Transmission Development Plan 2016 – 2025

Public Forum

16 October 2015
Eskom Transmission Development Plan 2016 - 2025

Planning for the South African Integrated Power System

Presented by: Mbulelo Kibido
Desired Outcomes for this Public Forum

- Information on the transmission infrastructure investment plans for the TDP period 2016 to 2025
- Insight into the assumptions and inputs on which these plans are based.
- Appreciation of the rigour that goes into the process of planning infrastructure investments in Transmission.
- An understanding of the generation and load growth that has been catered for in these plans
- The plans to create grid capacity to integrate the generation envisaged in the 2010 IRP.
- Information on the capital budget requirements to execute these plans.
- More importantly, to solicit comments and further inputs to improve these plans
Our Infrastructure Investment Planning Model

1. Demand and Generation Outlook (spatially)
   - I.R.P.
   - Customer Applications
   - Demand Forecasts

2. Perform Network Analysis and Determine Infrastructure Requirements
   - Reliability Criteria
   - Standards & Regulations
   - Life-Cycle Asset Plans
   - CCRA Evaluation

3. Evaluate Asset Condition and Performance
   - Asset Management Policies & Standards

4. Network Expansion Plans
   - Strategic Grid Plan

5. Asset Investment Plans
   - Cost Data

6. Align, Optimize, Prioritize, & Schedule the Programme
   - The Transmission Development Plan (the TDP)

7. Executability Assessment
   - Funding Constraints
The Key Plans

**Integrated Resource Plan (IRP)**
- The Department of Energy (Energy Planner) is accountable for the Country Electricity Plan, which is called the Integrated Resource Plan For Electricity (IRP 2010-2030).
- The Integrated Resource Plan (IRP) is intended to drive all new generation capacity development.
- Nersa licences new generators according to this determination.

**Strategic Grid Plan (SGP)**
- The Strategic Grid Plan formulates long term strategic transmission corridor requirements
- The Plan is based on a range of generation scenarios and associated strategic network analysis
- Horizon date is 20 years
- Updated every 2 - 3 years

**Transmission Development Plan (TDP)**
- The Transmission Development Plan (TDP) represents the transmission network infrastructure investment requirements
- The TDP covers a 10 year window
- Updated annually
- Indicates financial commitments required in the short to medium term
Recently Completed Projects
Major Projects Completed Recently

Transformation Projects:
1. Rustenburg - Bighorn
2. Polokwane - Tabor
3. Peninsula - Acacia
4. Lowveld - Malelane
5. Tshwane - Thuso
6. Northern Cape - Ferrum

Cape Corridor 1st 765kV: Zeus - Gamma
Cape Corridor 1st 765kV: Gamma - Kappa
Lewensaar: New Traction Substation
Mercury-Vryburg-Ferrum New Vryburg Substation
Witkop - Tabor 400kV injection
Lowveld Capacity Increase: Malelane & Komatipoort
Tx Medupi Integration Ph1: 1st, 2nd & 3rd Units
Tx Kusile Integration 1st & 2nd Units
Thuso Substation (Irene area)
Majuba - Umfolozi 1st 765kV into KZN
East London Strengthening Eros-Vuyani-Neptune

Substations
- Existing
- Existing with changes
- Planned

Planned MTS Lines
- Voltage (kV)

Existing MTS Lines
- Voltage (kV)

TDP 2016-2025

Created by: Grid Planning Transmission
2015/09/01
Since 2011, 42 projects (2142 MW) of RE IPPs were connected, ~88% (1865 MW) of which are in operation.

### Status of Current DOE IPP Programme – end August 2015

<table>
<thead>
<tr>
<th>Name of programme</th>
<th>MW contribution</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid Window 1</td>
<td>1436</td>
<td>All 28 projects connected</td>
</tr>
<tr>
<td>(28 projects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bid Window 2</td>
<td>1054</td>
<td>14 projects connected (706MW)</td>
</tr>
<tr>
<td>(19 projects)</td>
<td></td>
<td>5 projects in execution</td>
</tr>
<tr>
<td>Bid Window 3</td>
<td>1656</td>
<td>All projects in execution</td>
</tr>
<tr>
<td>(19 projects)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2142 MW of RE IPPs have been connected to the grid underpinned by a R2.4 billion Eskom network investment.
Thank you
TDP 2016 – 2025
Overview

Presented by: Leslie Naidoo
Linkages between the various plans

Expected demand

Current capacity and expected projects

Policy

Select options

Determine energy and capacity shortfalls

IRP 2010-2030

Disaggregate Demand Spatially

Disaggregate Generation Pattern Spatially

Strategic Network Scenario Analysis

20 Yr SGP

20 Yr Dx Master Plan

Connection Applications & Capacity Programmes

Dx Network Dev. Plans

Investment Plan

Adequacy criteria

Select robust generation scenarios

Adequacy Criteria: Voltage Limits Thermal Rating N-1 Contingency N-2 Contingency

10 Yr TDP

Detailed Network Analysis

Implementation strategy

Resource constraints

Determine infrastructure requirements
Assumed transmission capacity forecast and comparisons

Demand Forecasts

Note: Capacity constrained by 1.5GW at Time Of System Peak
Assumed generation pattern based on IRP 2010

- **4800 MW of wind generation** modelled as 100 MW blocks at potential sites across the Cape Drakensberg.
- **700 MW of CSP generation** modelled as 100 MW blocks at potential sites across the N. Cape.

- **4800 MW** of wind generation modelled as 100 MW blocks at potential sites across the Cape.

- **DOE OCGT 1 & 2**
- **IPP Coal 2250 MW**
- **IPP Coal 800 MW**

- **Nuclear 1 - 4800 MW**
- **CCGT - 2325 MW**
- **Ankerlig**
- **Koeberg**
- **Gourikwa**
- **Matimba**
- **Medupi**
- **Kusile**
- **Drakensberg**
- **Central Power Pool**
- **IPPP Pool**
- **Ingula**

Legend:
- Existing Power Stations (Eskom)
- New Build
- Nuclear 1
- CCGT Gas 1
- Renewables (REBID Windows 1 to 4)
  - Biomass
  - Concentrated Solar Power
  - Landfill Gas
  - Onshore Wind
  - Small Hydro
  - Solar Photovoltaic
  - Solar PV - Single Axis

(Diagram details not transcribed for the text representation.)
### Summary of Transmission Infrastructure Requirements over the TDP Period

#### Transmission Assets

<table>
<thead>
<tr>
<th>Transmission Assets</th>
<th>New assets expected in 2016 - 2020 (Kms)</th>
<th>New assets expected in 2021 - 2025 (Kms)</th>
<th>Total new assets (Kms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Kms of lines</td>
<td>2958</td>
<td>7011</td>
<td>9969</td>
</tr>
<tr>
<td>765kV lines (km)</td>
<td>350</td>
<td>1760</td>
<td>2110</td>
</tr>
<tr>
<td>400kV lines (km)</td>
<td>2589</td>
<td>4915</td>
<td>7504</td>
</tr>
<tr>
<td>275kV lines (km)</td>
<td>19</td>
<td>336</td>
<td>355</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Transformer MVA</th>
<th>29240</th>
<th>46155</th>
<th>75395</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformers (no)</td>
<td>71</td>
<td>94</td>
<td>165</td>
</tr>
<tr>
<td>Capacitors (no)</td>
<td>15</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Reactors (no)</td>
<td>6</td>
<td>15</td>
<td>21</td>
</tr>
</tbody>
</table>
Cumulative line requirements

