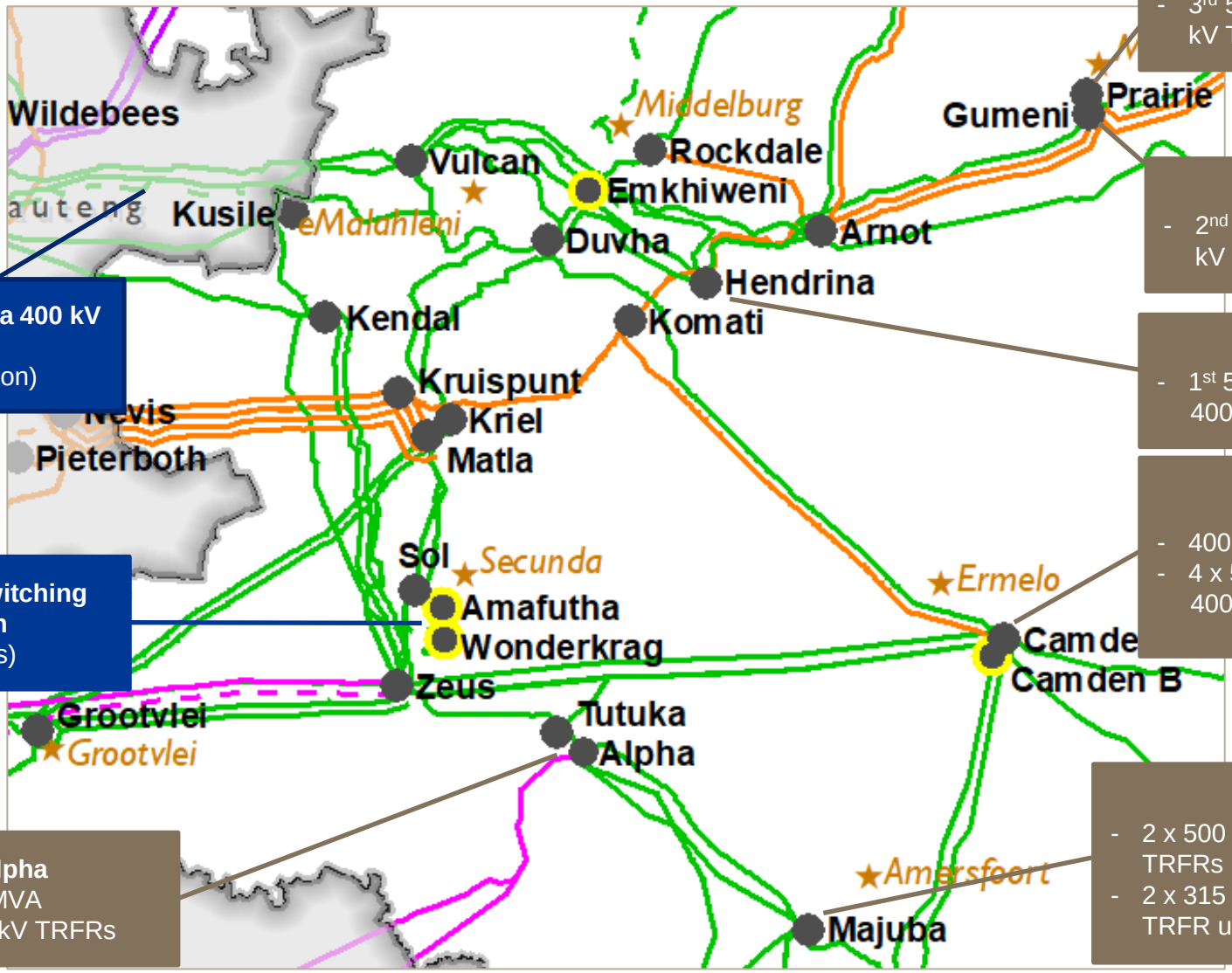
*** Compound Annual Growth Rate**

RE Generation Forecast in MP



	2024	2025	2026	2027	2029
Wind	200	800	700	1300	400
PV		254			
Battery Storage			239.5		

Generation developments in Mpumalanga



Kusile-Lulamisa 400 kV Line
(In Execution)

Amafutha Switching Station
(OCGTs)

Prairie
- 3rd 500 MVA 275/132 kV TRFR

Gumeni
- 2nd 500 MVA 400/132 kV TRFR

Hendrina
- 1st 500 MVA 400/132 kV TRFR

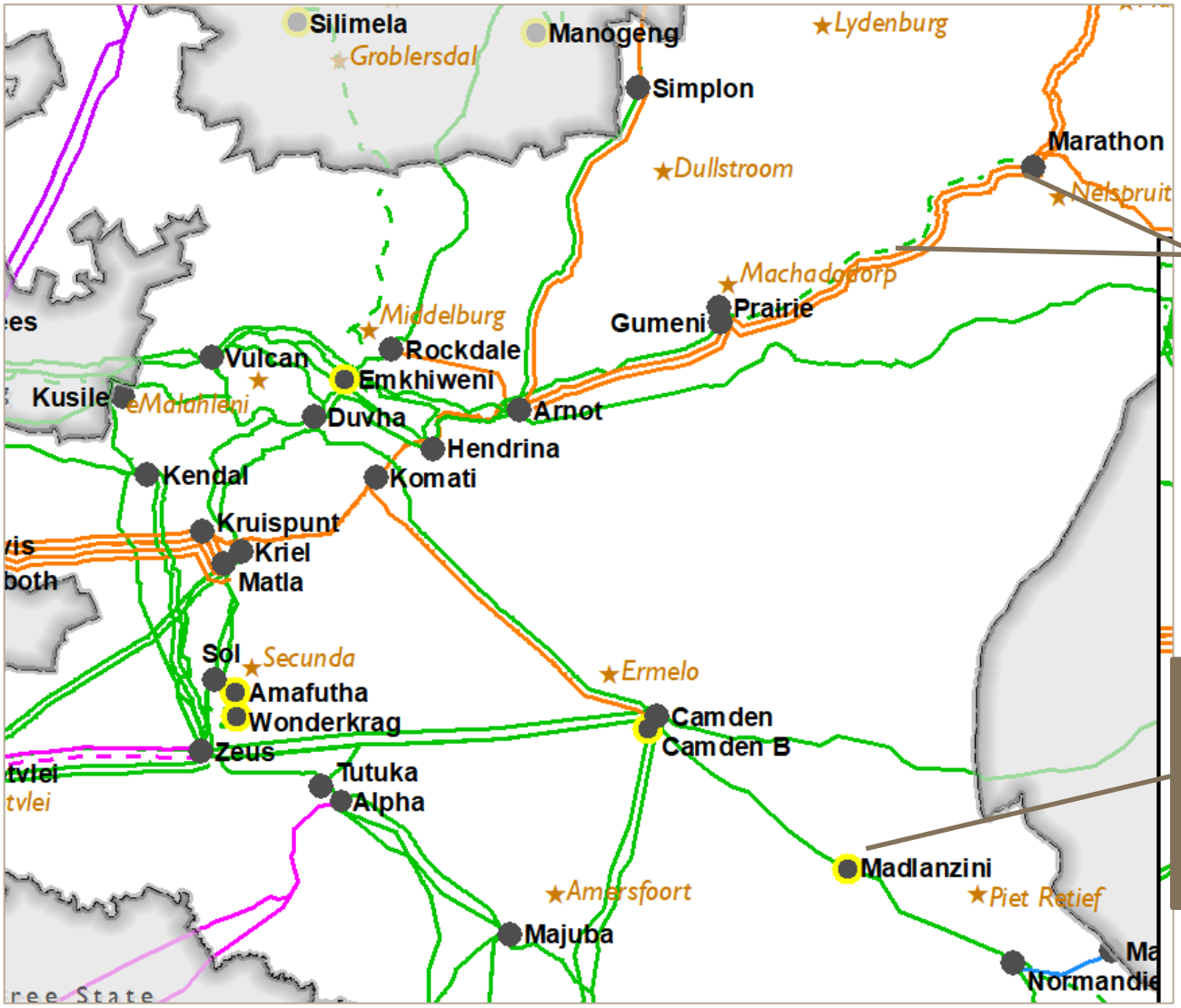
Camden B
- 400 kV LILO
- 4 x 500 MVA 400/132 kV TRFRs

Alpha
- 2 x 500 MVA 400/132 kV TRFRs

Majuba
- 2 x 500 MVA 400/132 kV TRFRs
- 2 x 315 MVA 400/88 kV TRFR upgrades

2023 - 2027 **2028 - 2032**

Developments plans for Mpumalanga



Marathon 400 kV Integration

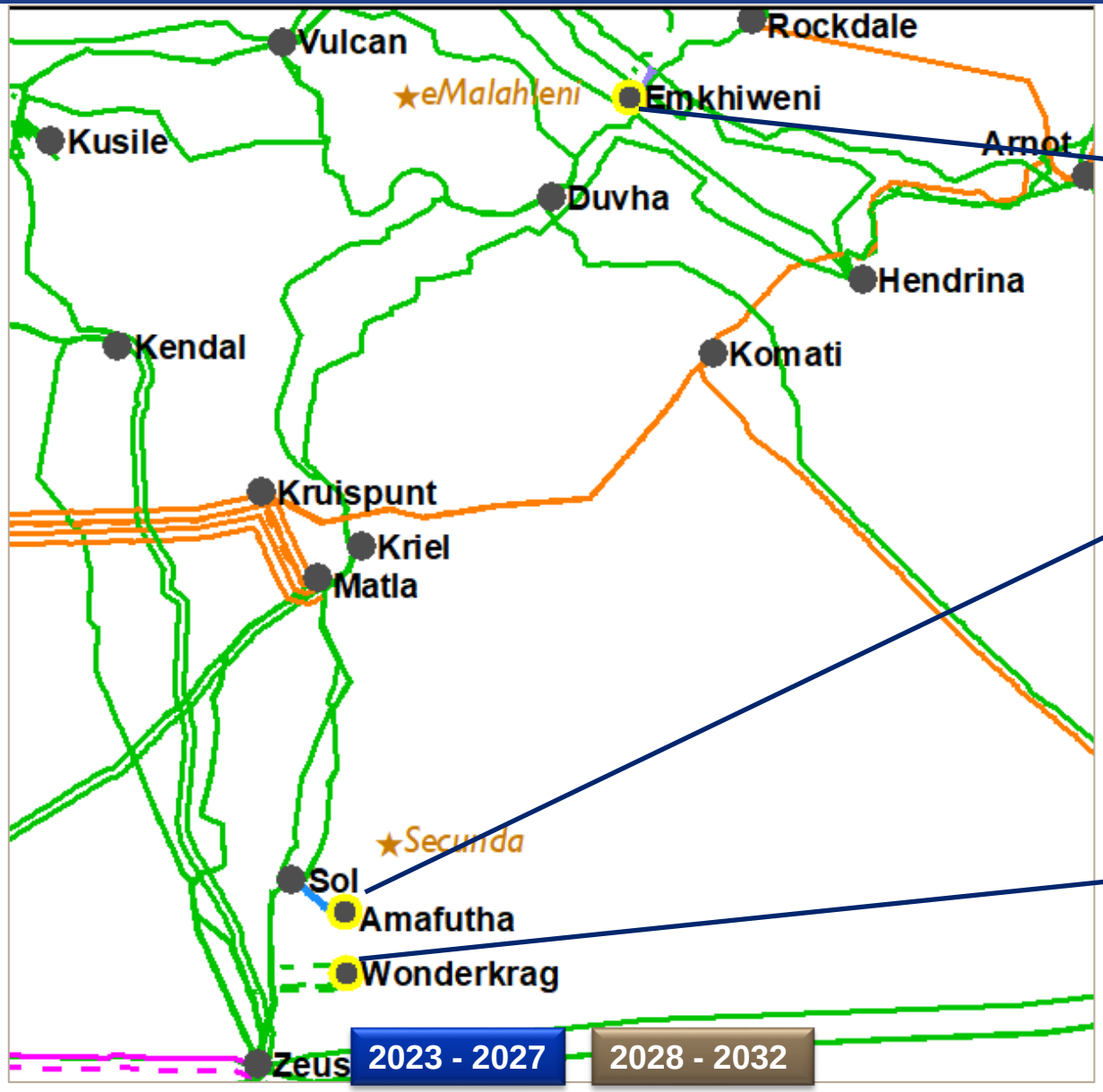
- Gumeni-Marathon line
- 500 MVA 400/132 kV TRFR

Ermelo-Richards Bay Freight Rail Strengthening: Madlanzini Substation

Required to improve security of supply and to increase tonnage capacity

2023 - 2027 | **2028 - 2032**

Development plans for Mpumalanga



Emkhiweni integration

Required to de-load Vulcan and Rockdale unfirm transformations

Amafutha 132 kV Switching Station

Will aid the transition of the load shift to Wonderkrag and will thereafter integrate OCGTs into Sol.

Wonderkrag integration

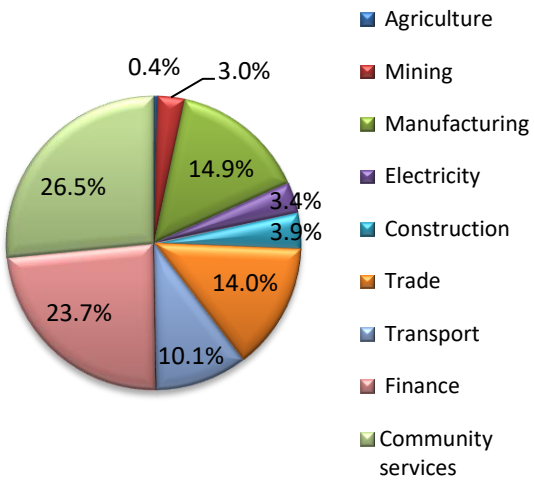
Required to address the unfirm transformation and fault level exceedance

Gauteng

Gauteng Province Profile

Load

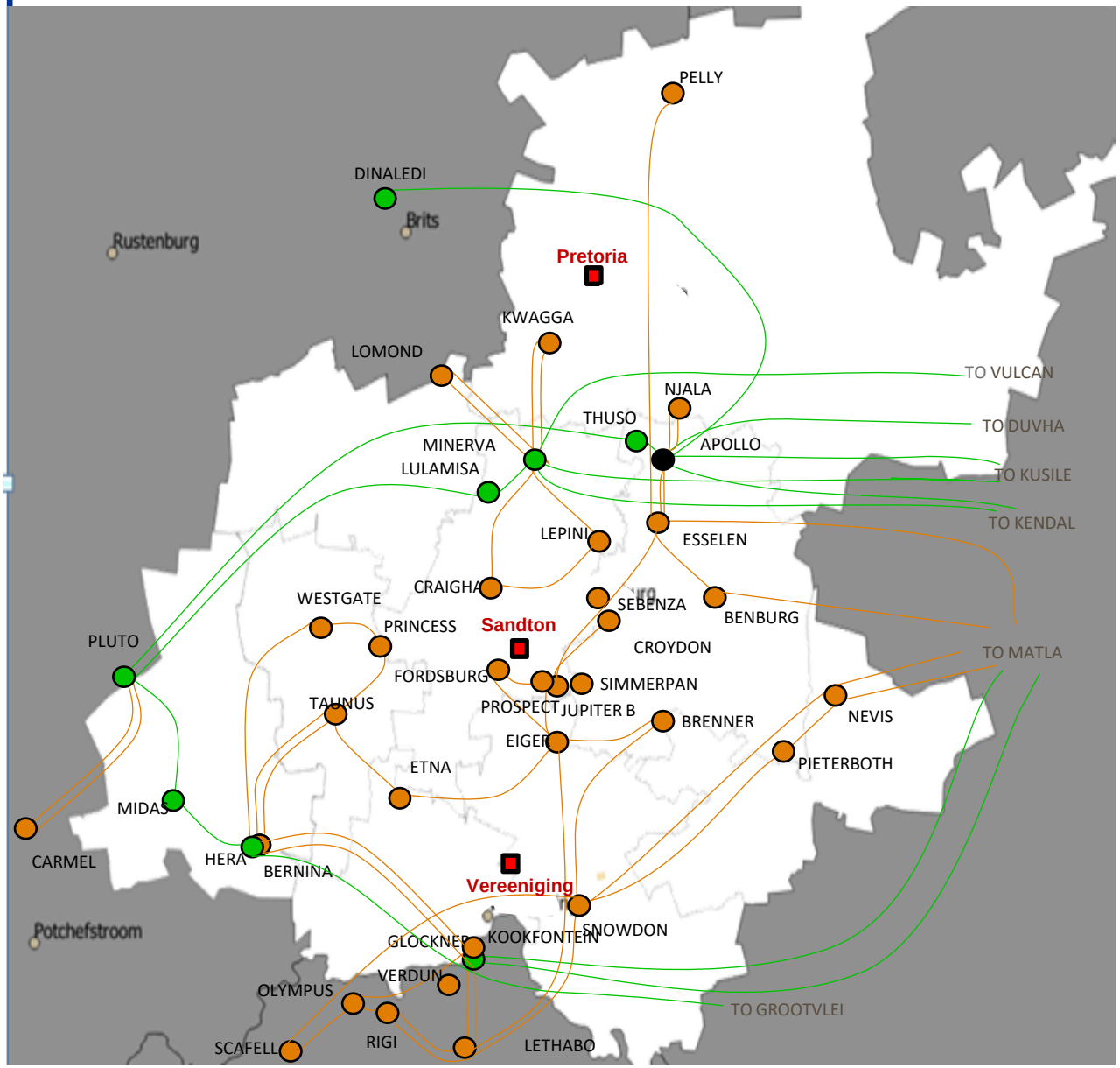
- Grid peak demand ~9 845 MW : 24th July '19



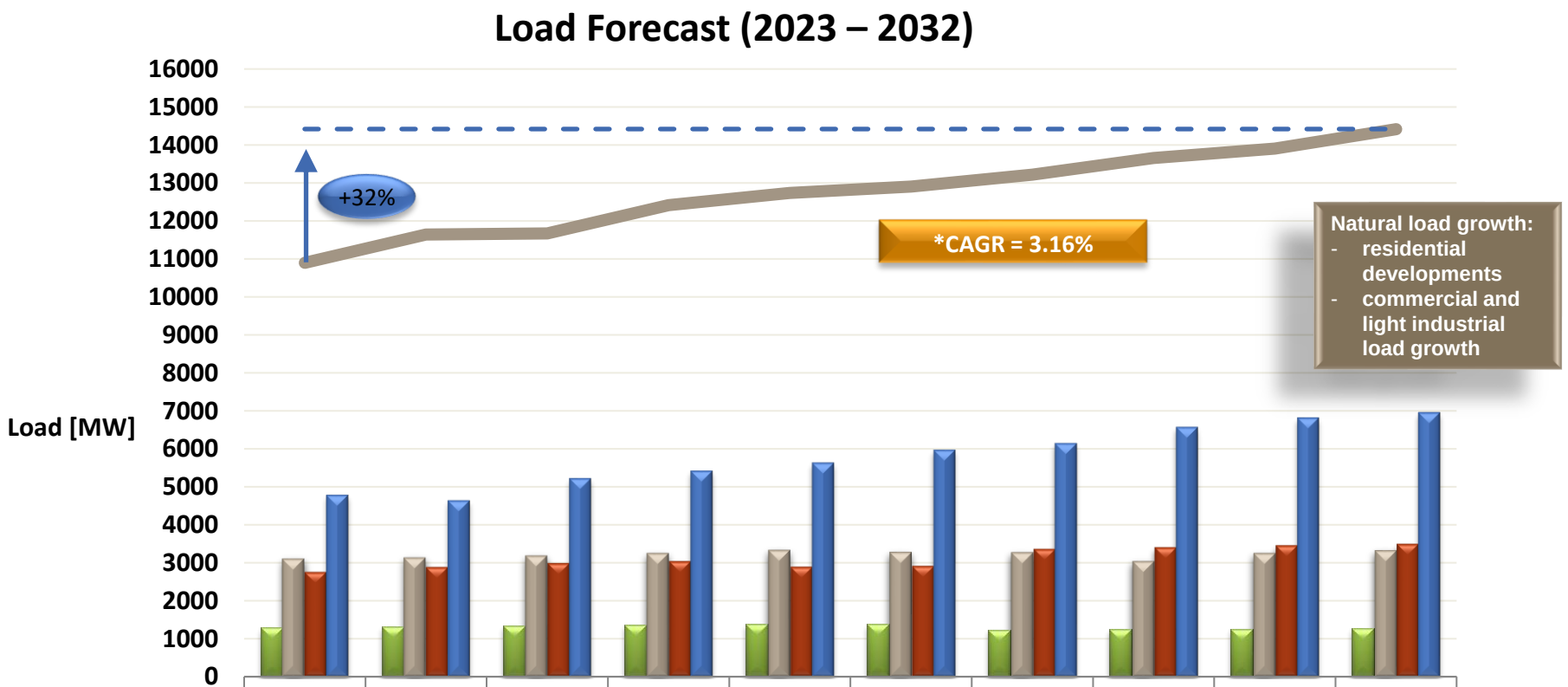
Generation

- Kelvin Power Station (in Johannesburg) and Rooiwal Power Station (in Tshwane) are some of the Independent Power Producers (IPP's) t hat lie within the defined Gauteng grid area. There is also potential Biomass IPP's in the region.

- The primary sources of power are Cahora Bassa, Lethabo, Matla, Kendal, Duvha, Grootvlei and Matimba power stations.



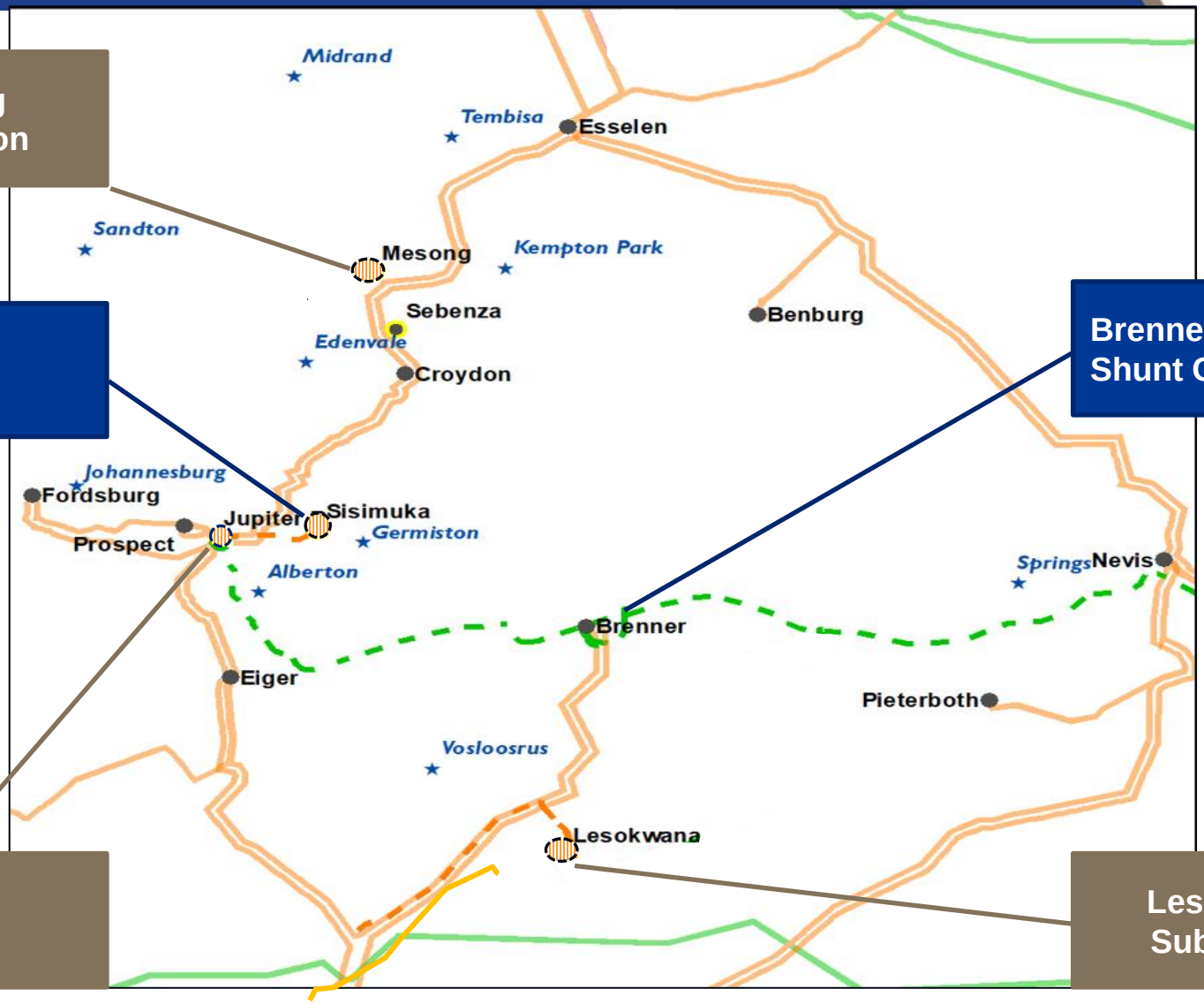
Gauteng Load Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Vaal	1295	1317	1338	1352	1372	1386	1234	1243	1259	1268
East Rand	3096	3123	3174	3239	3322	3270	3261	3031	3239	3313
West Rand	2751	2882	2984	3033	2888	2913	3353	3399	3454	3488
Johannesburg	4780	4633	5218	5415	5625	5960	6140	6562	6811	6948
Provincial Peak	10896	11644	11675	12418	12736	12902	13219	13656	13903	14417
2031 Peak	14417	14417	14417	14417	14417	14417	14417	14417	14417	14417

* Compound Annual Growth Rate

Development plans for Johannesburg East and South regions



Mesong Substation

Sisimuka Substation

Brenner 88kV Shunt Capacitors

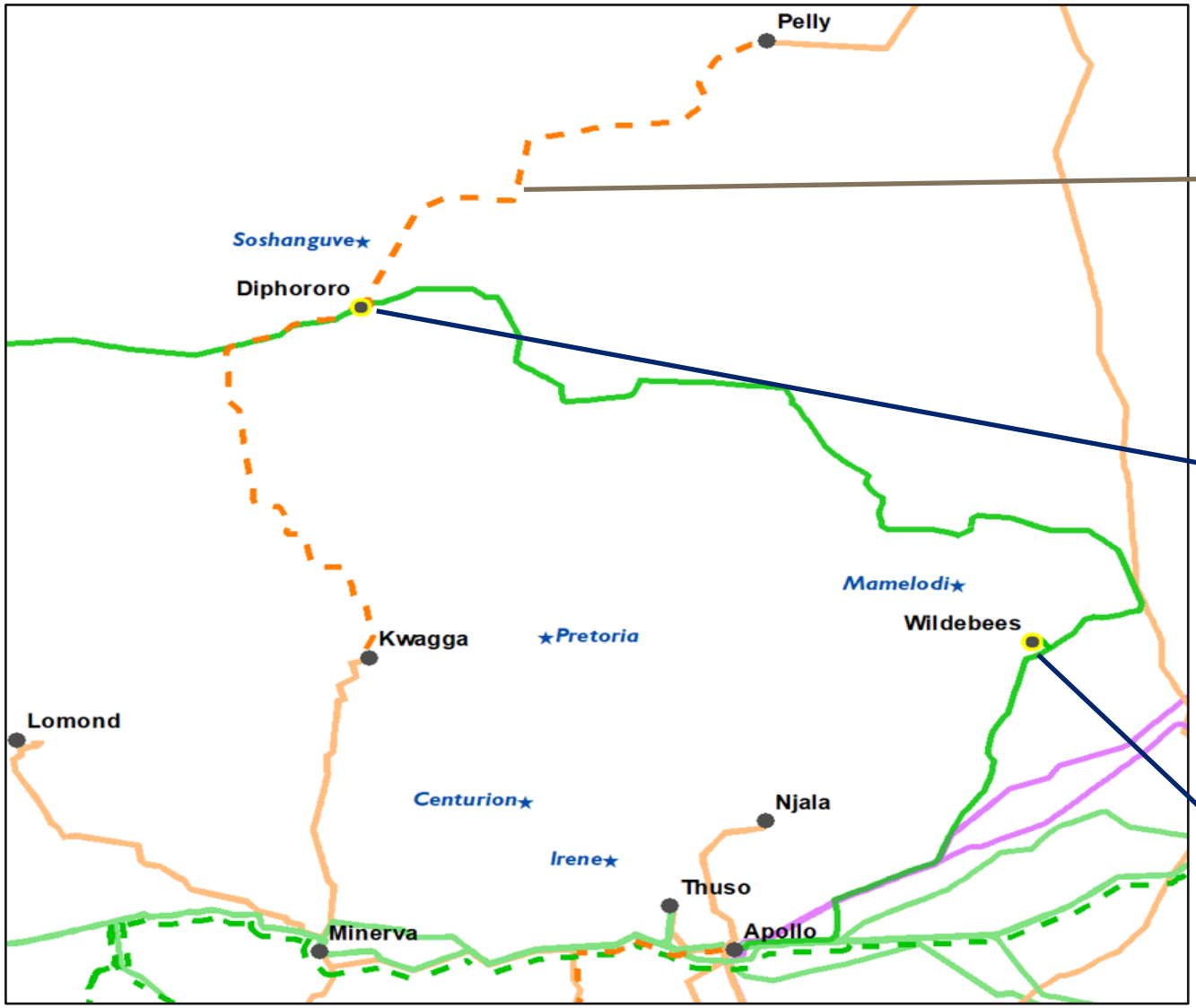
Jupiter B Integration

Lesokwana Substation

2023 - 2027

2028 - 2032

Development plans for the Tshwane area



Tshwane Phase 2
- Diphororo 400/275kV transformation
- Pelly-Diphororo – Kwagga 275kV line

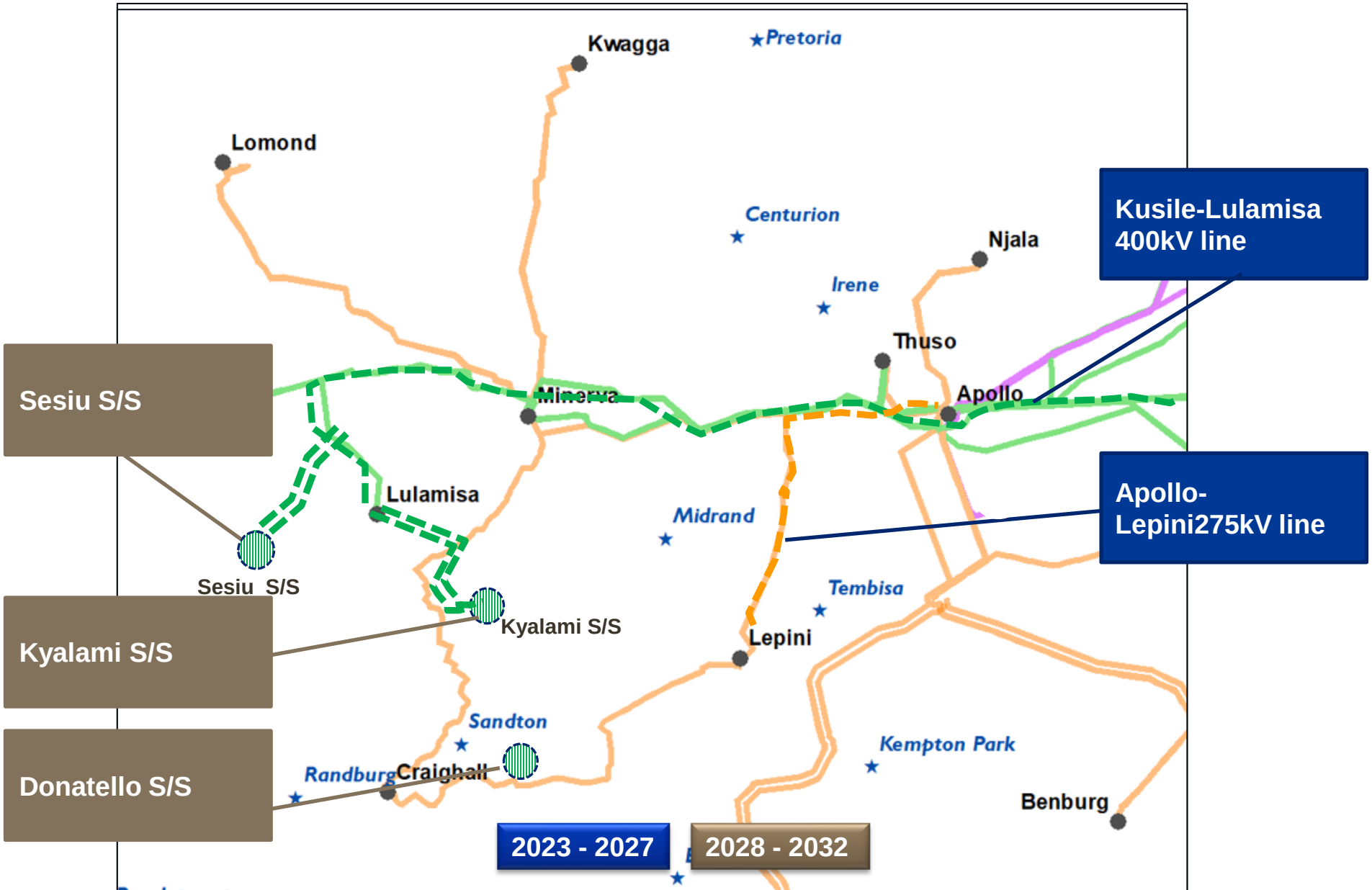
Diphororo S/S Integration
(PTA North)

Wildebees S/S Integration
(PTA East, Mamelodi)

