



# **GENERATION CONNECTION CAPACITY ASSESSMENT OF THE 2012 TRANSMISSION NETWORK (GCCA-2012)**

**Midrand**

**9 February 2011**



## **Welcome and Introduction**

*Kannan Lakmeeharan*

*Divisional Executive*

*System Operations and Planning Division*

## **Presentation of the Generation Connection Capacity Assessment of the 2012 Transmission Network (GCCA-2012) document**

*Ronald Marais*

*Strategic Grid Planning Manager*

*System Operations and Planning Division*

## **Questions and Clarifications Session**

# Welcome and Introduction

Kannan Lakmeharan

*Divisional Executive*

*System Operations and Planning Division*

**Presentation of the**  
***Generation Connection Capacity Assessment***  
***of the 2012 Transmission Network***  
**(GCCA-2012) document**

Ronald Marais

*Strategic Grid Planning Manager*

*System Operations and Planning Division*

- The Eskom Development Plans
- Study Background
- Introduction to Study
- 3 Tier Approach to Connection Capacity
- Why a GCCA document
- Overview of Study Results
- GCCA document Contents
- GCCA-2012 document Maps
- Connecting to the Transmission Network
- Generation Connection Applications
- Geographical Diversification of RE
- How to obtain a GCCA document
- What happens next

## **Integrated Resource Plan**

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

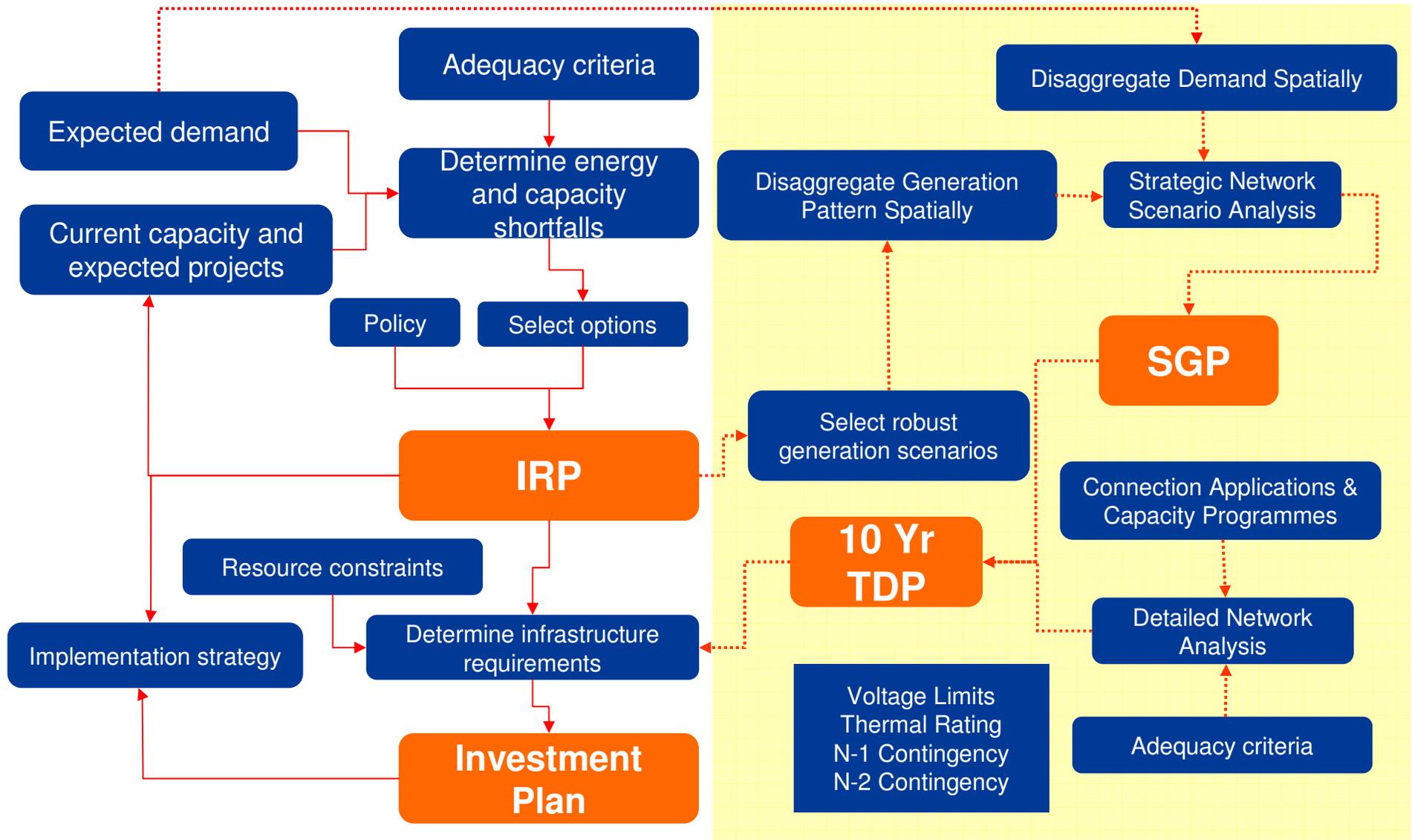
## **Strategic Grid Plan**

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

## **Transmission Development Plan**

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

# Linkages between the Development Plans



- “*Main Transmission Power Corridors View for 2030*” study (a.k.a. the Strategic Grid Plan) was completed in 2009 by Eskom Grid Planning.
- Identified impact on main power corridors of different generation scenarios
- Weakness was that impact of large amount of Renewables not considered
- Recommendation was to identify possible scenarios of large Renewables to consider in next study
- Studies that have resulted from this:
  - Wind Capacity Credit Study (with DoE)
  - Generation Connection Capacity Assessment

- Eskom Grid Planning undertook a study to determine the available connection capacity for new generation at Transmission substations in the Cape area for the integration of renewable energy generation. *(Note that Transmission refers to voltages > 132kV)*
- The objective of the study was to determine how much generation could be connected at each substation based on the expected 2012 network under three conditions:
  - No additional plant or lines on the Transmission network to connect the generation at the 132kV busbars of the substations
  - Localised Transmission network extension to collect the potential generation at 132kV, 275kV or 400kV and connect to existing Transmission substations which could be upgraded
  - Potential future generation connection capacity with the extension of the Transmission Grid including main corridors

Results can enable the connection of new generation in a 3 tier approach:

### **Level 1: (As quickly as possible – e.g. REFIT)**

Connect generation at 132kV level or lower as soon as possible with no transmission reinforcement. Only possible way to connect large amount of RE before end 2013.

