Transmission
10 Year Development Plan
2015 – 2024

Public Forum

Welcome!
The Eskom Transmission 10 Year Development Plan: 2015 – 2024

(TDP 2014)

Public Forum
10 October 2014
Overview and Purpose

The Objective of the TDP Public Forum is to:

- Contextualise the planning timelines relating to the demand forecast and generation patterns
- Share assumptions and results from the Transmission Development Plan 2015 – 2024
- Share information and results relating to the integration of RE as per the DOE IPP programs
- Share information on the estimated Transmission Capital Investment Requirements for period 2015 – 2024
- To solicit comments and inputs from stakeholders on the Transmission Plans
The TDP 2014 was formulated to address the following:

- Attain N-1 Grid Code reliability compliance by resolving both substation and line violations
- Determine new network infrastructure requirements to sustain and allow for future demand growth
- Determine new network infrastructure requirements to integrate new generation (Eskom and IPPs)
Planning for the South African Integrated Power System
The Different Plans

Integrated Resource Plan
- 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
- 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
- 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
Linkages between the various plans

- Expected demand
- Current capacity and expected projects
- Resource constraints
- Implementation strategy

IRP 2010-2030

- Determine energy and capacity shortfalls

Adequacy criteria

- Policy
- Select options

Disaggregate Demand Spatially

- Disaggregate Generation Pattern Spatially

Strategic Network Scenario Analysis

- Select robust generation scenarios

20 Yr
SGP

- 20 Yr Dx Master Plan

Connection Applications & Capacity Programmes

- Detailed Network Analysis

Dx Network Dev. Plans

Investment Plan

- Determine infrastructure requirements

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

10 Yr TDP
Transmission Development Plan
TDP 2015 – 2024
Overview
The purpose of the transmission system is to optimally and reliably transport the power from the source of generation to the location of the load.

Role of Transmission System Planner (TSP) is in accordance with the Eskom Transmission License issued by NERSA. The TSP is required to conduct the following activities for the electricity supply industry:

- To plan and augment the Transmission System
- Planning and augmentation to be in accordance with the Grid Code
- Customer connections to take place subject to a connection agreement
- Compliance monitoring is part of Eskom Transmission license

Network Code of SAGC specifies the following for transmission planning:

Technical criteria

- Voltage & thermal limits, reliability criteria, generation integration, etc.
- Generator connection conditions (Protection, Islanding, Governing, Black Start, etc)
- Connection conditions for generators, distributors and end-use customers (Protection, Power Factor, Fault Levels, etc)

Planning Process

Investment Criteria
Assumed Transmission Capacity Forecast and Comparisons

### Demand Forecasts

#### Actual Demand at time of System Peak

#### Contracted Max Demand

#### TDP 2014 Adjusted Forecast

#### 2010 IRP - Range of Demand Forecasts

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<tr>
<th>Year</th>
<th>2010 IRP High Demand (MW)</th>
<th>2010 IRP Low Demand (MW)</th>
<th>Mid Size Customer NMD (MW)</th>
<th>Top Customer NMD (MW)</th>
<th>2014 TDP Demand (MW)</th>
<th>Actual Peak Demand (MW)</th>
<th>NMD growth at 1.5%</th>
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Assumed Generation Capacity Plan

Assumed New Generation Capacity (MW)
TDP Period: 2015 to 2024

Assumptions above are based on the 2010 IRP with the following changes from the 2012 TDP:
- Ingula will now be completed between 2015 and 2016
- Co-Generation reduced from 3 x 200MW to 2 x 200MW units
- Additional Coal (IPP’s) added.
To date, a large amount of construction work has been completed, adding ~6,137 MW, ~5,524.3 km of transmission network, and ~24,565 MVA sub-stations.

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<td>443.40</td>
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<td>631.3</td>
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<tr>
<td>FY 2012/13</td>
<td>787</td>
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<tr>
<td>FY 2013/14</td>
<td>811</td>
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<tr>
<td>FY 2014/15</td>
<td>27</td>
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<tr>
<td>Total</td>
<td>5,524.3</td>
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<td>YE Target: 315 km</td>
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<th>Historic performance</th>
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<td>Sere Windfarm (100MW)</td>
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<td>Ingula Unit 3 (333 MW)</td>
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<td>Kusile HV Yard (90 MVA)</td>
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<td>Sterrekus (2,000 MVA)</td>
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Major Projects Completed Recently:

**Transformation Projects:**
1. Rustenburg
2. Polokwane
3. Peninsula WC
4. Malelane - Lowveld

**Transmission Development Plan 2015 - 2024**
- **Tx Medupi Integration**
  - 1\textsuperscript{st} & 2\textsuperscript{nd} Units
- **Mercury-Vryburg-Ferrum**
  - New Vryburg Substation
- **Lewensaa: New Traction Substation**
- **Cape Corridor 765kV: Zeus - Gamma**
- **Northern Grid**
- **Eastern Grid**
- **Western Grid**

**Key Projects:**
- **Witkop - Tabor**
  - 400kV injection
- **Lowveld Capacity Increase:** Malelane & Komatipoort
- **Tx Kusile Integration**
  - 1\textsuperscript{st} & 2\textsuperscript{nd} Units
- **Majuba - Umfolozi**
  - 1\textsuperscript{st} 765kV into KZN
- **Neptune - Vuyani**
  - New Vuyani Substation
Summary of Transmission Infrastructure Requirements over the TDP Period: 2015 - 2024

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<td>765kV line (km)</td>
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<td>400kV lines (km)</td>
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<td>275kV lines (km)</td>
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<td>199</td>
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<tr>
<td>Total Transformer MVA</td>
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<td>109</td>
<td>181</td>
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<td>Capacitors (no)</td>
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<td>12</td>
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<tr>
<td>Reactors (no)</td>
<td>17</td>
<td>14</td>
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- The km of Transmission Lines required compared to the previous TDP is stable
- The net amount of Transformation MVA (83600 vs 81400 MVA) is also stable taking into account that 3790 MVA was installed last year
2013 VS 2014 TDP Cumulative Line Requirements
Impacts of Re-Phasing / Re-Prioritisation

Unconstrained Plan to attain N-1 Compliance by 2018

Re-phasing of Projects in Alignment with Available Resources Í N-1 Compliance by 2022

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<td>Actual Built Accumulated</td>
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Unconstrained Plan to attain N-1 Compliance by 2018

Re-phasing of Projects in Alignment with Available Resources ìN-1 Compliance by 2022
N-1 Compliance Outlook with the Reprioritised Plan

Note. The 2022 date is based on the assumption that CAPEX constrains will be resolved in the short term
How do you decide which project to execute and which to defer?

- Projects in execution to continue as per plan

- Re-evaluate all projects in the portfolio in terms of readiness:
  - Servitudes acquired
  - Detail designs concluded
  - Interdependencies eg. Customer Connections (ensure alignment of plans)
  - Constructability / executability challenges
  - Valid business case

- Evaluate projects against criticality: Reliability, Customer Connections, Safety, Statutory

- Value adding benefits: power transfer improvements, economic impacts etc.

- “Bang for buck”
Planning for the South African Renewable Energy IPP Integration
## IRP capacities need to be allocated to market players – so far clear focus on allocating the RE capacities

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<tr>
<th>Year</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>
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<td><strong>8 400</strong></td>
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<td><strong>8 400</strong></td>
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</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

### Notes
- **Firm commitment necessary now**
- **Final commitment in IRP 2012**
Transmission Connection Requirements:
DoE RE Program 1 - 3 (Successful Bidders)
# Department of Energy RE IPP Programme

<table>
<thead>
<tr>
<th>Description</th>
<th>RE IPP 1</th>
<th>RE IPP 2</th>
<th>RE IPP 3</th>
<th>RE IPP 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Estimate Letters</td>
<td>~270</td>
<td>&gt;190</td>
<td>~500</td>
<td>~220</td>
</tr>
<tr>
<td>DoE Applications</td>
<td>54</td>
<td>79</td>
<td>93&lt;97</td>
<td>~81</td>
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<tr>
<td>Preferred Bidders (Nr)</td>
<td>28</td>
<td>19</td>
<td>21</td>
<td>N/A</td>
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<tr>
<td>DOE MW allocated</td>
<td>1436</td>
<td>1054</td>
<td>1475</td>
<td>N/A</td>
</tr>
<tr>
<td>Eskom connected Bidders (Nr)</td>
<td>27</td>
<td>16</td>
<td>19</td>
<td>N/A</td>
</tr>
<tr>
<td>Eskom connected MW</td>
<td>1431</td>
<td>884</td>
<td>1456</td>
<td>N/A</td>
</tr>
<tr>
<td>IPPs connected to date</td>
<td>26</td>
<td>7</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>IPP MW connected to date</td>
<td>1337</td>
<td>333</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