2014 vs 2015 TDP Cumulative Total Line km Requirements

### km of Line

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual built</td>
<td>600</td>
<td>443</td>
<td>631</td>
<td>787</td>
<td>811</td>
<td>319</td>
<td>3591</td>
<td>3272</td>
<td>4140</td>
<td>4746</td>
<td>5718</td>
<td>7165</td>
<td>8507</td>
<td>8760</td>
<td>10458</td>
<td>12094</td>
</tr>
<tr>
<td>Cumulated actual built</td>
<td>600</td>
<td>1043</td>
<td>1674</td>
<td>2461</td>
<td>3272</td>
<td>3591</td>
<td>3591</td>
<td>4014</td>
<td>4735</td>
<td>5230</td>
<td>5667</td>
<td>6549</td>
<td>7521</td>
<td>9726</td>
<td>10744</td>
<td>12109</td>
</tr>
<tr>
<td>2014 TDP</td>
<td>3272</td>
<td>4140</td>
<td>4746</td>
<td>5718</td>
<td>7165</td>
<td>8507</td>
<td>8760</td>
<td>10458</td>
<td>12094</td>
<td>14375</td>
<td>16668</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015 TDP</td>
<td>3591</td>
<td>4014</td>
<td>4735</td>
<td>5230</td>
<td>5667</td>
<td>6549</td>
<td>7521</td>
<td>9726</td>
<td>10744</td>
<td>12109</td>
<td>13560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cumulative transformer requirements

TDP 2014 vs TDP 2015 Cumulative Trf MVA Requirements

<table>
<thead>
<tr>
<th>Year</th>
<th>MVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1630</td>
</tr>
<tr>
<td>2011</td>
<td>5940</td>
</tr>
<tr>
<td>2012</td>
<td>2525</td>
</tr>
<tr>
<td>2013</td>
<td>3580</td>
</tr>
<tr>
<td>2014</td>
<td>3790</td>
</tr>
<tr>
<td>2015</td>
<td>2090</td>
</tr>
<tr>
<td>2016</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
</tr>
</tbody>
</table>

- **Actual Installed**: 1630, 5940, 2525, 3580, 3790, 2090
- **Actual Installed Cumulated**: 1630, 7570, 10095, 13675, 17465, 19555
- **2014 TDP**: 17465, 19485, 27065, 33920, 42955, 46955, 59575, 69875, 80290, 90235, 98850
- **2015 TDP**: 19555, 29100, 33730, 34855, 36125, 48735, 57115, 68010, 80205, 86950, 94950
Major projects planned for in the TDP period

- Cape Corridor 2nd 765kV
- North West / Kimberley Strengthening
- Vaal Strengthening
- N Cape Development
- Medupi Integration Ph2
- Kyalami, Soweto & West Rand
- Tshwane Strengthening
- Lowveld Strengthening
- Highveld South Secunda
- Empangeni Strengthening
- Pinetown Strengthening
- PE Strengthening
- Poseidon – Neptune 400kV
- NZhelele Integration
- North West Grid
- Eastern Grid
- Western Grid
N-1 Compliance outlook with the reprioritised plan

**Note.** The 2022 date is based on the assumption that the Transmission Capital Plan for the N-1 projects will be adequately resourced from the MYPD4 period and beyond.
TDP 2016 - 2025

Provincial Plans
North-West Province

TDP 2016 - 2025

Presented by: Queen Melato
North-West Province Profile

Generation:
- Matimba Power Station in Limpopo Province
- Medupi Power Station

Economic activity:
- Mining, Industrial, Re-distributors
- Commercial, Agricultural and Residential

Load drivers (Rustenburg CLN):
- Platinum mining and smelting operations
- Home to the largest platinum refinery; and two largest platinum mines
- The 4th largest integrated ferrochrome producer is based in the North West Province

Load drivers (Carletonville CLN):
- Richest gold-producing hub
- Supplies predominantly gold mines
- One of South Africa’s largest Game Reserves
Electricity Demand Forecast

North West Province Load Forecast

- Carletonville
- Rustenburg
- NW Province

Load (MW)
NWOU NDP’s Major Projects

Lichtenburg, Itsoseng, Lotlhokane and Mafikeng:
Major developments: Residential, Commercial, Industrial and Major Electrification (180 MW) and IPP Interest

Madibeng, Brits and Hartebeespoort:
Minor developments: Commercial, Industrial and Major Electrification (100 MW)

Matlosane and Potchefstroom:
Major developments: Residential, Commercial, Industrial & Major Electrification (180 MW)

Vryburg, Bophirima, Delareyville, Magopela, Ganyesa:
Minor developments: Residential, Industrial and Major Electrification – (250 MW)

Ruighoek, Manyane, Mogwase and Sun City:
Major developments: Mining, Commercial, Industrial (300 MW) and IPP Interest
Provincial TDP Overview

Ngwedi MTS
- 2x500 MVA TRFR
- 3rd 500 MVA TRFR

Rustenburg Strengthening Phase 3:

Marang Extension 2x500 MVA TRFR

Medupi Phases 1&2

Dineldi MTS 3rd 500 MVA TRFR

Mafikeng MTS
- 2x500 MVA TRFR

Mookodi MTS
2x 250 MVA TRFR (Commissioned)

Kimberly Strengthening Phase 3: In progress

Marang Extension
- 2x500 MVA TRFR

Trident, Ararat, Marang Network Optimization

Watershed Extension
- 1st 250 TRFR
- 2x30 MVar 88kV Cx’s
- 2x 30 MVar 132kV Cx’s

Bighorn Extension 2x500 MVA TRFR

TDP 2016-2025 North West
Thank you
Gauteng Province
TDP 2016 - 2025

Presented by: Tonderayi Gumunyu
Gauteng Province Profile

**Generation**
- Bulk supply from Mpumalanga, Free State, Lephalale and Apollo HVDC (from Mozambique)
- Independent Power Producers - Kelvin Power Station (Joburg), Rooiwal Power Station (Tshwane)

**Geographical area**
- Johannesburg North, Johannesburg South, East Rand, Vaal, West Rand and Tshwane

**Economic Activity**
- Major Customers: Re-distributors, residential and large commercial customers
Gauteng growth trend

Vaal CLN Load forecast

Average annual growth 1.2%

East Rand CLN Load Forecast

Average annual growth 2.4%

West Rand CLN Load Forecast

Average annual growth 3.7%

Tshwane CLN Load Forecast

Average annual growth 1.8%

JHB North CLN Load Forecast

Average annual growth 3.1%

JHB South CLN Load Forecast

Average annual growth 3.0%
Key developments in Joburg North/West Rand

Midrand and Kyalami

Orlando Precinct

Vilakazi Precinct
TDP Projects - JHB North Area

- **2019**: Construct Kusile-Lulamisa 400kV line
- **2020**: Establish Kyalami 400/132 kV S/S in the Leeukop area
- **2021**: Construct Apollo-Lepini 275kV line
- **2022**: Establish Demeter 400/88kV S/S
- **2024**: Establish Donatello 275/88 kV S/S
Establish 400 kV at Westgate S/S
Construct Hera-Westgate 400 kV line

Establish new Quattro S/S
275/88 kV transformation – City Power
275/132 kV transformation – Eskom

Etna – Quattro 400 kV lines (to be operated at 275 kV)

Establish 400 kV at Etna and Taunus S/S

Etna – Glockner 400 kV lines (to be operated at 275 kV)
Key Developments in Joburg South/East Rand

 Zendai Modderfontein (Mixed Development)
- 30,000 Housing units, commercial and light industry envisaged
- Potential 200,000 jobs

 Linbro Park (Mixed Development)
- 20,000 Housing units, commercial and light industry envisaged
- Alexandra Township re-blocking
Establish Jupiter B S/S