### **Level 2: (Targeted projects : 2014 - 2019)**

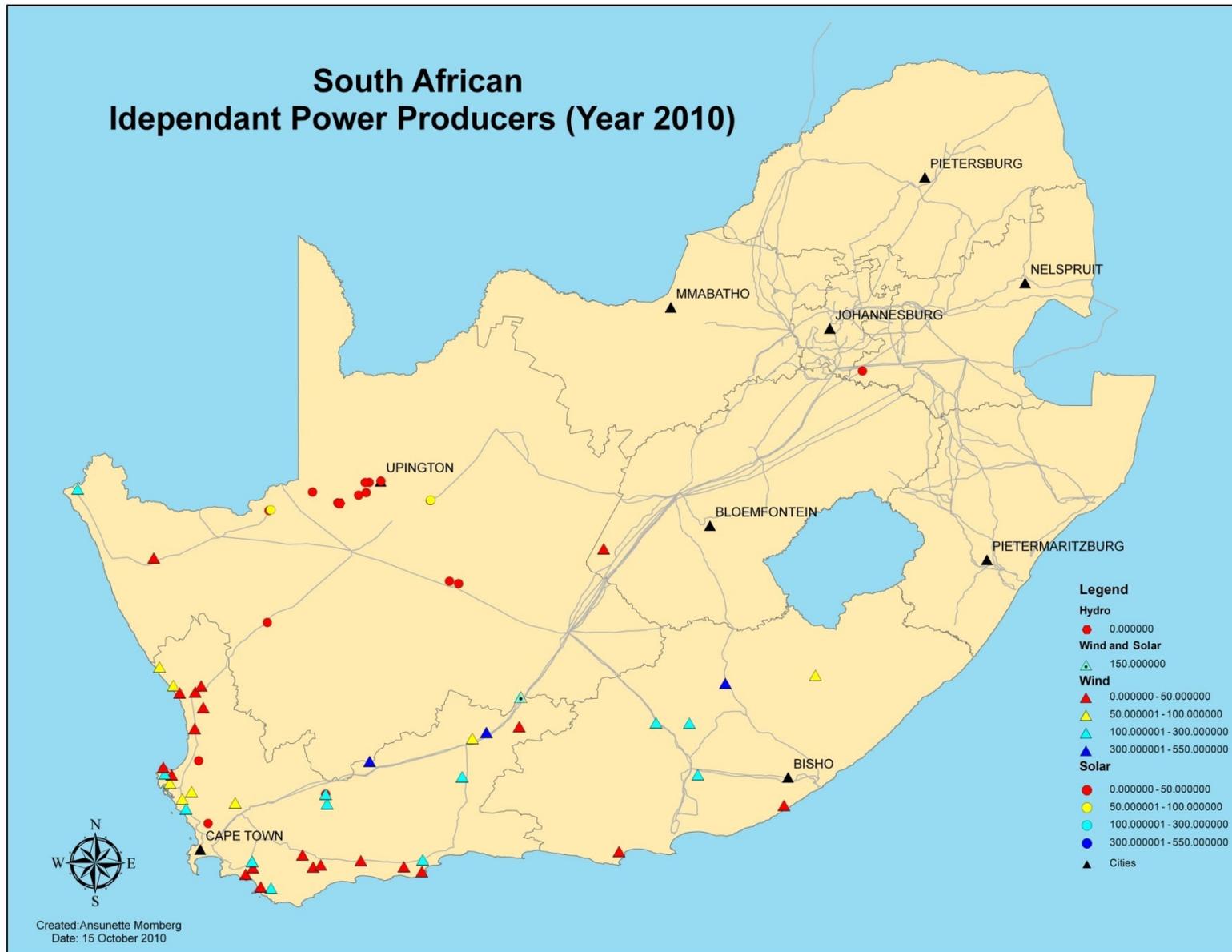
Target medium term large generation projects that can be connected directly to the existing 400kV Transmission substations and corridors with relatively minimal localised transmission work.

### **Level 3: (Strategic)**

More strategic development decisions to create Transmission hubs or corridors to access proven or targeted new generation resources in the longer term beyond 2018.

- Terms of licence require Eskom to enable open access to the transmission network
- Developers of new generation need some clarity on available connection capacity
- This is especially relevant for renewables with short lead time projects for the REFIT program
- Large number of enquiries and applications will overwhelm Eskom resources
- Document showing connection capacity on existing network will assist developers in their own evaluation of project viability and timing
- Decision to produce the “GCCA” document
- Targeted Cape provinces for study based on applications submitted

# Reason for Study Area Selection based on Location of Applications Received



The following ***Regional N-1 system generation connection capacities*** for the Level 1 and Level 2 conditions were obtained for the three provinces in the Cape:

<b>Area</b>	<b>Level 1</b>	<b>Level 2</b>
Western Cape Zone	2 988 MW	4 100 MW
Eastern Cape Zone	1 042 MW	1 600 MW
Northern Cape Zone	129 MW	1 000 MW
<b>TOTAL</b>	<b>4 159 MW</b>	<b>6 700 MW</b>

## Executive Summary

1. Introduction
2. Background
3. Methodology and Interpretation
4. Definition of Transmission Connection Capacity
5. MTS Substation details
6. Generation Connection Capacity
7. High Level Connection Cost Estimating

Appendix A: MTS Substation details Tables

Appendix B: MTS substation details Maps

Appendix C: Level 1 Connection Capacity Maps

Appendix D: Level 2 Connection Capacity Maps

# GCCA-2012 Appendix B Maps

## Generation Capacity Assessment 2012 - Voltages & Bay Availability

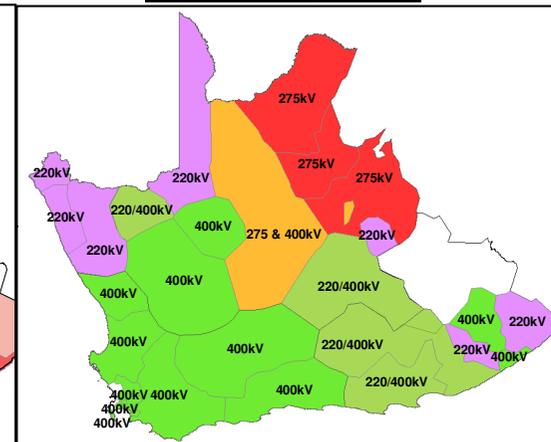
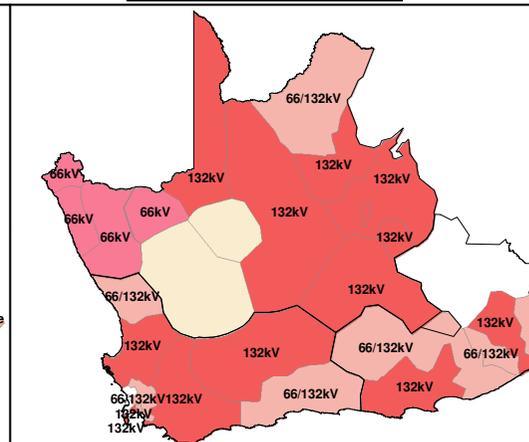
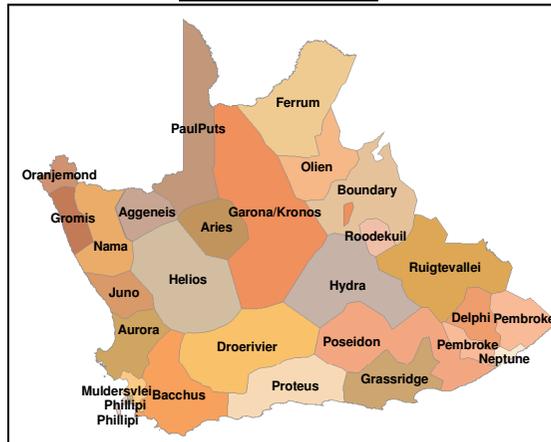
Sub Transmission