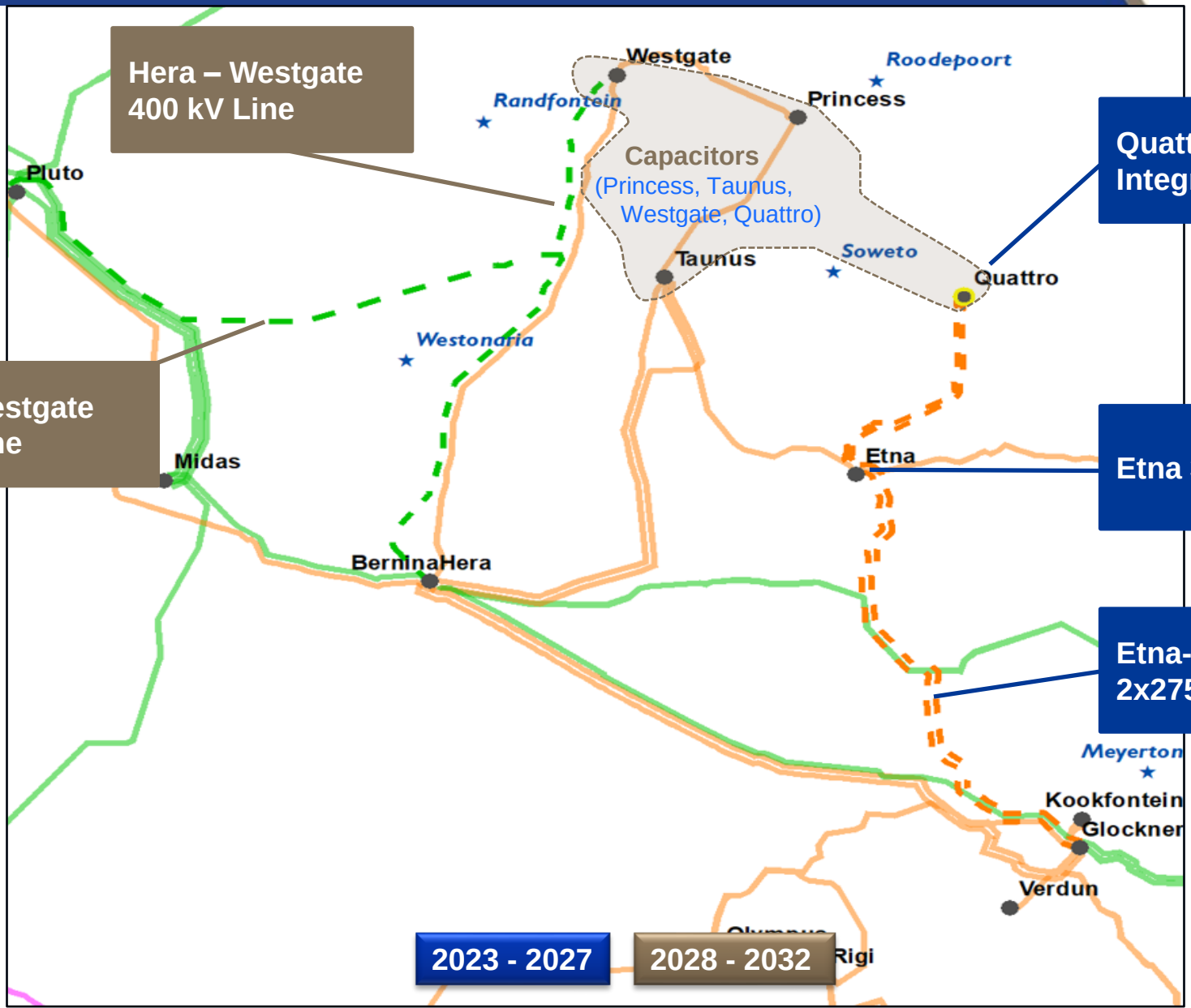
2023 - 2027

2028 - 2032

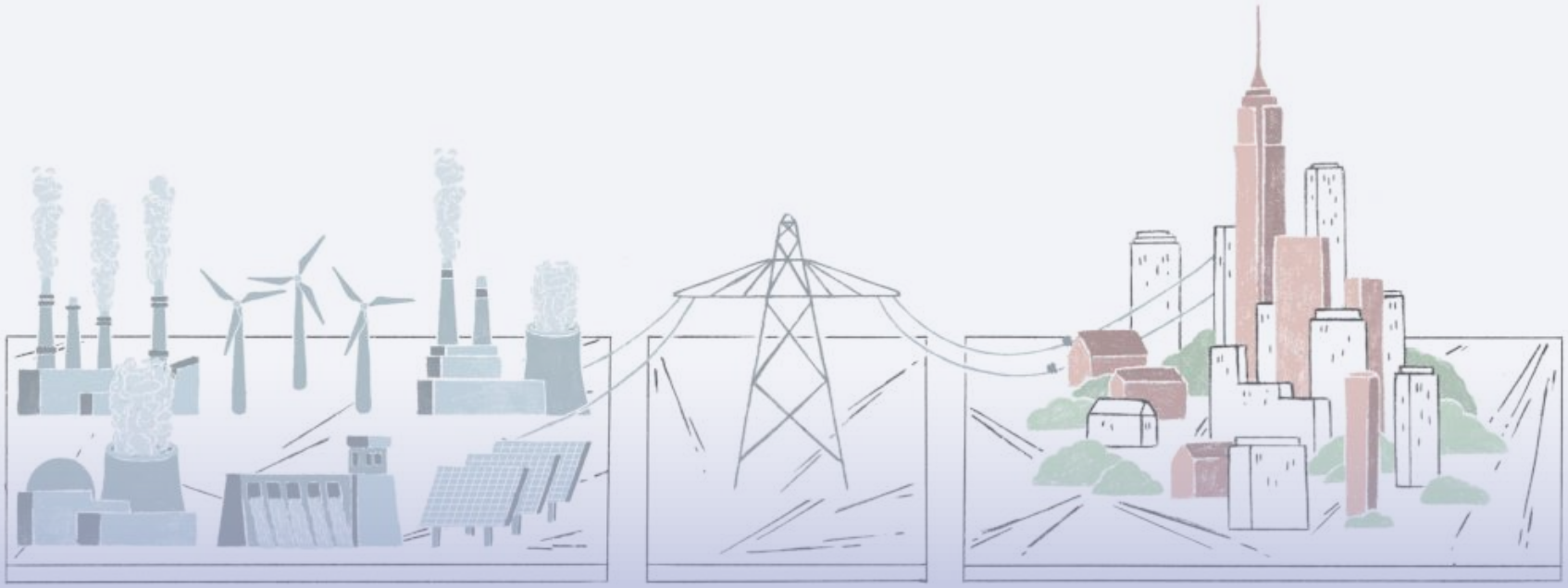
Development plans for the Johannesburg North region



Development plans for the West Rand & Vaal area



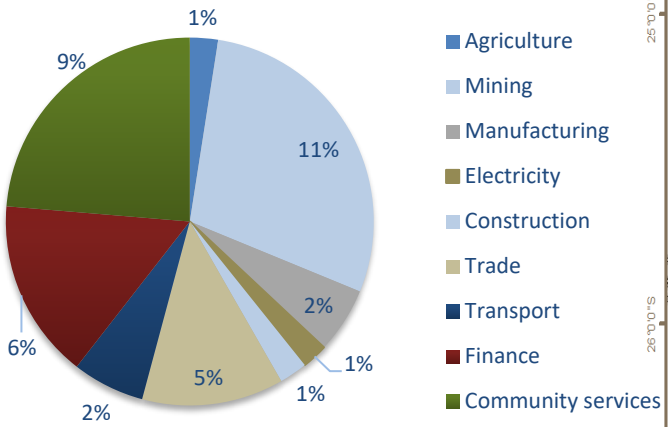
North West



North West Province Profile

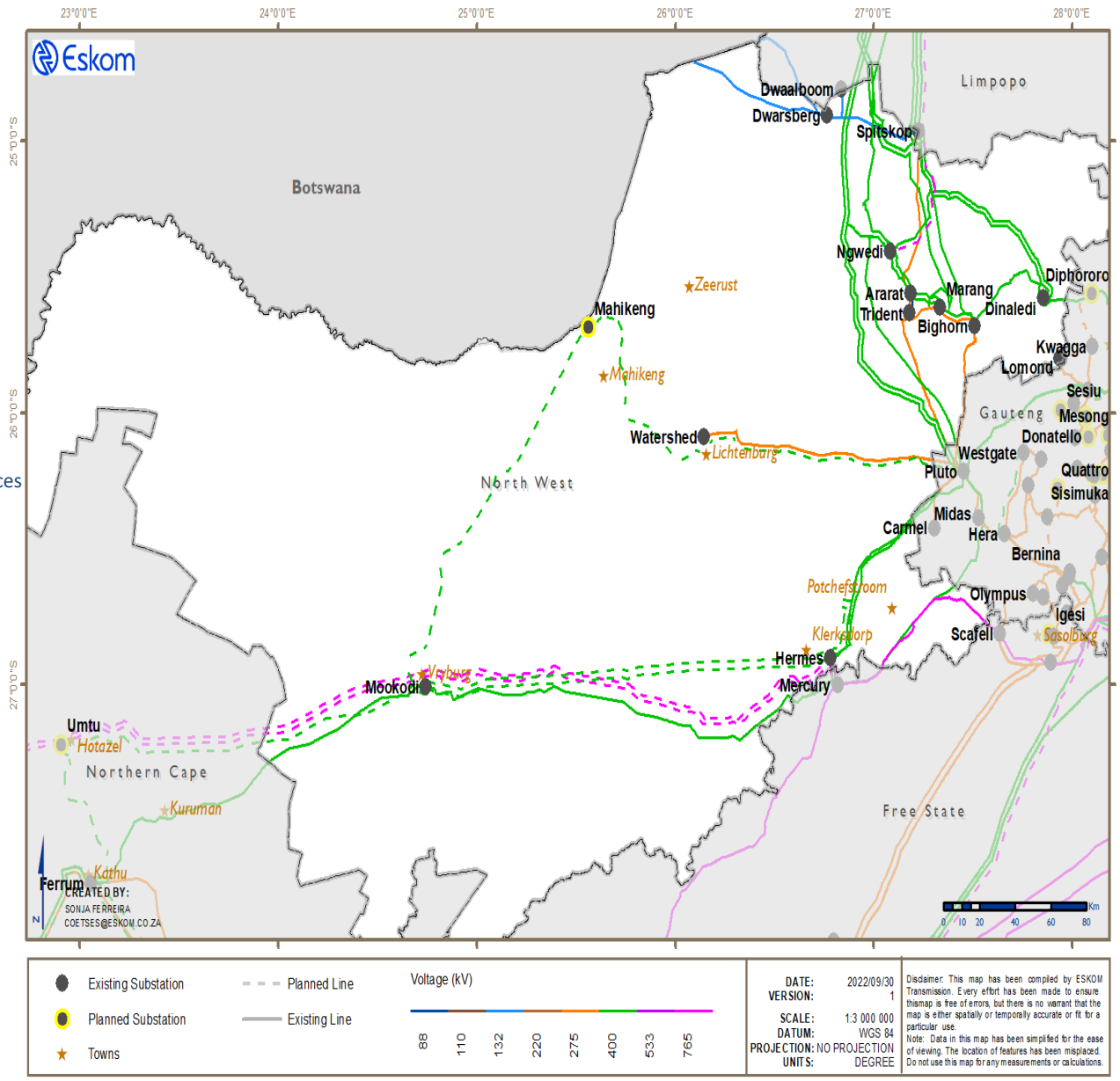
Load

2021 Peak: 3279 MW



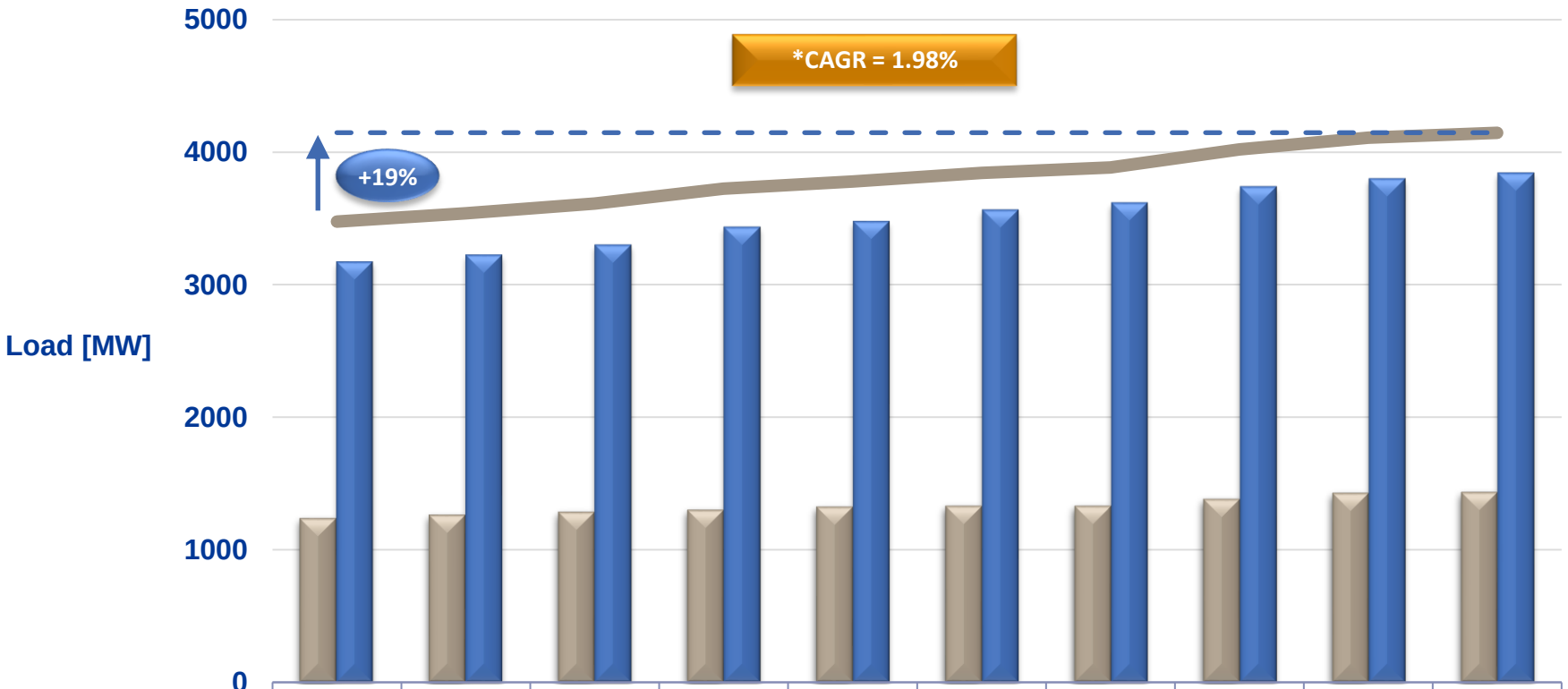
Generation

- There are no power stations located in the North West province. The province is supplied from power stations in Limpopo and Mpumalanga provinces.
- Current installed Renewable Energy is from PV IPPs with an output of 224.9MW



North West Load Forecast

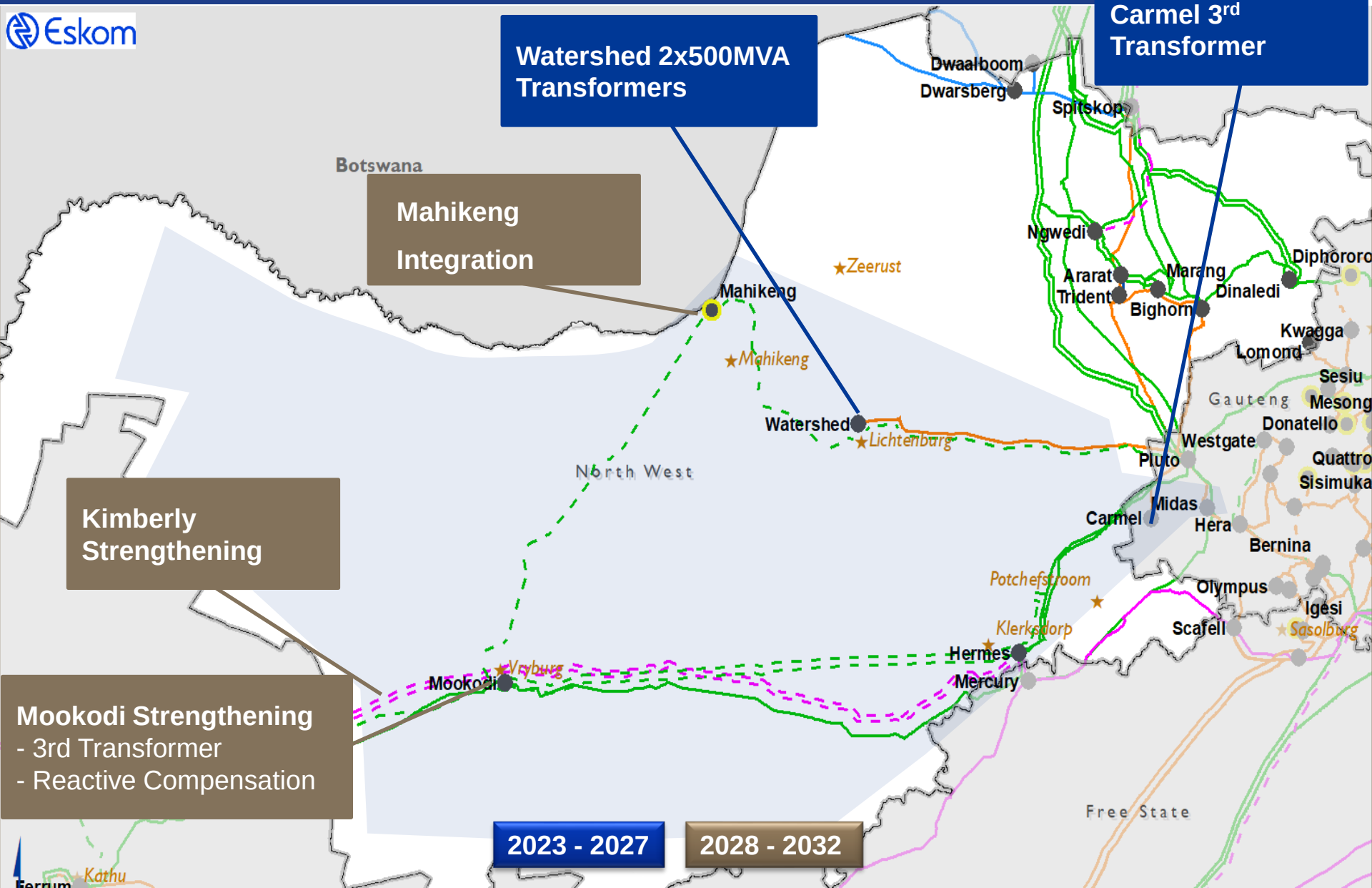
North West Province
Load Forecast (2023 – 2032)



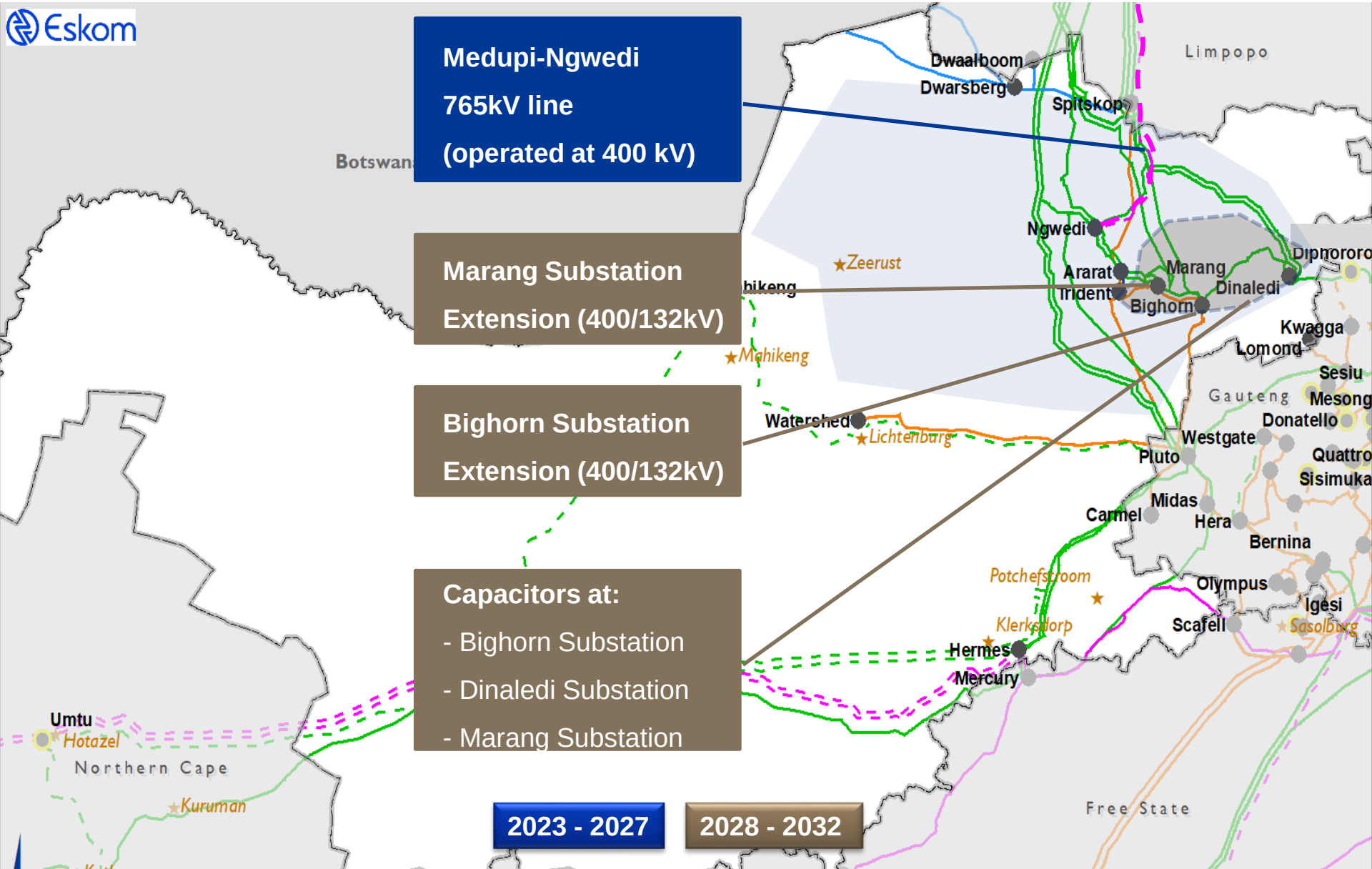
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Carletonville	1235	1260	1282	1298	1322	1327	1329	1380	1426	1433
Rustenburg	3172	3224	3299	3433	3476	3563	3617	3737	3797	3842
Provincial Peak	3476	3538	3613	3724	3778	3844	3884	4020	4108	4147

Growth Drivers in the Province: Mining, Manufacturing & Agriculture

Developments plans for Carletonville CLN



Development plans for the Rustenburg CLN



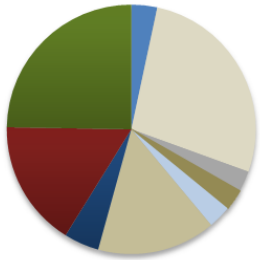
Limpopo

Limpopo Province Profile

Load

- Peak load of 3357 MW in 2020
- Peak load was 3106 MW in 2021

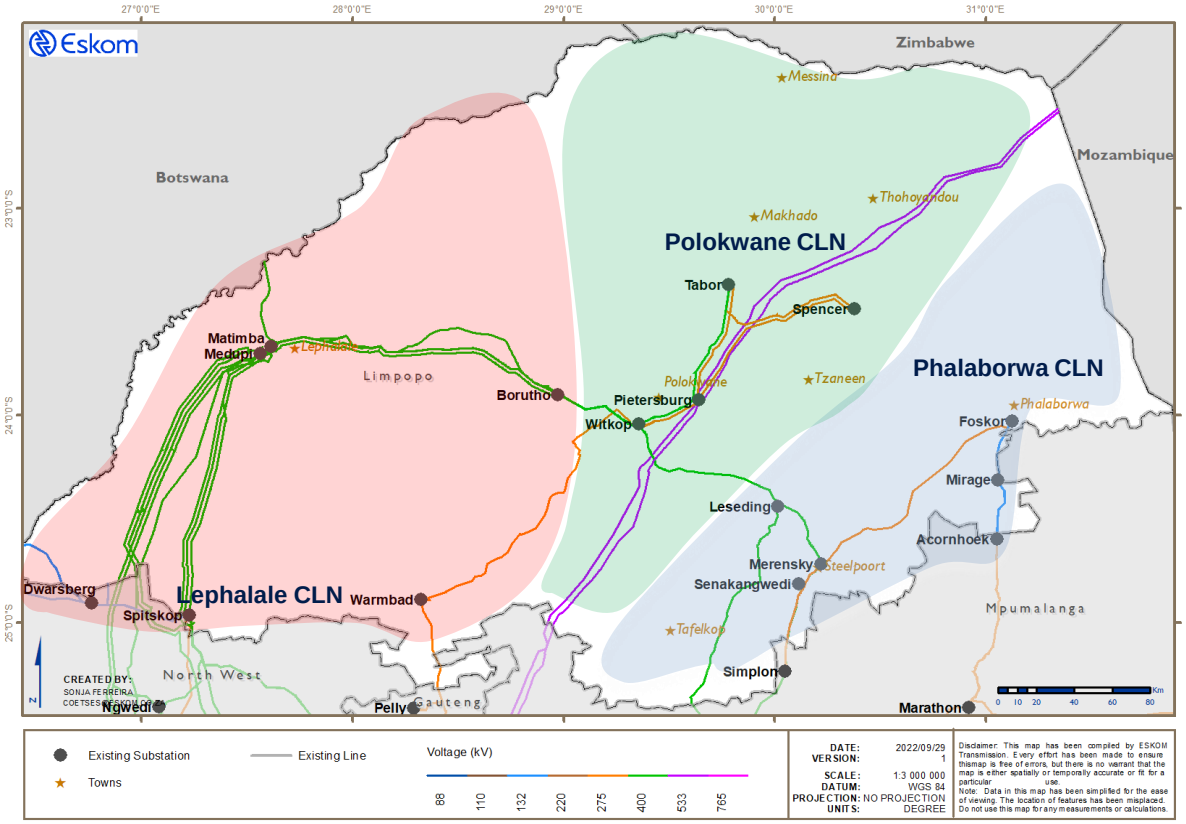
Economic Sectors



Agriculture | Mining | Manufacturing
Electricity | Construction | Trade
Transport | Finance | Community services

Generation

Type	Name	Output
Coal Base Load	Matimba	3325 MW
	Medupi (excl. unit 4)	2382 MW
Renewables	Witkop PV	30 MW
	Soutpan PV	28 MW
	Villa Nora PV	60 MW
Total Installed Generation		**6490 MW**



Limpopo Province Load Forecast

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Polokwane	1065	1090	1109	1131	1153	1190	1216	1280	1311	1339
Lephalale	1670	1708	1742	1764	1854	1872	1904	1946	1978	1995
Phalaborwa	1665	1692	1806	1828	1852	1877	1939	2020	2086	2109
Provincial Peak	4099	4183	4334	4395	4523	4600	4710	4886	5004	5069
2032 Peak	5069	5069	5069	5069	5069	5069	5069	5069	5069	5069

*Compound Annual Growth Rate

Load Drivers

Lephalale Load Growth Drivers:

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

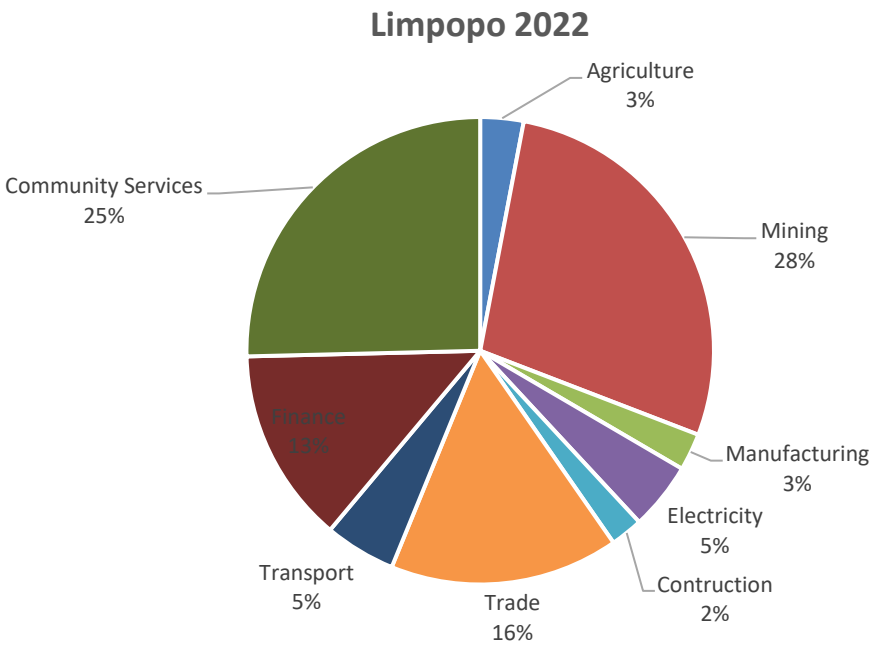
Polokwane Load Growth Drivers:

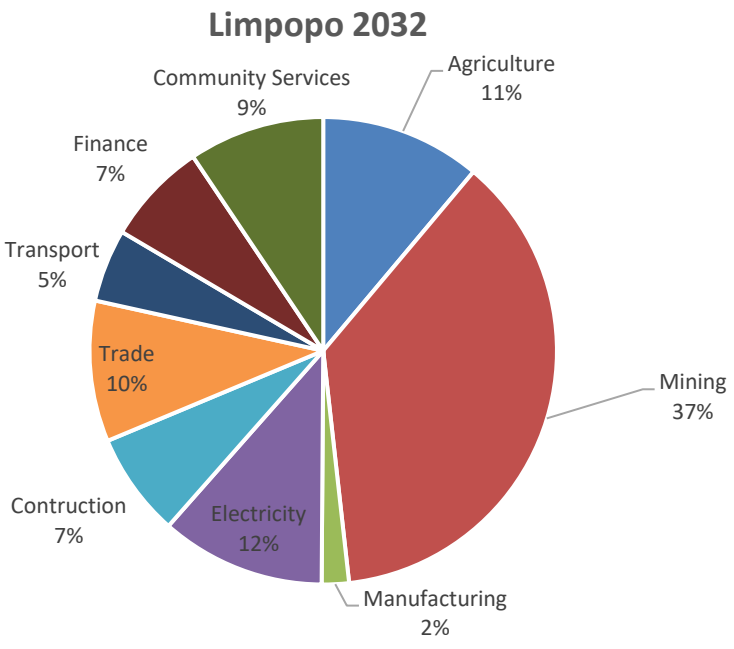
- Electrification
- Agriculture
- Diamond and Coal Mining

Phalaborwa Load Growth Drivers:

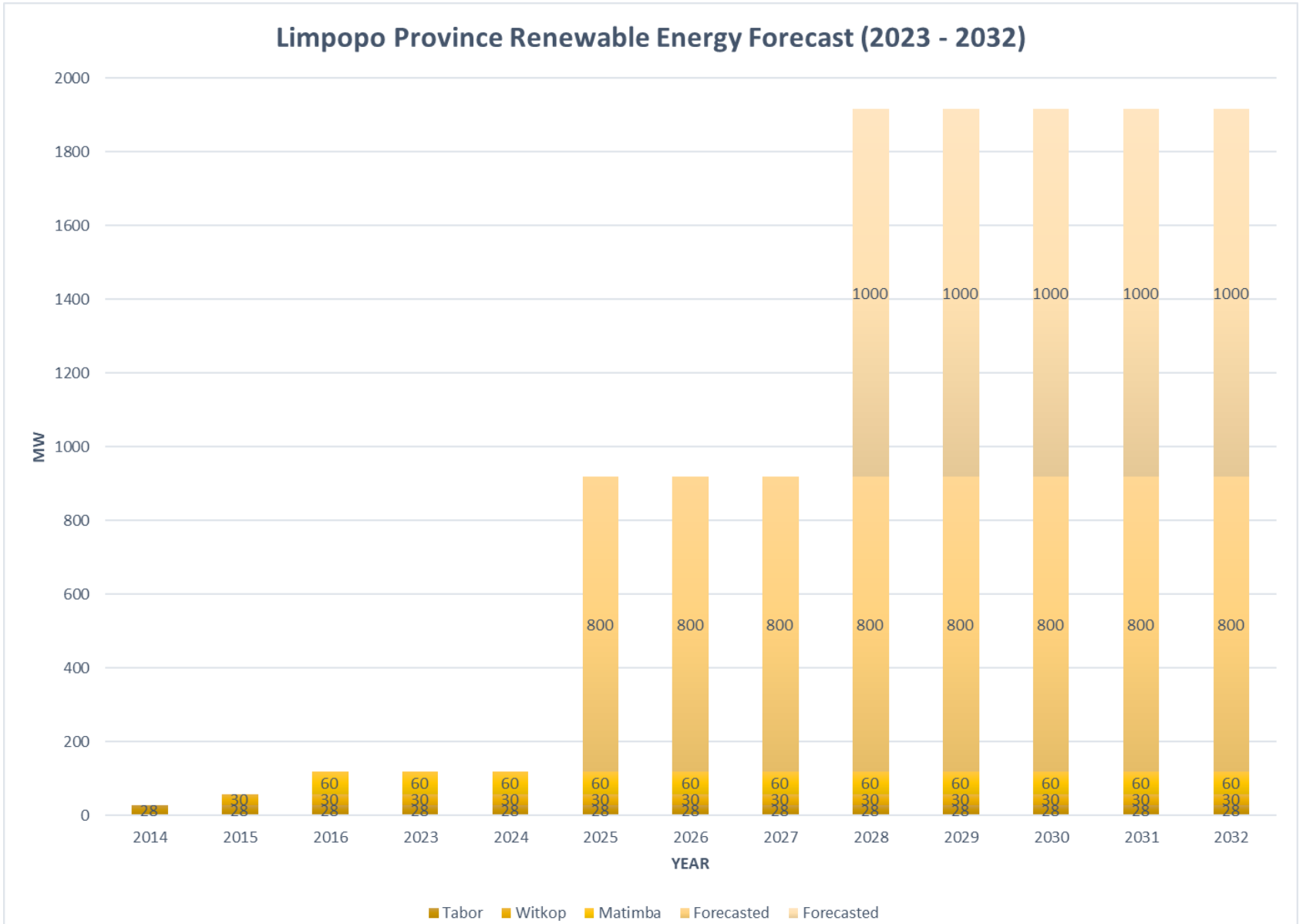
- Electrification
- Agriculture
- Chrome Mining