2014-02-17
Transmission Network Requirements for RE-IPPs 1,2&3

Legend

RE IPP 1
- Concentrated Solar Power
- Onshore Wind
- Solar Photovoltaic

RE IPP 2
- Concentrated Solar Power
- Onshore Wind
- Small Hydro
- Solar Photovoltaic

RE IPP 3
- Biomass
- Concentrated Solar Power
- Landfill Gas
- Onshore Wind
- Solar Photovoltaic

[Map showing various regions and energy sources in South Africa, including Western Cape, Eastern Cape, Northern Cape, and more.]
Enabling factors
- Available network capacity
- Diversification
- Large RE interest

Stakeholder
- Cooperation between DOE/DEA/Eskom/NERSA and RE association/developers
- Public communication of network capacity (GCCA) i.e. GCCA 2012 and GCCA 2016
- Development of generation application process

Continuous improvement
- Feedback and learnings
- Adapting processes and policies (Self Build)
**Background**

**Risks to Grid Access**

Å Servitude and EIA restrictions.
Å Limited spare capacity on networks after REBID 1, 2 and 3.
Å Quotations are issued on an individual basis.
Å Misaligned project development durations:
  Å Long Tx lines: 6 - 8 years
  å Distributed IPP plants: 2 - 5 years

**Mitigation**

Å Strategically Enable RE ãCollection Zones with new transmission infrastructure.
Assumption for Strategic IPP Study

Applications Received by the GAU till Dec 2012 together with information received by the IPPs.

<table>
<thead>
<tr>
<th>Operating Unit</th>
<th>IPP Quantity</th>
<th>Generation Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauteng</td>
<td>29</td>
<td>1,145</td>
</tr>
<tr>
<td>Limpopo</td>
<td>33</td>
<td>1,388</td>
</tr>
<tr>
<td>North West</td>
<td>49</td>
<td>1,892</td>
</tr>
<tr>
<td>Kwazulu-Natal</td>
<td>33</td>
<td>833</td>
</tr>
<tr>
<td>Free State</td>
<td>34</td>
<td>1,340</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>201</td>
<td>12,741</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>57</td>
<td>4,998</td>
</tr>
<tr>
<td>Western Cape</td>
<td>103</td>
<td>8,025</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>28</td>
<td>3,779</td>
</tr>
<tr>
<td>TOTAL</td>
<td>567</td>
<td>36,141</td>
</tr>
</tbody>
</table>
Transmission Connection Requirements for all applications

MAJOR TRANSMISSION SYSTEM

- CSP
- Solar PV
- Wind

Legend:
- Existing Substation (●)
- Existing Powertrain (●)
- Lines

Provinces:
- Eastern Cape
- Free State
- Gauteng
- KwaZulu-Natal

Key Locations:
- 3000MW Coal IPP
- 122MW Lambda
- 306MW Hermes SS
- 1100MW
- 271MW Mookodi SS
- 224MW
- 3125MW Kappa & Komburg SS
- 1576MW
- 475MW
- 70MW Ruigtevallei SS
- 1237MW
- 780MW
- 732MW
- 2266MW
- 1000MW
- 220MW
- 250MW
- 263MW
- 307MW
- 440MW
- 602MW
- 1325MW Blouwaters SS
- 400MW Sterrekus
- 135MW Mulderavlei SS
- 62MW Bacchus SS
- 220W Vryheid SS
- 442MW Western Cape
- 306MW Eastern Cape

Kilometers
Geo-spatial study results
Typical Wind & Solar Production Profile
Summary: Transmission RE Integration

- Integration of the DOE RE BIDs 1 and 2 are in execution and in most cases are on track.

- Integration of the DOE RE Bid 3 is accommodated within the allocated Transmission budget and is awaiting acceptance of Budget Quotes from the preferred bidders before execution.