Transmission

Substation Names

Available Voltages Levels

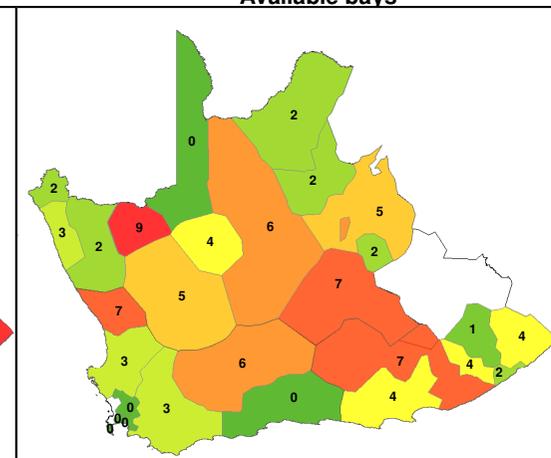
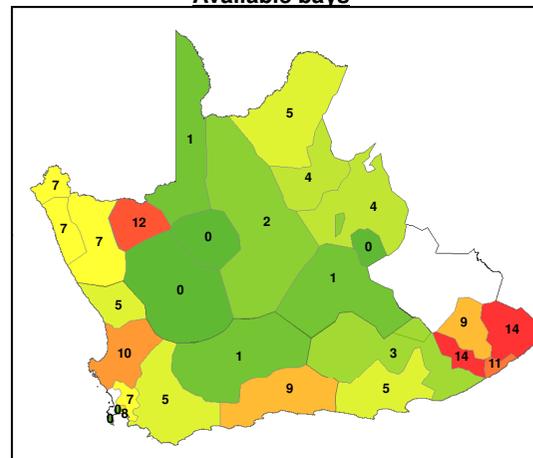
Available Voltages Levels



	66	132	220	275	400	Voltage
Aggeneis	12		4		5	66/220/400kV
Arias					4	400kV
Aurora		10			3	132/400kV
Bacchus		5			3	132/400kV
Boundary		4		5		132/275kV
Buffalo		7	1			66/132kV
Delphi		9			1	132/400kV
Droerivier		1			6	132/400kV
Ferrum		2	3	2		66/132/275kV
Garona		2		1		132/275kV
Grassridge		5	2		2	132/220/400kV
Gromis		7		3		66/220kV
Helios			1		5	400kV
Hydra			1	5	2	132/220/400kV
Juno		0	5		7	66/132/400kV
Kronos					5	400kV
Muldersvlei		3	4		0	66/132/400kV
Nama		7		2		66/220kV
Neptune			11		2	132/400kV
Olien			4		2	132/275kV
Oranjemond		7		2		66/220kV
Paulputs			1	0		132/220kV
Pembroke		6	8	4		66/132/220kV
Phillipi			0		0	132/400kV
Poseidon		1	2	5	2	66/132/220/400kV
Proteus		3	6		0	66/132/400kV
Roodekuil			0	2		132/220kV
RuigteVallei		7	2	0		66/132/220kV
Stikland		5	3		0	66/132/400kV