Economic Sectors





Limpopo Renewable Energy Forecast

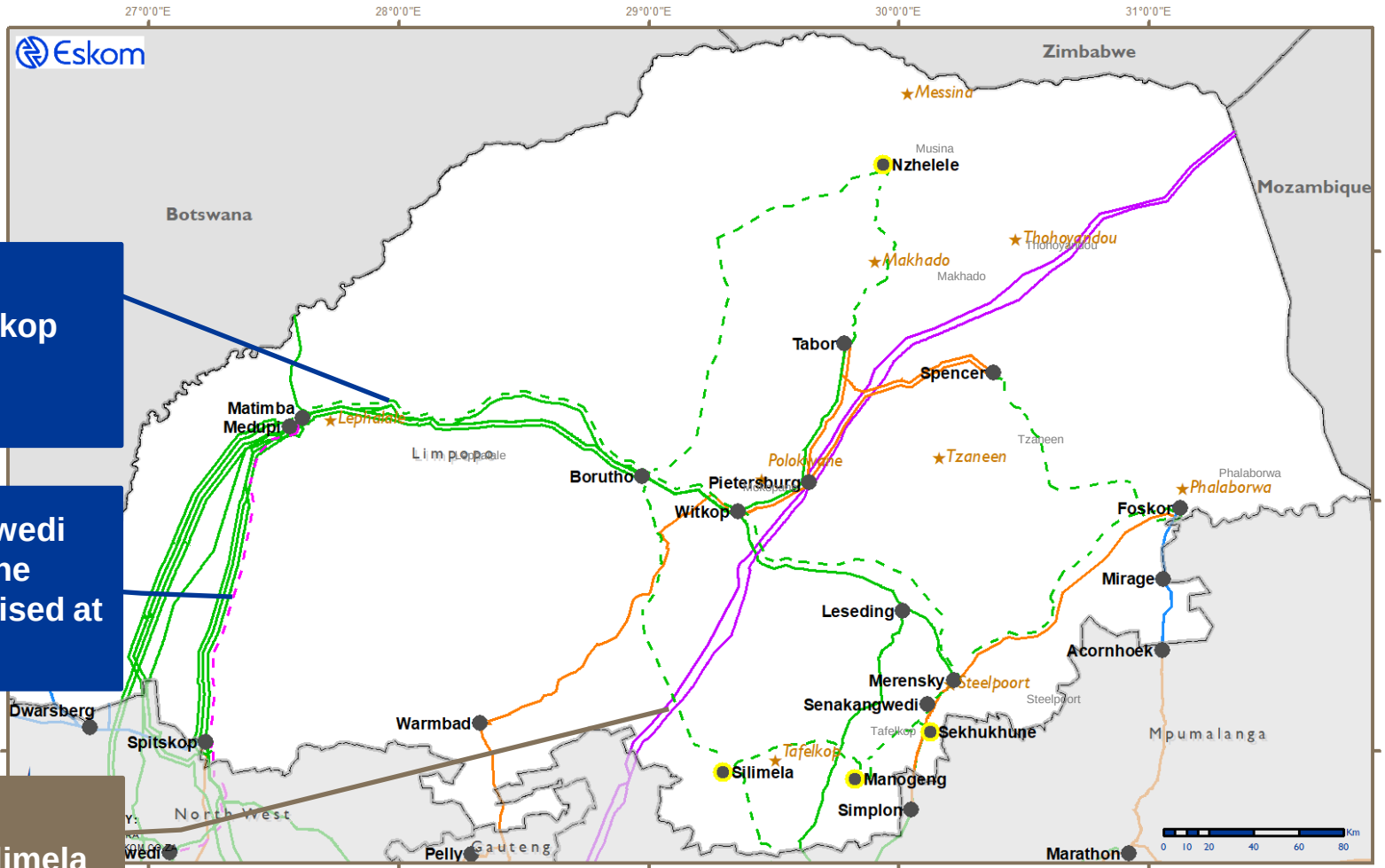


Strengthening associated with generation integration

Medupi - Witkop 400 kV line

Medupi - Ngwedi 1st 765 kV line (To be energised at 400 kV)

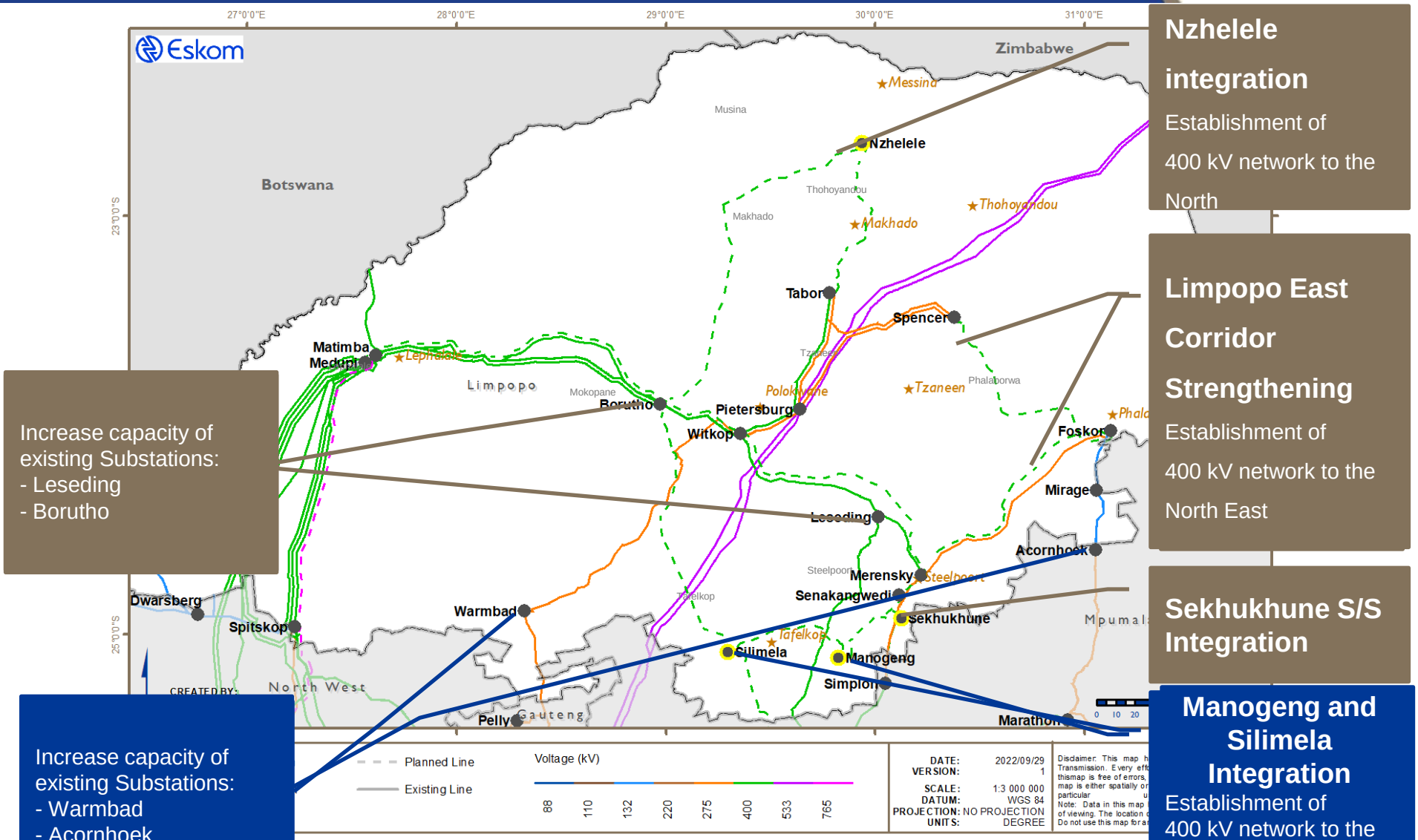
Borutho - Silimela 400 kV line



2023 - 2027

2028 - 2032

Strengthening associated with load growth



Nzhelele integration

Establishment of 400 kV network to the North

Limpopo East Corridor Strengthening

Establishment of 400 kV network to the North East

Sekhukhune S/S Integration

Manogeng and Silimela Integration

Establishment of 400 kV network to the South

Integrate Pump Storage

Increase capacity of existing Substations:
- Leseding
- Borutho

Increase capacity of existing Substations:
- Warmbad
- Acornhoek

2023 - 2027

2028 - 2032

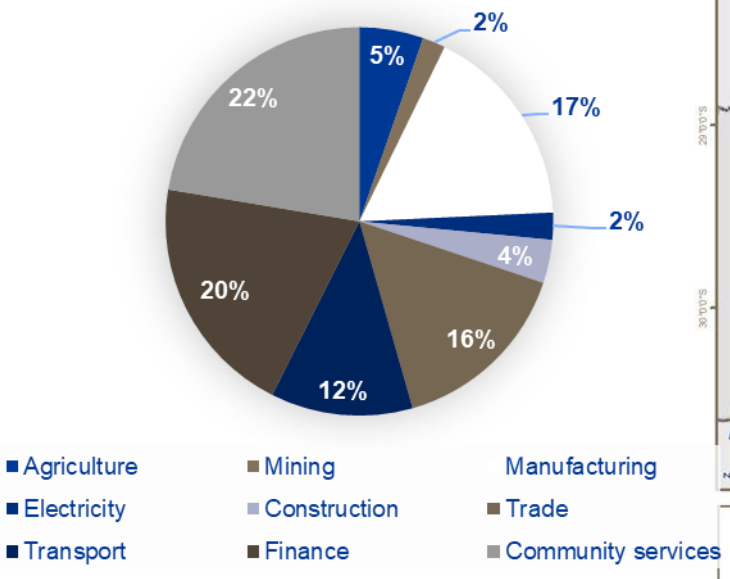
KwaZulu-Natal

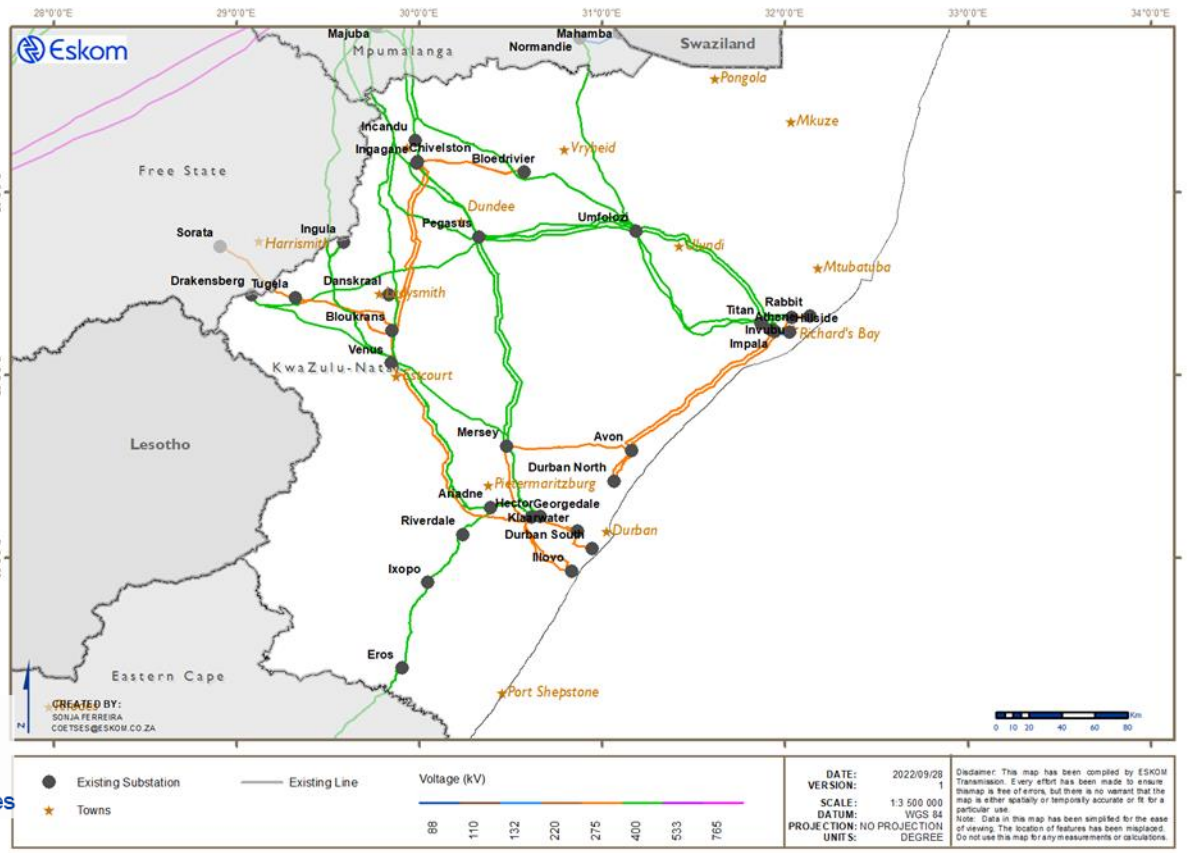
KwaZulu-Natal Province Profile

Peak Load

- 5904 MW in 2020
- 6070 MW in 2021

Economic Sectors

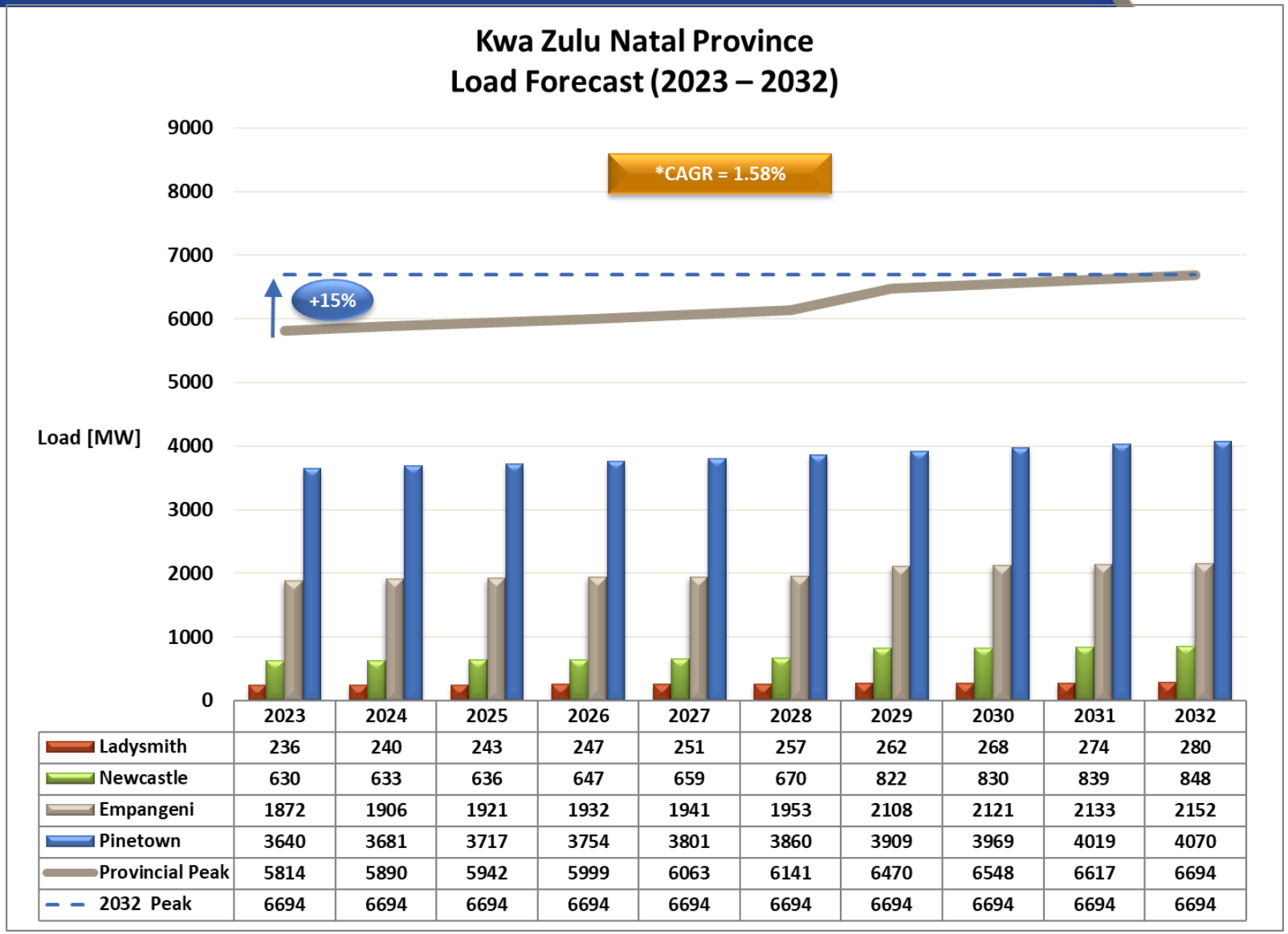




Generation

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

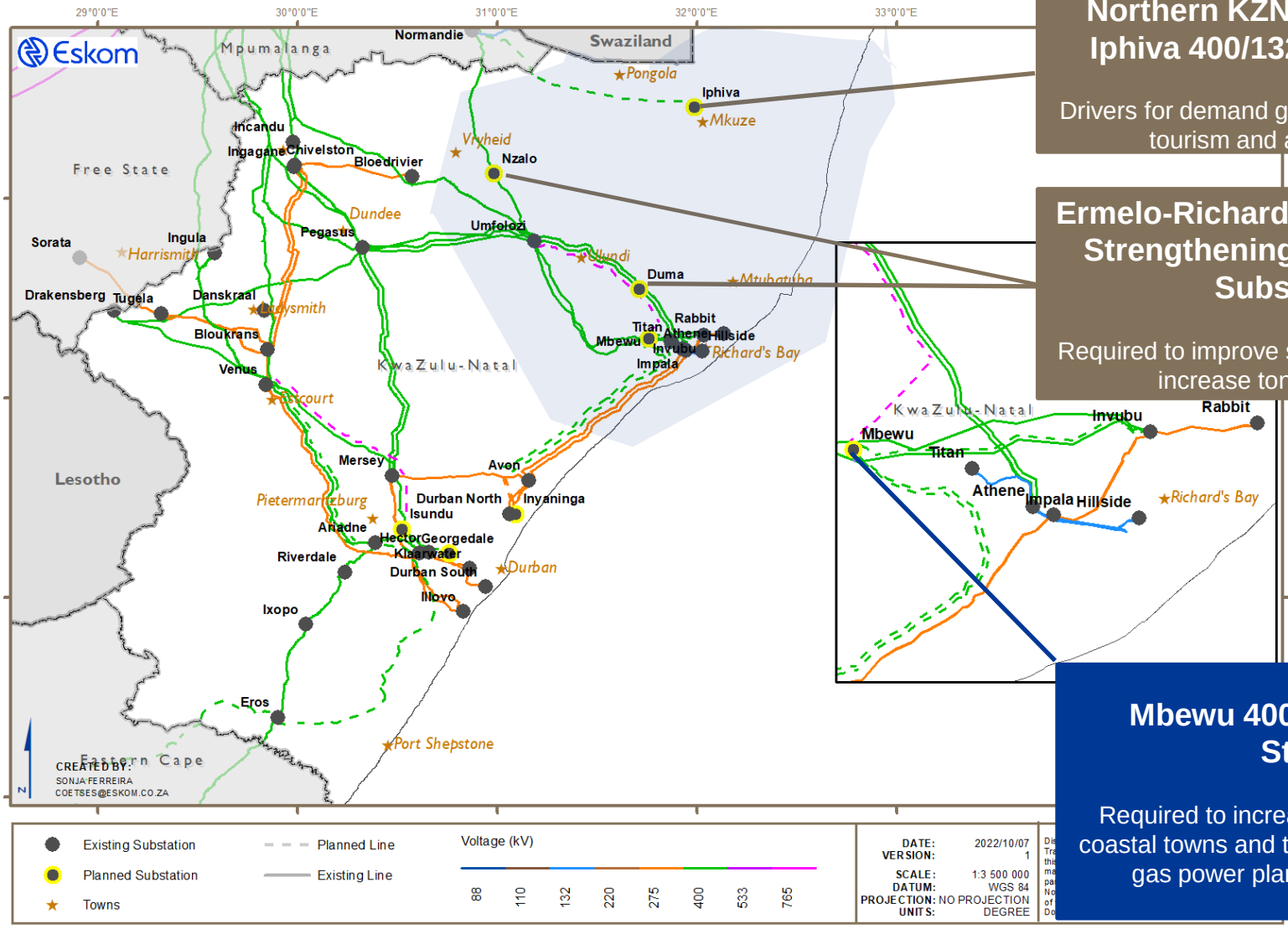
KwaZulu-Natal Load Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Ladysmith	236	240	243	247	251	257	262	268	274	280
Newcastle	630	633	636	647	659	670	822	830	839	848
Empangeni	1872	1906	1921	1932	1941	1953	2108	2121	2133	2152
Pinetown	3640	3681	3717	3754	3801	3860	3909	3969	4019	4070
Provincial Peak	5814	5890	5942	5999	6063	6141	6470	6548	6617	6694
2032 Peak	6694	6694	6694	6694	6694	6694	6694	6694	6694	6694

Growth drivers in the province: Commercial, Light industrial, Residential, Tourism & Electrification

Development plans for Empangeni CLN



Northern KZN Strengthening: Iphiva 400/132 kV Substation

Drivers for demand growth are electrification, tourism and agro processing

Ermelo-Richards Bay Freight Rail Strengthening: Duma & Nzalo Substations

Required to improve security of supply and to increase tonnage capacity.

Mbewu 400 kV Switching Station

Required to increase power transfers to coastal towns and to facilitate integration of gas power plants in Richards Bay

2023 - 2027

2028 - 2032

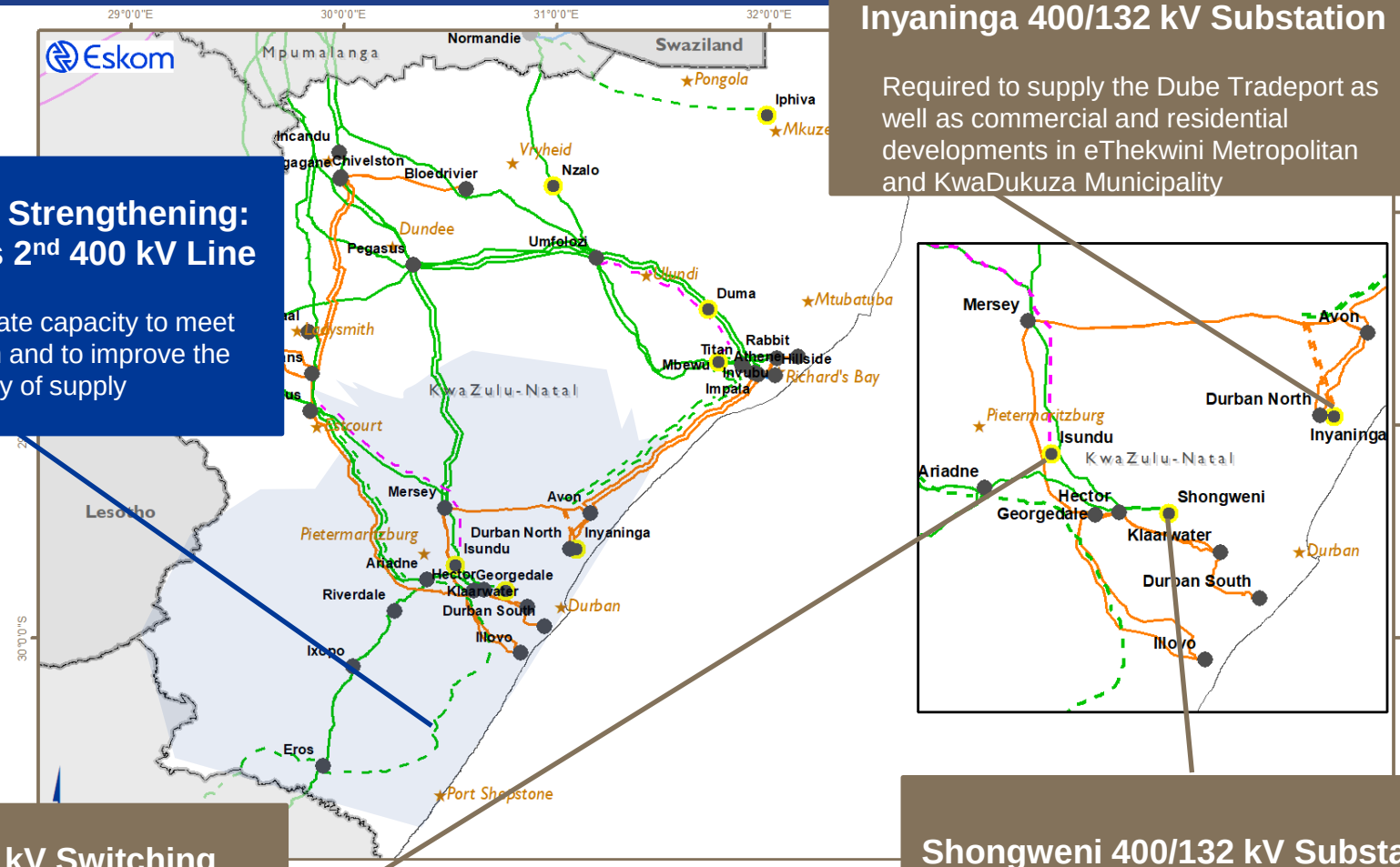
Development plans for Pinetown CLN

South Coast Strengthening: Ariadne-Eros 2nd 400 kV Line

Required to create capacity to meet demand growth and to improve the security of supply

Inyaninga 400/132 kV Substation

Required to supply the Dube Tradeport as well as commercial and residential developments in eThekwini Metropolitan and KwaDukuza Municipality



Isundu 400 kV Switching Station

Required to provide network redundancy and to increase power transfers to the southern parts of KwaZulu-Natal

Shongweni 400/132 kV Substation

Required to supply commercial and residential developments around Hillcrest, Ntshongweni and Cato Ridge

2023 - 2027 **2028 - 2032**

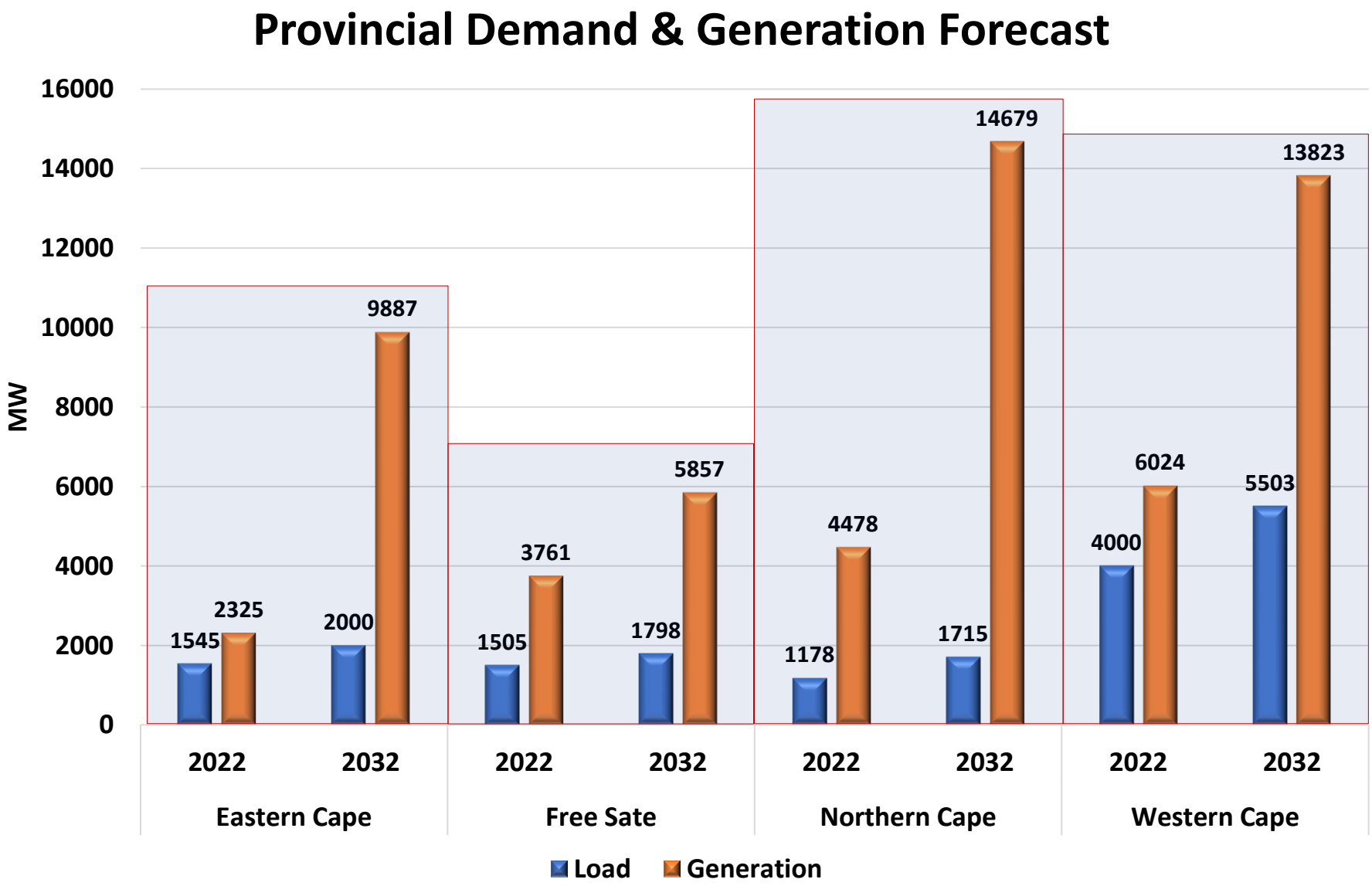
Questions?

Transmission Development Plans: Southern Grids

(Free State, Northern Cape, Eastern Cape and Western Cape)

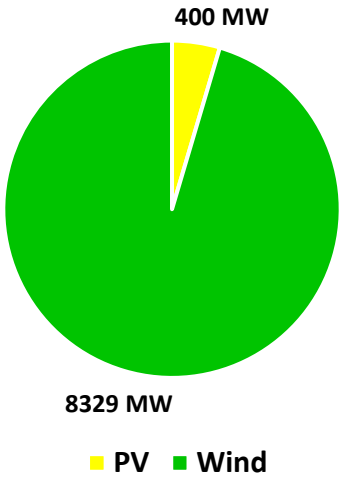
Presented by: Thokozani Bengani

Provincial demand and generation forecast

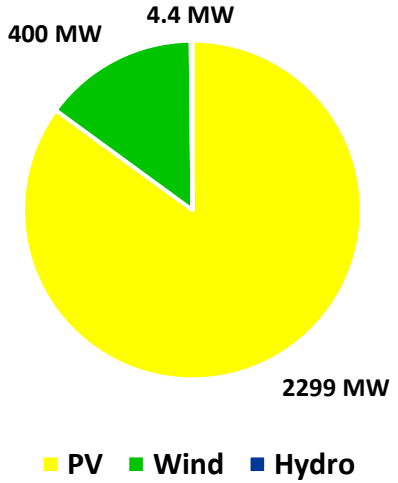


Provincial RE generation mix in 2032

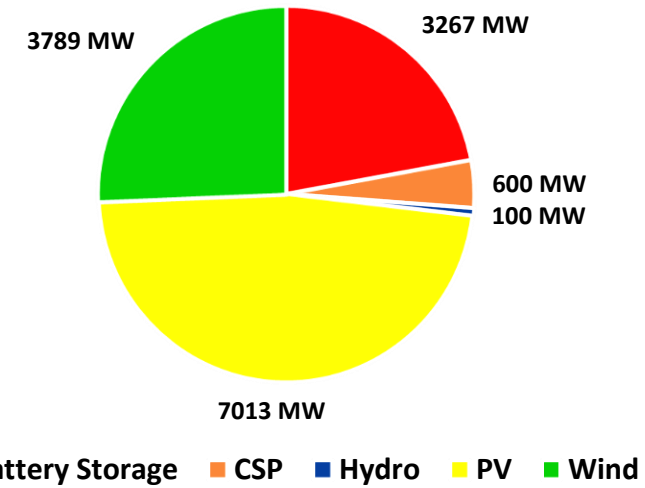
Eastern Cape



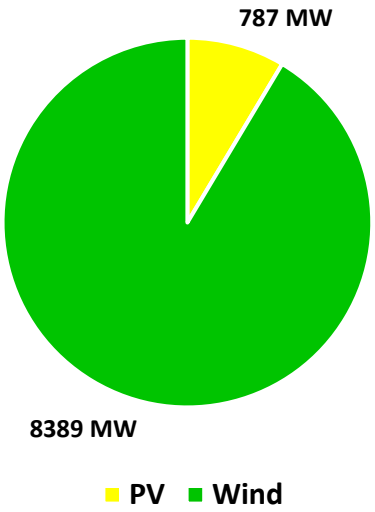
Free State



Northern Cape



Western Cape

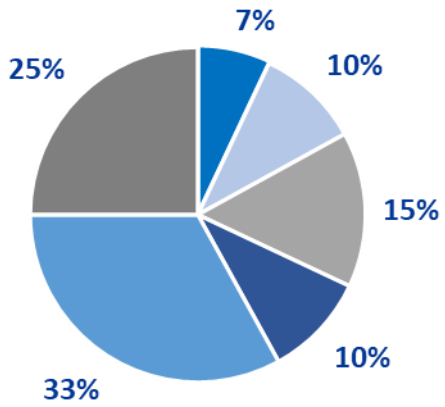


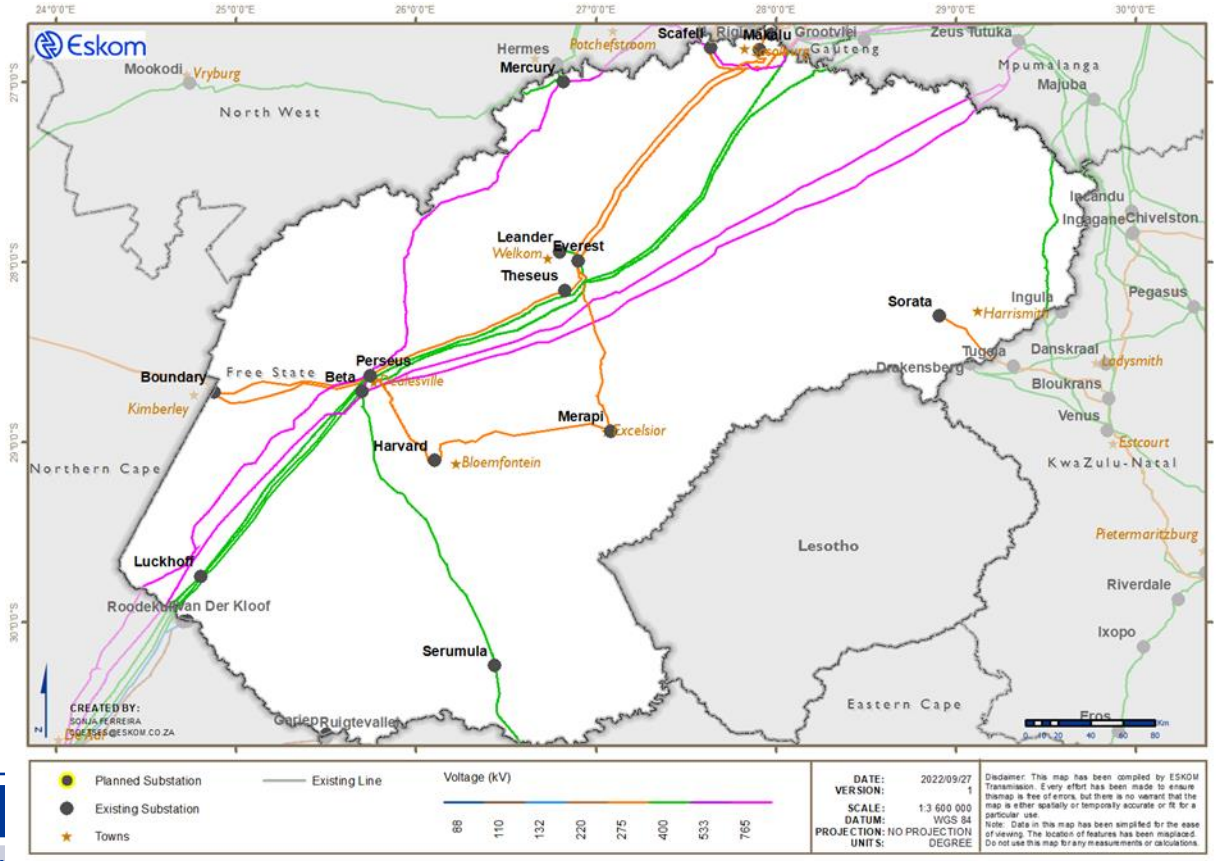
Free State

Free State Province Profile

Load

2021 Peak: 1505 MW



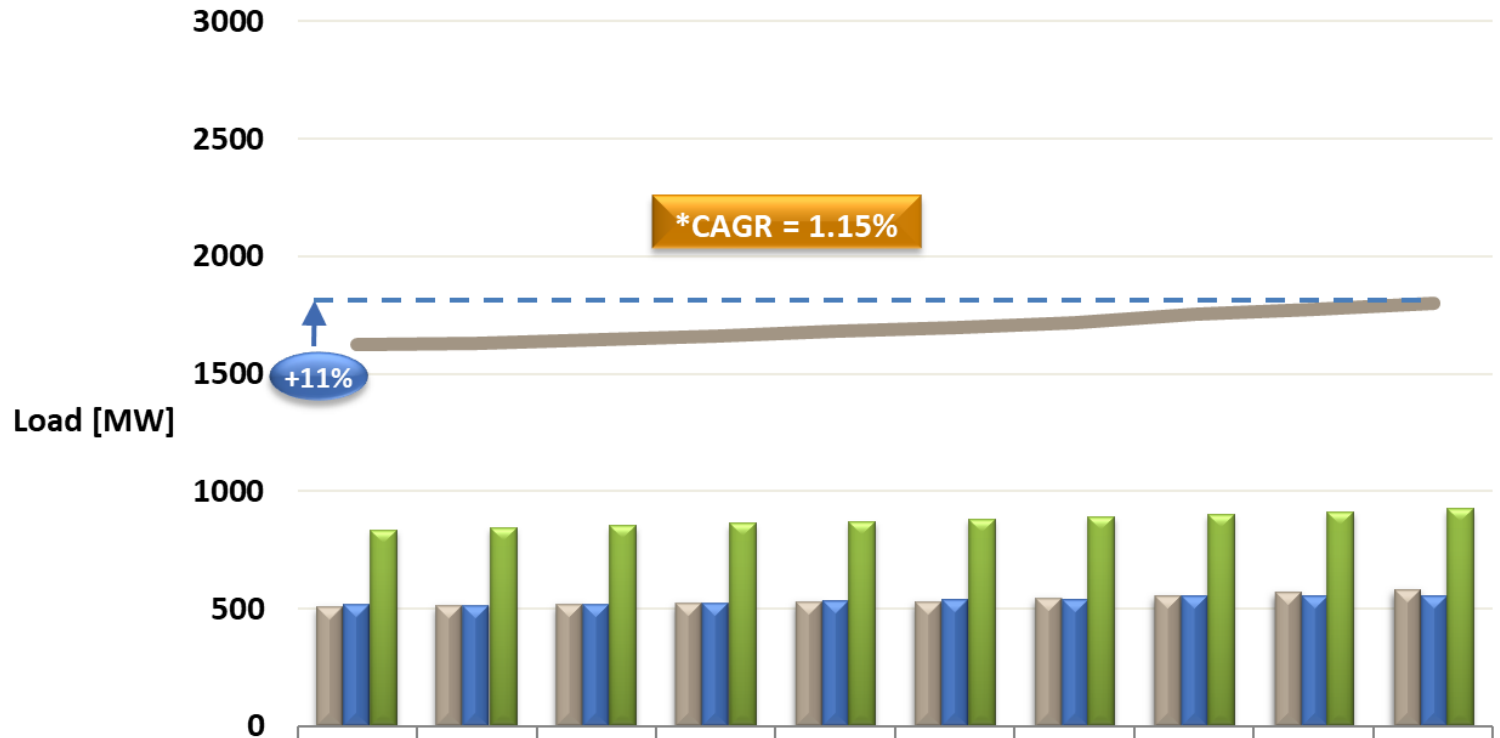


Generation

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

Free State Load Forecast

Free State Province Load Forecast (2023 – 2032)