- Integration of potential IPPs, beyond Bid window 3, that require "deep" strengthening are at risk due to lack of Capex in the Transmission plan in the MYPD3 allocation. Discussions are currently underway with the DOE, National Treasury & NERSA to consider other "funding models" for the next rounds of the DOE RE IPP program.
Transmission Provincial Development Plans 2015 - 2024
NORTH WEST PROVINCE

TDP 2015 - 2024

By: Queen Melato
North West Province Profile

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

**Economic activity:**
- Mining (30%), Industrial (30%), Re-distributors (10%),
- Commercial (5%), Agricultural (5%) & Residential (20%)

**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):**
- Supplies predominantly gold mines
- Richest gold-producing hub
Electricity Demand Forecast

CLN: Provincial Load Forecast Peak Loading

- Carletonville
- Rustenburg
- NW Province

<table>
<thead>
<tr>
<th>Year</th>
<th>Carletonville</th>
<th>Rustenburg</th>
<th>NW Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1796</td>
<td>2694</td>
<td>4195</td>
</tr>
<tr>
<td>2019</td>
<td>1935</td>
<td>3159</td>
<td>4759</td>
</tr>
<tr>
<td>2024</td>
<td>1830</td>
<td>3397</td>
<td>4884</td>
</tr>
</tbody>
</table>
Rustenburg: Major Developments
(Mining, Commercial, industrial)
Projected growth: 285 MW

Mahikeng: Minor Developments
(Commercial, industrial and major electrification)
Projected growth: 125 MW

Brits: Minor Developments
(Commercial, industrial and major electrification)
Projected growth: 60 MW

Vryburg: Minor Developments
(Residential, industrial, major electrification)
Projected growth: 100 MW

Klerksdorp & Potchefstroom: Major Developments
(Residential, Commercial, Industrial)
Projected growth: 110 MW
Provincial TDP Overview

Watershed Ext Strengthening

Mookodi MTS:
- 2x 250 TRFR_2014

Kimberley Strengthening:
- Phase 2 & 3_2016&2018

Dineldi:
- 3rd 500 TRFR_2016

Bighorn Strengthening:
- 2x500 TRFR_2017

Ngwedi_MTS
- 2x500 TRFR_2016

Marang B_MTS
- 2x500 TRFR_2018

Medupi Phases 1&2_2014-15

Rustenburg Strengthening- 2024

Marang B_MTS
- 2x500 TRFR_2018

Medupi Phases 1&2_2014-15

TDP (2015-2024)
North West

Legend
- Towns
- Substations

TDP Lines
voltage
- 275
- 400
- 765

MTS Lines
voltage
- 55
- 110
- 130
- 220
- 275
- 400
- 533
- 765

PROVNAME
- Free State
- Gauteng
- Limpopo
- Mpumalanga
- North West
- Northern Cape
Thank you
Limpopo Province Profile

Generation
- Matimba Power Station = 3805MW
- Medupi Power Station in progress (Construction) = 4800MW

Transmission
- Load demand = 3269MW
- Number of Substations = 10
- Transmission Supply Areas (CLNs) = 3 (Polokwane, Lephalale and Phalaborwa)

General
- Economic mix - Platinum mining, Coal, high concentration of Electrification, Game Farms, Industrial, Farming, Residential & Commercial, International Tie Line i Botswana

Key Developmental Areas
- Nzhelele/Thohoyandou Zone
- Mokopane Zone
- Lephalale Zone
- Steelpoort Zone
- Groblersdal Zone
Limpopo Province Network Expansion
Drivers

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>2015</th>
<th>2020</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polokwane</td>
<td>2.24%</td>
<td>1311</td>
<td>1468</td>
<td>1593</td>
</tr>
<tr>
<td>Lephalale</td>
<td>6.0%</td>
<td>1070</td>
<td>1341</td>
<td>1510</td>
</tr>
<tr>
<td>Phalaborwa</td>
<td>4.0%</td>
<td>1222</td>
<td>1656</td>
<td>1751</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 2024 Load
- Polokwane 33%
- Lephalale 31%
- Phalaborwa 36%
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 (Lehpalale) and the new 400kV and 765kV Corridor

Marble Hall and Steelpoort new Substations– Electrification, Chrome and Platinum mining in the Groblersdal and Steelpoort areas
New Nzhelele Substation and a new 400kV Corridor

Medupi P/S Integration Scheme | Expected CO Date  
---|---
Medupi-Spitskop (x2) - Execution | 2014
Spitskop-Dinaledi (x2) - Execution | 2014
Medupi-Marang - Execution | 2014
Borutho 400/132kV - Execution | 2015-16
Ngwedi LiLo off Matimba-Midas | 2015-16
Turn Marang-Midas into Ngwedi | 2015-16
Borutho LiLO (Matimba-Witkop Line) | 2015
Medupi-Borutho | 2015-16
Borutho-Witkop | 2015-16
1st Medupi-Ngwedi (400kV) | 2015-16
2nd Medupi-Ngwedi (765kV) | 2015-16
Borutho 400/132kV - Execution | 2015-16
Ngwedi LiLo off Matimba-Midas | 2015-16
Turn Marang-Midas into Ngwedi | 2015-16
Borutho LiLO (Matimba-Witkop Line) | 2015
Medupi-Borutho | 2015-16
Borutho-Witkop | 2015-16
1st Medupi-Ngwedi (400kV) | 2015-16
2nd Medupi-Ngwedi (765kV) | 2015-16