Available bays

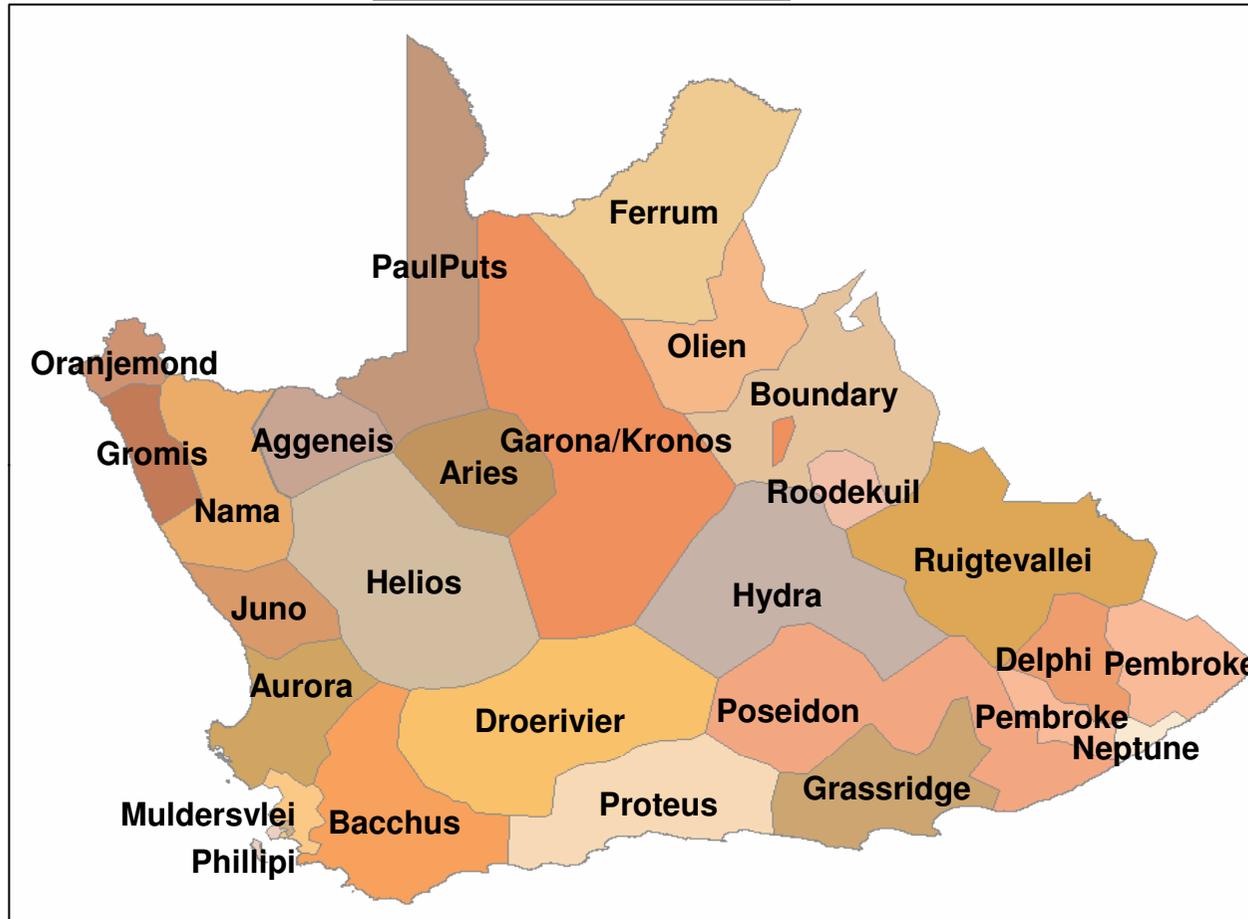
Available bays



# Map 1 – Spatial supply areas of Transmission Substations

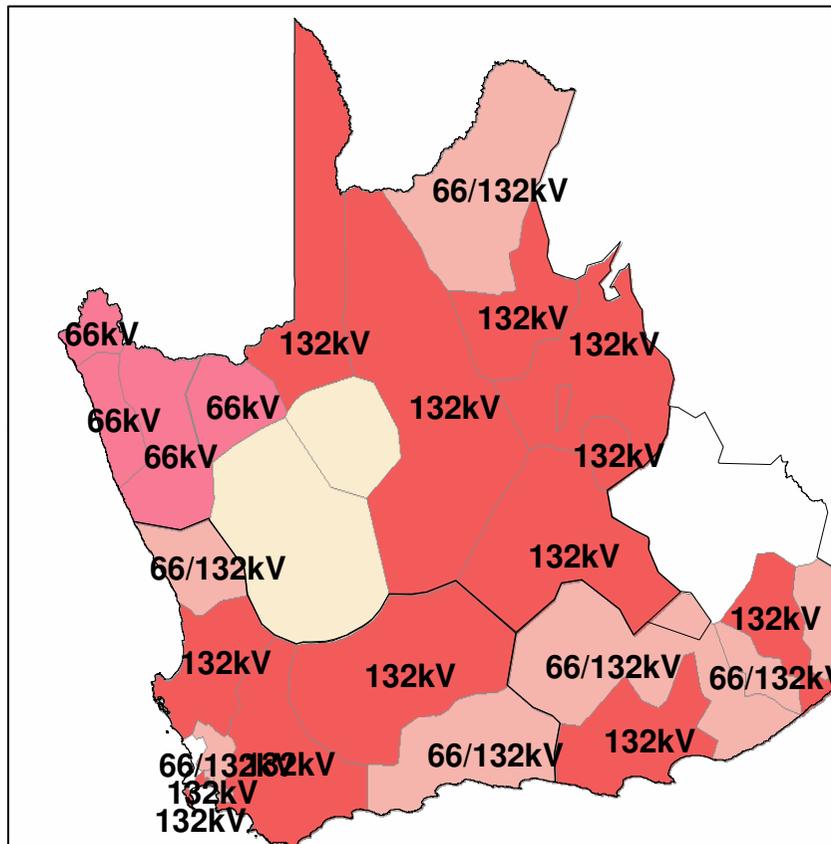
Spatial map of the geographical areas supplied by the main Transmission substations.

## Substation Names



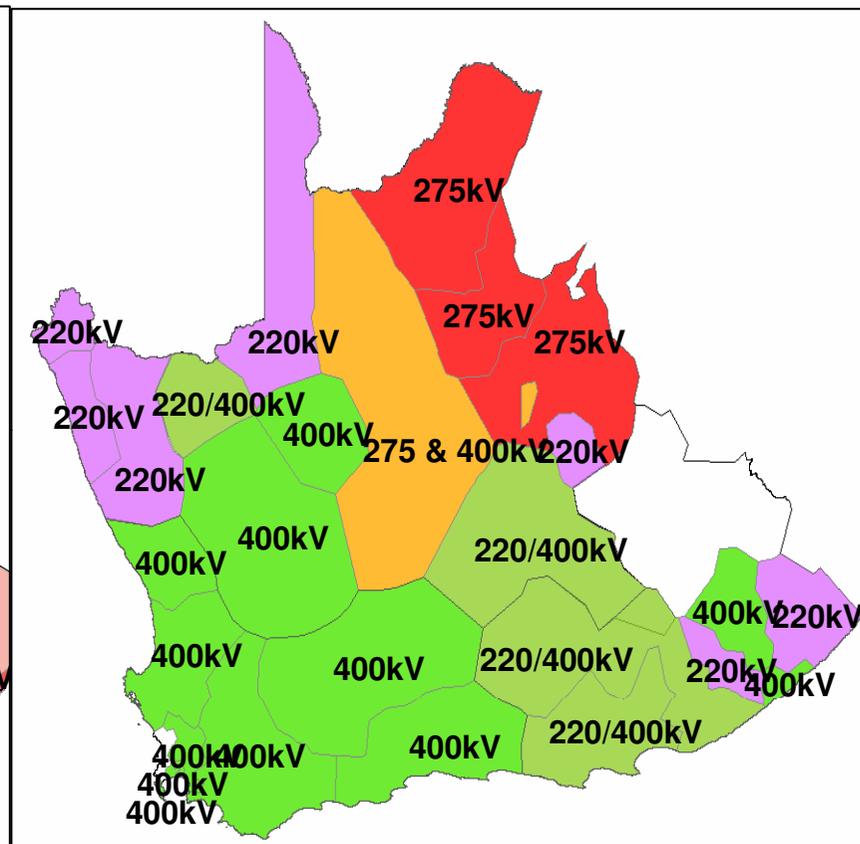
## Sub Transmission

### Available Voltages Levels



## Transmission

### Available Voltages Levels





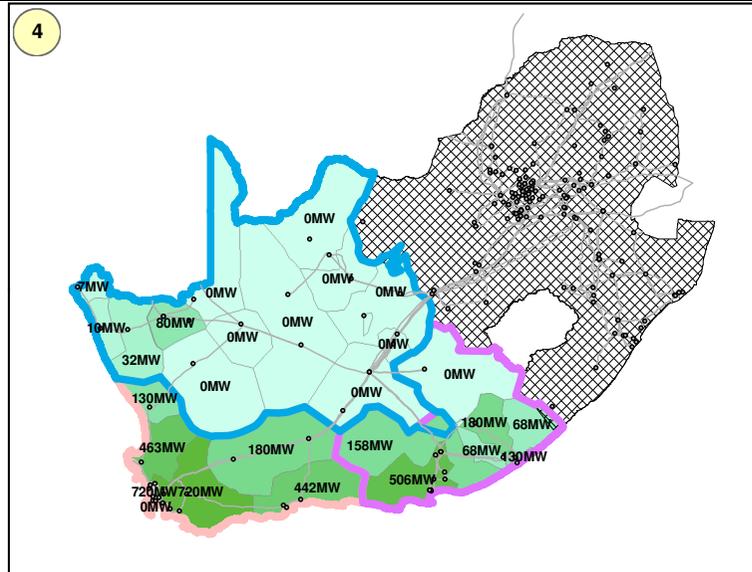
# Appendix C – Level 1 Generation Connection Capacity



## Generation Connection Capacity Assessment for 2012 Level 1 - Available Connection Capacity with no transmission strengthening

### System N-1 Generation Capacity (Participation weighted by substation potential gen capacity)

- 1 Transmission Substation name and supply area
  - 2 Local Transmission Substation generation N-1 network capacity assessment. Only includes local substation network loading, voltage and thermal ratings. Does not evaluate aggregated network capacity impact.
  - 3 System N-1 Generation Capacity per Zone. The regional network generation capacity assessment. This limit is the maximum N-1 capacity that the zonal network can absorb. The aggregated substation generation integration can not exceed this limit.
  - 4 System N-1 Generation Capacity. This limit is calculated by increasing the local substation limit until the zone limit is met. The increased generation is weighted by the max local capacity determined in (2).
- To increase this limit major backbone strengthening will be required.



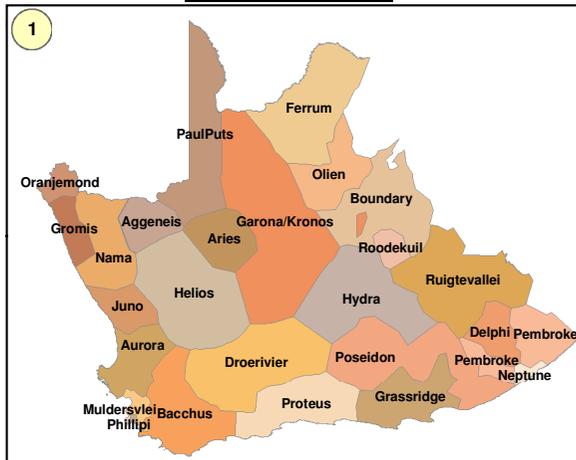
Current (2012) Max Generation Capacity = 4159MW

This is dependant on diversification of wind resources, wind farm performance and the available spinning reserve.