City Power to establish Sebenza 275/88 kV S/S

Establish North Rand 275/132 kV S/S

Establish Siluma 275/88 kV S/S

Construct Matla-Jupiter 2 x 400kV lines (to be operated at 275kV)
TDP Projects - Tshwane Area

- **2020**
  - Loop in and out Apollo-Dinaledi 400kV line into Wildebees 400/132 kV S/S

- **2023**
  - Establish Diphororo 400/275kV S/S
  - Construct Diphororo – Kwagga 275 kV line

- **2023**
  - Energise Diphororo– Pelly 275 kV line

- **2020**
  - Loop in and out Wildebees-Dinaledi 400kV line into Diphororo (Phoebus) 400/132 kV S/S
Thank you
Limpopo Province
TDP 2016 - 2025

Presented by: Dalton Matshidza
Limpopo Province Profile

**Generation**
- Matimba Power Station = 3805 MW
- Medupi Power Station = 4800 MW (Under Construction)

**Transmission**
- Load demand = 2807 MW
- Number of Substations = 10
- Customer Load Networks = 3 (Polokwane, Lephalale and Phalaborwa)

**General**
- Economic mix - Platinum mining, Coal, high concentration of electrification, Game Farms, Industrial, Farming, Residential and Commercial, International Tie Line – Botswana

**Key Developmental Areas**
- Nzhelele/Thohoyandou Zone
- Mokopane Zone
- Lephalale Zone
- Steelpoort Zone
- Groblersdal Zone
Economic Activity (Growth):

- Industrial 30%
- Mining 30%
- Commercial 5%
- Residential 20%
- Agricultural 5%
- Re-distributors 10%

<table>
<thead>
<tr>
<th>Transmission Supply Areas (CLN’s)</th>
<th>Percentage Growth</th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polokwane</td>
<td>3.13%</td>
<td>1 506</td>
<td>1 556</td>
<td>1 871</td>
</tr>
<tr>
<td>Lephalale</td>
<td>5.45%</td>
<td>866</td>
<td>1 240</td>
<td>1 383</td>
</tr>
<tr>
<td>Phalaborwa</td>
<td>7.61%</td>
<td>1 889</td>
<td>2 543</td>
<td>3 390</td>
</tr>
</tbody>
</table>

Major Provincial Development Locations:

- Nzhelele Zone – Electrification, Agriculture, Industrial, Diamond and Coal mining
- Mokopane Zone – Platinum mining
- Lephalale Zone - Integration of Medupi Power Station and Coal mining
- Steelpoort Zone - Chrome and Platinum mining
- Groblersdal Zone - Electrification, Agriculture and Platinum mining

Limpopo CLN % Contribution to 2025 Load

- Polokwane 31%
- Phalaborwa 45%
- Lephalale 24%
Limpopo Province Network Expansion Drivers

Major Developments / Main Load Drivers

- **Nzhelele Substation Integration** will supply Nzhelele/Thohoyandou – Electrification, Agriculture, Industrial, Diamond and Coal mining

- **Medupi Power Station** – Coal mining in the Waterberg area (Lephalale) and the new 400kV and 765kV Corridor

- **Marble Hall and Steelpoort new Substations** – Electrification, Chrome and Platinum mining in the Groblersdal and Steelpoort areas
Provincial overview of Limpopo Province

Key Corridor Projects & Medupi P/S Integration (2015 – 2019)

<table>
<thead>
<tr>
<th>Medupi P/S Integration Scheme</th>
<th>Expected CO Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medupi-Spitskop (x2)</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Spitskop-Dinaledi (x2)</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Medupi-Marang</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Medupi 400/132kV MTS</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Ngwedi LiLo off Matimba-Midas</td>
<td>2015-16</td>
</tr>
<tr>
<td>Turn Marang-Midas into Ngwedi</td>
<td>2015-16</td>
</tr>
<tr>
<td>Borutho LILO (Matimba-Witkop Line)-Execution</td>
<td>2015-16</td>
</tr>
<tr>
<td>Medupi-Borutho - Execution</td>
<td>2015-16</td>
</tr>
<tr>
<td>Borutho-Witkop - Execution</td>
<td>2015-16</td>
</tr>
<tr>
<td>1st Medupi-Ngwedi (400kV) - Execution</td>
<td>2015-16</td>
</tr>
<tr>
<td>2nd Medupi-Ngwedi (765kV) - Execution</td>
<td>2015-16</td>
</tr>
</tbody>
</table>

New Medupi P/S with new 400kV and 765kV Corridor

New Borutho Substation and a new 400kV corridor from Medupi

New (Silimela) Marble Hall Substation and a new 400kV Corridor

2nd Merensky-Foskor 275kV(400kV) line
Provincial overview of Limpopo Province
Key Corridor Projects & Waterberg Generation Integration (2019 – 2025)

<table>
<thead>
<tr>
<th>Waterberg Generation Stability Integration at 400kV</th>
<th>Expected CO Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borutho–Silimela 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Medupi–Witkop 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Witkop–Senakangwedi B 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Merensky-Foskor 1st 400kV line</td>
<td>2024</td>
</tr>
<tr>
<td>Foskor-Spencer 1st 400kV line</td>
<td>2024</td>
</tr>
</tbody>
</table>
Integration of Future Power Stations and Renewable Projects (Tx & Dx Projects)

- Medupi 6x800MW: Units will be available from 2015 - 2019
- Witkop Solar PV 30MW: Commissioned
- Tabor Solar PV (28MW): Commissioned

Power Stations

<table>
<thead>
<tr>
<th>Power Stations</th>
<th>Expected CO Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medupi 6x800MW</td>
<td>Units will be available from 2015 - 2019</td>
</tr>
<tr>
<td>Witkop Solar PV 30MW)</td>
<td>Commissioned</td>
</tr>
<tr>
<td>Tabor Solar PV (28MW)</td>
<td>Commissioned</td>
</tr>
</tbody>
</table>

- 30MW Witkop Solar PV
- 28MW Tabor Solar PV
- Phokoje-Waterberg 400kV Corridor
- SAPP-Polokwane 400kV Corridor
- Mozambique-RSA HVDC Corridor
Thank you
Mpumalanga Province
TDP 2016 - 2025

Presented by: Makoanyane Theku
Mpumalanga Province Profile

Power Generation
- Power Stations: 11
- MW installed: 22 704 MW

Geographic area
Ehlanzeni, Nkangala and Gert Sibande district municipalities

Current load characteristics / mix
Mining, Commercial, Residential and Industrial
Major provincial developments
• Integration of Kusile Power Station
• Electrification connections
• Integration of Baseload IPPs

North-East TDP execution successes (Project expected in 2015)

<table>
<thead>
<tr>
<th>Transmission Project</th>
<th>Associated Distribution Projects</th>
<th>Connection Capacity enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gumeni Substation integration</td>
<td>• Gumeni - Machadodorp feeder • Gumeni – Witkloof feeder</td>
<td>500 MVA</td>
</tr>
<tr>
<td>Kruispunt substation reinforcement</td>
<td>None, required to resolve transmission line constraints</td>
<td>661 MVA</td>
</tr>
<tr>
<td>Normandie transformation upgrade</td>
<td>None, required to resolve transmission transformation constraints</td>
<td>250 MVA</td>
</tr>
<tr>
<td>• 2nd 250MVA 400/132kV transformer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Challenges in developing and maintaining transmission infrastructure
• Delays in servitude acquisition
• Theft and vandalism of transmission and distribution infrastructure
• Subsidence risk – Under-mined land instability and underground mine fires
**Geographic area**

Key drivers (load growth): Mining, Tourism, Commercial developments, electrification, and the establishment of the Industrial Development Zone (IDZ) near Middelburg.