New Medupi Power Station with new 400kV and 765kV Corridor

New Mokopane Substation and a new 400kV corridor from Medupi

New Marble Hall Substation and a new 400kV Corridor

2nd Steelpoort to Phalaborwa 275kV line
Waterberg Generation Stability Integration at 400kV

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Expected CO Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boruthoï Silimela 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Medupii Phokoje 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Medupii Witkop 1st 400kV line</td>
<td>2022</td>
</tr>
<tr>
<td>Witkopí Senakangwedi B 1st 400kV line</td>
<td>2022</td>
</tr>
</tbody>
</table>
Thank you
MPUMALANGA PROVINCE
TDP 2015 - 2024

By: Makoanyane Theku

Powering your world
Mpusmalanga Province Profile

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

Geographic area
- Geographic Areas: Witbank, Nelspruit, Middelburg, Kwaggafontein, Ermelo & Secunda
- Customer Load Networks (areas)
  - Lowveld CLN
  - Highveld North CLN
  - Highveld South CLN

Economic activities
- Industrial
- Mining
- Commercial
- Agricultural
- Re-distributors
- Tourism
Mpumalanga Province: Expansion Drivers

Electrical infrastructure development objectives
- Enable economic development
- Provincial
- National
- Improve power transfer capacity and network reliability

Major provincial developments
- Integration of Kusile Power Station, located about 20km west of Witbank

Challenges in establishing and maintaining electrical infrastructure
- Delays in servitude acquisition
- Theft and vandalism of transmission and distribution infrastructure

Mpumalanga Province: Load forecast per CLN

Mpumalanga Province: Average CLN % Growth and 2024 Loads
Mpumalanga Province: Expansion Drivers

Major developments / Main load drivers

- **Load growth drivers**
  - Mining
  - Agriculture
  - Manufacturing
  - Infrastructure developments
  - Electrification
  - Tourism

- **Infrastructure: Kusile**
- **Tourism**
- **Mining & Infrastructure: Coal line**
- **Universal access to electricity, sanitation and water supply**
Mpusmalanga Province: Development Plans

Kusile power station integration

Emkhiweni (Rockdale B) Substation

Lowveld Strengthening Scheme 2A

Witbank

Ermelo

Nelspruit

TDP 2015-2017 Mpumalanga
Mpumalanga Province: Development Plans

Kusile power station integration

Nelspruit

Witbank

Ermelo

Lowveld Strengthening Scheme 2B

Lowveld Strengthening Scheme 3A

Highveld South Reinforcement

TDP 2018-2024
Mpumalanga
Thank you
GAUTENG PROVINCE
TDP 2015 - 2024

By: Tonderayi Gumunyu

Powering your world
Gauteng Province Profile

**Generation**
- Kelvin Power Station = 70MW
- Rooiwal Power Station = 60MW
- Bulk supply from Mpumalanga, Free state, Lephalale and Apollo HVDC (from Mozambique).

**Geographical Supply Area**
- Johannesburg North, Johannesburg South, East Rand, West Rand, Vaal and Pretoria.

**Economic Activity**
- Re-distributors, Residential and Commercial.
Gauteng Province Expansion Drivers

**Economic mix:**
- Industrial 1.7%
- Mining 1.5%
- Commercial 10%
- Residential 9.8%
- Agricultural 1.9%
- Re-distributors 75.1%

**Major Provincial Developments locations:**
- Midrand/ Kyalami area
- Soweto and Randfontein areas
- Modderfontein/Edenvale area
- Tshwane area

---

**Gauteng, CLN % Growth and 2024 Loads**

- East Rand, 1.3%, 2941MW
- JHB North, 2%, 2973MW
- JHB South, 2.9%, 2915MW
- Tshwane, 2.1%, 2941MW
- Vaal, 0.9%, 1783MW
- West Rand, 1.4%, 2326MW