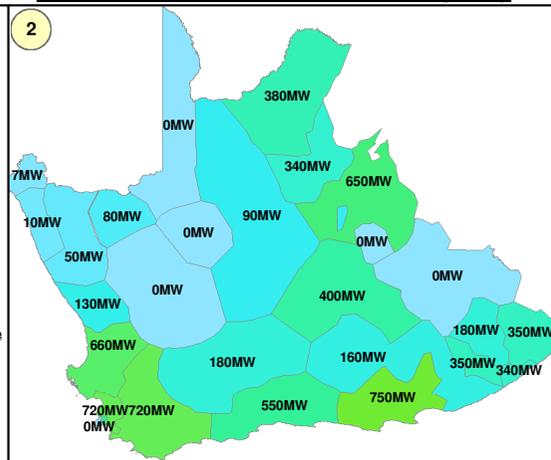
#### Legend

- Tx\_Subst\_LF
- TxLines
- RenwZone
  - <all other values>
  - 10
  - 32
  - 68
  - 80
- Zone
  - <Null>
  - Zone West
  - Zone North
  - Zone East
  - 130
  - 158
  - 180
  - 333
  - 442
- LoadTxSub
  - Current Limit N-1
  - 0
  - 7
  - 463
  - 506
  - 720

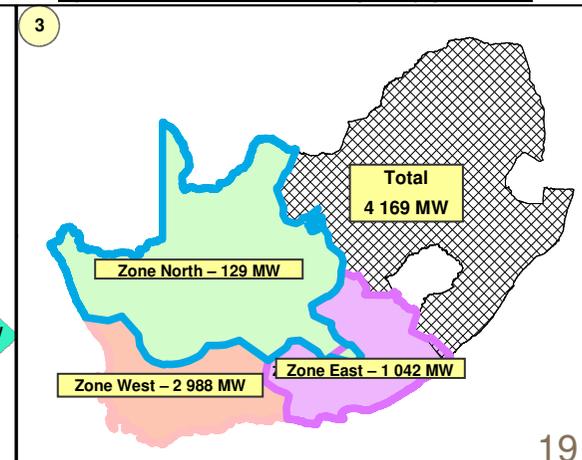
### Substation Names



### Local Substation N-1 Generation Capacity

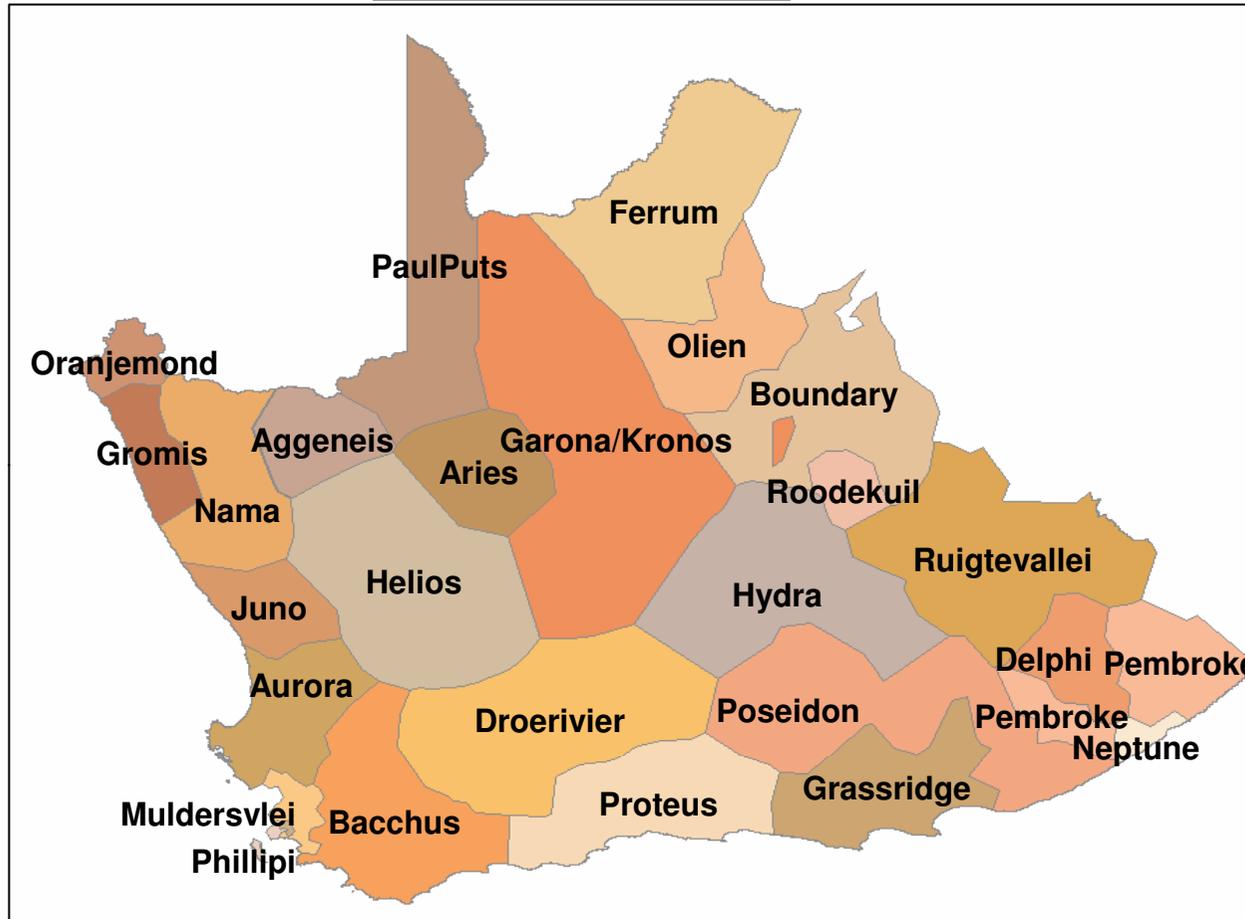


### System N-1 Generation Capacity per Zone



1 Transmission Substation name and supply area

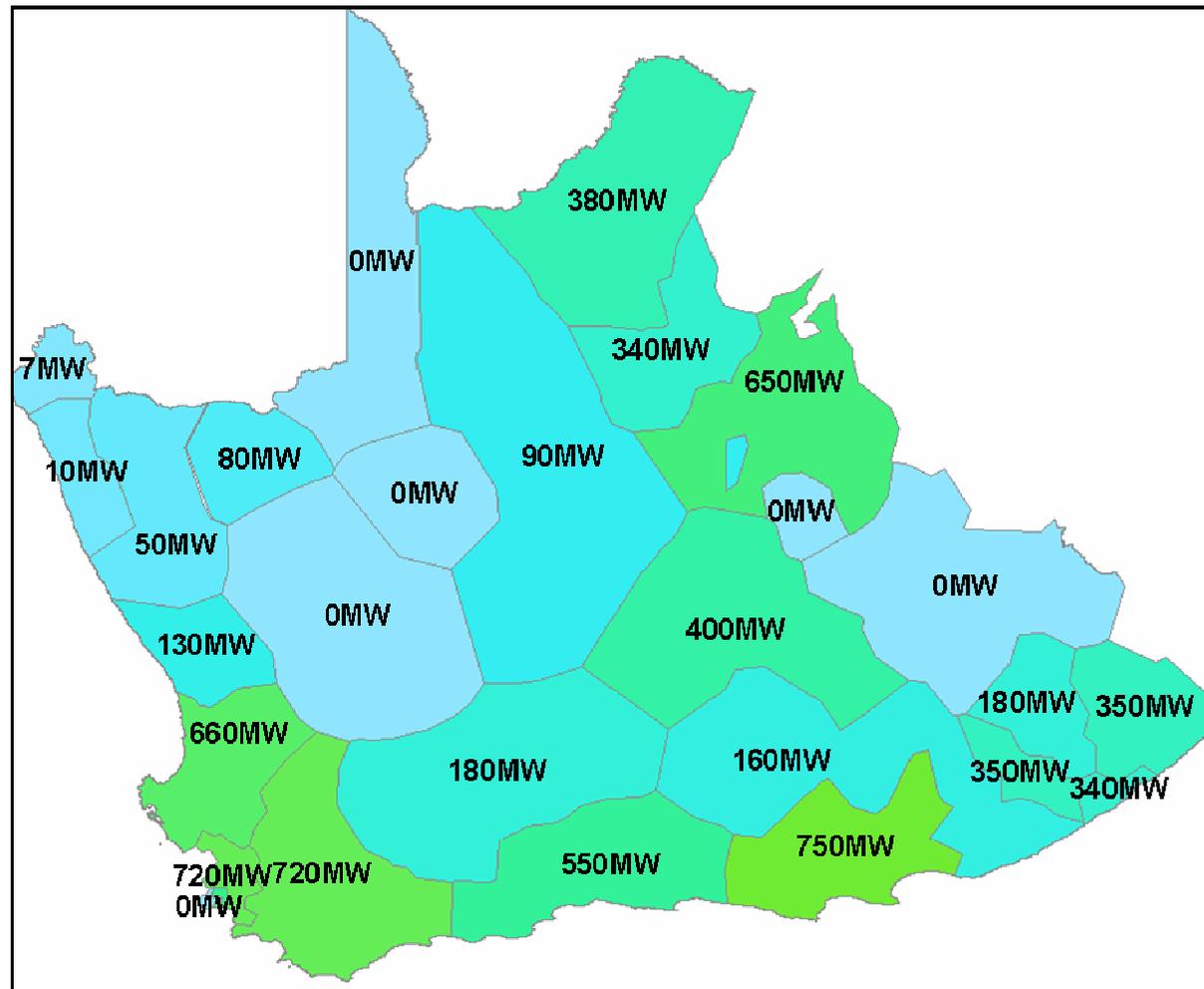