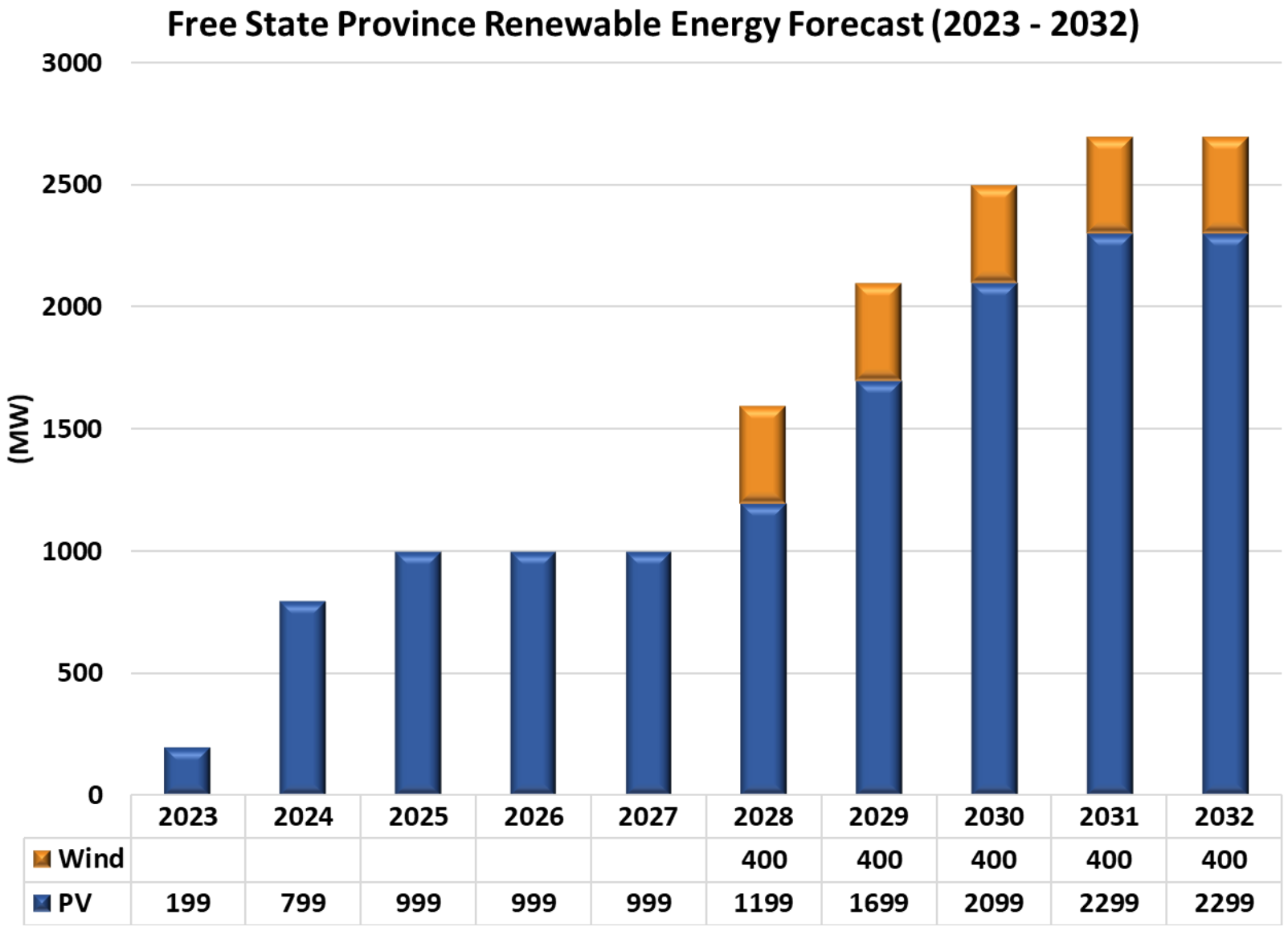


	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Bloemfontein	507	511	515	520	524	528	541	554	567	580
Sasolburg	518	509	518	520	529	538	538	553	554	554
Welkom	836	844	853	862	871	880	891	901	913	924
Provincial Peak	1623	1627	1646	1660	1679	1698	1720	1752	1775	1798

Growth Drivers in the Province: Industrial, Logistics & Residential Electrification

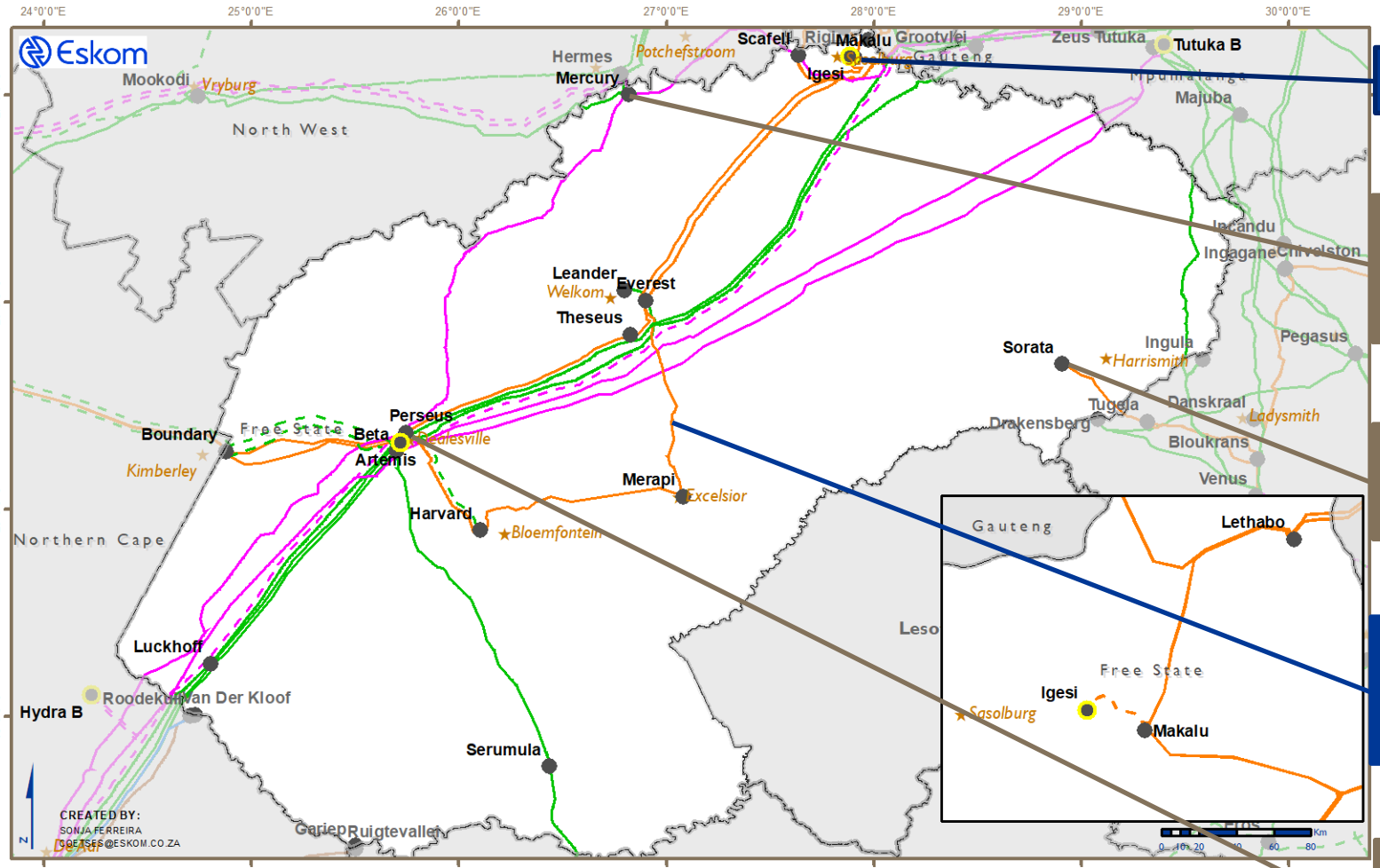
* Compound Annual Growth Rate

Free State Renewable Energy Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Wind						400	400	400	400	400
PV	199	799	999	999	999	1199	1699	2099	2299	2299

Development plans for the Free State Province



Igesi Substation

Mercury 1st 765/400 kV Transformer

Sorata-Tugela 400 kV Line

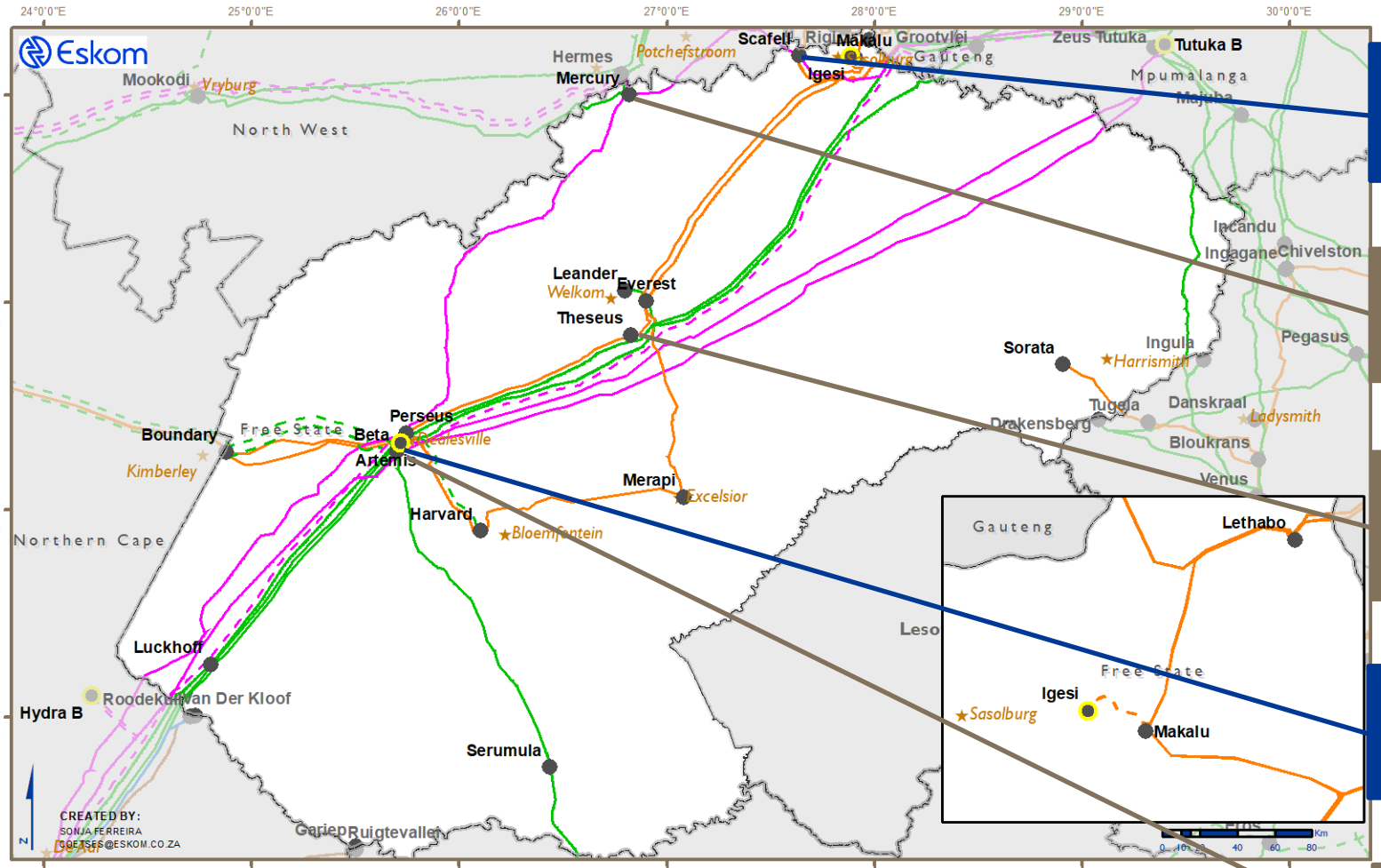
Everest-Merapi 400 kV Line – commissioned

Perseus 2nd 765/400 kV Transformer

2023 - 2027

2028 - 2032

Transformer projects to enable RE integration



Scafell Transformer Upgrade

Mercury 3rd 500MVA Transformer

Theseus 3rd 500MVA Transformer

Artemis 2nd 500MVA Transformer

Artemis 3rd 500MVA Transformer

2023 - 2027

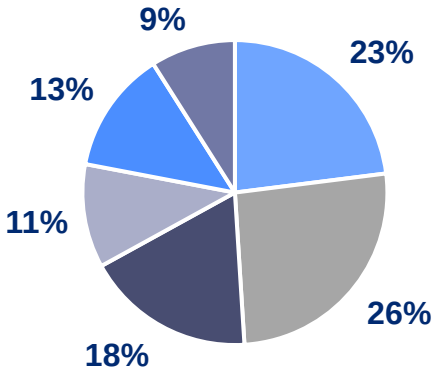
2028 - 2032

Northern Cape

Northern Cape Province Profile

Load

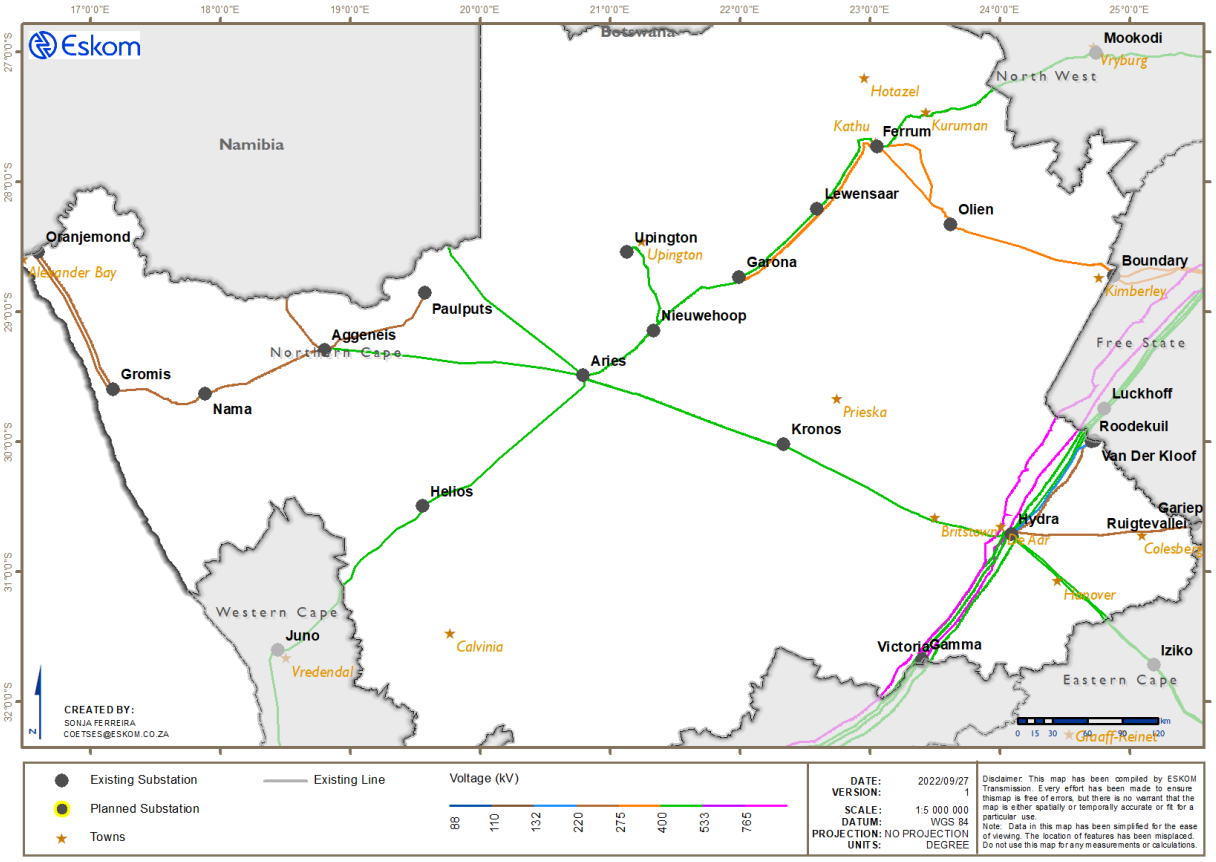
2021 Peak Demand: 1178 MW
Midday Demand: 770 MW



- Agriculture
- Mining
- Manufacturing
- Logistics
- Commercial
- Community Services

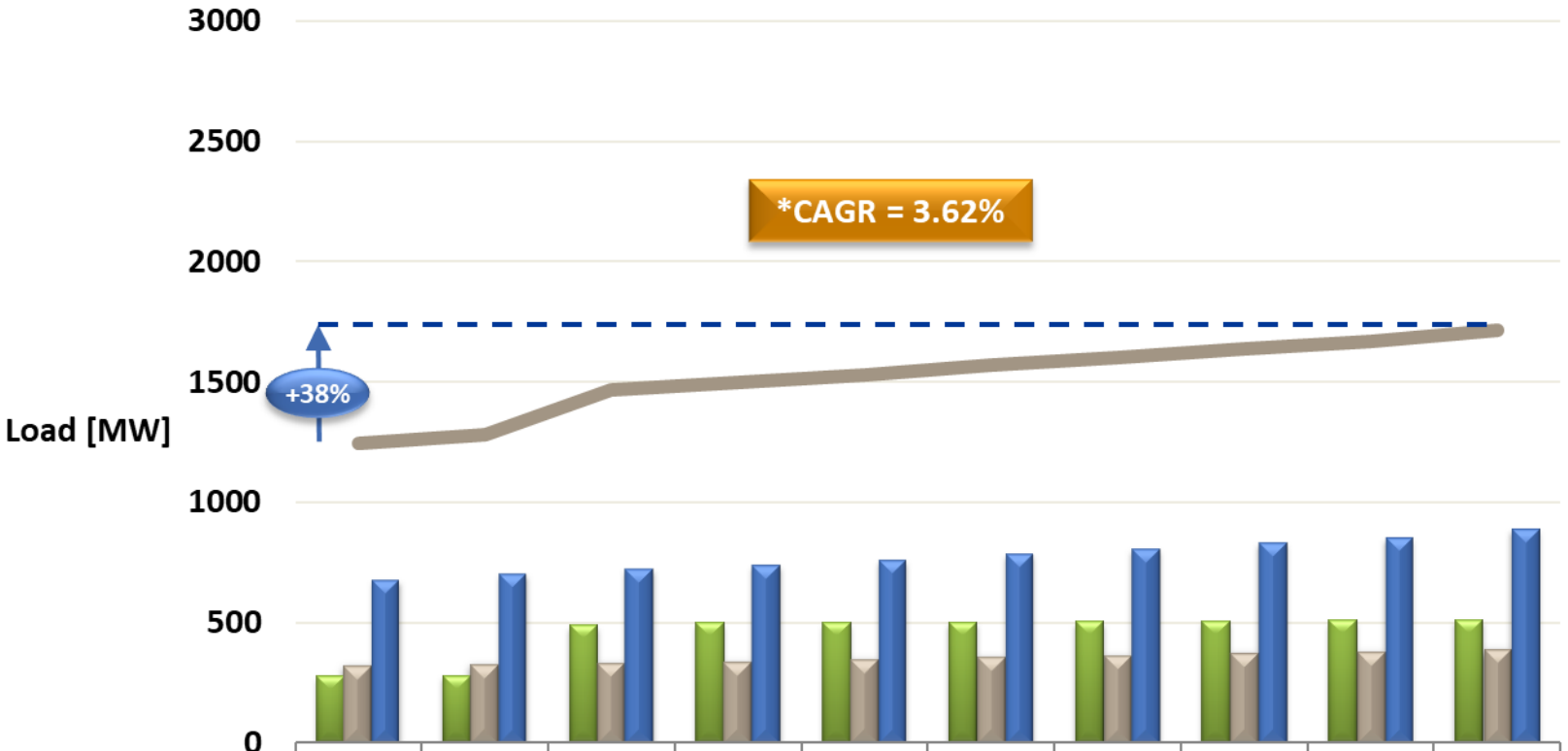
Generation

Type		Name	Output
Eskom	Hydro	Gariep	360 MW
		Van Der Kloof	240 MW
IPP	Hydro	IPPs	10 MW
	CSP	IPPs	600 MW
	Wind	IPPs	965 MW
	PV	IPPs	2303 MW
Total Installed Generation			**4478 MW**



Northern Cape Load Forecast

Northern Cape Province Load Forecast (2023 – 2032)

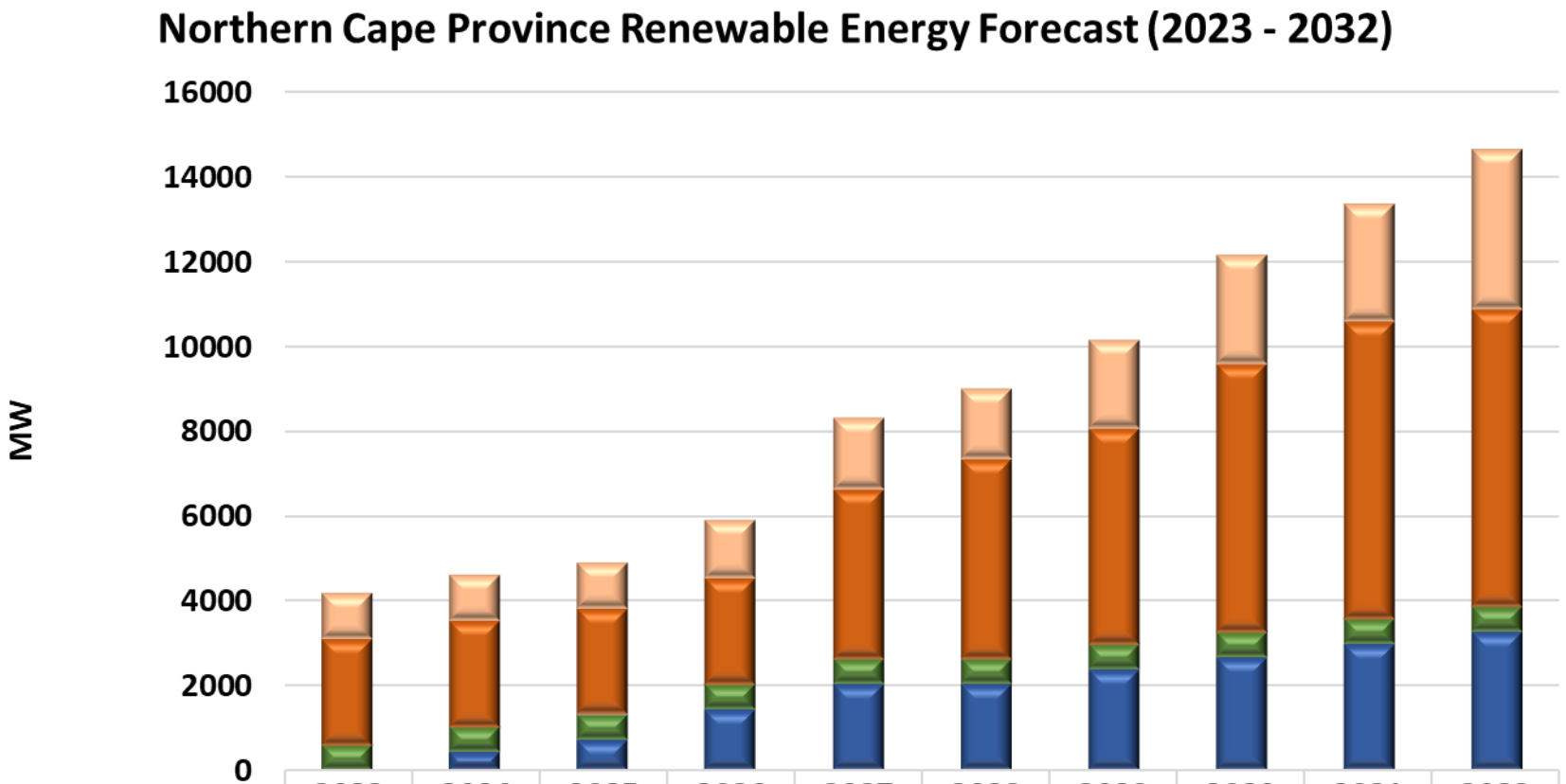


	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Namaqualand	278	280	489	498	500	501	504	507	509	511
Karoo	322	328	333	339	348	357	366	375	380	388
Kimberley	679	704	723	742	762	789	810	832	854	889
Provincial Peak	1245	1279	1467	1500	1531	1569	1603	1637	1667	1715

Growth Drivers in the Province: Industrial, Logistics & Mining

* Compound Annual Growth Rate

Northern Cape Renewable Energy Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Wind	1089	1089	1089	1389	1689	1689	2089	2589	2789	3789
PV	2513	2513	2513	2513	4013	4713	5113	6313	7013	7013
Hydro	10	10	10	10	10	10	10	10	10	10
CSP	600	600	600	600	600	600	600	600	600	600
Battery Storage	0	425	725	1425	2025	2025	2367	2667	2967	3267

Development plans for Namaqualand CLN

Paulputs: LILO Aries-Kokerboom 400 kV Line

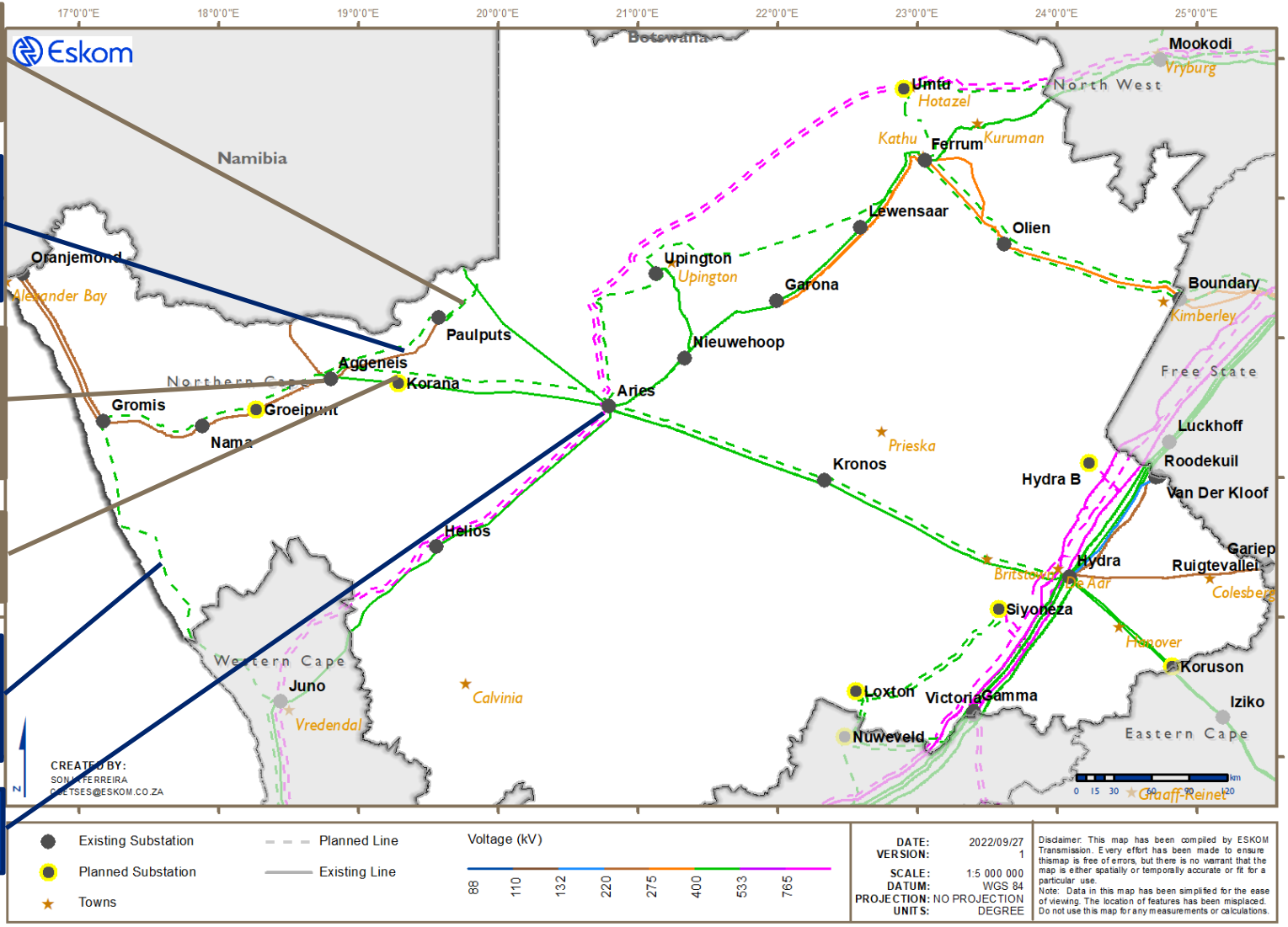
Aggeneis-Paulputs 400 kV Line & 400/132 kV Transformer

Aries-Aggeneis-Gromis 400 kV Line

Korana 400/132 kV Substation

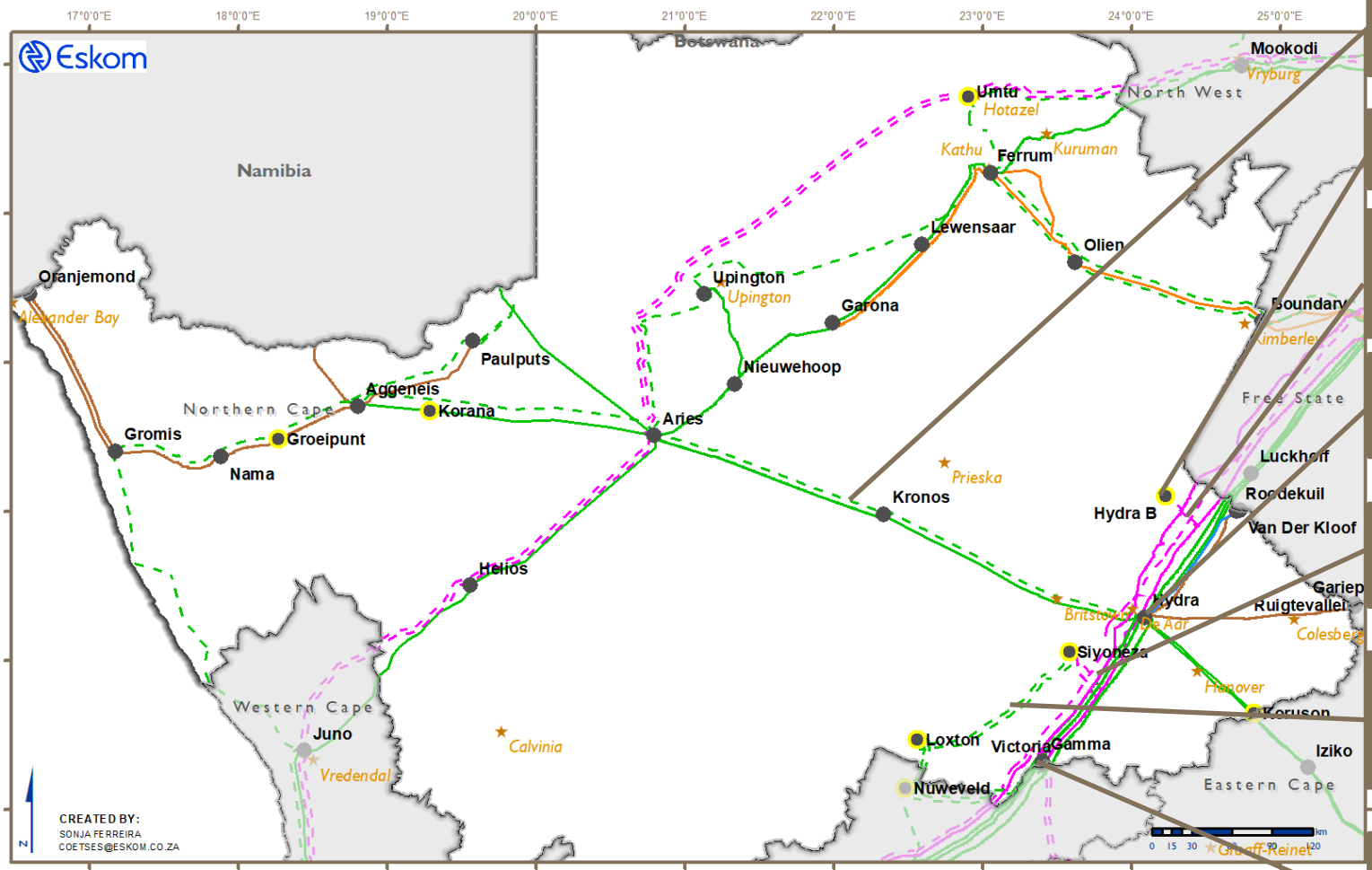
Gromis-Juno 400 kV Line & 400/220 kV Transformer