Load growth: 2.3 % per annum
Mpumalanga Province: Development Plan

- Kusile power station integration
- Coal IPP integration
- Lowveld Strengthening Scheme 2 and 3
- Highveld South Reinforcement

Locations:
- Witbank
- Nelspruit
- Ermelo
Mpumalanga Province: Development Plan

Kusile power station integration

Witbank Lowveld Strengthening Scheme 2 and 3

Nelspruit Shunt Compensation
Thank you
KwaZulu-Natal Province
TDP 2016 - 2025

Presented by: Thokozani Bengani
KwaZulu-Natal Province

- **Generation**
  - Power supply into the province is mainly from the Mpumalanga Province power pool
  - Drakensberg Pumped Storage with 1000 MW installed capacity
  - Ingula Pumped Storage under construction - planned capacity 1330 MW
  - Avon OCGT under construction – planned capacity 680 MW

- **Electricity Demand**
  - Load demand in 2014 was 6799 MW
  - Expected demand in 2025 is 8045 MW

- **Load Distribution**
  - Redistributors, Commercial, Mining, Industrial, Residential, Agricultural, Traction
Expansion Drivers

- Concentration of economic activities
  - Port of Durban and Pietermaritzburg
- Other significant contributors
  - Richards Bay, Ladysmith and Newcastle
- Development proposals
  - Dube trade port at La Mercy
  - Bolstering of the Ermelo-Richards Bay coal link
  - Richards Bay IDZ
  - Tourism (iSimangaliso Wetland Park)
- Public infrastructure delivery (universal access to basic services)
Key developments in Northern KwaZulu-Natal

iSimangaliso wetland park: Tourism

Integration of Candover Substation near Mkuze

Universal access to basic services
Key developments in eThekwini Metropolitan

Shongweni development

Integration of Shongweni and Inyaninga Substations

Dube tradeport development

Cornubia development

Old airport dig-out
Key developments in the South Coast

South coast: commercial & tourism

New Multi Product Pipeline

2\textsuperscript{nd} Ariadne-Eros 400kV line and Integration of St Faiths Substation

Universal access to basic services
Key developments in Empangeni, Ulundi, Vryheid and Newcastle

Coal Mining and Ermelo-Richards Bay Coal line

Integration of Nzalo, Duma Substations to reinforce the Ermelo-Richards Bay coal link

Industrial activities

Universal access to basic services
KZN 765kV Strengthening

Purpose: To increase power transfer from the power pool into KZN to cater for load growth in the province
Thank you
Free State Province

**Electricity demand**
Load demand in 2014 was 2357 MW
Expected demand in 2025 is 2706 MW

**Generation**
Power supply into the province is mainly from Mpumalanga Province power pool
Lethabo Power Station 3558 MW

**Load distribution**
Redistributors, Mining, Commercial, Industrial, Residential, Agriculture Traction and International
Important road and rail links traverse the province including:
- N1 (Cape Town-Johannesburg)
- N3 (Durban-Johannesburg)

The province plans to leverage the advantage of its transport infrastructure and its locality:
- Harrismith Logistics Hub
- Industrial developments in the Harrismith and Botshabelo

Public infrastructure delivery (universal access to basic services)

There is a potential for renewable energy generation

Solar PV commissioned 124 MW
Key developments in Eastern Free State

- New Multi Product Pipeline (NMPP)
- Extension of Sorata Substation
- Universal access to basic services
Key developments in Sasolburg and Vaal Triangle

Mining activities

Industrial activities

Integration of Makalu B Substation
Key developments in Mangaung and surrounding regions

Universal access to basic services

Solar power generation

Bloemfontein Strengthening:
Everest-Merapi 400kV and Beta-Harvard-Merapi 400kV lines and Integration of 400kV at Harvard and Merapi Substations
Transmission Development Plan:
2016 - 2025 Free State Province

Legend

---

Substations
- Existing
- Existing with changes
- Planned

Existing Lines
- 275kV
- 400kV
- 765kV

Planned Lines
- 275kV
- 400kV
- 765kV

- 2 x Beta-Harvard 400kV Lines
- Harvard 400/132kV Substation
- Harvard-Merapi 400kV Line
- Sorata 275/13 kV Substation (extension)
- Everest-Merapi 400kV Line
- Merapi 400/132kV Substation and associated 275kV Lines
- Makalu B 275/88kV Substation and associated 275kV Lines
Thank you
Western Cape Province
TDP 2016 - 2025

Presented by: Ahmed Hansa
Western Cape Province Profile

Customers
- 334,464 customers:
  - Redistributors
  - Residential
  - Agriculture
  - Industrial, mining and commercial
  - Prepaid
- 3,800 MW of peak load on 11 June 2014
- Forecasted to grow to 4,960 MW in 2025

Network Coverage
- Vredendal
- Saldanha
- Cape Town
- Mossel Bay
- George
- Beaufort West

Generation

<table>
<thead>
<tr>
<th>Eskom Power Stations</th>
<th>Power</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia</td>
<td>19</td>
<td>170</td>
</tr>
<tr>
<td>Ankerlig</td>
<td>21</td>
<td>1,350</td>
</tr>
<tr>
<td>Gourikwa</td>
<td>22</td>
<td>740</td>
</tr>
<tr>
<td>Koeberg</td>
<td></td>
<td>1,860</td>
</tr>
<tr>
<td>Sere</td>
<td>31</td>
<td>100</td>
</tr>
<tr>
<td>Palmiet</td>
<td>18</td>
<td>400</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>4,620 MW</strong></td>
</tr>
</tbody>
</table>
Cape Corridor

• The deficit between Koeberg generation and the Greater Cape load is offset by the generation pool in the Highveld via the Cape Corridor

• Comprises of 400kV and 765kV lines originating from Zeus Substation (near Bethal) and Alpha Substation (near Standerton) in the Mpumalanga Province to Hydra Substation (near De Aar) in the Northern Cape

• It then extends into the Western Cape and terminates at Muldersvlei Substation (near Klapmuts)

• New 765kV lines:
  • Zeus – Mercury and Mercury – Perseus in December 2012
  • Hydra – Perseus in July 2013
  • Perseus – Gamma and Hydra – Gamma in February 2014
  • Gamma – Kappa in April 2015
Expansion Drivers

- One of the fastest growing economies in the country
- Financial and business services, manufacturing, tourism, agriculture and fishing
- Economy is dominated by the city of Cape Town
- Huge potential for renewable energy penetration
- Gas and oil imports and gas generation are also major drivers
- 1000 MW of growth forecasted over the next ten years
Renewable Generation

- The Western Cape has huge potential for renewable energy generation due to its climate and proximity to the coastal line.

- Several projects have been approved in the Western Cape under the DoE’s Renewable Energy IPP Procurement Programme (REIPPPP)

- **Sere Wind Farm** is an Eskom wind generating facility which was completed in January 2015 and has a capacity of 100 MW. It is located north-west of Vredendal in Skaapvlei, approximately 300 km north of Cape Town.