---

**LOAD IN 2024 (MW)**

- 0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5%
- 0 500 1000 1500 2000 2500 3000 3500

---

**% GROWTH**

- East Rand
- JHB North
- JHB South
- Tshwane
- Vaal
- West Rand
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
Key Developments in Joburg North / West Rand

- Mall of Africa
- Kyalami Substation
- Orlando Precinct
- Vilakazi Precinct
- Quattro Substation
Gauteng Province Development Plans

**JHB North Strengthening:**
- Build Apollo – Lepini 400kV line and install Capacitor banks at Lepini

**West Rand Strengthening:**
- Establish Westgate and Quattro 400kV substations

**Vaal Strengthening:**
- Build the Glocker – Etna 400kV lines

**JHB East /South Strengthening:**
- Establish Simmerpan, Jupiter B, North Rand and Sebenza substations

**JHB North Strengthening:**
- Establish Demeter, Kyalami and Craighall B 400kV substations

**Tshwane Strengthening:**
- Establishment of Wildebees, Verwoerdburg and Phoebus 400kV substations

**JHB East /South Strengthening:**
- Build Apollo – North Rand – Sebenza 275kV lines and Matla – Jupiter B 400kV lines
Thank you
KwaZulu-Natal Province

- **Generation**
  - Drakensberg Pumped Storage with 1000MW installed capacity
  - Ingula Pumped Storage under construction with planned capacity 1330MW
  - Avon OCGT IPP under construction with planned capacity 670 MW

- **Economic Activity**
  - Load demand in 2013 = 6 730 MW
  - Expected demand in 2024 = 8654 MW
  - Load distribution:
    - Re-distributors, Commercial, Mining, Industrial, Residential, Agriculture & Traction
Key Developments in Northern KwaZulu-Natal

Northern KZN: Expected growth (2015 – 2024) is 90 MW
Key Developments in Northern KwaZulu-Natal

iSimangaliso wetland park: tourism

Integration of Candover Substation

Universal access to electricity, sanitation and water supply
Key Developments in eThekwini Metropolitan

eThekwini Metro: Expected growth (2015-2024) is 500 MW
Key Developments in eThekwini Metropolitan

Shongweni development

Cornubia development

Integration of Shongweni & Inyaninga Substations

Dube tradeport development

Old airport dig-out
Key Developments in the South Coast

South Coast: Expected growth (2015-2024) is 150 MW
Key Developments in the South Coast

South coast: commercial & tourism

New Multi Product Pipeline (NMPP)

2nd Ariadne-Eros 400 kV line & Integration of St Faiths Substation

Universal access to electricity, sanitation and water supply
Key Developments in Empangeni, Ulundi, Vryheid & Newcastle

Coal Mining & Ermelo-Richards Bay Coal line

Universal access to electricity, sanitation and water supply

Industrial activities

Expected growth (2015-2024) is 380 MW
System Reliability Improvement Initiatives

- Empangeni 765 kV Integration
- Pinetown 765 kV Integration
- Eastern Cape/KwaZulu-Natal Link
Thank you
Free State Province

- **Generation**
- Lethabo Power Station: 3558 MW

- **Economic Activity**
- Load demand in 2013 = 2039 MW
- Expected demand in 2024 = 2430 MW
- Load distribution = Mining, Industrial, Re-distributors, Commercial, Agricultural, Residential, Traction & International
Key Developments in Sasolburg & Vaal Triangle

Sasolburg & Vaal Triangle: Expected growth (2015-2024) is 150 MW
Key Developments in Sasolburg & Vaal Triangle

Integration of Makalu B Substation

Mining activities

Industrial activities
Key Developments in Eastern Free State

Harrismith & Qwaqwa: Expected growth (2015-2024) is 40 MW
Key Developments in Eastern Free State

Universal access to electricity, sanitation and water supply

New Multi Product Pipeline (NMPP)

Extension of Sorata Substation
System Reliability Improvement Initiatives

- Everest-Merapi 275kV line
- 3rd 275/132kV 250MVA transformer
- Perseus-Harvard-Merapi 400kV servitude acquisition
Thank you
NORTHERN CAPE PROVINCE

TDP 2015 - 2024

By: Jamila Kombe
Northern Cape Province Profile

**Generation**
- Van Der Kloof PS = 240 MW

**Transmission**
- Number of Main Substations = 15
- Number of CLNs = 4
- Radial network impacting Reliability & QoS during outages