Aries SVC



2023 - 2027 **2028 - 2032**

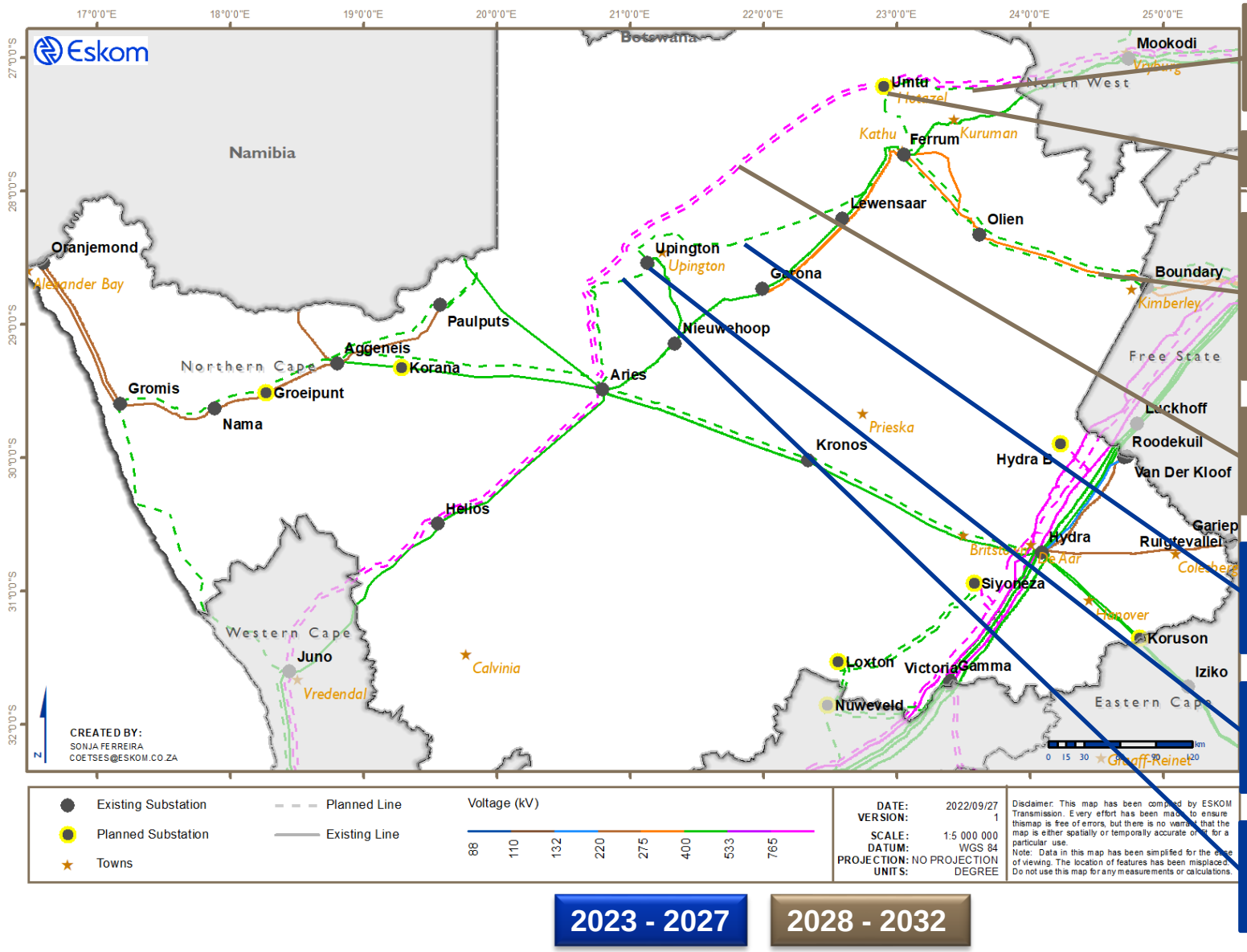
Development plans for Karoo CLN



- Hydra-Kronos-Aries 400 kV line
- Hydra B 400/132 kV
- Perseus-Gamma-Sterrekus 765 kV Line 2
- Hydra 2nd 765/400 kV Transformer
- Siyoneza 765 kV Strengthening
- Nuweveld-Loxton-Siyoneza Strengthening
- Gamma 1st 765/400 kV Transformer

2023 - 2027 | **2028 - 2032**

Development plans for Kimberley CLN



Ferrum-Mookodi-Mercury 400 kV Line

Umtu Substation

Beta-Boundary-Ferrum 400 kV Line & Boundary 400/132 kV

Mercury-Aries-Juno-Sterrekus 765 kV Line

Ferrum-Upington 400 kV Line

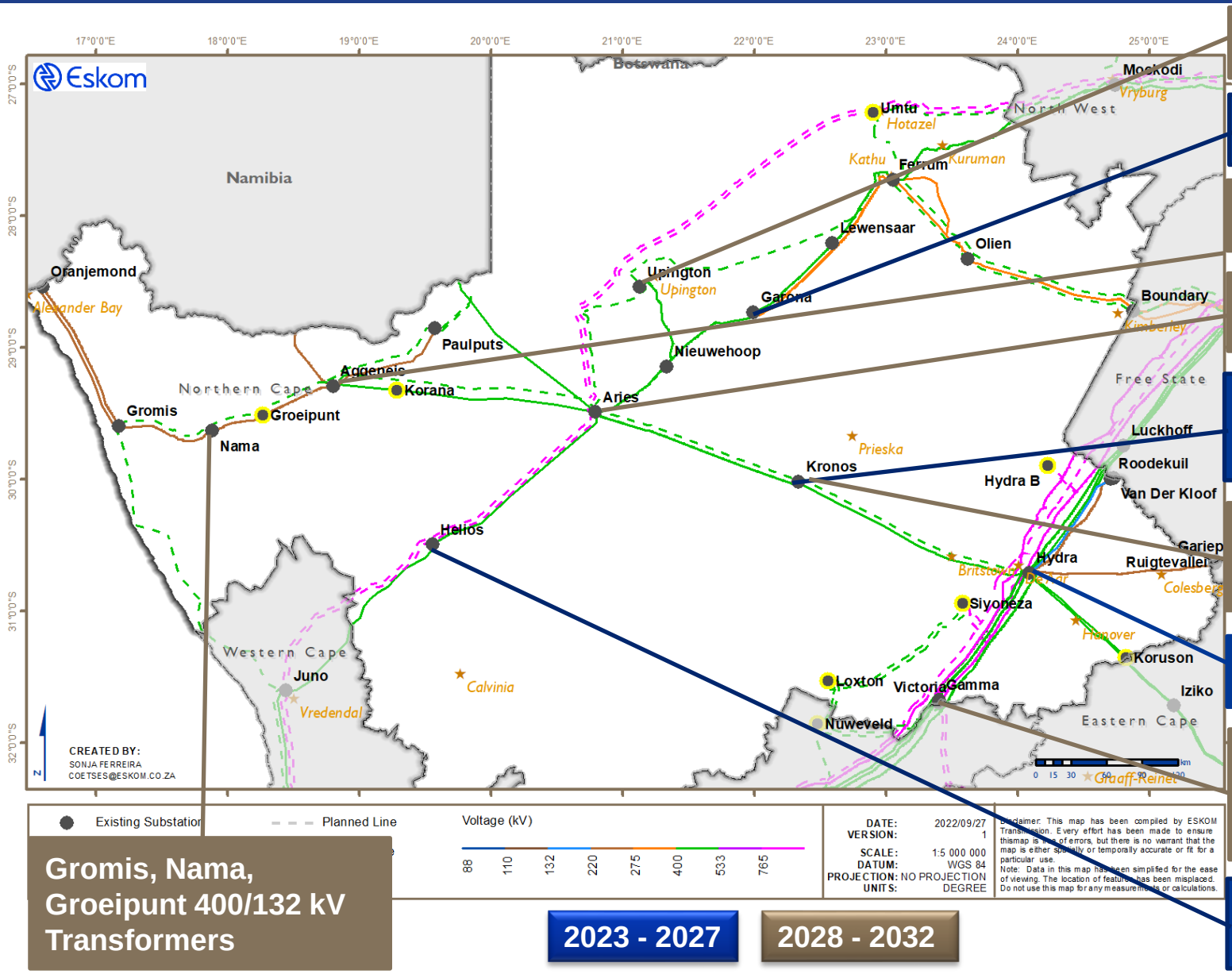
Upington 2nd 400/132 kV Transformer

Aries-Upington 400 kV Line

2023 - 2027

2028 - 2032

Transformer projects to enable RE integration



Upington 3rd Transformer

Garona 400/132 kV Transformer

Aggeneis 400/132 kV Transformer

Aries 400/132 kV Transformer

Kronos 2nd 400/132 kV Transformer

Kronos 3rd 400/132 kV Transformer

Hydra Transformer Upgrade

Gamma 2nd 400/132 kV Transformer

Helios 2nd Transformer

Gromis, Nama, Groeipunt 400/132 kV Transformers

2023 - 2027

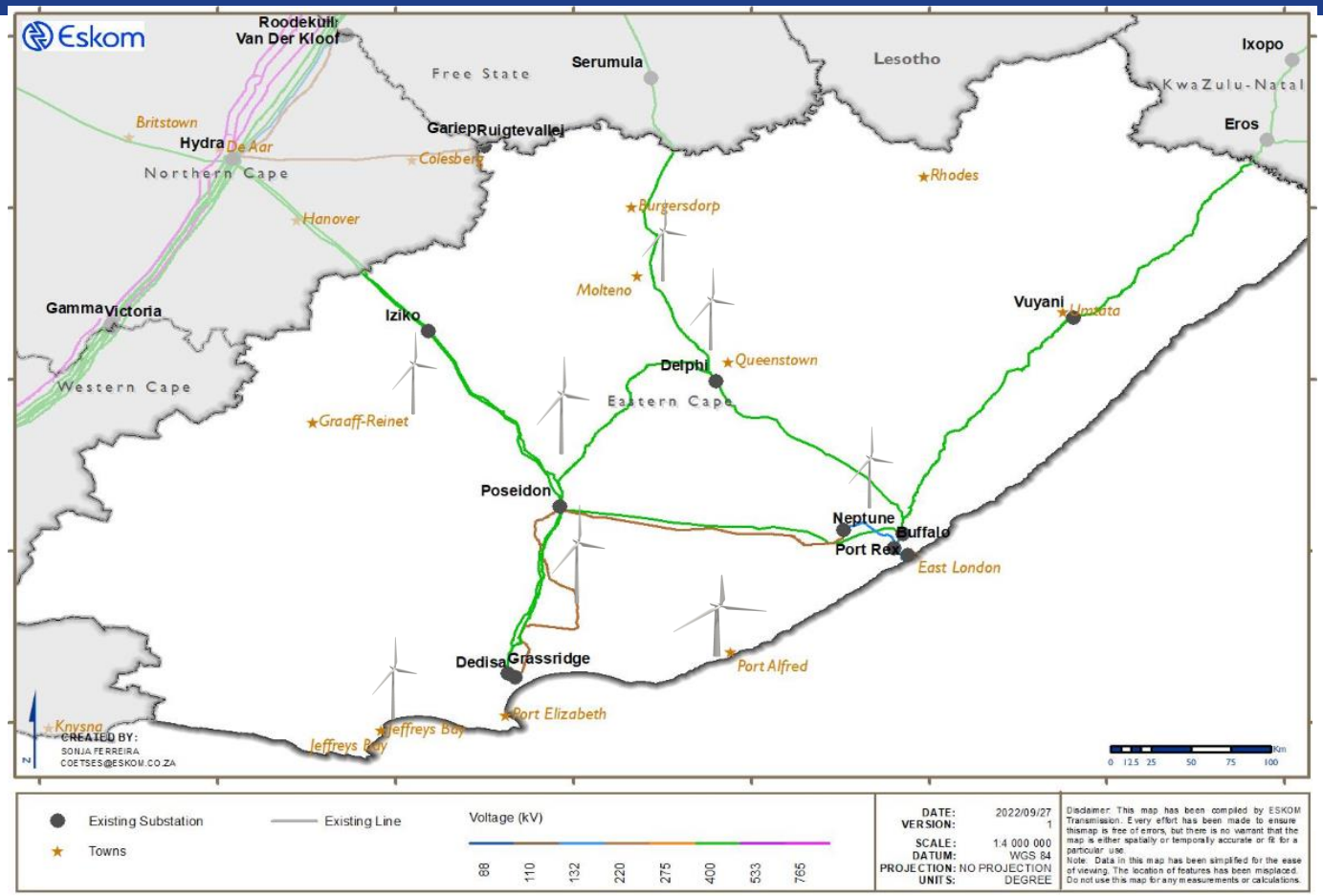
2028 - 2032

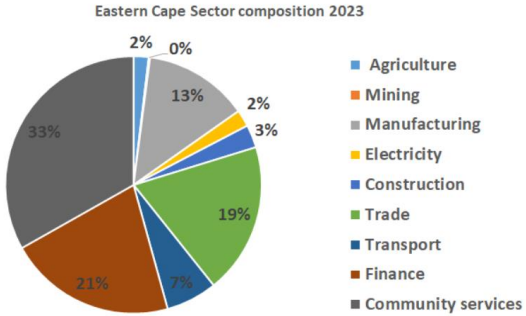
Eastern Cape

Eastern Cape Province Profile

2020 Recorded

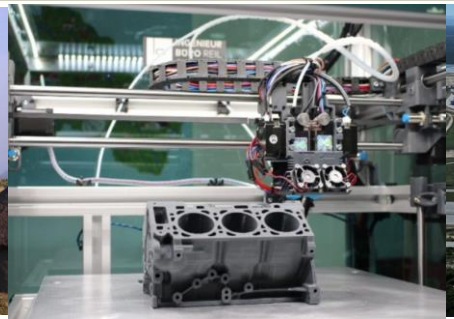
Peak 1545 MW



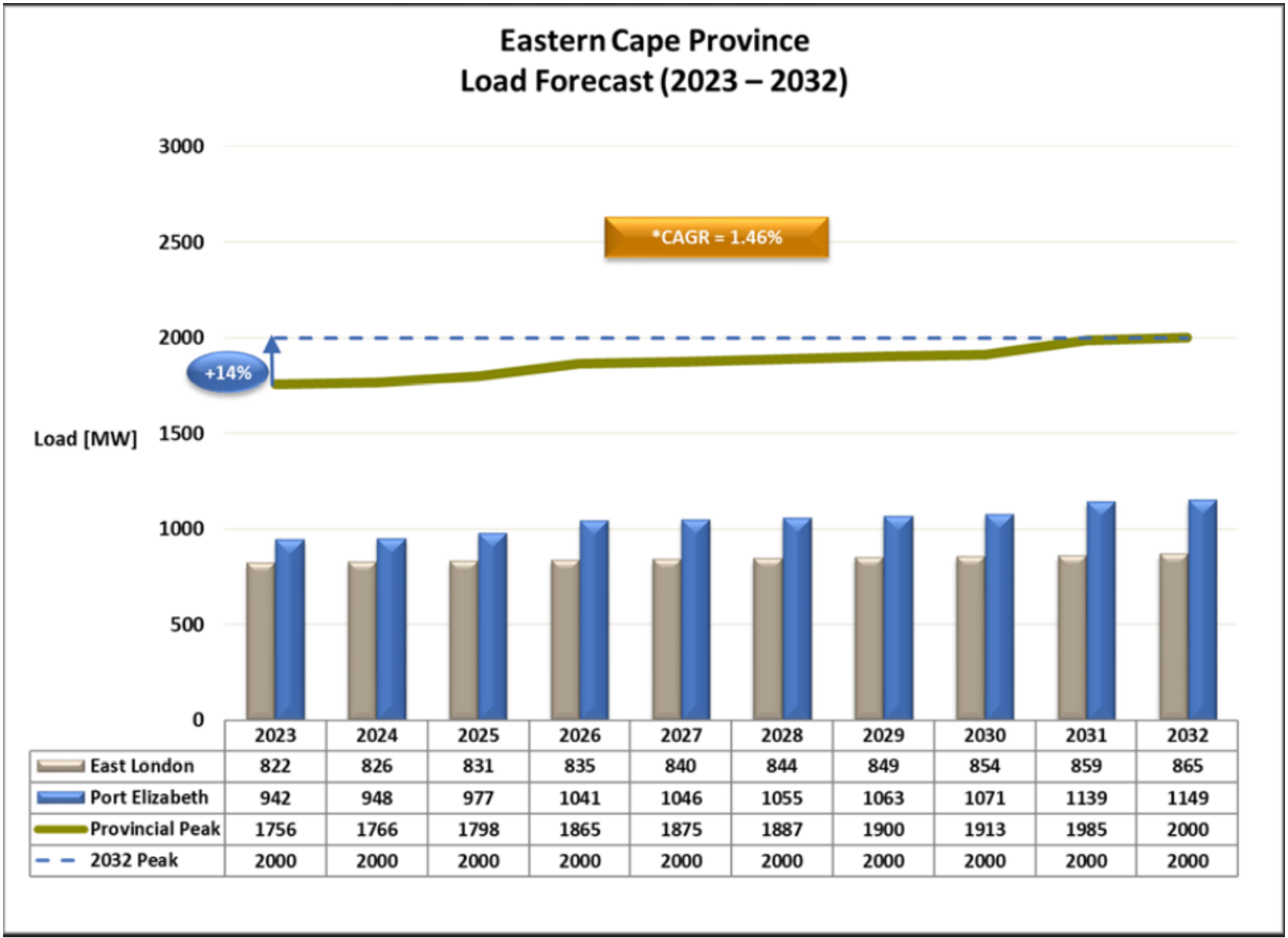


Generation

Type		Name	Output
Peaking	Gas	Port Rex	171 MW
		Dedisa	372 MW
RE IPP	Wind & Solar	ALL	~1782 MW
Total Installed Generation			**~2325 MW**

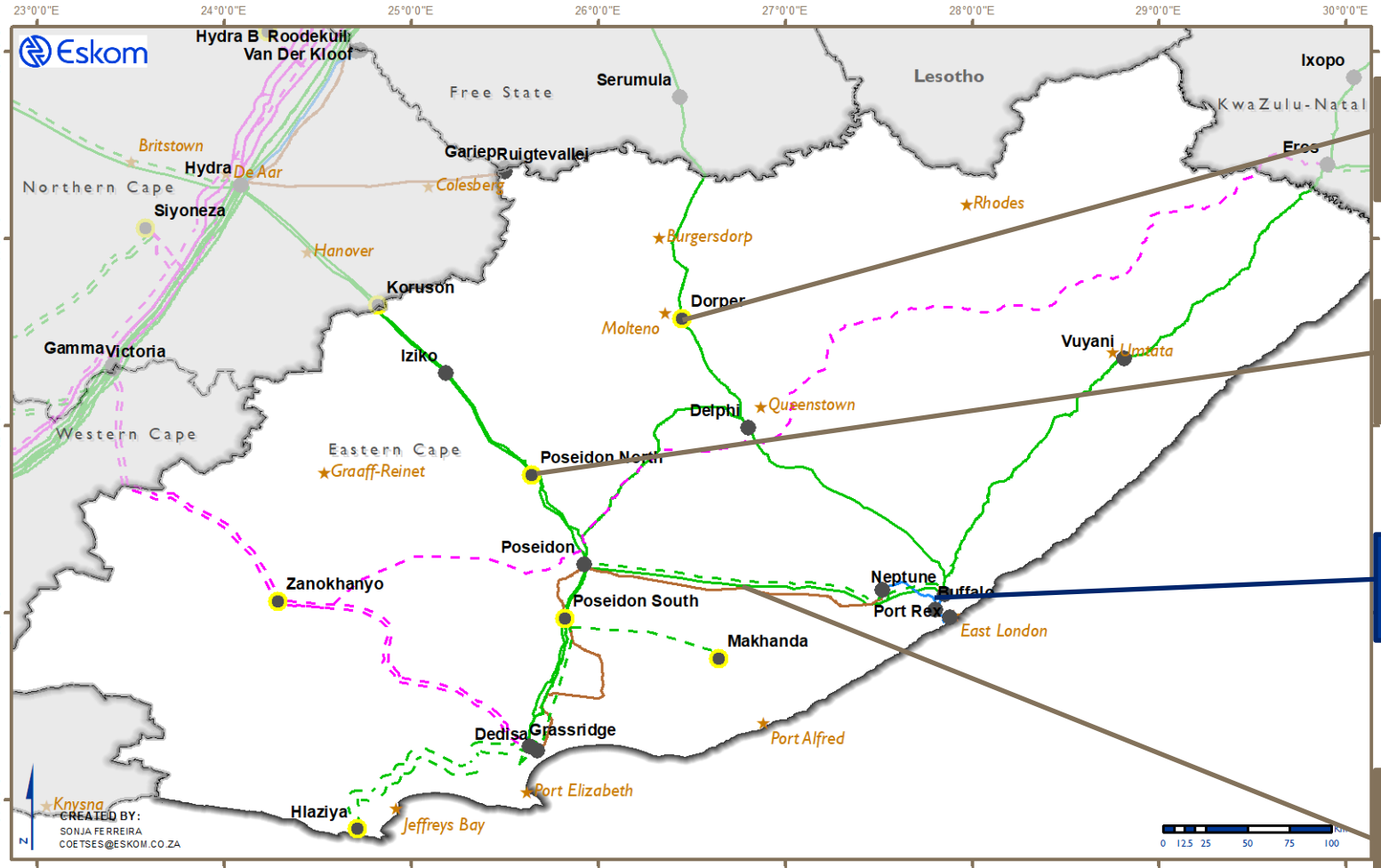


Eastern Cape Province Load Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
East London	822	826	831	835	840	844	849	854	859	865
Port Elizabeth	942	948	977	1041	1046	1055	1063	1071	1139	1149
Provincial Peak	1756	1766	1798	1865	1875	1887	1900	1913	1985	2000
2032 Peak	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

Development plans for East London CLN



Dorper 400/132 kV Substation

Poseidon North 400/132 kV Substation

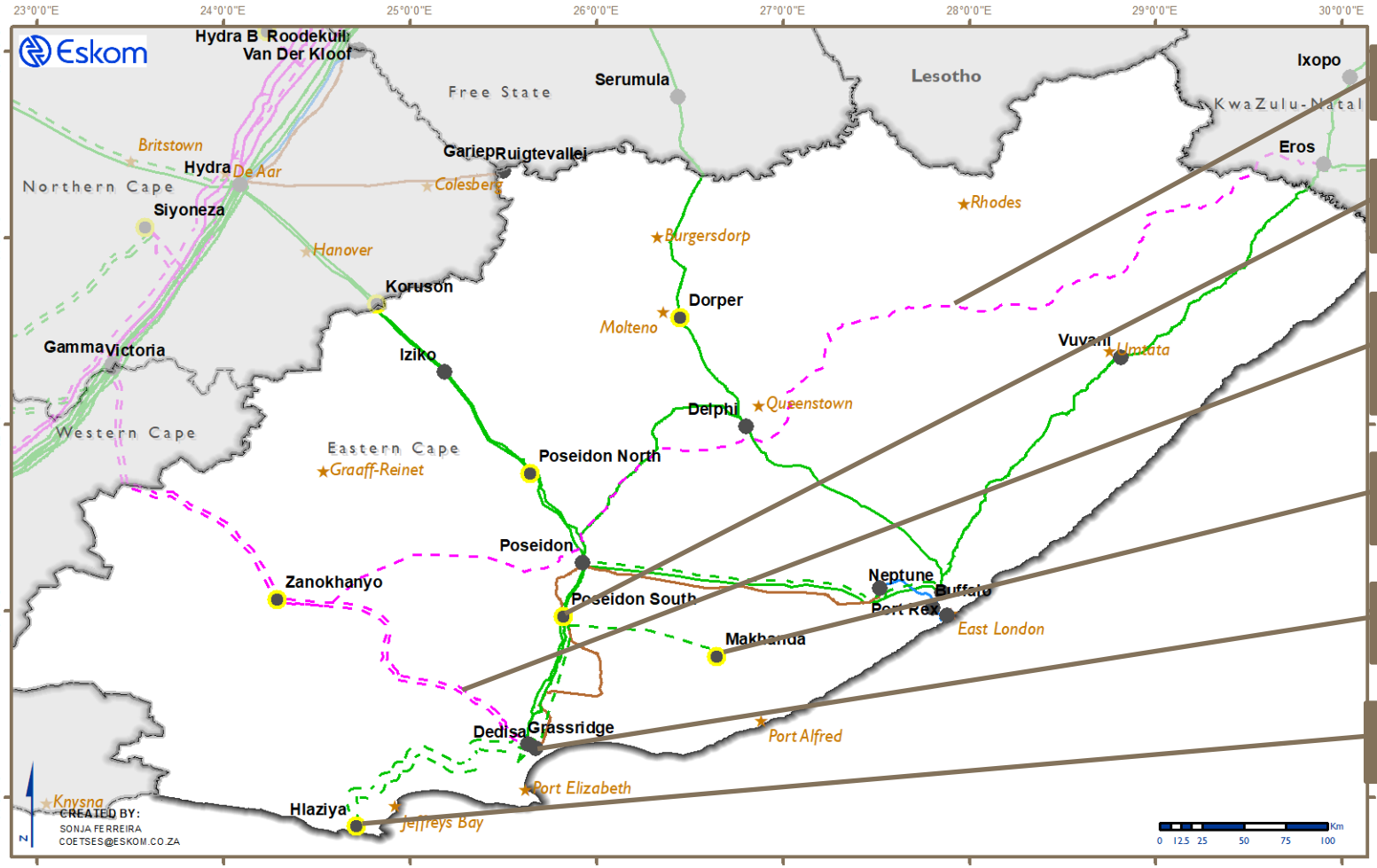
Pembroke 400 kV Integration

Poseidon-Pembroke 400 kV Line

2023 - 2027

2028 - 2032

Development plans for Port Elizabeth CLN

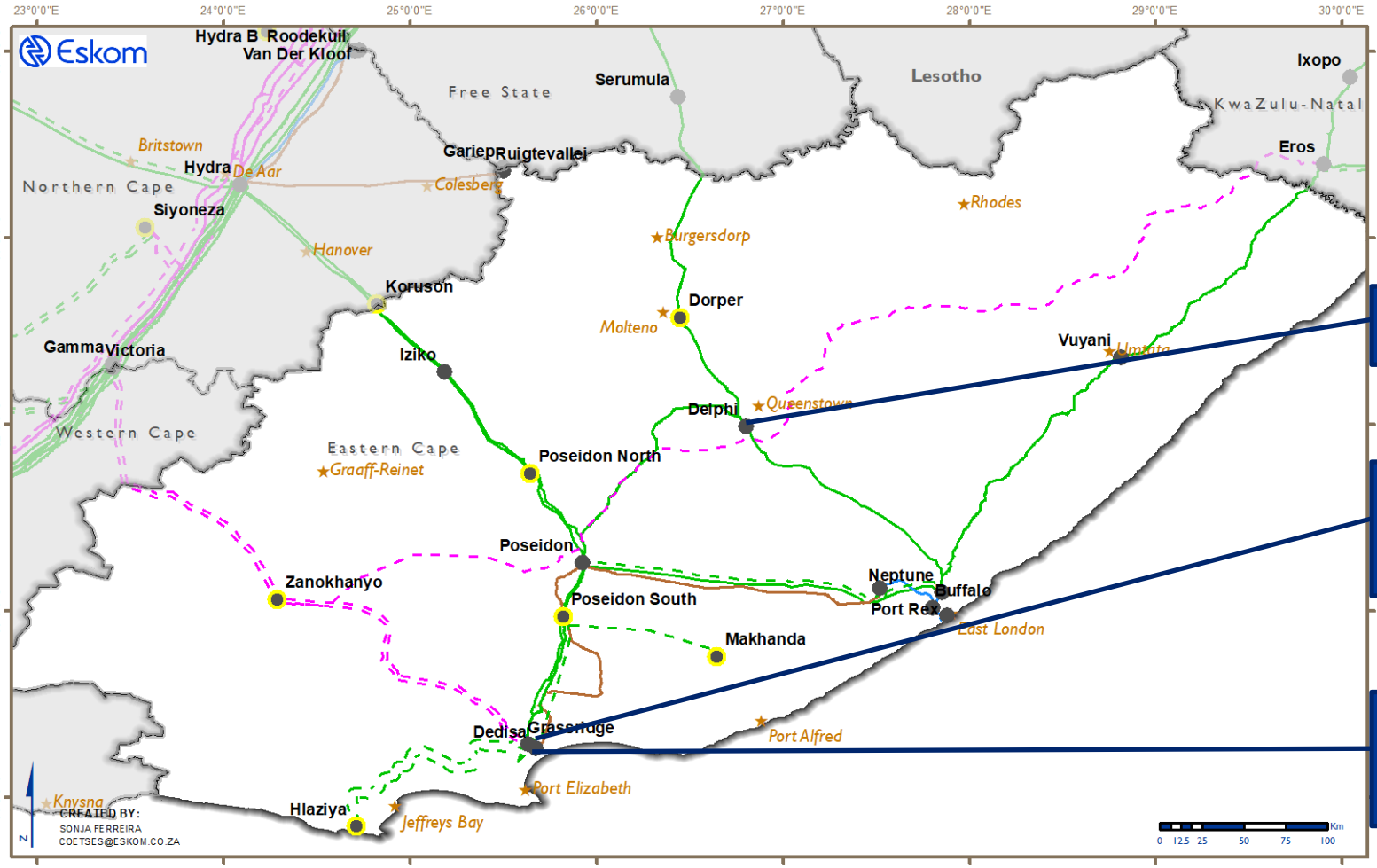


- EC-KZN 765 kV Lines
- Poseidon South Integration
- Gamma-Grassridge 765 kV Lines
- Grahamstown Integration
- Coega Gas Integration
- Hlaziya Integration