---

<table>
<thead>
<tr>
<th>REIPPPP Round</th>
<th>Technology</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wind</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>PV</td>
<td>41</td>
</tr>
<tr>
<td>REIPPPP 1 Capacity</td>
<td></td>
<td>132</td>
</tr>
<tr>
<td>2</td>
<td>Wind</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>PV</td>
<td>18</td>
</tr>
<tr>
<td>REIPPPP 2 Capacity</td>
<td></td>
<td>243</td>
</tr>
<tr>
<td>3</td>
<td>PV</td>
<td>75</td>
</tr>
<tr>
<td>REIPPPP 3 Capacity</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>Wind</td>
<td>558</td>
</tr>
<tr>
<td>REIPPPP 4 Capacity</td>
<td></td>
<td>558</td>
</tr>
<tr>
<td><strong>Total RE Generation Capacity</strong></td>
<td></td>
<td><strong>1008</strong></td>
</tr>
</tbody>
</table>
Substantial load growth on the West Coast is expected due to the Saldanha Bay IDZ.
Substations (Peninsula)

Residential, commercial and light industrial load growths in the Peninsula

Integration of new 400/132kV substations: Mitchell’s Plain (Erica), Firgrove (Pinotage) and Houhoek (Asteria)
Substations (Outeniqua)

- Area will mainly develop for tourism
- Huge potential and interest for IPP wind generation

Integration of new 400/132 kV substations: Vryheid (Agulhas), Blanco (Narina), Komsberg and Koruson (Kappa)
Transmission Lines

Ankerlig-Sterrekus 1st and 2nd 400 kV lines

Koeberg-Acacia 2nd 400kV line

Erica integration 400kV lines

Cape Corridor 1st and 2nd 765kV lines

Blouwater integration 400 kV lines (operated at 132kV)

Droervier-Narina-Gourikwa 400kV line
Thank you
Eastern Cape Province
TDP 2016 – 2025

Presented by: Caswell Ndlhovu
Eastern Cape Province Profile

General
- EC Population 6.7 million (0.4% growth)
- 3rd most populous province
- 8.1% of total South African GDP
- 4th largest contributor to GDP
- Major Industries
  - Automotive, tourism, agriculture, agro-processing,

Generation in Eastern Cape
- Port Rex 171MW
- Dedisa OCGT 373MW
- RE IPP (Wind) 800MW

Load Served
- Load demand = 1 445 MW
- No. customers served = 638 187
- Geographic Areas = *Nelson Mandela Metro, Buffalo City Metro, Mthatha
Eastern Cape grid forecast and highlights

**Load Drivers**
- Coega IDZ - Industrial
- Natural Load Growth
- Electrification
- Agro-Processing

**Renewables**
- Round 1: 470 MW
- Round 2: 337 MW
- Round 3: 197 MW
- Round 4: 429 MW
- Total: 1432 MW

Constitutes 55% of the 2025 forecasted load and will likely exceed load in future.

**OCGT and Nuclear**
- Possibility Approximately 4500MW of Nuclear by 2023 at Thyspunt
- Appetite for Gas Generation

**Completed in 2014/5**
- Eros – Vuyani 400kV line
- Vuyani (Mthatha) Substation
- Vuyani-Neptune 400kV line
Eastern Cape expansion drivers

- Manufacturing (5%) – Auto Industry - Exports
- Construction (11%) – Commercial Growth
- Agriculture, Forestry and Agro Processing
- Tourism and Sports
- Renewables and possible Nuclear

Challenges
- Increasing load will result in low voltages around PE
- More generation will require adequate integration plans
- Maintaining required level of reliability as the load grows
Development Plan - Port Elizabeth CLN

- Poseidon 400/132kV 500 MV trfr (2016)
- Poseidon Transformer Upgrade (2019)
- Poseidon Shunt Cap (2016)

Gamma-Grassridge 765kV Line

Grassridge 765/400kV Substation (2024)

Thyspunt Integration

Grassridge 3rd Transformer (2020) and Shunt Cap (2016)

Poseidon 400/132kV 500 MV trfr (2016)

Grassridge 3rd trfr (2019) and Shunt Cap (2016)

Legend:
- Future Substations
- Current Substations

Future Lines
- 132kV
- 400kV
- 765kV

Current Lines
- 132kV
- 220kV
- 400kV
- 765kV

Eastern Cape

Created by: Transmission Grid Planning
2013/03/30
Transmission network development summary

East London Network

- Neptune-Pembroke 400kV line
- Pembroke-Poseidon 400kV line
- Pembroke B conversion to 400kV
- Delphi 100MVar Shunt Capacitor
- Delphi 3rd transformer
- Pembroke and Buffalo transformer normalisation

Port Elizabeth Network

- Grassridge – Dedisa 132kV Line
- Grassridge Third 400/132kV transformer
- Dedisa Third 400/132kV transformer
- Gamma – Grassridge 765kV lines
- Poseidon, Grassridge, Dedisa 1st 100MVar Shunt Caps
- Poseidon 400/132kV transformer (Renewables)
- Poseidon 220/66kV 80 MVA transformer
- Strategic IPP Integration Plans
- Thyspunt Integration
Thank you
Northern Cape Province

TDP 2016 - 2025

Presented by: Jamila Kombe
Northern Cape Province Profile

Generation
- Van Der Kloof PS = 240 MW
- Gariep PS = 360 MW
- IPPs = 3569 MW (REBID 1 to 4)

Transmission
- Load demand in 2014 = 742 MW
- Expected demand in 2025 = 1671 MW
- Number of Main Substations = 15

Radial network impacting Reliability and QoS during outages

Distribution

Geographical Area: Kimberley and Upington Distribution Zones, 15 Customer Network Centres from Springbok, Calvinia, De Aar to Jan Kemdorp.

Approx. Economic mix:
- Commercial (21%)
- Mining (52%)
- Agriculture (27%)
**Northern Cape Province expansion drivers**

### Generation Drivers
- Huge solar resources
- REIPPP programme
  - Round 1 - 685 MW
  - Round 2 - 330 MW
  - Round 3 - 1216 MW
  - Round 4 - 1339 MW
- Generation will exceed load by 2017/18!

### Load Drivers
- Anticipated mining loads in the Kimberly area
- Iron Ore line tonnage increase
- Natural load growth

---

![Renewable Generation Scenarios](image1.png)

<table>
<thead>
<tr>
<th>Year</th>
<th>Alloc Renewable Generation</th>
<th>Renewables Forecast</th>
<th>Northern Cape Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>685</td>
<td>685</td>
<td>1252</td>
</tr>
<tr>
<td>2017</td>
<td>1014</td>
<td>1014</td>
<td>1284</td>
</tr>
<tr>
<td>2018</td>
<td>2230</td>
<td>2230</td>
<td>1339</td>
</tr>
<tr>
<td>2019</td>
<td>3569</td>
<td>4461</td>
<td>1361</td>
</tr>
<tr>
<td>2020</td>
<td>5353</td>
<td>1406</td>
<td>1406</td>
</tr>
<tr>
<td>2021</td>
<td>6245</td>
<td>1457</td>
<td>1457</td>
</tr>
<tr>
<td>2022</td>
<td>7137</td>
<td>1492</td>
<td>1492</td>
</tr>
<tr>
<td>2023</td>
<td>8029</td>
<td>1522</td>
<td>1522</td>
</tr>
<tr>
<td>2024</td>
<td>8921</td>
<td>1579</td>
<td>1579</td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td></td>
<td>1671</td>
</tr>
</tbody>
</table>

![Northern Cape, CLN % Load Growth and 2025 Loads](image2.png)
Key developments in the Northern Cape

PV and CSP are 59% of the connections
Wind is 41% by 2018

Transnet Orex tonnage increase and Kimberley potential mining
Northern Cape Province - Development Plan

- Aries-Nieuwehoop-Ferrum 400kV line
- Juno-Gromis 400kV line
- Upington Substation and 4x400kV lines
- 2nd Oranjemond-Gromis 400kV line
- Aggeneis-Paulputs 2nd 220kV line and transformation upgrade
- Kimberley Phase 3
- Kimberley Phase 4
- Gariep Strengthening

Substations
- Nama Tx Trf
- Paulputs Tx Trf
- Aries SVC
- Kronos Tx Trf
- Helios Tx Trf
- Hydra Tx Trf

TDP 2016-2025 Northern Cape
Thank you
Transmission Refurbishment and Strategic Spares Plan 2016 – 2025

Presented by: Collin Reddy
The South African Grid Code stipulates that the Transmission company is responsible for the renewal, optimisation, reconfiguration and decommissioning of existing assets to ensure sustainability of the network.