**Distribution**
- Geographical Area: Kimberley & 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

Load Drivers
- Anticipated mining loads in the Kimberley Area
- Natural Load Growth

Generation Drivers
- Huge solar resources
- REIPP Programme
  - Round 1: 689 MW
  - Round 2: 330.1 MW
  - Round 3: 1016 MW

Economic growth (2014-2030)
- Agriculture: 35% from 37%
- Mining: 47% from -2%
- Manufacturing: 47% from 31%
- Construction: 48% from 38%

Generation will exceed load by 2016/2017
KEY DEVELOPMENTS IN THE NORTHERN CAPE

PV and CSP are over 65% of the connections

Transnet Orex tonnage increase and Kimberley potential mining
Northern Cape Province: Development Plans

Challenges in establishing and maintaining infrastructure

- Servitude acquisition
Current Projects:

To strengthen the network around Kimberley and support increase in anticipated mining activity, and IPP’s the following projects are being executed:

- Kimberley Strengthening Phase 2 (Mercury-Mookodi-Ferrum 400kV line)
- Gariep Strengthening (Ruigtevallei Hydra De-rate to 132kV, Ruigtevallei Dreunberg)
- *Garon Strengthening (Kronos transformation + Kronos Cuprum 2x132kV lines)
- *Paulputs 2nd Transformer (250MVA)
- Nama 2X20MVA 66/22kV transformer establishment
- Aries – Nieuwehoop 400kV line
- Aries 400kV SVC installation
- Nieuwehoop – Ferrum 400kV line
- * Upington Solar Park Phase 1 (Upington S/S & Upington – Nieuwehoop 400kV line)
- *Hydra 500MVA 400/132kV Transformer
- Kimberley Strengthening Phase 3 (Hermes-Mookodi-Hotazel-Ferrum line)
- 2nd Gromis - Oranjemond 220kV (400kV) lines
- *IPP Dependency
**Planned Projects:**

Further network strengthening is planned to improve network reliability and support future growth in the Kimberley CLN (customer load network); and to facilitate integration of Renewable Energy such as Wind & Solar Parks (CSP / PV).

The following projects are planned:

- Aggeneis-Paulputs 2nd 220kV (built at 400kV) line
- Juno - Gromis 400kV line
- *Kronos 2nd 250MVA transformer
- Helios 400/132/66kV Transformation
- *Paulputs 3rd Transformer
- *Hydra B 400/132kV Substation
- Upington Solar Park Phase 2
- Kimberley Phase 4 (Beta ï Ferrum 400kV corridor)
- Hydra ï Aries 2nd 400kV line (Outside current TDP) ï Strategic
- *IPP Dependency
Thank you
Eastern Cape Province Profile

General
- EC Population 6.7 million (0.4% growth)
- Economic Mix:
  - Motor vehicle assembly industry*, Construction*, Light industry, Food processing, Textiles and Clothing, Farming, Residential and Commercial,

Generation in Eastern Cape (870MW)
- (NC) Gariep 4x90MW = 360MW
- (EC) Port Rex 3x57MW = 171MW
- Renewable Wind to feature prominently in future, current renewable connections amount to 340MW to Grow to +1000MW

Load Served
- Load demand = 1445 >>>2100MW
- Electricity Penetration - 75:60:30
  - Lighting (75) : Cooking(60): Heating(30)
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
- Rural Electrification

AUTO MANUFACTURING FOR EXPORTS (DETROIT OF AFRICA)

COEGA IDZ (400MW)

RENEWABLE IPPs (1000MW)
Eastern Cape Province: Development Plan

**Completed Reliability Capacity**

- **Gamma-Grassridge 1**
- **Gamma-Grassridge 2**
- **Grassridge – Dedisa 132kV line**
- **Dedisa 3rd trfr**
- **Grassridge 3rd trfr**
- **Delphi Transformation Upgrade**
- **Vuyani-Neptune Commissioned**
- **Eros – Vuyani 400kV**
- **Poseidon – Neptune 400kV**
- **Pembroke Transformation Upgrade**
- **Thypunt Integration**

**TDP 2015-2024 - Eastern Cape**

Created by: [Eskom]
Renewables in the Eastern Cape

**Round 1 – 3**
- 100% Wind
  - Poseidon 380MW
  - Grassridge 500MW
  - Delphi 100MW
- Access to Grassridge and Poseidon fully blocked
- Benefits from commissioned about 240MW renewables in the Eastern Cape beginning to be realised (lower trfr loadings)
- As more diversity is realised due to dispersion full value of renewables will be attained