2023 - 2027

2028 - 2032

Transformer projects to enable RE integration



Delphi 500 MVA Transformer

Grassridge 4th 500 MVA Transformer

Dedisa 3rd & 4th 500 MVA Transformers

2023 - 2027

2028 - 2032

Western Cape

Western Cape Province Profile

Transmission Network

- 400 kV: ~2 800 km
- 765 kV: ~550 km

- 14 Substations
- 50 Transformers
- 16 300 MVA

Load

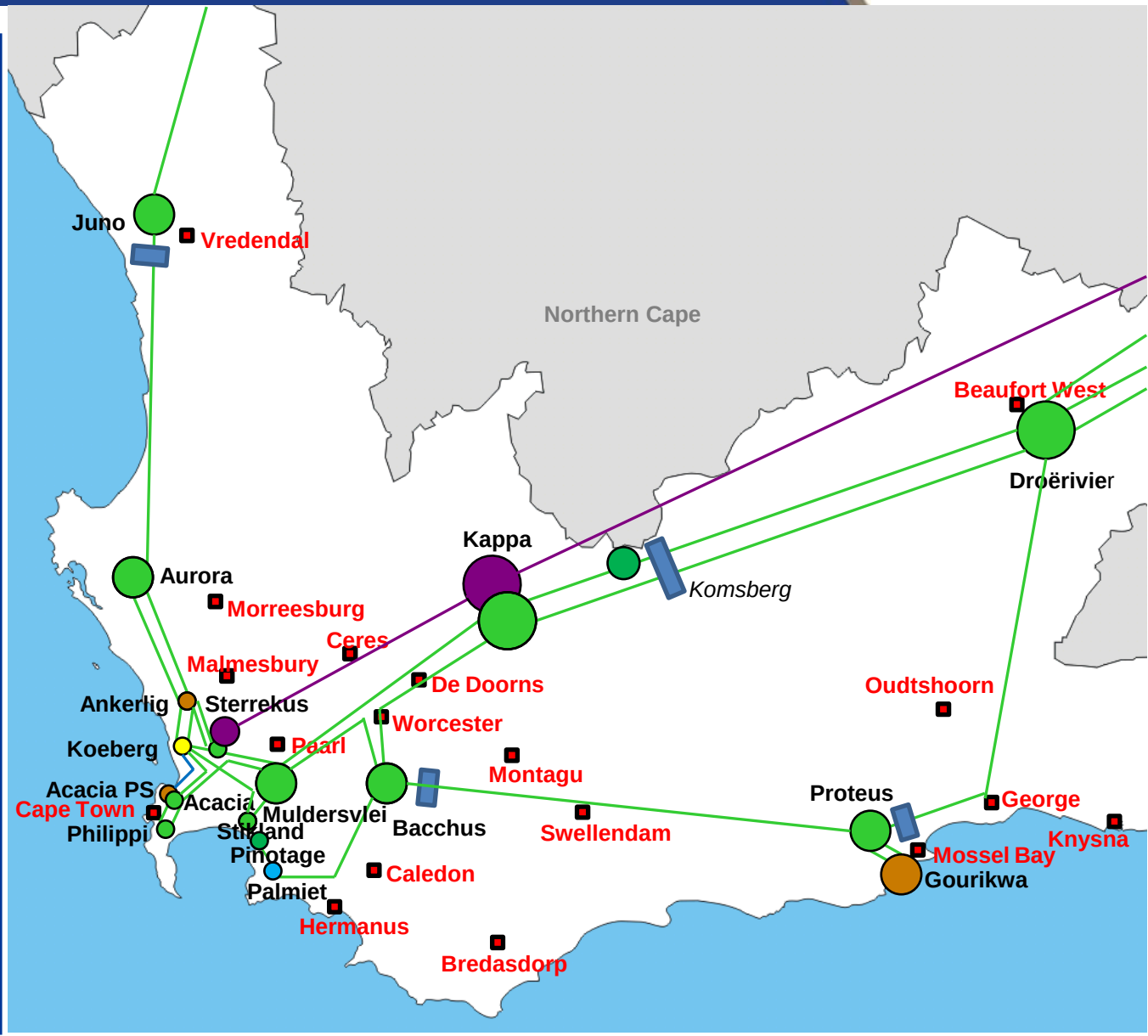
- Peak load: ~ 4 000 MW

Generation

- Installed: 6 024 MW

CLNs

- Outeniqua
- Peninsula
- West Coast

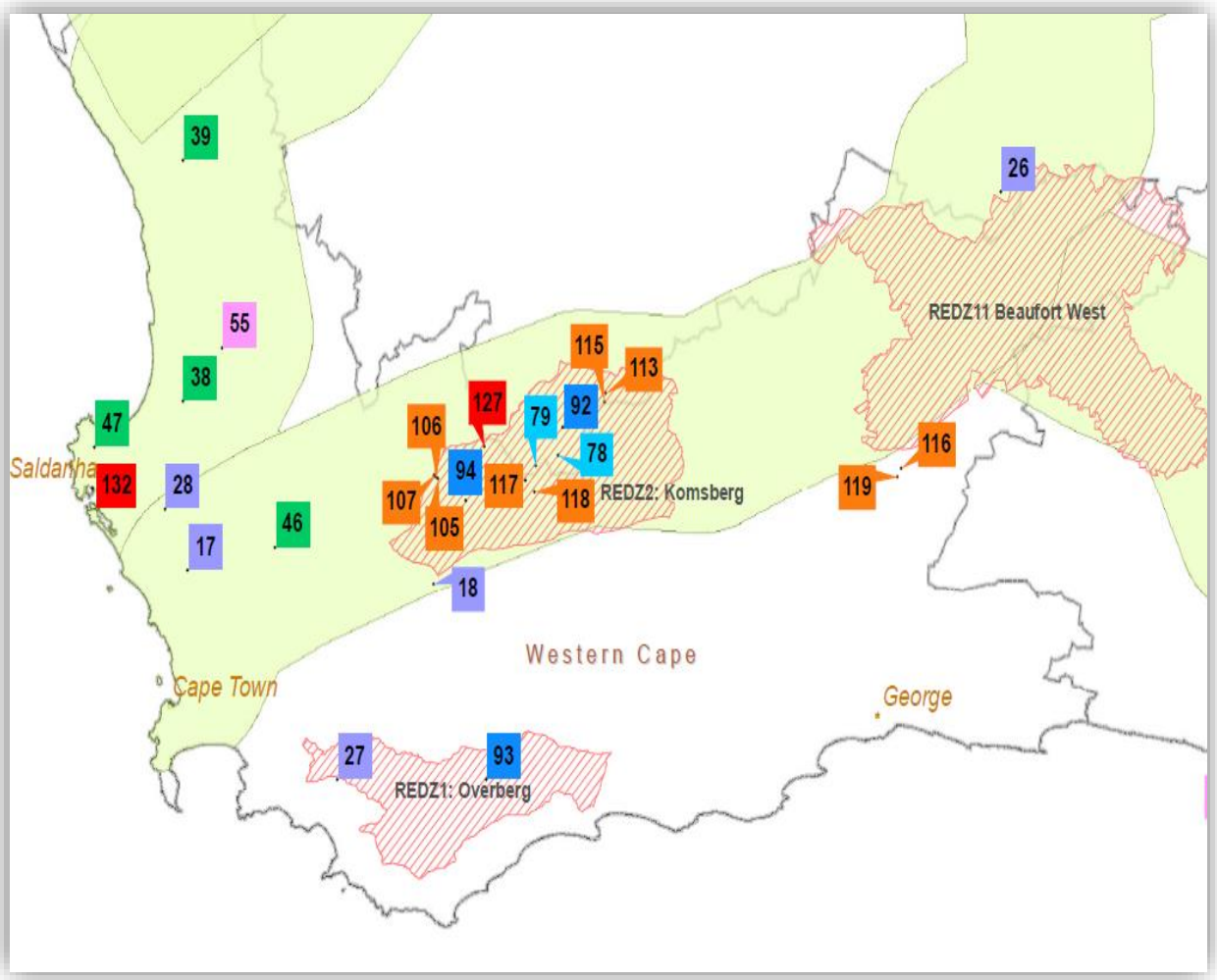


Eskom Power Stations in the Western Cape

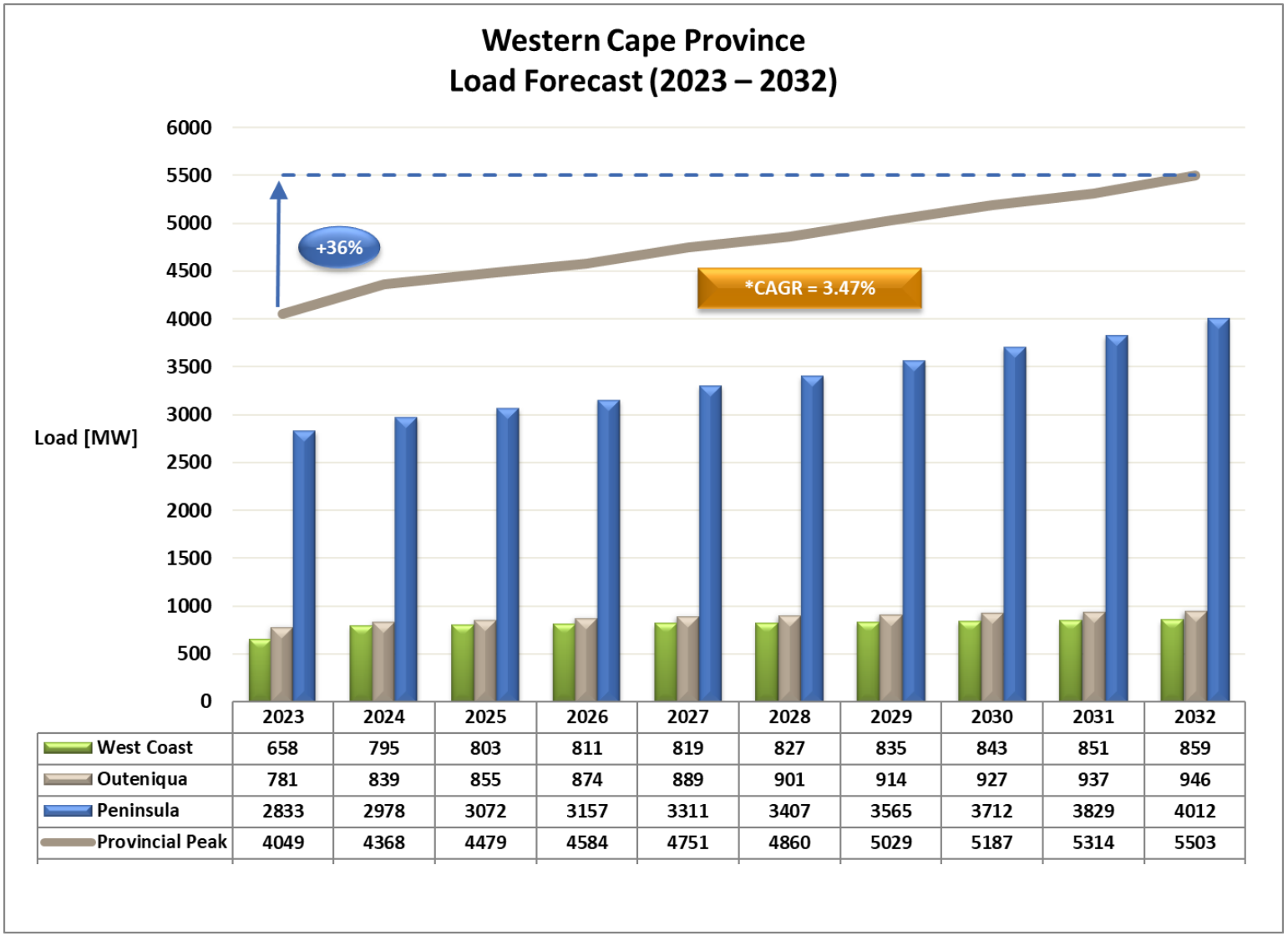
Eskom Power Stations		
Acacia	19	171 MW
Ankerlig	21	1 327 MW
Gourikwa	22	740 MW
Koeberg	5	1 830 MW
Sere	23	100 MW
Palmiet	18	400 MW
Total		**4 568 MW**

IPPs in the Western Cape

IPPs (up to RMIPPPP)	
PV	134 MW
Wind	874 MW
Gas	320 MW
Hybrid	128 MW
Total	**1 456 MW**



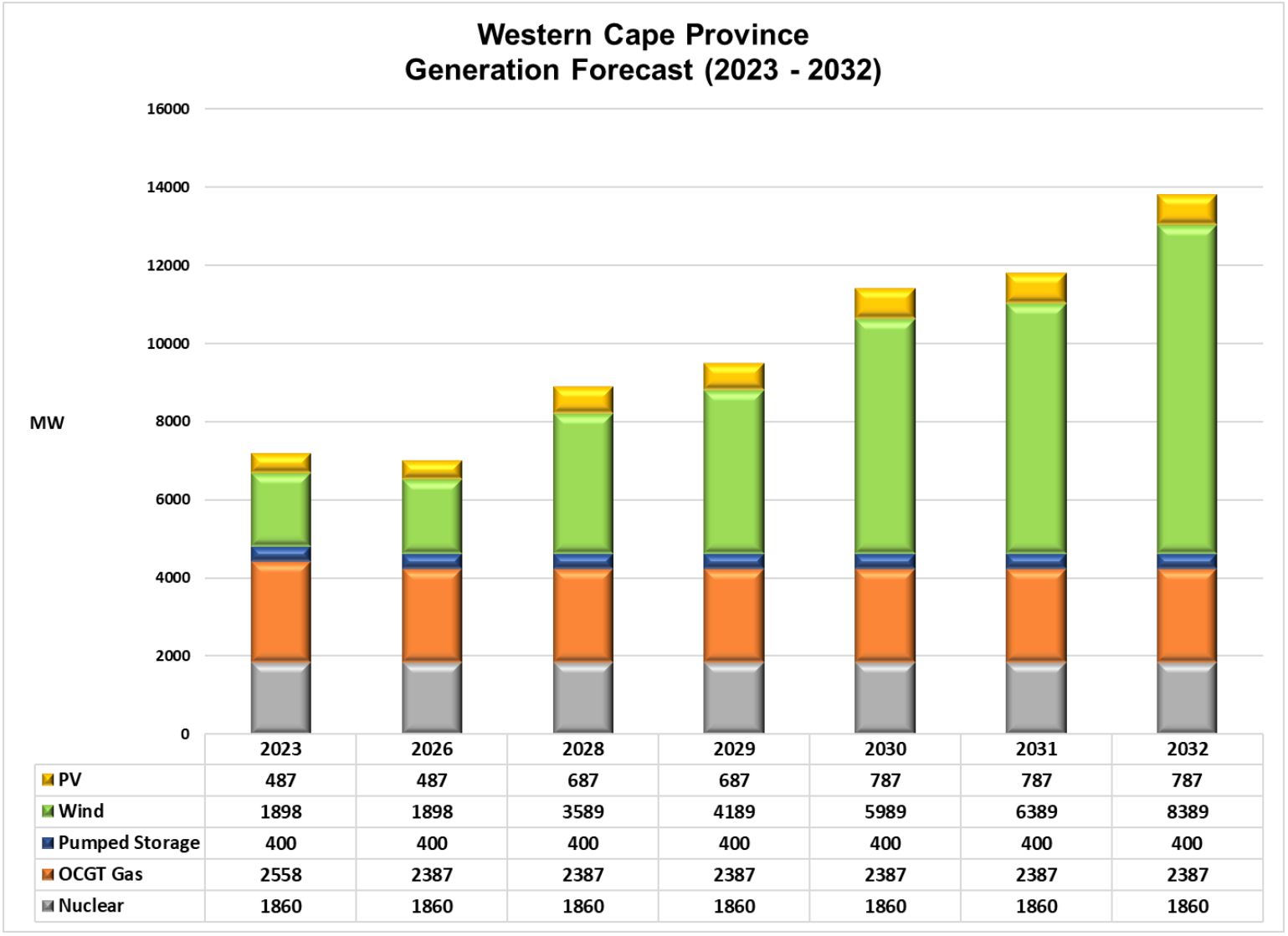
Western Cape Load Forecast



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
West Coast	658	795	803	811	819	827	835	843	851	859
Outeniqua	781	839	855	874	889	901	914	927	937	946
Peninsula	2833	2978	3072	3157	3311	3407	3565	3712	3829	4012
Provincial Peak	4049	4368	4479	4584	4751	4860	5029	5187	5314	5503

*** Compound Annual Growth Rate**

Western Cape Generation Forecast



	2023	2026	2028	2029	2030	2031	2032
PV	487	487	687	687	787	787	787
Wind	1898	1898	3589	4189	5989	6389	8389
Pumped Storage	400	400	400	400	400	400	400
OCGT Gas	2558	2387	2387	2387	2387	2387	2387
Nuclear	1860	1860	1860	1860	1860	1860	1860

Development plans for Peninsula CLN

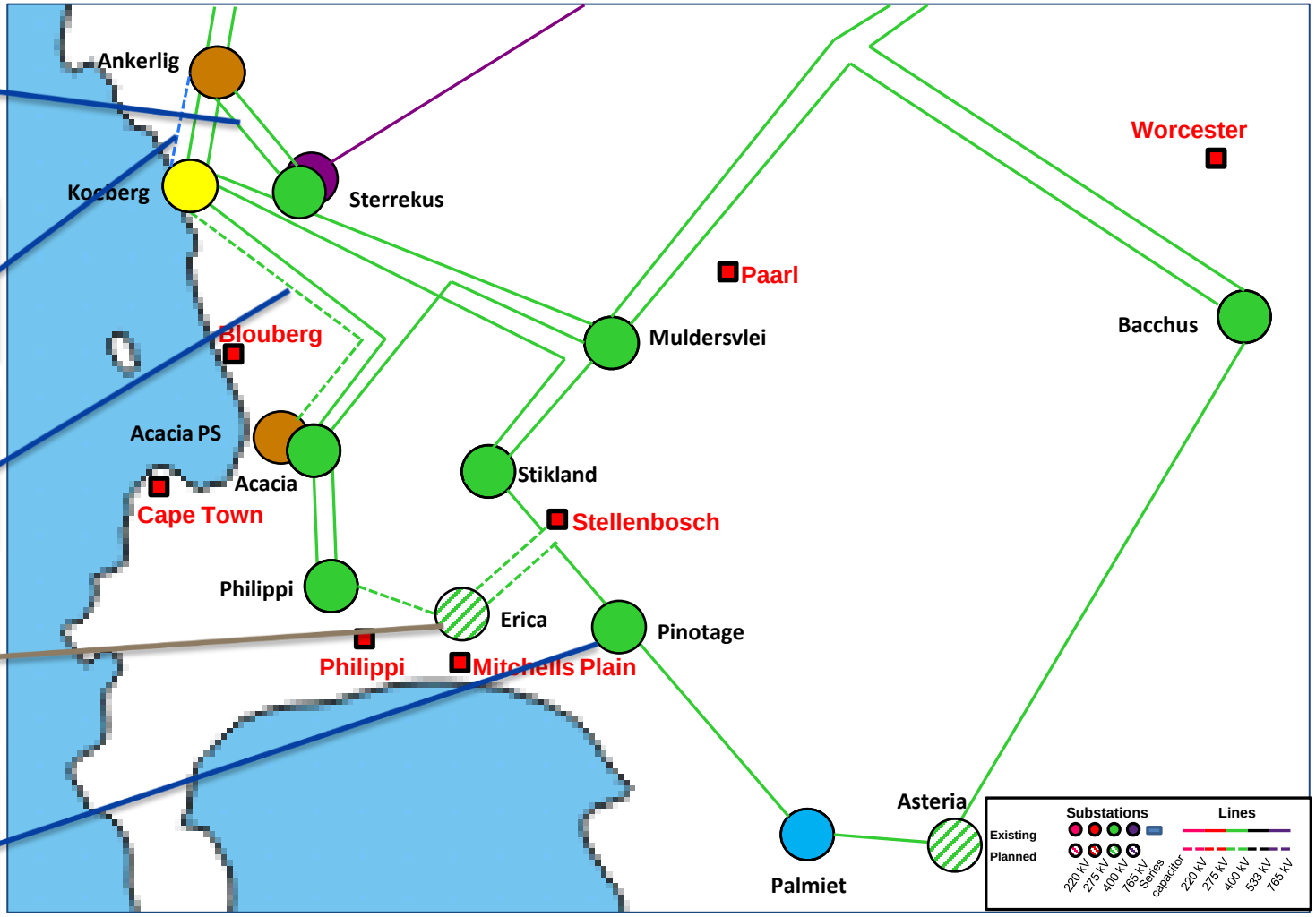
Ankerlig – Sterrekus 1st & 2nd 400 kV lines – commissioned

Relocate Koeberg offsite supply to Ankerlig

Operate Koeberg – Acacia 2nd line at 400 kV

Erica Substation

Pinotage Substation – commissioned



2023 - 2027

2028 - 2032

Development plans for Outeniqua and West Coast CLNs

Eskom

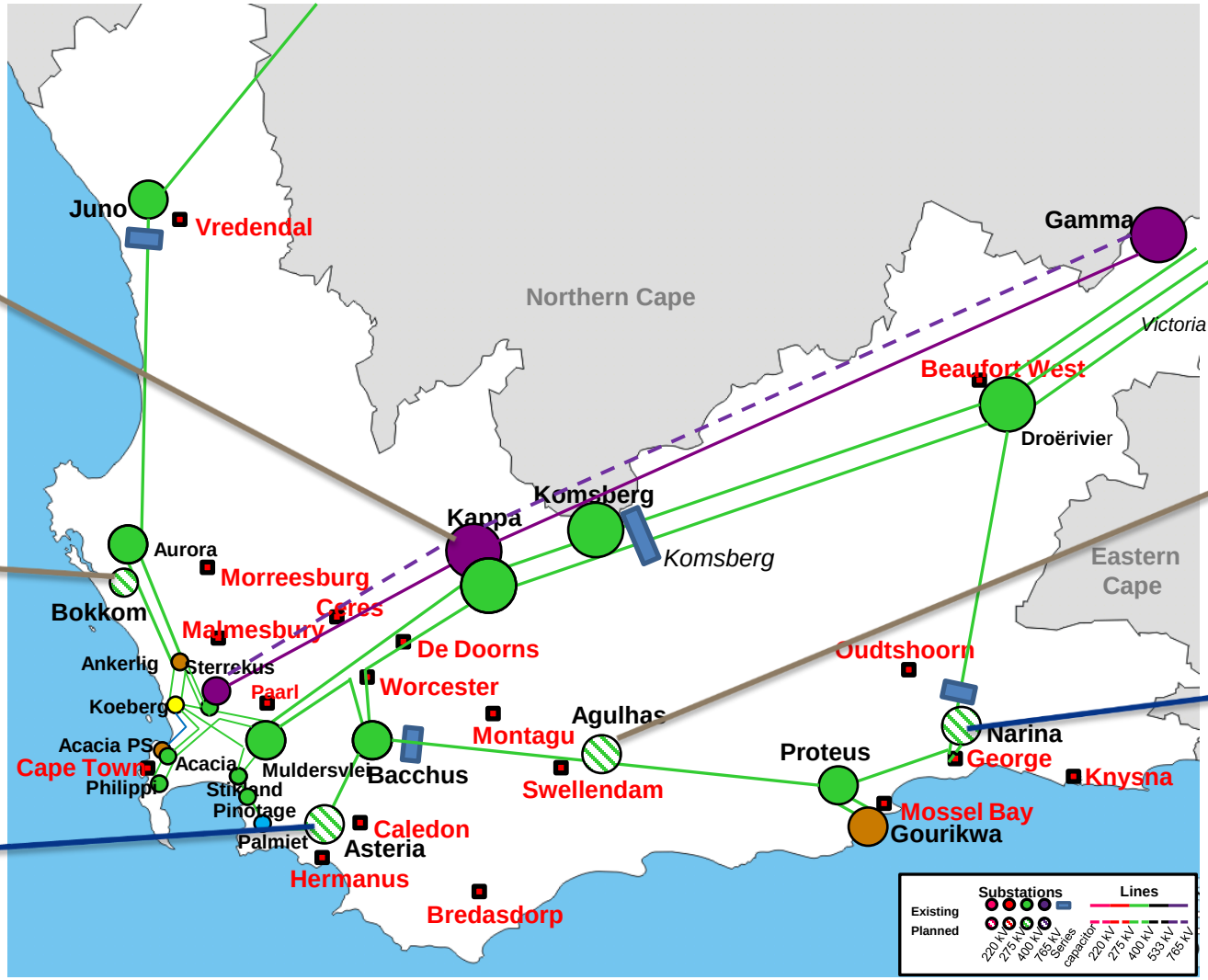
Kappa 2nd 765/400 kV Transformer

Bokkom Substation (Phase 1)

Asteria Substation

Agulhas Substation

Narina Substation



2023 - 2027

2028 - 2032

Major developments to enable RE integration

Eskom

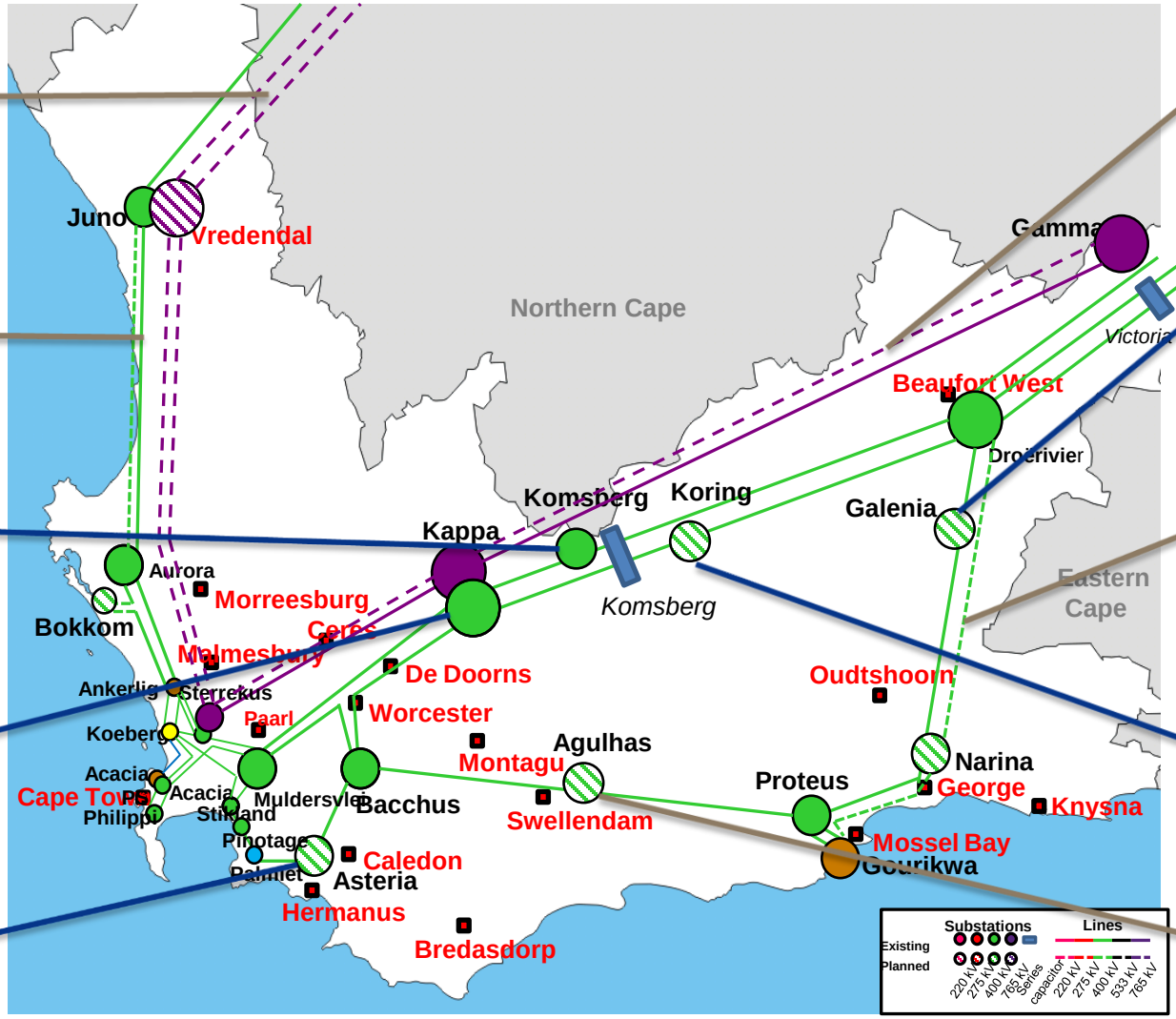
Cape Corridor Phase 5 and 6 (new 765 kV corridor)

Aurora – Juno 2nd 400 kV line

Komsberg Substation – commissioned

Kappa ext. 400/132 kV – commissioned

Asteria Substation



Cape Corridor Phase 4 (2nd 765 kV line)

Galenia Substation (IPP Self-build)

Droërivier – Narina – Gourikwa 400 kV line

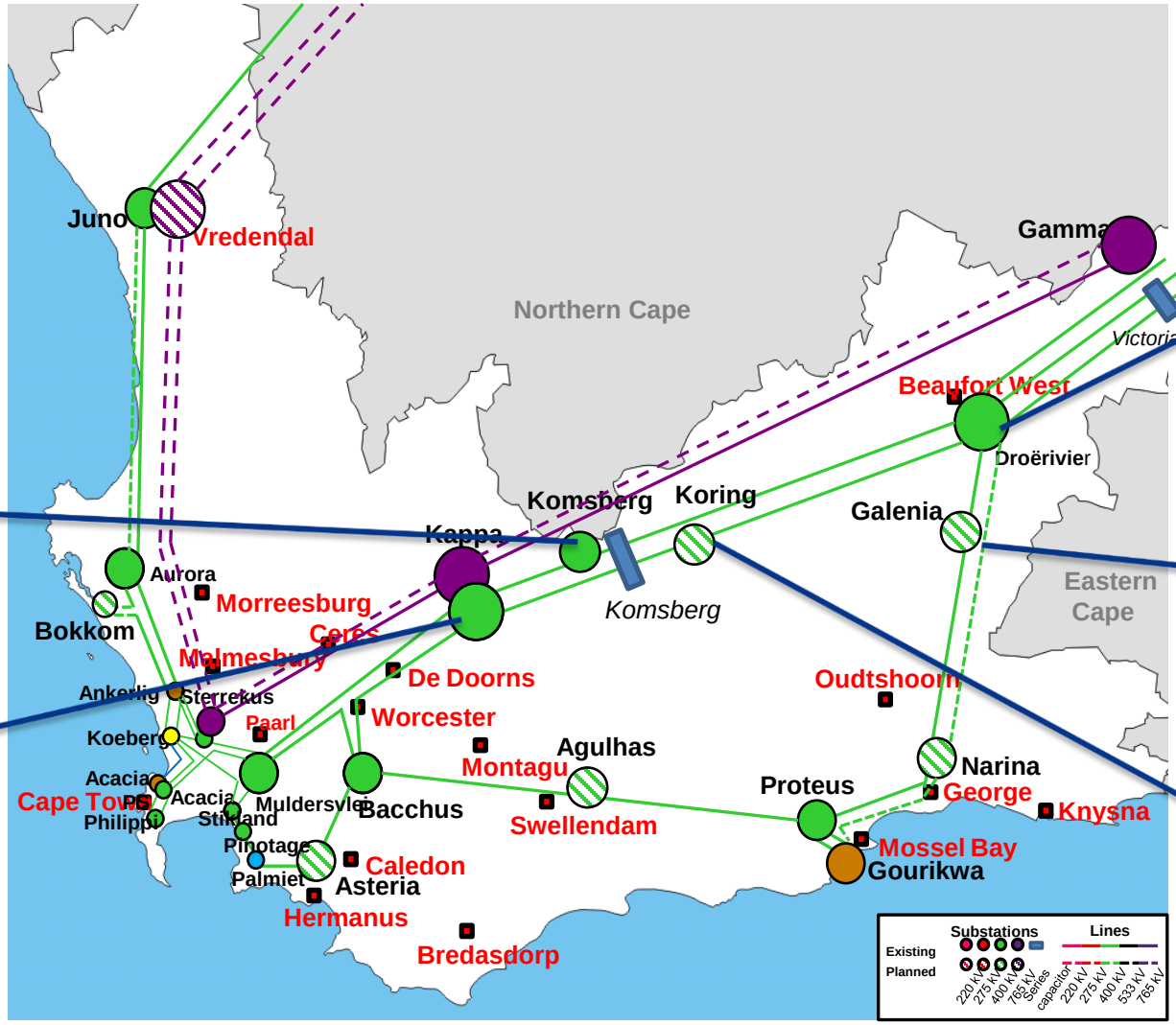
Koring Substation (IPP Self-build)

Agulhas Substation

2023 - 2027

2028 - 2032

Transformer projects to enable RE integration



Komsberg
3rd 500 MVA

Kappa
2nd 500 MVA

Droerivier
1st 500 MVA

Galenia
2nd 500 MVA

Koring
2nd 500 MVA

2023 - 2027

2028 - 2032

Questions?

Transmission Development Plan 2023 – 2032

Summary and Capex Analysis

Leslie Naidoo
Senior Manager: Transmission Grid Planning

The TDP challenges

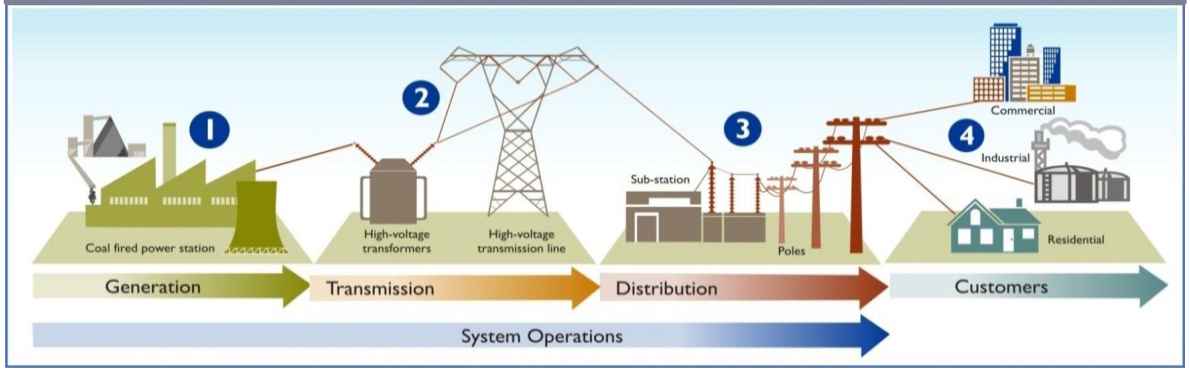
Current situation

- The IRP 2019 that was gazetted in November 2019, proposes ~ 30 **GW** of new generation capacity to be connected to the system by **2030.** When considering the Eskom 2035 Corporate strategy, applications processed via the DMRE procurement programmes, non-DMRE applications and engagements with RE associations, ~ 53GW of new generation capacity will be required by 2032. Failure to deliver will lead to an increased risk to the security of electricity supply for the country.
- Current network reliability constraints (N-1) as well as meeting the anticipated demand growth also requires significant new network infrastructure.
- This will require an **acceleration of investments** in Transmission infrastructure by development of new corridors and substations, and strengthening at existing substations over the period 2023 – 2032 to address both the new generation capacity, as well as the network strengthening requirements across the country for **security of supply.**

Problem statement

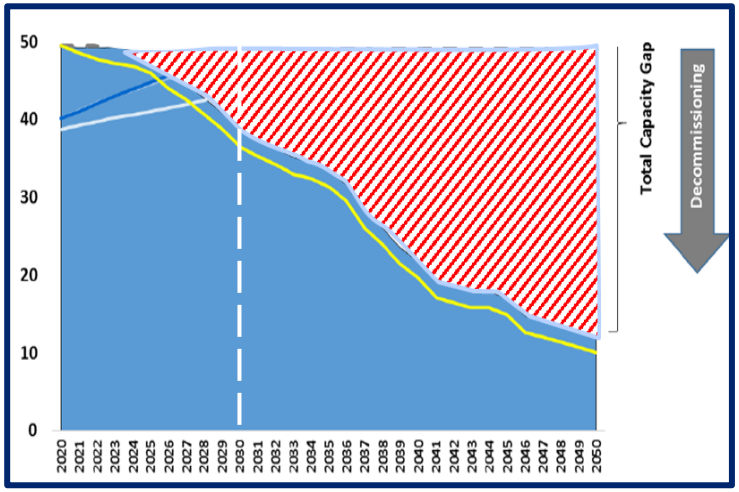
- The grid strengthening required to accommodate this aggressive renewable integration, as well as ensuring the sustainability of the network requires **significant investments.**
- Timelines to implement Transmission Infrastructure take **~ 8 – 10 years** to build due to **servitude challenges.**
- The **resource capacity** in the country across the EPCM value chain is limited.
- The **capital requirements** to achieve the TDP is substantial and is limited by the Eskom's balance sheet.

Electricity value chain



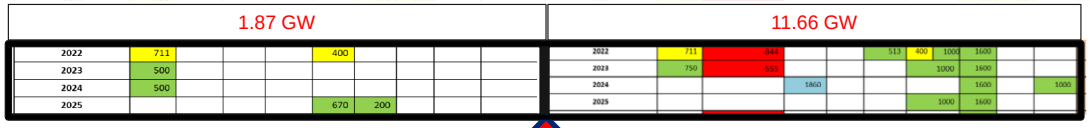
What is the challenge?

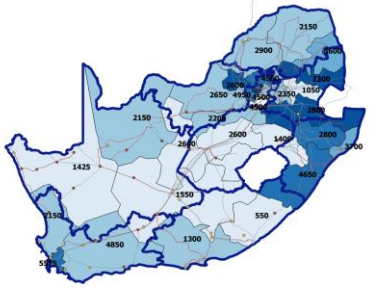
We are facing coal decommissioning – 9,5GW by 2030 and continues beyond



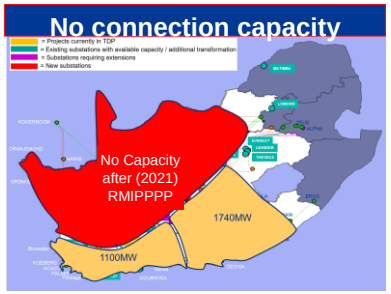
IRP 2019 capacity requirements

	IRP 2019 Coal	Storage	PV	Wind	Gas	Total	Delta	
2020	1433		114	300		1847	0	
2021	1433		300	818		2551	0	
2022	711	513	1400	1600		4224	3113	
2023	750		1000	1600		3350	2850	
2024				1600	1000	2600	2100	9.7GW
2025			1000	1600		2600	1730	
2026				1600		1600	-3150	
2027	750			1600	2000	4350	550	
2028			1000	1600		2600	-1800	17GW
2029		1575	1000	1600		4175	-1275	
2030			1000	1600		2600	0	
Totals:	5077	2088	6814	15518	3000	32497	4118	





Not only brought forward but also compressed

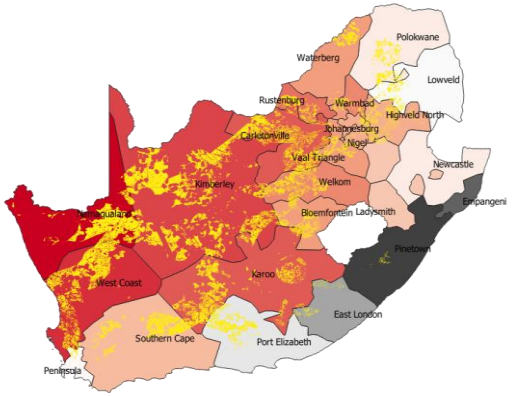


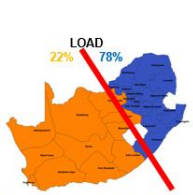
Renewables brought forward from 2018 IRP to 2019 IRP by 9,8GW

What is the challenge? cont.