The development of the Transmission refurbishment plan is premised on an asset management (AM) framework.

The asset management approach involves asset condition assessment and asset risk assessment, to support the compilation of refurbishment plans.

The AM approach seeks to sustain a reliable and quality of supply, by managing the delicate balance between; network performance, network risks and capital constraints.
Development of the TDP 2016 - 2025
(Asset Refurbishment Framework)
Development Mandate:

- Capital Spares: Supply restoration
- Production Equipment: Maintenance support
- Customer Connections: Secure revenue base
- N-1 transformation projects for regulatory compliance
- Statutory network requirements
- Refurbishment of network: long term sustainability and reliability of the network, covering asset classes in the following disciplines:
  - Substations
  - Transmission lines
  - Telecommunications
  - Associated general infrastructure
# Transmission substations refurbishment requirements (Needs)

## Transmission's Substation Plant Condition Assessment Overview

<table>
<thead>
<tr>
<th>Equipment</th>
<th>A (86-100%)</th>
<th>B (71-85%)</th>
<th>C (51-70%)</th>
<th>D (31-50%)</th>
<th>E (0-30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Transformer</td>
<td>1413</td>
<td>515</td>
<td>1340</td>
<td>410</td>
<td>418</td>
</tr>
<tr>
<td>Transformer</td>
<td>51</td>
<td>251</td>
<td>152</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Surge Arrester</td>
<td>3218</td>
<td>530</td>
<td>3034</td>
<td>1212</td>
<td></td>
</tr>
<tr>
<td>Reactor</td>
<td>22</td>
<td>17</td>
<td>20</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Protection</td>
<td>40</td>
<td>871</td>
<td>1238</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>Isolators</td>
<td>3752</td>
<td>3356</td>
<td>1886</td>
<td>1323</td>
<td>693</td>
</tr>
<tr>
<td>Current Transformer</td>
<td>3000</td>
<td>3198</td>
<td>508</td>
<td>2597</td>
<td></td>
</tr>
<tr>
<td>Circuit Breaker</td>
<td>2034</td>
<td>638</td>
<td>123</td>
<td>60</td>
<td>403</td>
</tr>
<tr>
<td>Capacitor</td>
<td>12</td>
<td>30</td>
<td>34</td>
<td>13</td>
<td>5</td>
</tr>
</tbody>
</table>

**Legend:**
- A - Normal Maintenance (86-100%)
- B - Normal Maintenance (71-85%)
- C - Maintenance & Monitoring (51-70%)
- D - Possible Project/Life Extension (31-50%)
- E - Raise Project (0-30%)
The 10-year Asset Renewal Plan formulation process

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

Plan Semi-constrained to reflect bottle necks in the Capital Plan value chain
### Project Prioritisation Matrix (Snapshot)

**Update Constraint Score**

<table>
<thead>
<tr>
<th>ITEM_NAME</th>
<th>STAGE</th>
<th>BUS Score</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kriel HV Yard Refurb</td>
<td>PCRA</td>
<td>7.24</td>
<td>9 9 8 7 9 4 2 8 6 6 3 9</td>
</tr>
<tr>
<td>Spritskop 2 X 500 Mva 132kv Transformer Upgrade(Era)</td>
<td>ERA</td>
<td>6.88</td>
<td>8 6 8 7 6 8 2 2 8 6 2 8</td>
</tr>
<tr>
<td>Apollo CS: Breakers 11kV Replacement</td>
<td>ERA</td>
<td>6.74</td>
<td>8 6 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>FORDSBERG SS REFURBISHMENT - ERA</td>
<td>ERA</td>
<td>6.74</td>
<td>8 6 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Drakensberg Refurbishment Phase 1: Generator Breakers</td>
<td>ERA</td>
<td>6.70</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Verus S/S Replacement Of 3X 275kv Bushings</td>
<td>ERA</td>
<td>6.68</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Tabor S/S : Replacement Of 3X275 kv Bushings</td>
<td>ERA</td>
<td>6.66</td>
<td>7 6 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Phased Replacement Of High Risk Transformers</td>
<td>ERA</td>
<td>6.70</td>
<td>6 6 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Phased Replacement Of High Risk TRFRS PH 2</td>
<td>ERA</td>
<td>6.70</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Athene S/S Replacement Of 7X400kv Bushings</td>
<td>ERA</td>
<td>6.45</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Invubu S/S Replacement Of 3X275kv Bushings</td>
<td>ERA</td>
<td>6.50</td>
<td>8 6 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Impala S/S : Replacement Of 4X275kv Bushing</td>
<td>ERA</td>
<td>6.66</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>North West Protection Ref - Marang</td>
<td>ERA</td>
<td>6.66</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Makalu SS Refurbishment</td>
<td>ERA</td>
<td>6.50</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Ariadne S/S : Replacement Of 3X 400kv Bushings</td>
<td>ERA</td>
<td>6.50</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Camden Komati Tower No253 Rpl Exe</td>
<td>ERA</td>
<td>6.45</td>
<td>7 6 6 7 8 2 2 8 6 7 3</td>
</tr>
<tr>
<td>Drakensberg Refurbishment Phase 2: Feeder Bays</td>
<td>PCRA</td>
<td>7.24</td>
<td>9 9 8 7 9 4 2 8 6 6 3 9</td>
</tr>
<tr>
<td>Alpha 11kV Reticulation</td>
<td>ERA</td>
<td>6.38</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Replacement of Delie Breakers at Bloodriver</td>
<td>ERA</td>
<td>6.36</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>South Grid DC Ref 2013/14-Neptune</td>
<td>ERA</td>
<td>6.36</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>PORT REX - BUFFALO NO 2 132KV LINE TOWER (ERA)</td>
<td>ERA</td>
<td>6.34</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Hydra Ruigventvalle No1 220kv LineReplacement of 3 woodpoles with steel poles/structures</td>
<td>ERA</td>
<td>6.34</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Various Ss Underrated Terminal Equip Ref</td>
<td>ERA</td>
<td>6.33</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Jupiter-Underrated Terminal Equip Ref</td>
<td>ERA</td>
<td>6.33</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Prospect-Underated Terminal Equip Ref</td>
<td>ERA</td>
<td>6.33</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Zuns, Ausv</td>
<td>ERA</td>
<td>6.28</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Acacia SS Ref</td>
<td>ERA</td>
<td>6.28</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Eiger SS Ref</td>
<td>ERA</td>
<td>6.28</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Replace Underated</td>
<td>ERA</td>
<td>6.27</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Amot 275kv Ref</td>
<td>ERA</td>
<td>6.27</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Minera SS Ref</td>
<td>ERA</td>
<td>6.26</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Craghill SS Ref</td>
<td>ERA</td>
<td>6.26</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Acacia SS Ref</td>
<td>ERA</td>
<td>6.25</td>
<td>8 6 8 7 5 7 4 5 5 5 7</td>
</tr>
<tr>
<td>Hendrina 132V Feeder Upgrade Phase 3</td>
<td>ERA</td>
<td>6.23</td>
<td>9 6 8 6 9 4 3 5 5 4 8 6 6 3 9</td>
</tr>
<tr>
<td>Hendrina - 132V Optimum 1&amp;2 feeder bays upgrade</td>
<td>ERA</td>
<td>6.23</td>
<td>9 6 8 6 9 4 3 5 5 4 8 6 6 3 9</td>
</tr>
</tbody>
</table>

**Critical projects never stood out and had not been started**

16 Weighted criteria

Prioritisation defined to eliminate sensitivity to interpretation
The current 10 year Transmission refurbishment plan is a reflection of the needs of the network, since it is based on asset condition assessments, asset criticality and network risks.