## Substation Names



## Map 2 – Level 1 System N-1 Local Substation Capacity

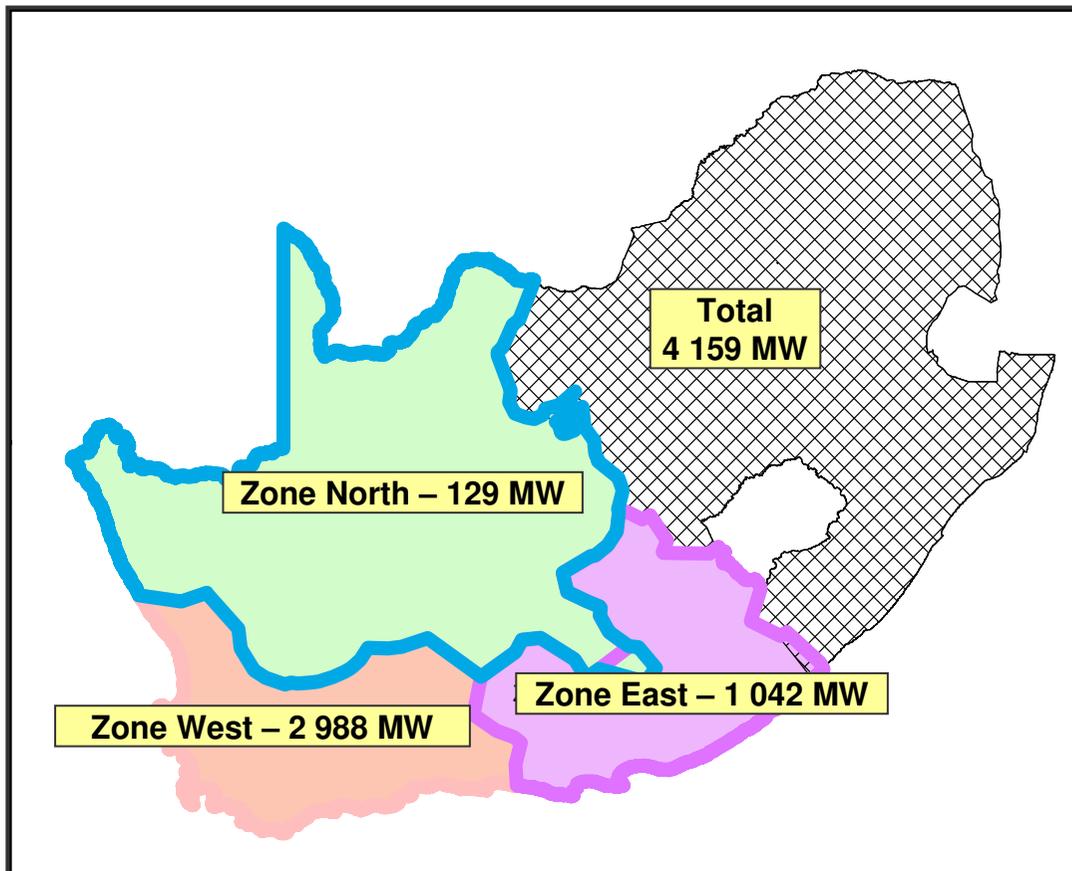
2

Local Transmission Substation generation N-1 network capacity assesment. Only includes local substation network loading, voltage and thermal ratings. Does not evaluate aggregated network capacity impact.



- 3 System N-1 Generation Capacity per Zone. The regional network generation capacity assessment. This limit is the maximum N-1 capacity that the zonal network can absorb. The aggregated substation generation integration can not exceed this limit.