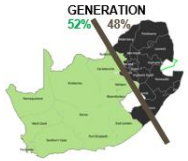
Northern Cape Supply Area with most efficient solar resource taking into account DFFE and CSIR restriction areas has no connection capacity after BW5 / RMIPPP

Solar sites(yellow) & lowest cost(red)



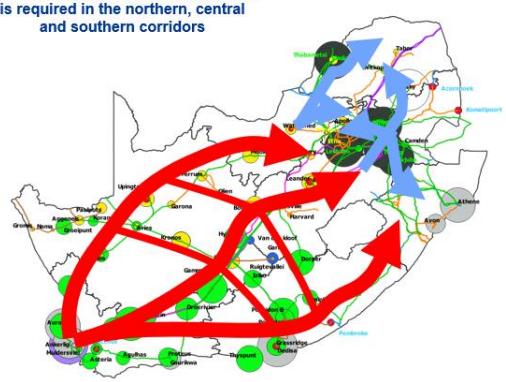


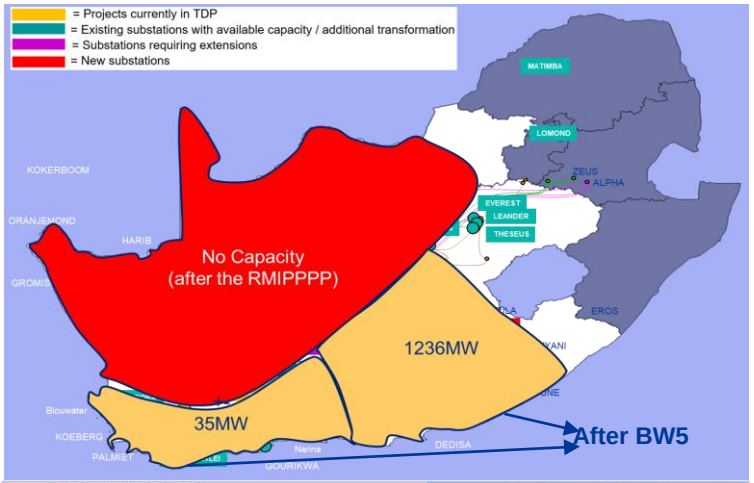
Lower load in the South remains

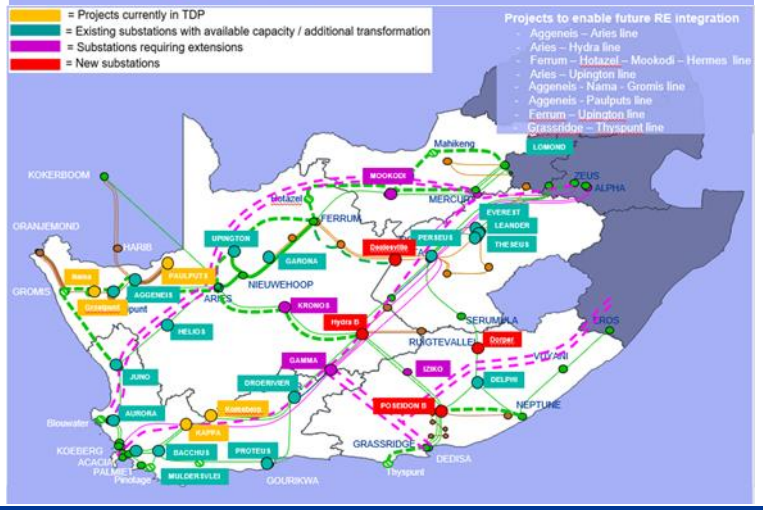


Generation increase in the South

Significant transmission development is required in the northern, central and southern corridors

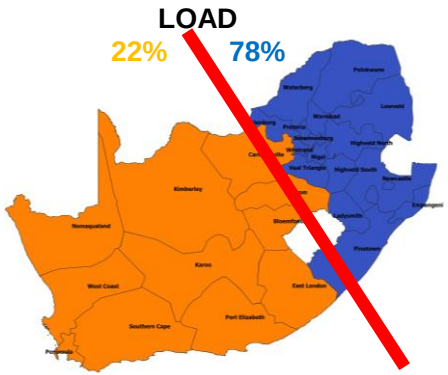




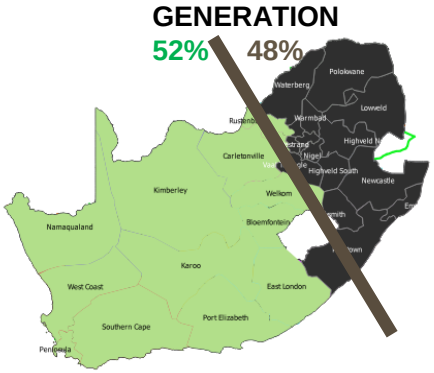


Transmission network infrastructure augmentation in areas with Renewable Energy resources is critical for the Country to maximise on the lowest cost energy

What does this mean for the Transmission network?



Lower load in the South remains



Generation increase in the South

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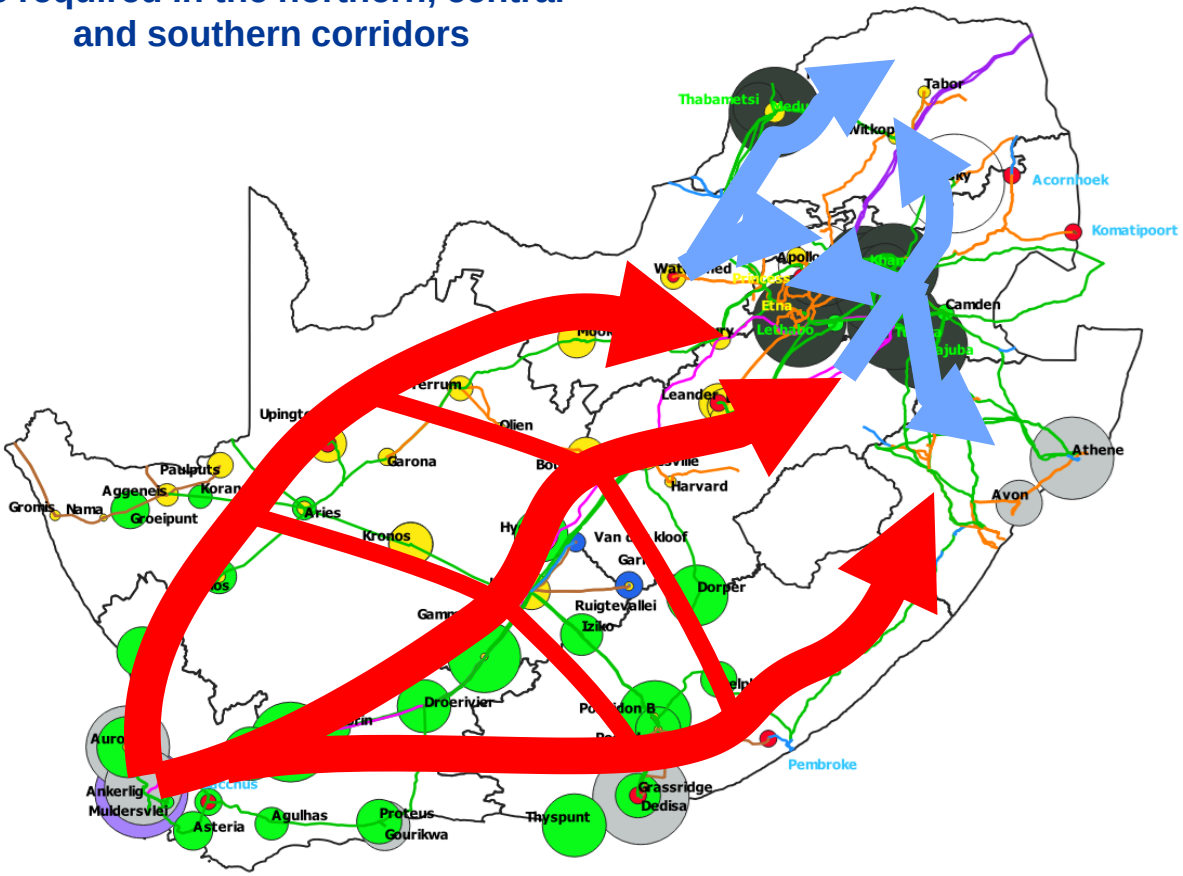
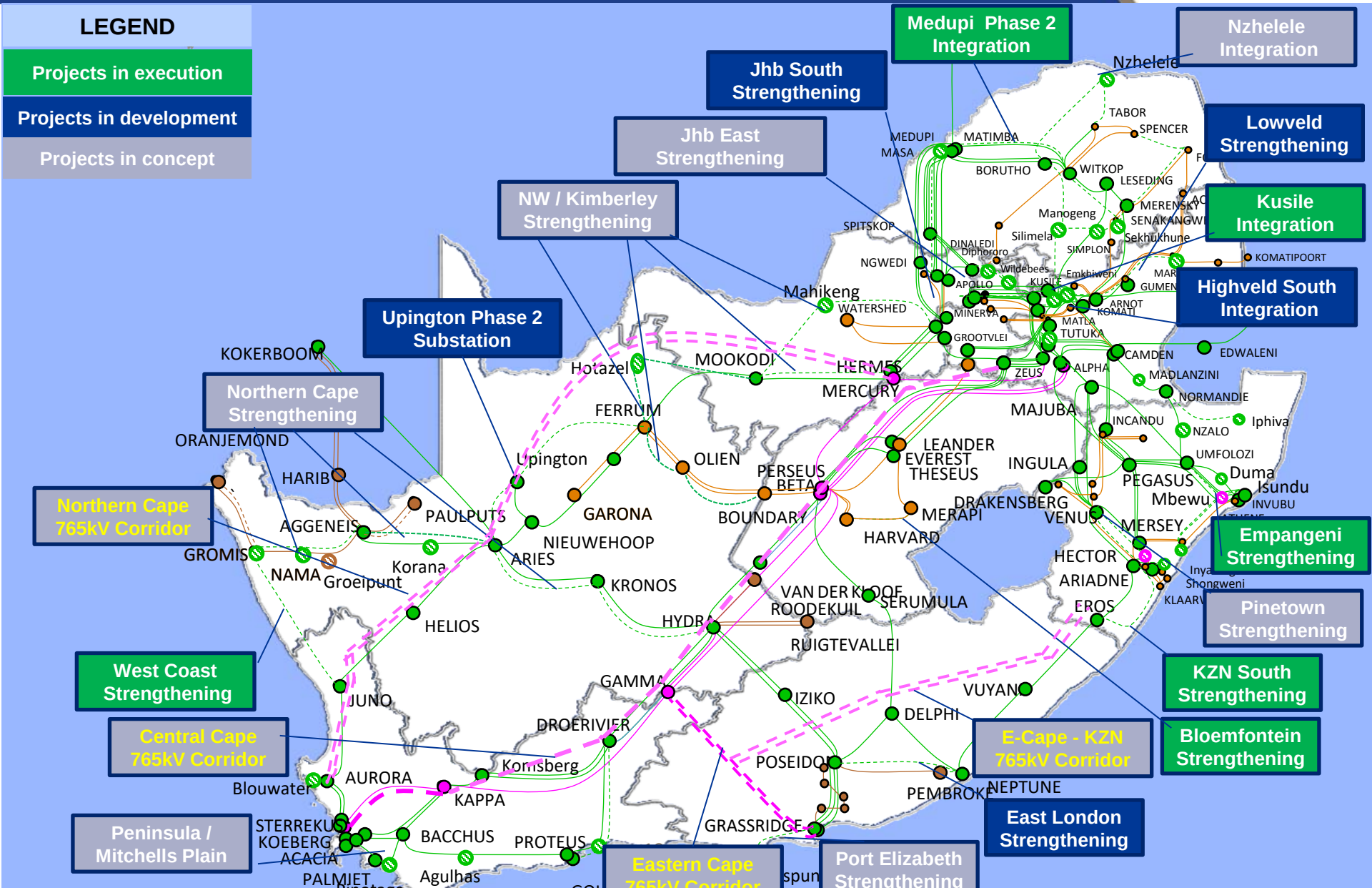


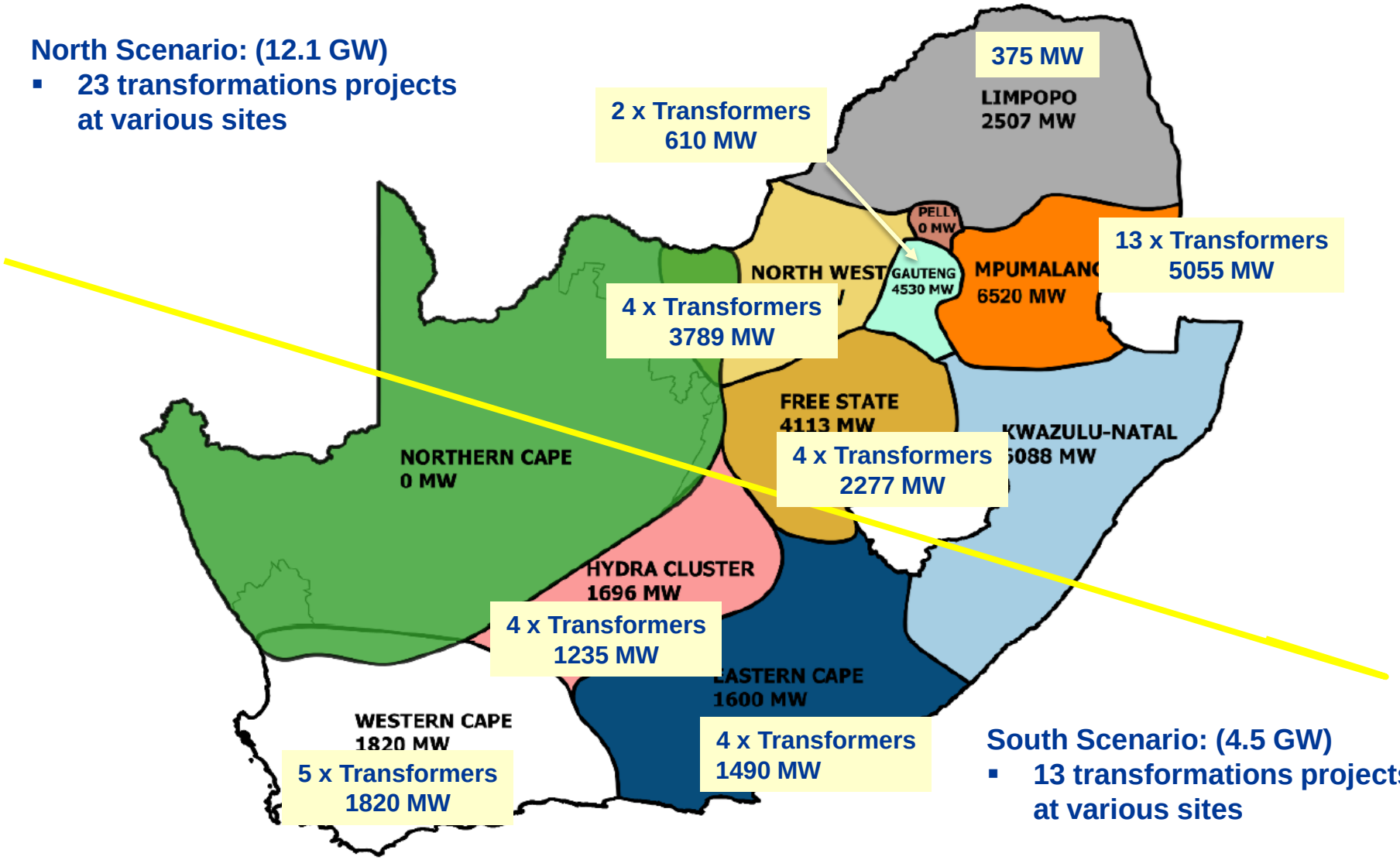
Transmission development plan: 2023 - 2032



Accelerating grid capacity for RE: North and South scenario by introduction of additional transformations ~ 16.6 GW

North Scenario: (12.1 GW)

- **23 transformations projects at various sites**



South Scenario: (4.5 GW)

- **13 transformations projects at various sites**

Summary of Transmission infrastructure requirements over the TDP 2022 period 2023 - 2032

Transmission Assets Nationally	New Assets expected 2023 - 2027	New Assets expected 2028 - 2032	Total New Assets: 2023 - 2032
Power lines (km)			
765 kV	200	6128	**6328**
400 kV	2679	5019	**7698**
275 kV	14	178	**192**
Total length (km)	**2893**	**11325**	**14218**
Transformers			
Number of units	60	110	**170**
Total capacity (MVA)	26970	78 895	**105865**
Capacitors			
Number of units	11	29	**40**
Total capacity (MVar)	560	2 140	**2700**
Reactors			
Number of units	6	46	**52**
Total capacity (MVar)	600	14 113	**14713**

***What the network requires to meet the generation and demand growth for the Country*:**

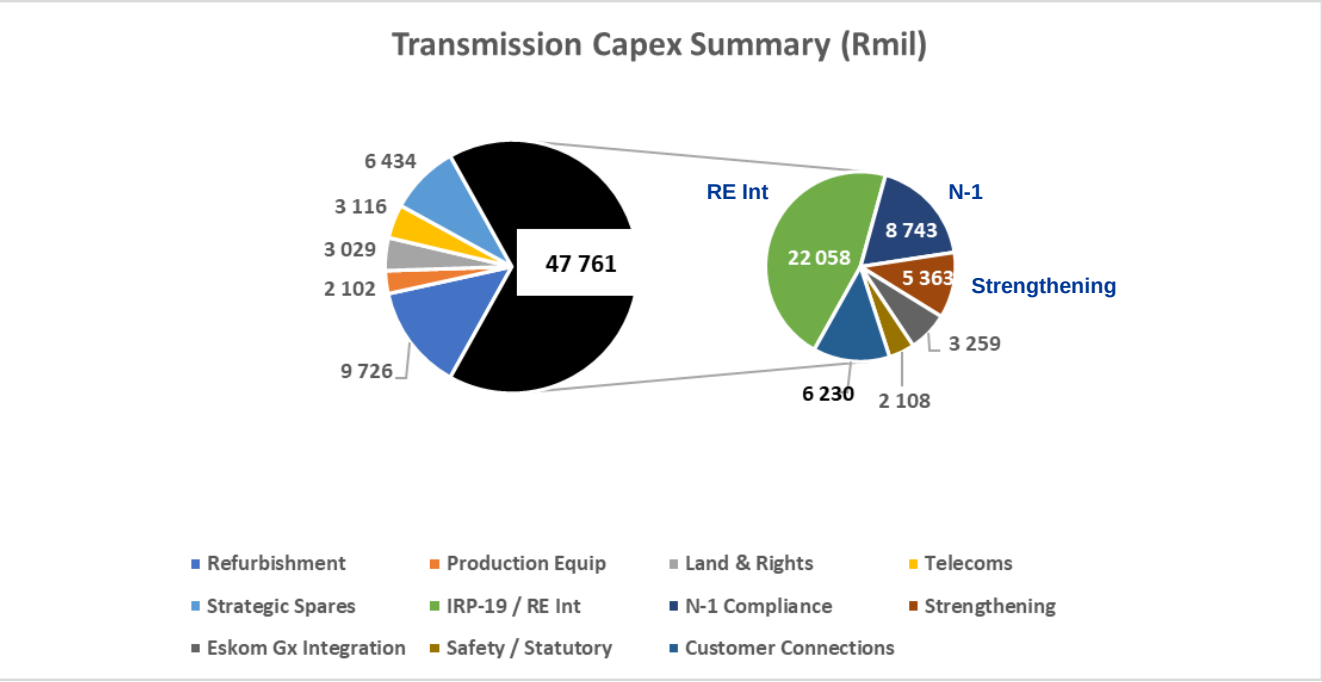
Assumptions: *Capex, servitudes, resource capacity and capability across the EPCM value chain are resolved.*

Our focus is on the next 5 years
While we resolve the challenges in the later years

Transmission 5 Year CAPEX Plan: FY2023 - 2027

Summary of Transmission Capex Plan (R Million) FY 2023 – 2027

Transmission Capex: Categories (Rmil)	Total FY 23 - 27
Capacity Expansion	47 761
Refurbishment	9 726
EIA & Servitudes	3 029
Telecommunications	3 116
Production Equipment	2 102
Strategic Spares	6 434
	72 168



Challenges / Risks

- Network capacity constraints especially in the Northern, Western and Eastern Cape regions require significant network augmentations in terms of 765kV corridors across many provinces

- Capex requirements to fund the new network infrastructure and refurbishment plans will impacts Eskom's balance sheet

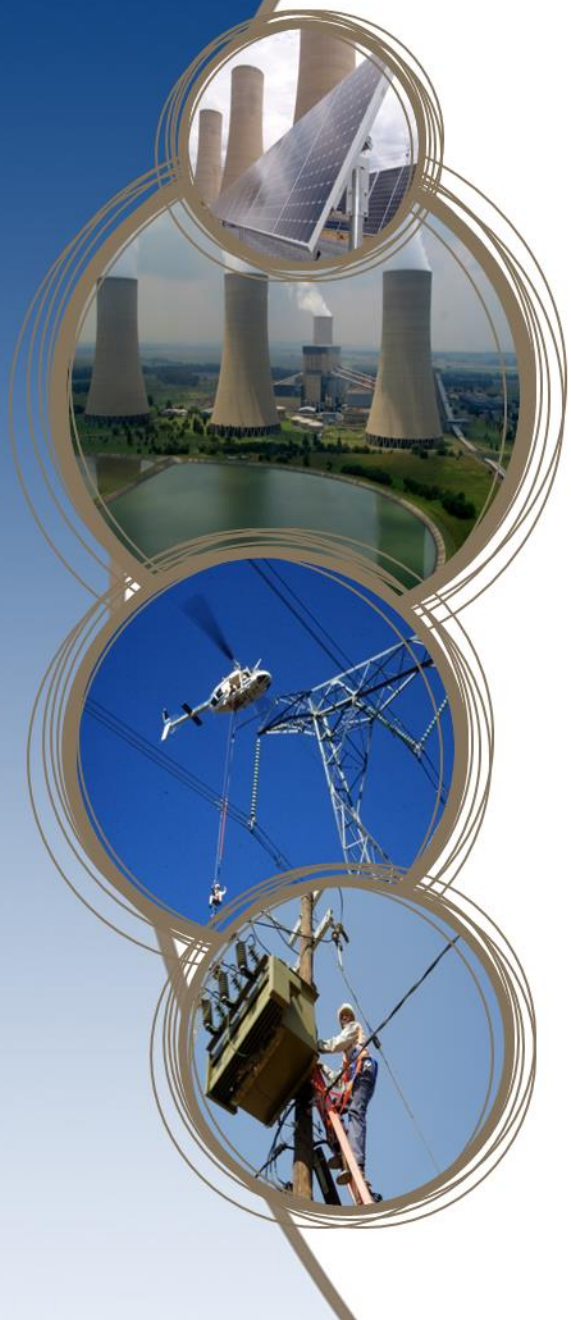
- Deferments over the years places huge pressure on the Transmission build programme ito "back loading" as well as on the sustainability of supplier and construction industry

- The major risks in implementing the TDP 2022 are:
  - Time taken to acquire servitudes
  - Constrained resource capacity in the country across the engineering, procurement, and construction value chain to execute the plan
  - Capex requirements especially in the latter 5 years of the plan

Questions?

Transmission Development Plan (TDP) 2023 – 2032

Public Forum



TDP 2022

Delivery Interventions

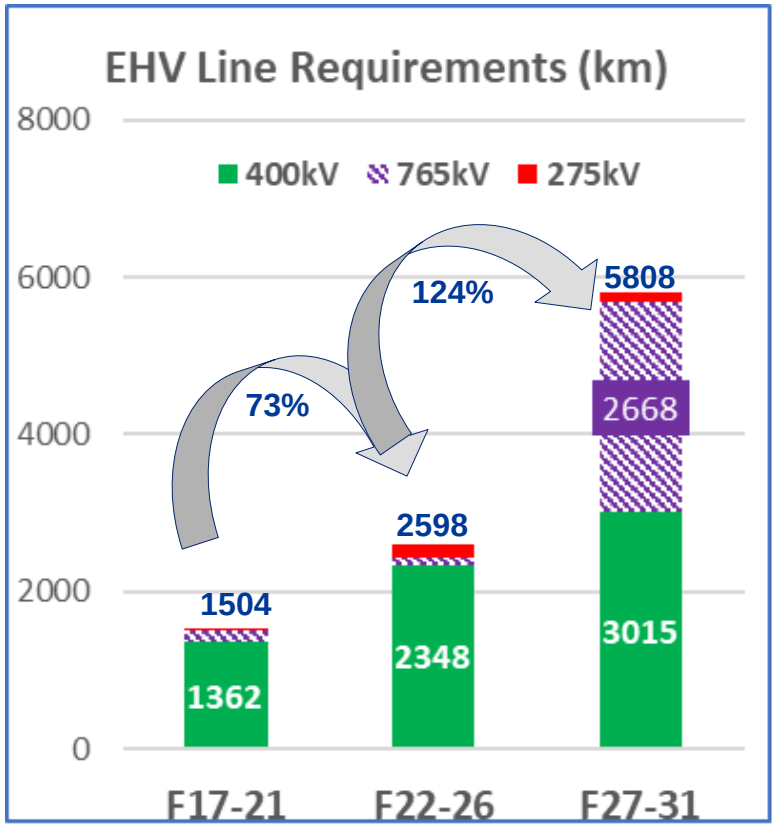
Prince Moyo
General Manager: Asset Management

Contents

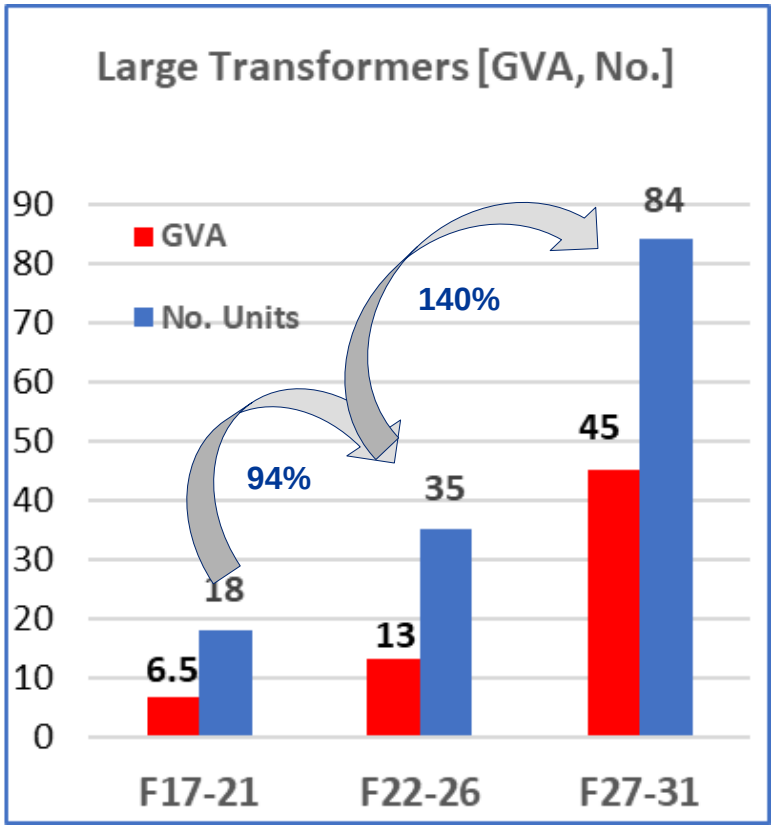
1. Background

TDP 2021

~ 8406 km of line:



~ 119 transformers ~ 58 GVA:

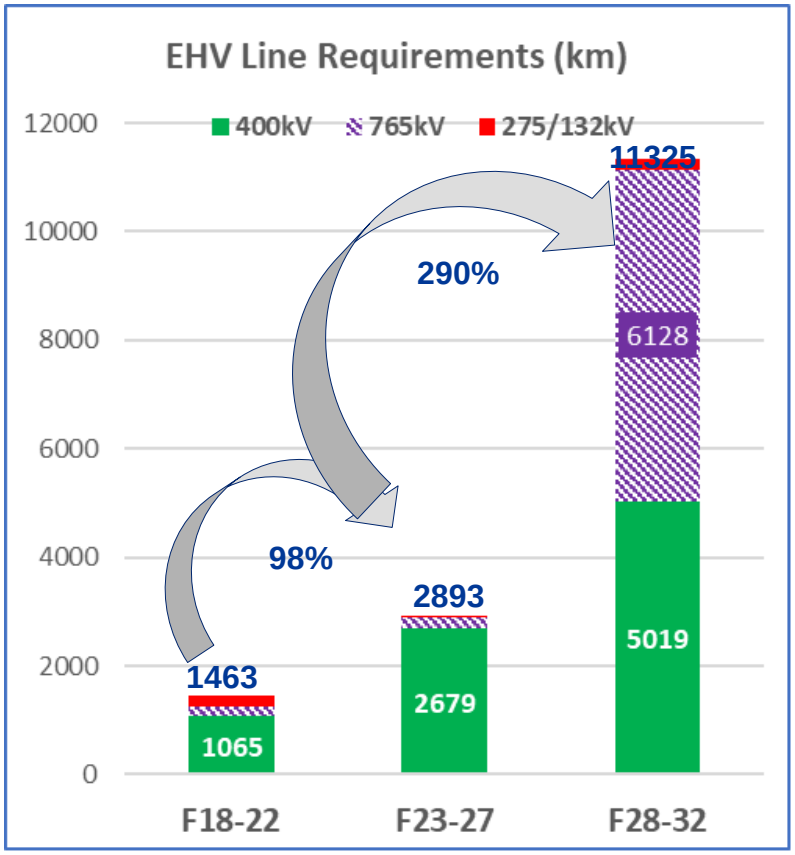


F22-26 cf F17-21: **73%** increase in line km, **94%** increase in transformers
F27-31: **124%** increase in line km, **140%** increase in transformers

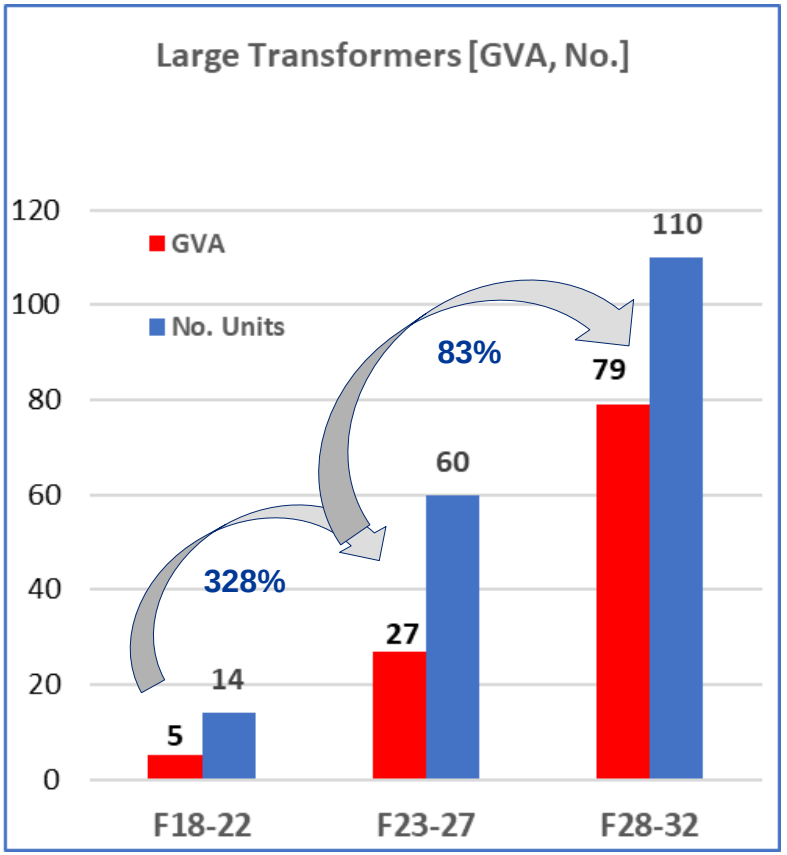
1. Background

TDP 2022

~ 14218 km of line:



~ 170 transformers ~ 106 GVA:



Compared to the previous 5yrs: **98%** increase in line km, **328%** in transformers
Following 5yrs (FY28–FY32): **290%** increase in line km, **83%** in transformers