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

The plan supports two key strategic imperatives of Eskom Holdings:

- Leading and partnering to keep the lights on
- Ensuring our financial sustainability
Thank you
TDP 2016 – 2025
Capex Analysis

Presented by: Ragini Ramkumar
Transmission Capital Expenditure Drivers

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

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

3. Asset Purchases:
   - Specialised equipment for: live-line work; fault location systems, and online condition monitoring, etc.
Transmission 10-year Capex Plan: FY 2016 – 2025

Summary of Transmission Capex Plan (R Million):
FY 2016 - FY 2025

<table>
<thead>
<tr>
<th>Category</th>
<th>Totals: (FY16-25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Expansion 1</td>
<td>151,152</td>
</tr>
<tr>
<td>Capital Expansion for IPPs 2</td>
<td>30,305</td>
</tr>
<tr>
<td>Refurbishment</td>
<td>16,948</td>
</tr>
<tr>
<td>Capital Spares</td>
<td>2,531</td>
</tr>
<tr>
<td>Telecoms</td>
<td>4,019</td>
</tr>
<tr>
<td>Aviation</td>
<td>669</td>
</tr>
<tr>
<td>Production Equipment</td>
<td>630</td>
</tr>
<tr>
<td>Other</td>
<td>1,831</td>
</tr>
<tr>
<td>Land &amp; Rights</td>
<td>4,940</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>213,026</strong></td>
</tr>
</tbody>
</table>

Notes:
1) Capital Expansion: reliability projects (N-1), network strengthening for load growth, integration of generation (Medupi, Kusile, Ingula, IPPs up to Bid Window 3)
2) Capital Expansion for IPPs - to integrate IPPs beyond Bid Window 3 (Renewables, gas, new coal)
The total Transmission Capital Plan amounts to R213 billion over the TDP period 2016 – 2025 of which:

- R151 billion is required for reliability (N-1) projects, integration of committed generation (Medupi, Kusile, Ingula, IPPs up to Bid Window 3) and connection of new load onto the system

- R30 billion is required to integrate new IPPs (i.e., RE, gas, coal, co-gen) beyond Bid Window 3 of the DoE’s IPP programme
• The liquidity position of Eskom may impact the execution of the Transmission Development Plan.

• The IPP programme may also trigger extensive network reinforcements.

• The time taken to acquire servitudes and secure water use licenses continues to be a challenge to the TDP roll out.

• Under-investments in Transmission infrastructure threatens network reliability and load growth in the country.

• The execution ability to accomplish the plan remains a challenge.
Planning for the Integration of South African Renewable Energy IPPs

Presented by: Leslie Naidoo
New build options

<table>
<thead>
<tr>
<th></th>
<th>Coal (PF, FBC, imports, own build)</th>
<th>Nuclear</th>
<th>Import hydro</th>
<th>Gas – CCGT</th>
<th>Peak – OCGT</th>
<th>Wind</th>
<th>CSP</th>
<th>Solar PV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>2015</td>
<td>500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400</td>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>2016</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2017</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2018</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2019</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>237</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2020</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>237</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2021</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>237</td>
<td>0</td>
<td>400</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>2022</td>
<td>250</td>
<td>0</td>
<td>1,143</td>
<td>805</td>
<td>400</td>
<td>100</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>250</td>
<td>1,600</td>
<td>1,183</td>
<td>805</td>
<td>400</td>
<td>100</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>250</td>
<td>1,600</td>
<td>283</td>
<td>805</td>
<td>400</td>
<td>100</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>250</td>
<td>1,600</td>
<td>0</td>
<td>805</td>
<td>1,600</td>
<td>100</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>805</td>
<td>1,600</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,600</td>
<td>0</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>2028</td>
<td>1,000</td>
<td>474</td>
<td>690</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2029</td>
<td>250</td>
<td>1,600</td>
<td>0</td>
<td>237</td>
<td>805</td>
<td>0</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
<td>948</td>
<td>0</td>
<td>0</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,250</strong></td>
<td><strong>9,600</strong></td>
<td><strong>2,609</strong></td>
<td><strong>2,370</strong></td>
<td><strong>3,910</strong></td>
<td><strong>8,400</strong></td>
<td><strong>1,000</strong></td>
<td><strong>8,400</strong></td>
</tr>
</tbody>
</table>

**First Procurement**

**Block by DoE:**

1. **Firm commitment necessary now**
2. **Final commitment in IRP 2012**

<table>
<thead>
<tr>
<th>Block by DoE</th>
<th>1st Window</th>
<th>2nd Window</th>
<th>3rd Window</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,850</td>
<td>652</td>
<td>571</td>
<td>787</td>
<td>3,500MW</td>
</tr>
<tr>
<td>200</td>
<td>150</td>
<td>50</td>
<td>200</td>
<td>1,436MW</td>
</tr>
<tr>
<td>1,450</td>
<td>634</td>
<td>423</td>
<td>435</td>
<td>1,422MW</td>
</tr>
</tbody>
</table>

---

1. Built, owned & operated by IPPs. 2. Commitment necessary due to required high-voltage infrastructure, which has long lead time. 3. Commitment necessary due to required gas infrastructure, which has long lead time. 4. Possibly required grid upgrade has long lead time and thus makes commitment to power capacity necessary.
Since 2011, 42 projects (2142 MW) of RE IPPs were connected, ~88% (1 865 MW) of which are in operation.

### Status of Current IPP Programme – end August 2015

<table>
<thead>
<tr>
<th>Name of programme</th>
<th>MW contribution</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid Window 1</td>
<td>1436</td>
<td>All 28 projects connected.</td>
</tr>
<tr>
<td>(28 projects)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bid Window 2</td>
<td>1054</td>
<td>14 projects connected (706MW)</td>
</tr>
<tr>
<td>(19 projects)</td>
<td></td>
<td>5 projects in execution</td>
</tr>
<tr>
<td>Bid Window 3</td>
<td>1656</td>
<td>All budget quotations issued</td>
</tr>
<tr>
<td>(19 projects)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2142 MW of RE IPPs have been connected to the grid underpinned by a R2.4 billion Eskom investment.
All 28 projects from Bid Window 1 were connected, adding 1 436 MW to the grid.
14 of the 19 projects from Bid Window 2 have been completed, adding a total of 706 MW to the grid, with 5 projects in progress.
19 budget quotations for bid window 3 have been issued.

- 1 Biomass power project in KwaZulu-Natal
- 5 Landfill gas projects in Gauteng
- 1 Concentrated Solar power project in the NC
- 8 Onshore wind project across two provinces
- 6 PV solar power projects across four provinces

2 Budget quotations are in progress and expected end Aug 2015.
42 projects (2 142 MW) of RE IPPs have been connected, between bid window 1 and 3, at a capital cost of R2.4 Billion.
Opportunities to maximise IPP grid connections

- Direct IPP projects towards areas where network capacity is already available
- Target specific geographic areas for IPP projects to optimise on timelines for readiness of the grid infrastructure
- Expedite the EIA, servitude acquisition and Water Use License Authorizations (WULA) processes
- Align the timetables of the IPP programme to the timetables of the feasible grid plans.
Transmission
Strategic Grid Planning
Integrating Future IPPs

Presented by: Ronald Marais
Strategic Planning - Overview

- Context
- What has been done
- Long Term Grid Assessment (The 2040 Tx Study)
- Medium Term Requirements for IPP Grid Access
- Impact of Generation Scenarios
- Way forward
Strategic Planning - Context