## System N-1 Generation Capacity per Zone

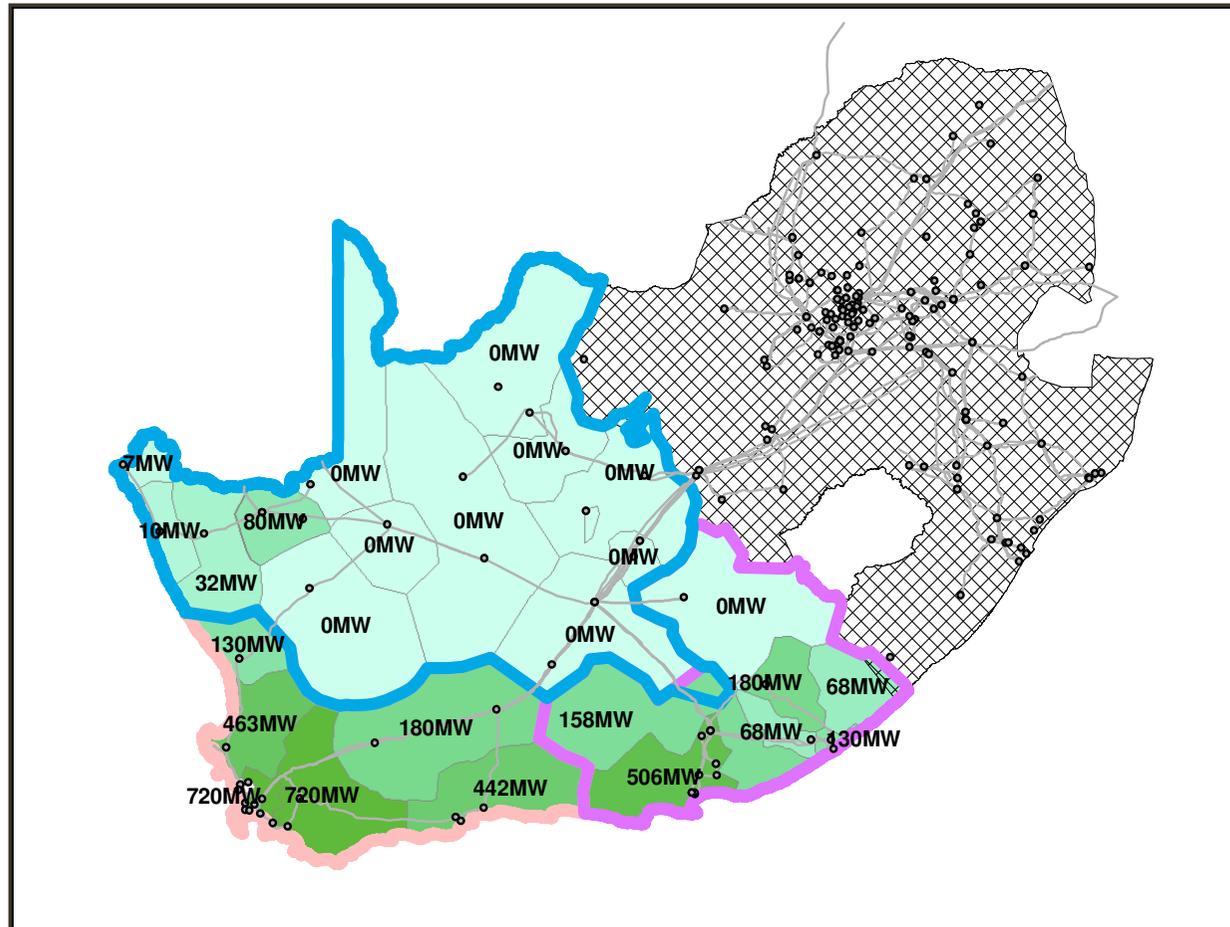


Area	Level 1
Western Cape Zone	2 988 MW
Eastern Cape Zone	1 042 MW
Northern Cape Zone	129 MW
<b>TOTAL</b>	<b>4 159 MW</b>

## Map 4 – Level 1 Weighted allocation of Zonal Capacity

4

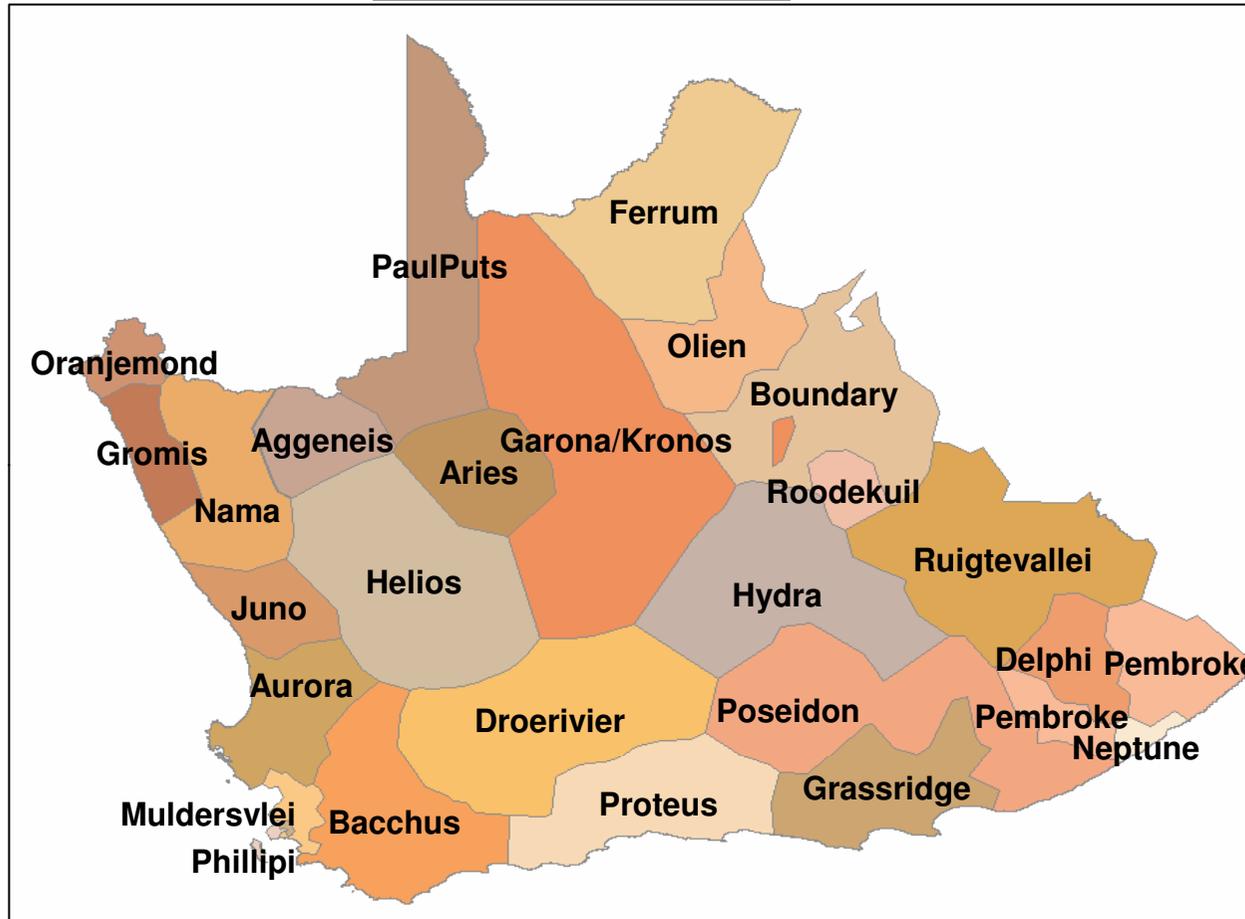
System N-1 Generation Capacity. This limit is calculated by increasing the local substation limit until the zone limit is met. The increased generation is weighted by the max local capacity determined in (2). To increase this limit major backbone strengthening will be required.