**Round 4 and beyond**
- Future planning will revolve around collector stations to prevent blockages and sub-optimal usage of resources
Thank you
Western Cape Transmission Development Plan (2015 – 2024)

By: Ahmed Hansa
Western Cape Province Profile

- **Customers**
  - 324,000 customers
  - Residential: 93%
  - Agriculture: 4%
  - Industrial, mining and commercial: 3%
  - 3,675 MW of load

- **Generation**
  - Eskom Power Stations
    - Acacia: 171 MW
    - Ankerlig: 1,327 MW
    - Gourikwa: 740 MW
    - Koeberg: 1,830 MW
    - Klipheuwel: 3 MW
    - Palmiet: 400 MW
    - Total: 4,471 MW

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

- One of the fastest growing economies in the country.
- Financial and business services, manufacturing, tourism, agriculture and fishing, wine and brandy.
- Economy is dominated by the city of Cape Town
- Huge potential for renewable energy penetration
- Gas & oil imports are also major drivers
Residential, commercial and light industrial load growths in the Peninsula

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

Substantial load growth in the West Coast is expected due to the Saldanha Bay IDZ.

Integration of new 400/132 kV substation: Blouwater
Area will mainly develop for tourism.

Huge potential and interest for IPP wind generation.

Integration of new 400/132 kV substations: Vryheid (Agulhas) and Blanco (Narina)
Western Cape TDP Overview

- Ankerlig-Sterrekus 1st and 2nd 400 kV lines
- Cape Corridor 1st and 2nd 765 kV lines
- Koeberg-Acacia 2nd 400 kV line
Thank you
Transmission Capital Expenditure Drivers

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

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

3. **Asset Purchases:**
   - Specialised equipment for: live-line work; fault location systems, and online condition monitoring, etc.
Transmission Grid: Age of Major Equipment

Age in Years

Number of units

- Transformers
- Transmission Lines
- Shunt Banks
- Reactors
- Series Banks
- SVC
## 10 Year Transmission Capex Summary

<table>
<thead>
<tr>
<th>Categories</th>
<th>FY15-24 (Rm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Expansion</td>
<td>145,968</td>
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<tr>
<td>Refurbishment</td>
<td>7,680</td>
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<tr>
<td>Capital spares</td>
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<td>EIA and servitudes</td>
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<td>Strategic</td>
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<td>Production Equipment</td>
<td>519</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>162,779</strong></td>
</tr>
</tbody>
</table>
TDP CAPEX Challenges: R146bn?

- TDP Projects had to be prioritised and re-phased in alignment with available CAPEX, resulting in the following programmes continuing as per plan:
  - Integration of the Medupi, Kusile, Ingula projects
  - Integration of the DOE RE Bids 1, 2, and 3
  - Connection of future IPP and Load connections that do NOT require deep strengthening
  - Integration of the Eskom CSP, Sere, and RE projects near Upington
  - EIA and Servitudes Acquisition
  - Projects in execution to continue as per plan
  - Projects addressing safety issues deemed highly critical

- Key programmes at risk:
  - Connection of new loads and IPPs that require deep strengthening
  - Integration of the future REBID IPP projects (IPPs beyond REBID 3).
  - N-1 compliance will be delayed from 2016 to 2022 (subject to availability of Capex going forward)
Thank you
The TDP infrastructure requirements over the 10 year period is fairly consistent to that presented in the 2012 TDP as well as the CAPEX requirements (R146bn vs R149bn).

Projects had to be re-prioritised and re-phased to align with more realistic completion dates project readiness analysis and available CAPEX.

Projects required for the DOE Renewable Energy (RE) IPP programs 1 & 2 are in most cases on track, some completed while others are in execution or nearing completion.

Projects to address the DOE RE IPP program 3 are awaiting the “go ahead” to move into execution.

Apply value engineering principles “scrubbing” to identify opportunities for cost savings
Continue with strategic EIAs and servitude acquisitions

Continue with project development (concept and detail designs) on all projects while the investment decisions will be based on project criticality, readiness and available resources

Consider “Self Build” and other project funding methodologies where applicable

The conclusion is that the transmission projects in this TDP will result in the overall network becoming Grid Code compliant, while catering for increased load growth and integration of new generation and this is crucial for the economic growth and development of SA.
Thank you