- Planning is part of a Process Framework to deliver transmission infrastructure
- Planning is based on the Transmission Load Demand Forecast and the Integrated Resource Plan (IRP)
- Current official document is the 2010 IRP
- The TDP is based on spatial assumptions for the 2010 IRP (The view that Eskom has taken)
- The GAP is the agreement with stakeholders on the physical location and associated timing of the future generation
Determining the Future Grid

Conducted Transmission 2030 Study

Conducted Transmission 2040 Study

Identify Future Corridors

Flexibility to move to Different Scenarios

Reduce Implementation time to meet generation & demand development

Impact of Intermittence

Grid Capacity

Expanding the Grid

Publish Annual Transmission Development Plan

Prepared Generation Connection Capacity Assessment (GCCA)

Provide information on spatial network capacity available to connect Generation

Developed a Tx Self-Build Policy

Enable faster implementation to ensure success of REIPP

Developed Streamlined Application Process

On Time Grid Access

Created Generation Connection Application Procedure

Outputs and Studies Completed

Generation Assumptions

Scenario Corridor Analysis

Mapping the Demand and Generation

Comparing Demand Balances for each Generation Scenario

Renewable Energy Application Integration Analysis Cluster Area Study

Intermittency - Renewable Energy Cloud Cover Impact

Final SIP 10 Corridors

Published Annual Transmission Development Plan

Engagement Within ESKOM Outside ESKOM

SEACorridors for SIP 10 project
Why we need strategic investment

Change in Generation Spatial Footprint

- Need to be able to adapt to the uncertainty of future
- Identify and invest in critical power corridors for the future transmission network
- Unlock and create a flexible and robust grid to be able to respond to the changing future

Irrespective of generation scenario
However there is uncertainty in:

- Where is the location?
- What is the size?
- What is the type?
2040 Tx Study – New Generation Allocation

Energy resources for electricity

- GAS
- CSP
- Wind
- Nuclear
- Coal

Significant change in Generation location

Load Demand for each area for 2020 & 2040

Load Density in 2020

- 77%

Load Density in 2040

- 75%

No significant change in load location

Significant change in Generation location
Comparing Demand Balances for each Generation Scenario

**Current Network Transfer**
- IRP Base
- Net 2011
- 36 GW
- 47 GW
- 77%
- 78%
- 23%
- 22%
- 11%

**Future Network Transfer**
- Net 2020
- 48 GW
- 64 GW
- 75%
- 75%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
- 25%
1. Strategic Investment in the EIAs & Land acquisition is critical to meet future IRP connection timeframes.
2. Reducing Tx investment today compounds future Tx Grid roll out leading to high risk of Gx capacity delays.

Change in generation diversity has major impact on future Tx Grid:
- Grid Access - Increased connection capacity needed in new areas (delivery time > 8yr)
- On Time Connection - Smaller IPP generation plant can be constructed faster (delivery time < 5yr)
- Unknown locations - Multiple unspecified IPP sites require market access for best price.

<table>
<thead>
<tr>
<th>Change in Location - Spatial Footprint</th>
<th>Change in Construction 3yr - 5yr Speed of IPP plant rollout</th>
<th>Strategic EIAs &amp; Servitudes can enable faster grid development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Generation Footprint</td>
<td>Solar Wind Nuclear Gas</td>
<td>Transmission Line Project Timeline</td>
</tr>
<tr>
<td>Future Generation Potential Footprint</td>
<td>Current Eskom Wind, Solar &amp; REIPP 1.2.3.4</td>
<td>Eng 1yr Eia &amp; Land Acquisition 2yr &gt;3yr Construction 3yr</td>
</tr>
</tbody>
</table>

- **Beyond 2020 Demand Balance significantly changed by dispersed generation in South**
- **Significantly More Transmission Corridors and Grid Access required**
- **Change of Spatial Footprint into areas with limited Demand requires additional Transmission Capacity**
- Need to reduce the time to increase grid access by investing in strategic access and corridors servitudes.
- The 2040 Network Study findings and supporting studies enabled the five power corridors to be further refined.
- DEA has used SIP 10 SEA studies to undertake all the Environmental Impact studies which will be valid for a longer period.
- Relatively simple process to be put in place to secure final environmental authorisation.
- Plan is to gazette corridors and the process by March 2016.
## Future IPP Programmes

<table>
<thead>
<tr>
<th>Name of programme</th>
<th>MW Contribution</th>
<th>Target Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-IPP Window 4 and RE-IPP Window 4B</td>
<td>1121 1084</td>
<td>Dec 2019 Dec 2019</td>
</tr>
<tr>
<td>RE-IPP Expedited Program</td>
<td>1800 7700</td>
<td>Dec 2019 2020 - 2025</td>
</tr>
<tr>
<td>Future RE-IPPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal / Baseload</td>
<td>2500</td>
<td>2018 - 2022</td>
</tr>
<tr>
<td>Cogeneration¹</td>
<td>800 1000</td>
<td>2016 - 2017 2017 - 2018</td>
</tr>
<tr>
<td>Gas: Power barges LNG Plant</td>
<td>1770 3000</td>
<td>2017 - 2019 2020 - 2022</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19 005</strong></td>
<td></td>
</tr>
</tbody>
</table>

1. It is assumed that Cogeneration will be consumed within the developers’ operations; hence minimal network investment will be required.
IRP Generation by 2025 with uncertain location

Assumptions made for Gen sites for 2020 to 2025

Final sites dependant on DoE programmes

Certain Tx projects in TDP - but additional projects required if all gen projects in as assumed by 2025

**Distributed RE Generation**

7x new 400kV MTS plus lines

Possible sites

**Concentrated Generation**

Two sites:

- 1x Coal
- 1x Nuclear & Gas

Tx Project needed
Strategic IPP Tx Connection Projects to unlock capacity

- GP identified Tx projects to create additional grid connection capacity as quickly as possible for the on-time connection of DOE programmes
- These consisted of phased transmission substation and line projects
- Proposal is to undertake the preparation works for all the projects to reduce the response time to implement

**Tx Project Phasing**

Phase 1: Limited work at existing substations/projects (<2 yrs)

Phase 2: Limited work at existing substation with limited Tx line work (2-4 yrs)

Phase 3: Existing projects or New substations with some Tx line work that requires full EIA studies and long lead lines (4-5 yrs)

Phase 4: Existing projects or New substations with **backbone** Tx line work required with longer lead time (6-8 yrs)

Phase 5: New projects or New substations with backbone Tx line work required with longest lead time. (8-10 yrs)
Potential projects include:

- at existing MTS substations
- at new TDP substations
- at possible new RE gen collection MTS substations
Preparation Status

- Already in TDP and projects to be accelerated
- Projects triggered by successful RE Bids
- Projects defined and ready to be developed
- Complex projects still to be fully defined for development

Costing for all above projects being prepared
Impact of Gen Scenarios with different locations

**Scenarios**
- TDP studies done on IRP Baseline Scenario
- DoE requested impact of different locations for some of generation from 2020 to 2025
- Five scenarios considered
- Based on relocation of large RE, coal, nuclear and gas

**Impact**
- Three scenarios have limited impact
- Moving 2000 MW to N Cape will require extra 400kV lines & MTS in Northern Corridor
- Locating nuclear, gas and additional wind to W Cape will require extra 400kV lines to and through N Cape plus direct HVDC to KZN
The way forward

- Know what is required in the long term (Power Corridors, gas integration, coal integration, nuclear integration and REDZ collection networks)
- Identified the Tx options to create grid access for IPPs and other generation options
- Issue is the sequencing of the implementation of the Tx options (practicalities and timing)
- Need to formalise the Process Framework from assumptions to release of Tx projects to enable alignment for on-time delivery
- This alignment is required for the next TDP update studies and the future MYPD applications
Thank you