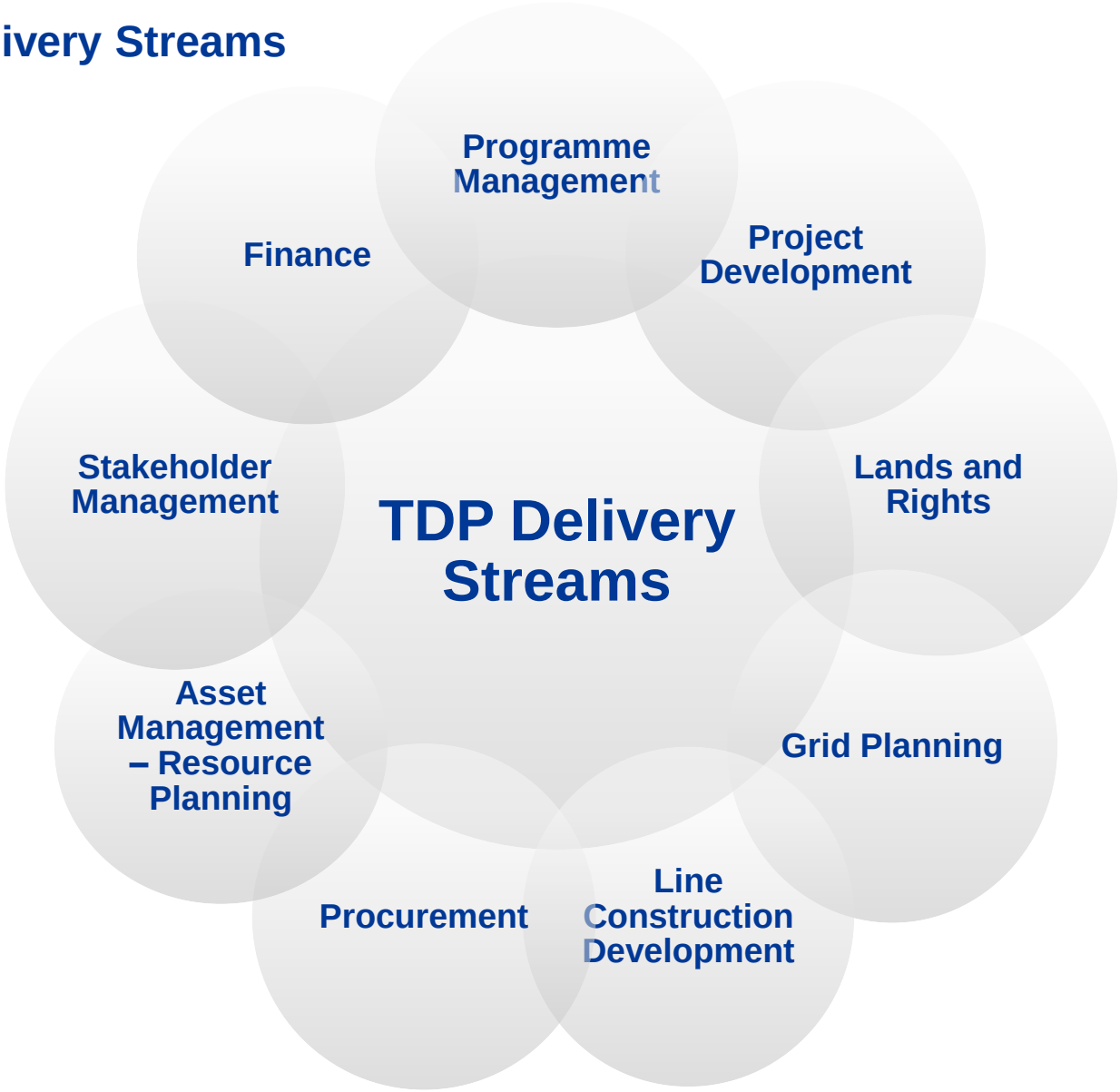
2. TDP Delivery SteerCo

Background:

- TDP Delivery SteerCo established in December 2020
- It is a sub-committee of Transmission Board
- PMO in place and senior managers formally appointed as Project Leader and Programme Manager
- SteerCo has set out priority areas and recorded some achievements; outlined in later slides
- Engagements have been conducted with industry (bilaterally and in open workshops), development agencies (IDC) and government (DTIC, DFFE, DPWI)
- Project plan indicates that the last major step change interventions will be achieved by December 2023

2. TDP Delivery SteerCo

TDP Delivery Streams



2. TDP Delivery SteerCo

TDP Delivery Priority Initiatives

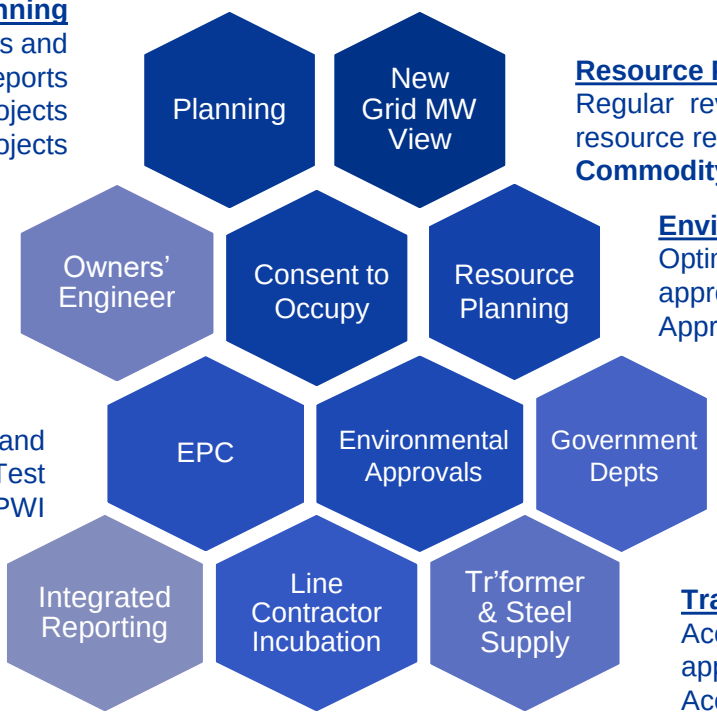
Planning
Planning and release of URSs and Reports
- Deadline for 3 year projects
- Same for 5 year projects

Owners' Engineer (OE)
Compiling a new **Owners' Engineer (OE)** enabling contract agreement to double/ treble delivery of FEED

Consent to Occupy
Streamlining existing expropriation and servitude acquisition processes. Test cases with DPWI

EPC
Compiling new **Lines and Substation EPC** enabling contracts to boost delivery of projects and reduce Eskom interface

Integrated Reporting
Integrated reporting of TDP projects, cradle to grave – programme status and physicals



Resource Planning
Regular review of internal and external resource requirements plan (10 year)
Commodity and service contracts

Environmental Approvals
Optimization and expediting of the approval of the relevant Environmental Approvals and permits for TDP projects

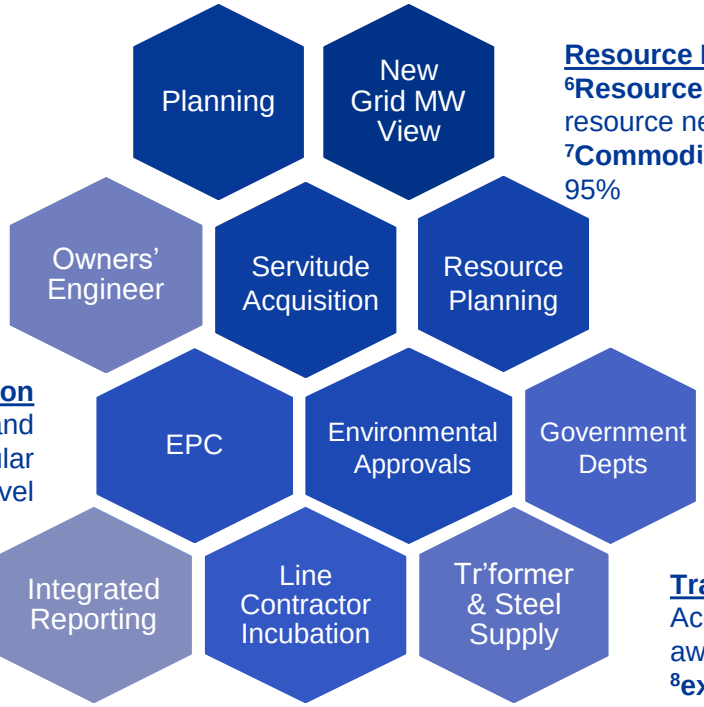
Government Depts
Engagements with the Government and NatJoints for alignment on the support needed to deliver the program

Transformer & Steel Supply
Accredited Factories s;
application for exemption with DTIC
Accredit additional supplier for fabricated structural steel

Line Contractor Incubation
Implementation of **Line Contractor incubation** to develop the local skills … additional 200km per year capacity

2. TDP Delivery SteerCo

TDP Delivery Streams - Achievements



Owners' Engineer (OE)
New [1]**Owners' Engineer (OE)** tender enquiry to be issued in the next few months

Servitude Acquisition
Achieved tabling of expropriations and [2]**POA/CTO** with DPWI. Regular correspondence at DG and GCEO level

EPC
New [3]**Lines** and [4]**Substation EPC** tender enquiries to be issued during 2023

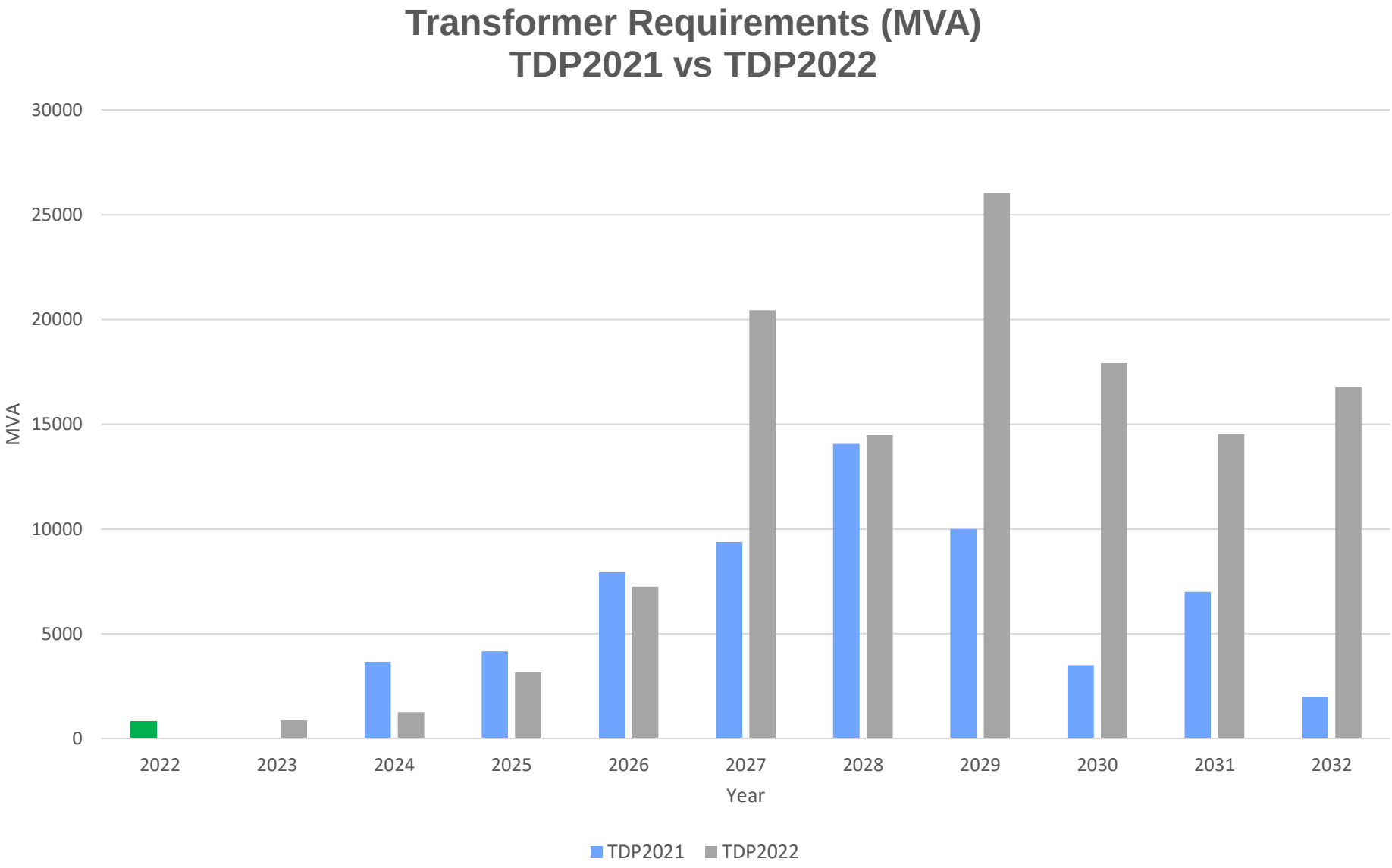
Resource Planning
[6]**Resource Modelling** done; internal resource needs adjusted upwards;
[7]**Commodity and service contracts** 95%

Transformer & Steel Supply
Accredited 6 new factories (total now 14); awarding 11 trfrs; supplemental [8]**exemption approved by DTIC**
Tender evaluations ongoing for [9]**additional supplier** for fabricated structural steel

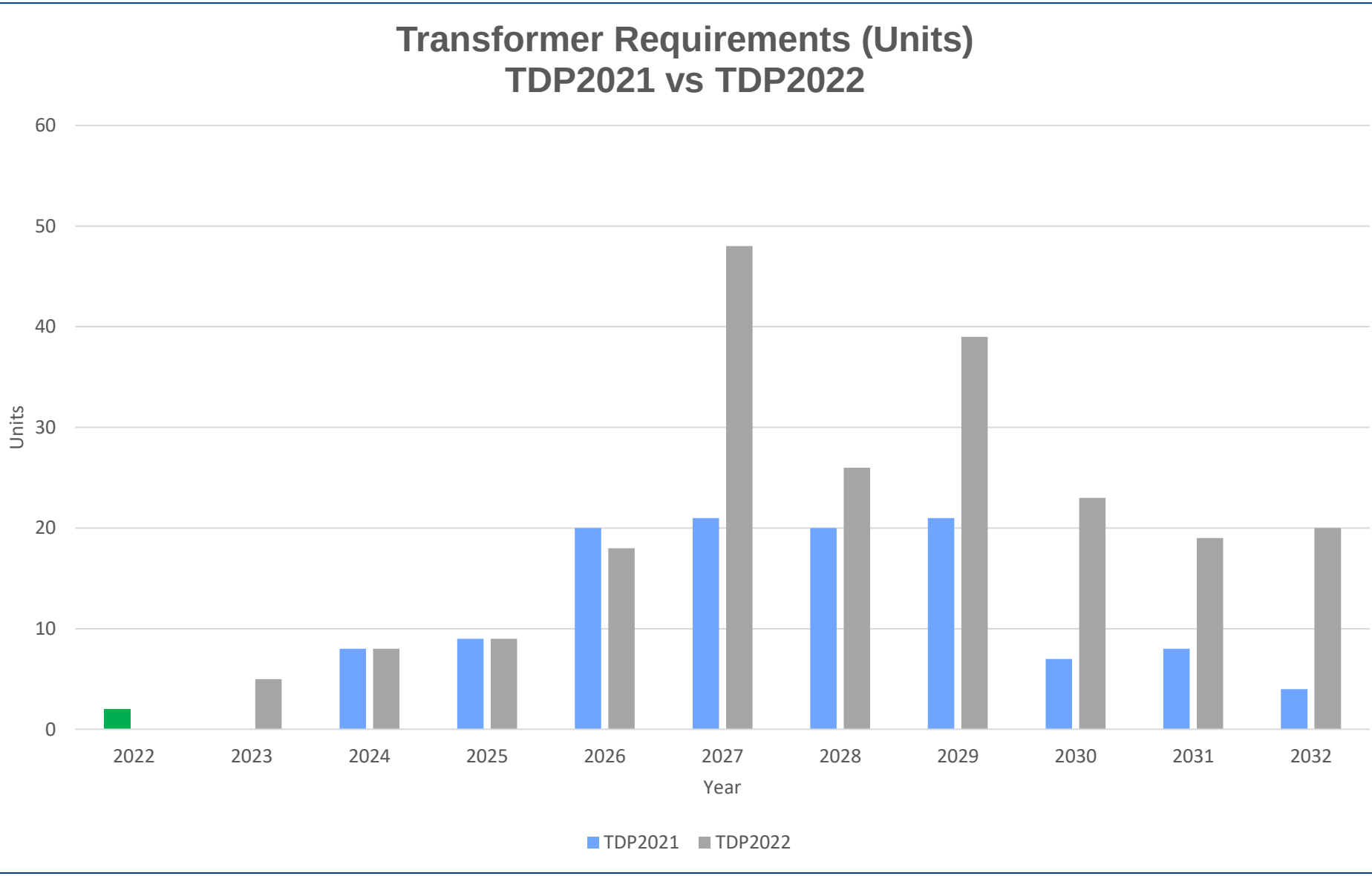
Line Contractor Incubation
[5]**Line Contractor incubation** tender evaluations ongoing

3. TDP 2022 Physicals

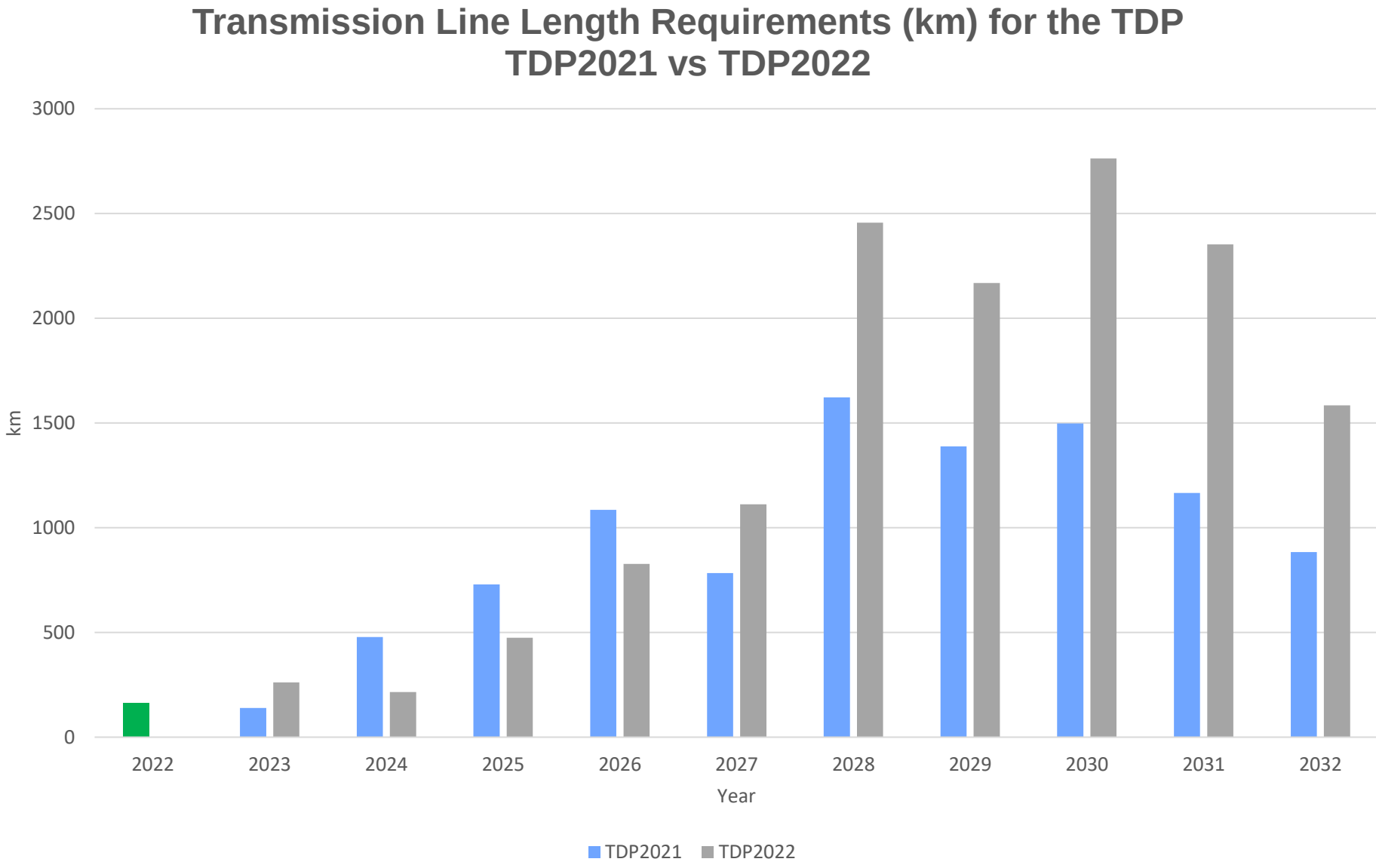
Transformer Demand (MVAs)



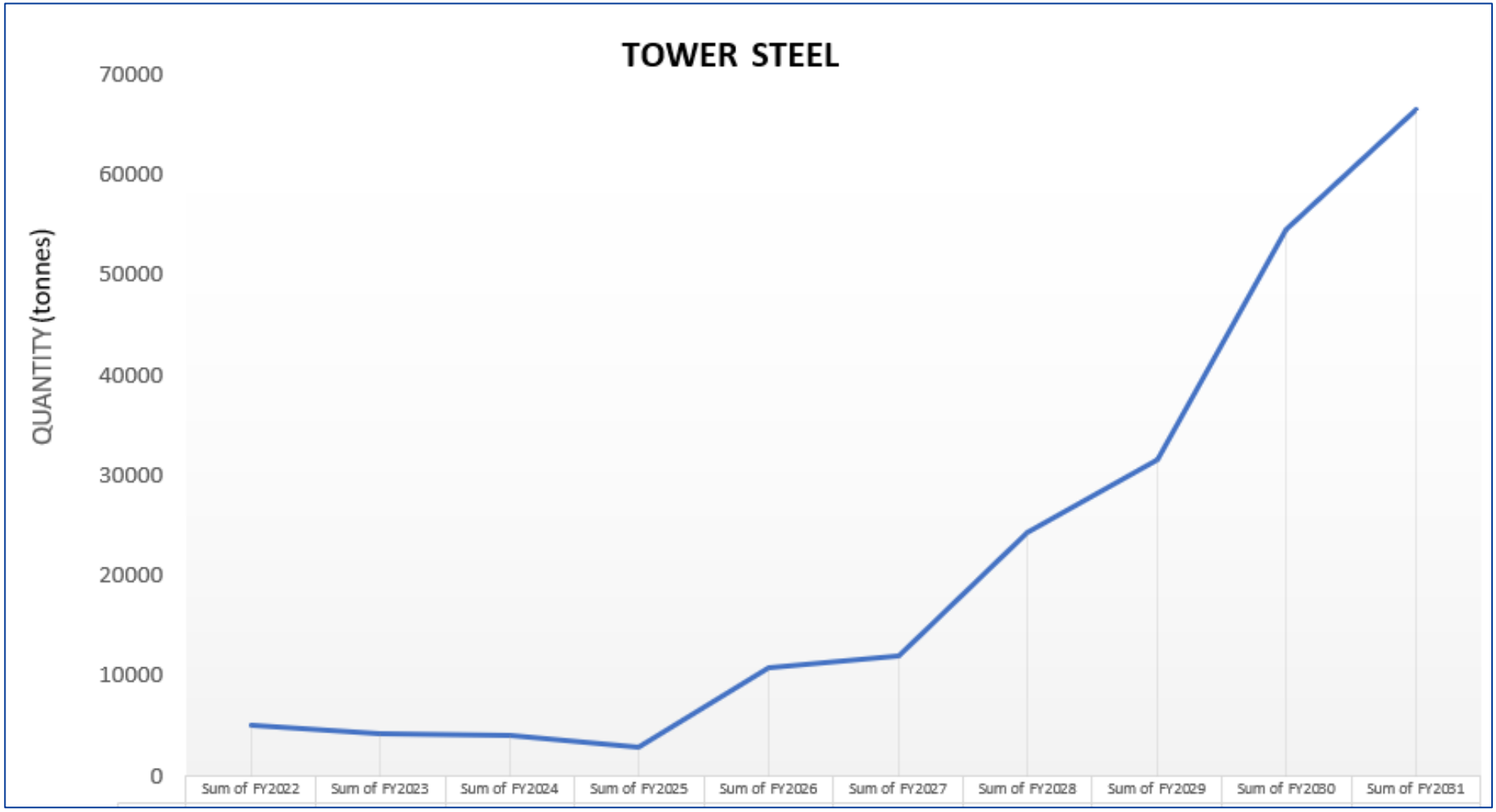
Transformer Demand (units)



Overhead Lines Demand (km)

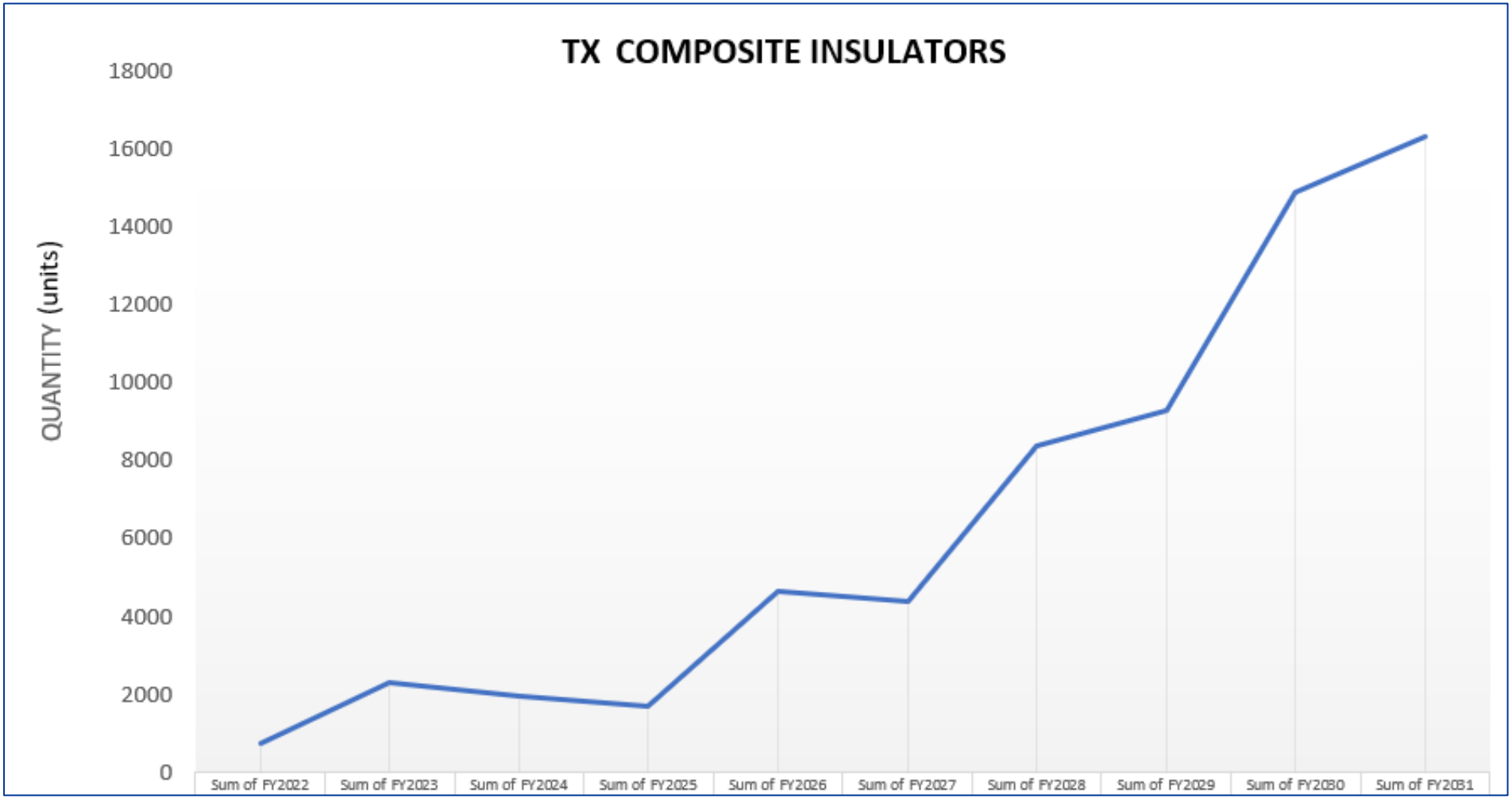


Tower Steel Demand (TDP2021)



*info not available yet for TDP2022

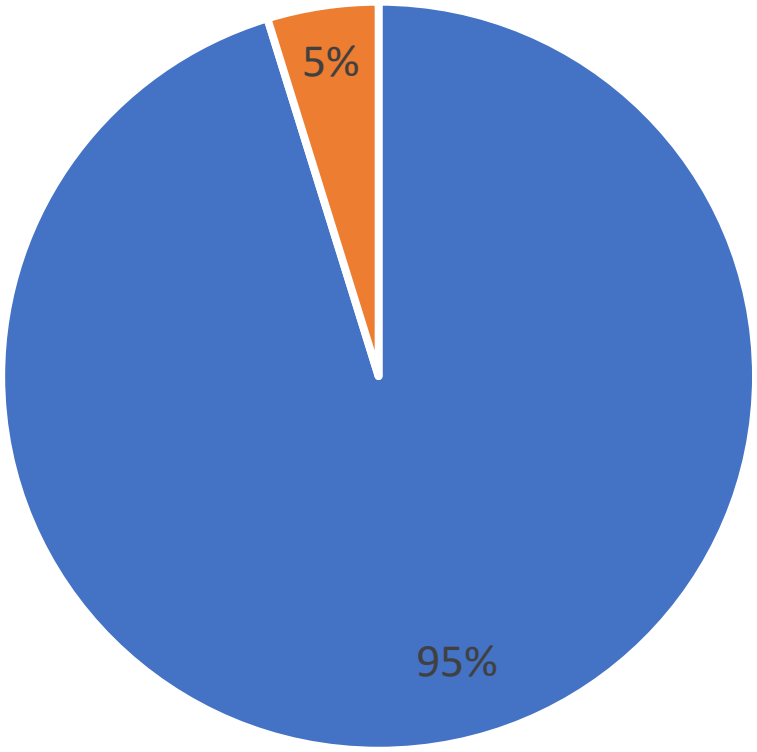
Composite Insulator Demand (TDP2021)



*info not available yet for TDP2022

4. Contracts Status

Active vs Expired Contracts

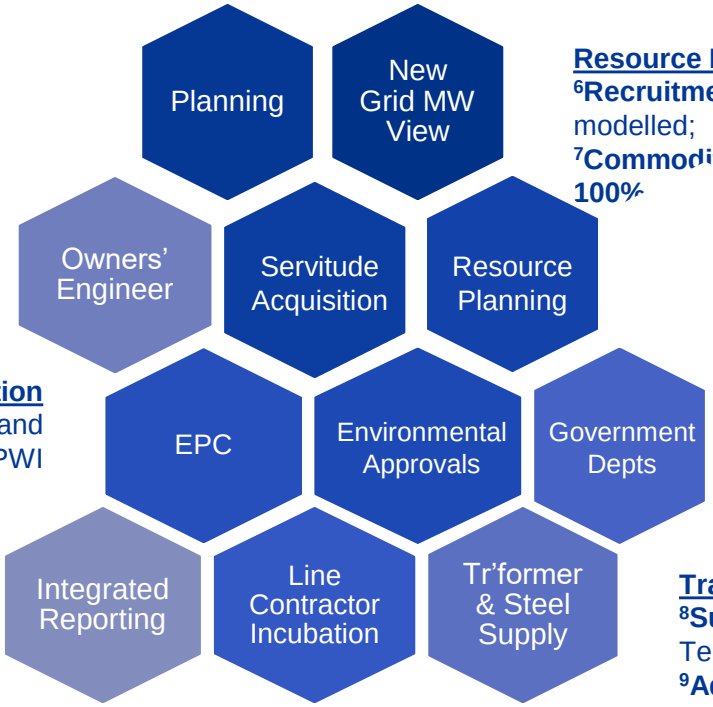


Open Contracts = 80

Expired Contracts = 04

5. Future Focus

TDP Delivery Streams – Future Focus



Owners' Engineer (OE)

[1]**Owners' Engineer (OE)** awarded and utilised to accelerate rate of dev't of projects

Servitude Acquisition

Achieved tabling of **expropriations** and [2]**POA/CTO** with DPWI

EPC

New [3]**Lines** and [4]**Substation EPC** tender awarded and utilised to accelerate execution projects

Resource Planning

[6]**Recruitment** to create capacity as modelled;

[7]**Commodity and service contracts 100%**

Transformer & Steel Supply

[8]**Supplemental Contracts** concluded

Tender evaluations ongoing for [9]**Additional supplier(s)** for fabricated structural steel in place

Line Contractor Incubation

[5]**Line Contractor** capacity increased by at least 200km per annum

Questions?

TDP 2022

Projects in Execution

Naresh Singh
General Manager: Transmission Projects Delivery

Introduction

Partnership is required in the execution of the TDP

Joint commitment is required in delivering on fundamental building block of this country, entrusted to us by Government and people of South Africa

Previous discrepancies between the TDP and the execution plan due to various reasons

However, the TDP and execution plans are getting closer aligned

- Change in generation mix requires more Tx connections
- New/Renewable energy is here to stay
- Significant increase capital allocation
- Changes in the regulatory and governance environment

Challenge

The biggest challenge is to:

- Deliver what the country needs
- In a manner that is cost and time efficient
- That lasts the duration for which the assets are meant to last
- In a safe, environmentally and socially responsible way

Project Execution challenges, improvement initiatives and opportunities

Procurement process inefficiencies

- Implemented earlier approval of procurement strategies where applicable
- Implemented Panel contracts to shorten duration to contract award
- Procurement process gap analysis and process improvements ongoing (Reduced National Treasury approvals, single and sole source practices etc.)
- Process improvements to reduce contract termination, liquidation, arbitration/adjudication
- Reduce re-tenders, reduce tender requirements – but suppliers and contractors to read documents, follow requirements, attend clarification sessions
- Cost effective pricing from the market is required
- Reduce tender period extensions from the market

Contracting methodology change required

- Change in primary contracting strategy from multiple packages with free issue to EPC
- Expectations is that this will result in speedier execution at a lower costs, still need to meet developmental objectives
- 4 x EPC contracts to the market by March 2023, 2 x issued to the market in October 2022
- Owners Engineer and EPC panel implementation to commence

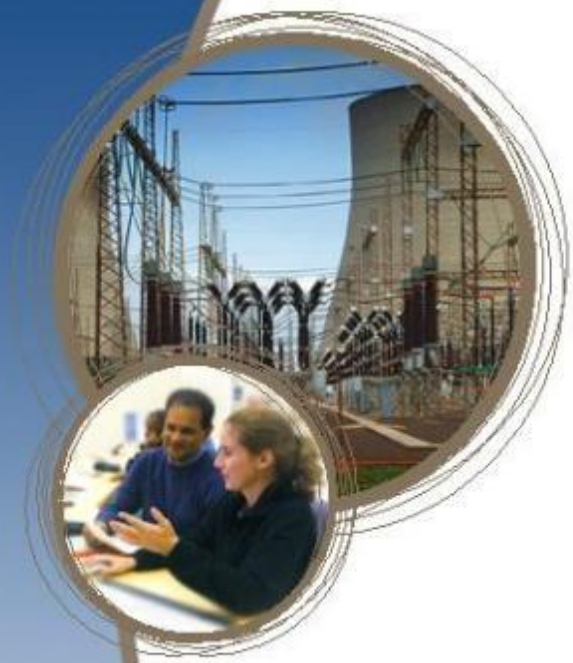
Project Execution challenges, improvement initiatives and opportunities

Bespoke Engineering designs	• Challenging current engineering practices with a view of simplifying procurement and manufacturing whilst reducing capital cost • EPC approach will also help uncover overdesign which is costly and complex to implement
Insufficient line contractor capacity	• Line contractor incubation program - RFI issued to the market, evaluations nearing completion, target 4 contractors on incubation model
Limited number of steel suppliers	• Accredit additional steel suppliers - RFI issued to the market, next steps to evaluate submissions and desktop accreditation
Project community instability	Stability guideline implemented, conducted whilst project is in development phase, include as tender returnable Security Threat Assessment is conducted, Security Advisors assigned Security contract implementation ongoing

In conclusion

- Sense of urgency is required
- Cost prudency and returning transmission capital costs to globally competitive costs
- Efficient project execution after contract award – done correctly the first time, executed as planned
- Quality workmanship that will last generations
- Safe execution - we can never let our guard down
- Compliance to environmental safeguards and social commitments
- Continuous education and pipelining
- Ethical behavior – let us jointly return the business to the highest ethical standards

Questions?



Thank you