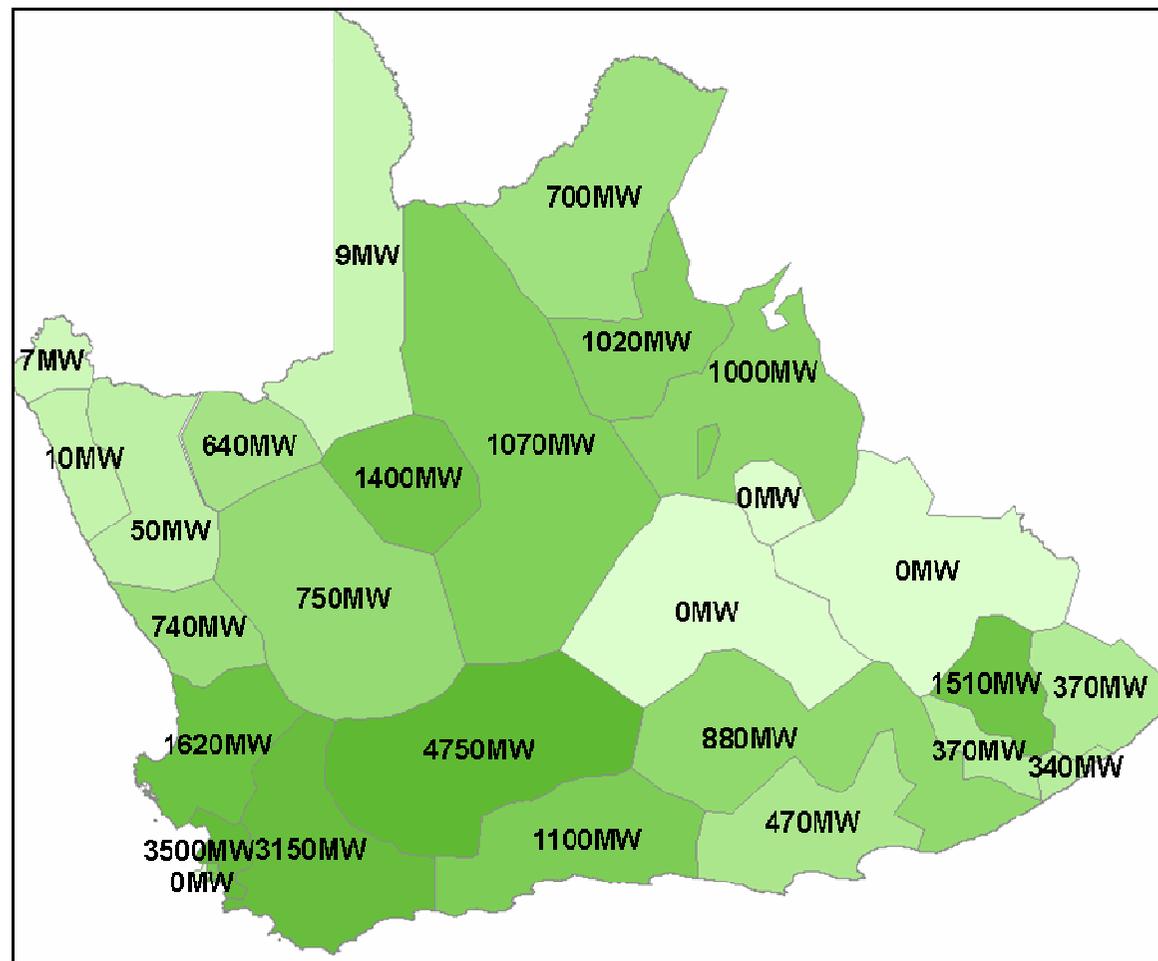
1 Transmission Substation name and supply area

## Substation Names



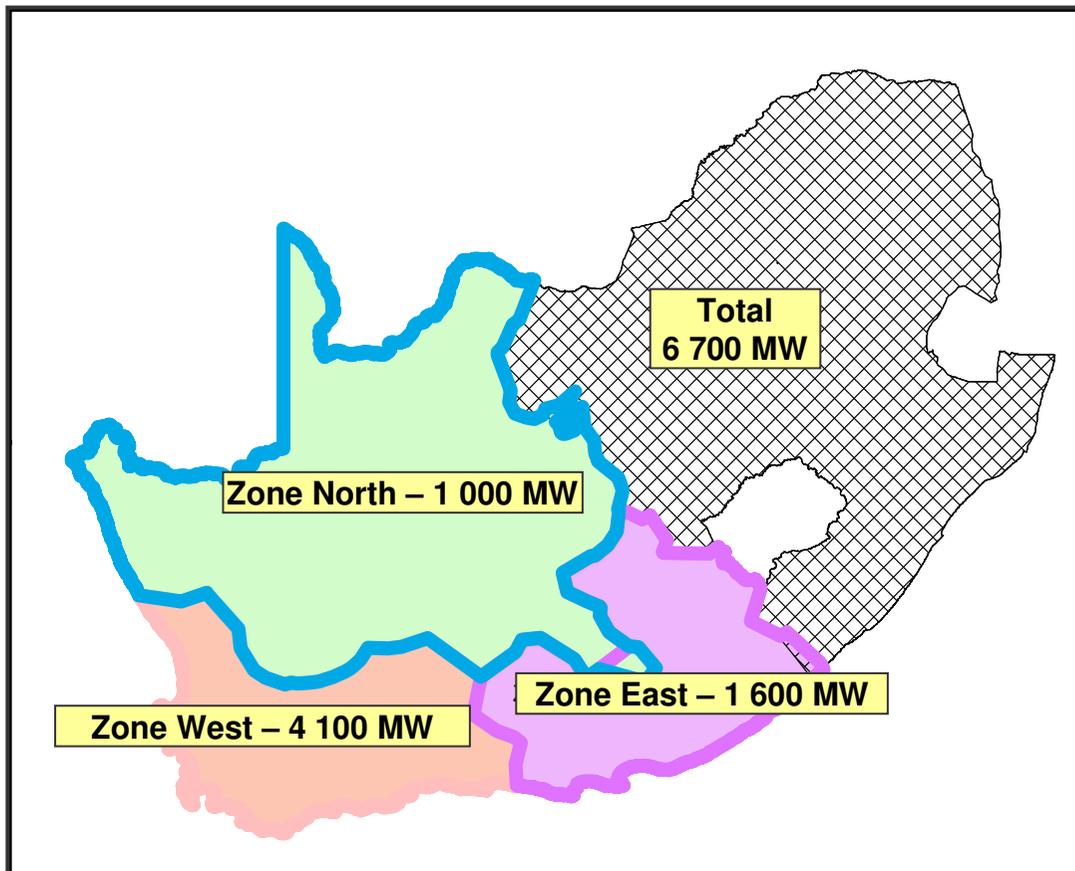
## Map 2 – Level 2 System N-1 Local Substation Capacity

- 2 Local Transmission Substation generation N-1 network capacity assessment. Only includes local substation network loading, voltage and thermal ratings. Does not evaluate aggregated network capacity impact.



- 3 System N-1 Generation Capacity per Zone. The regional network generation capacity assessment. This limit is the maximum N-1 capacity that the zonal network can absorb. The aggregated substation generation integration can not exceed this limit.

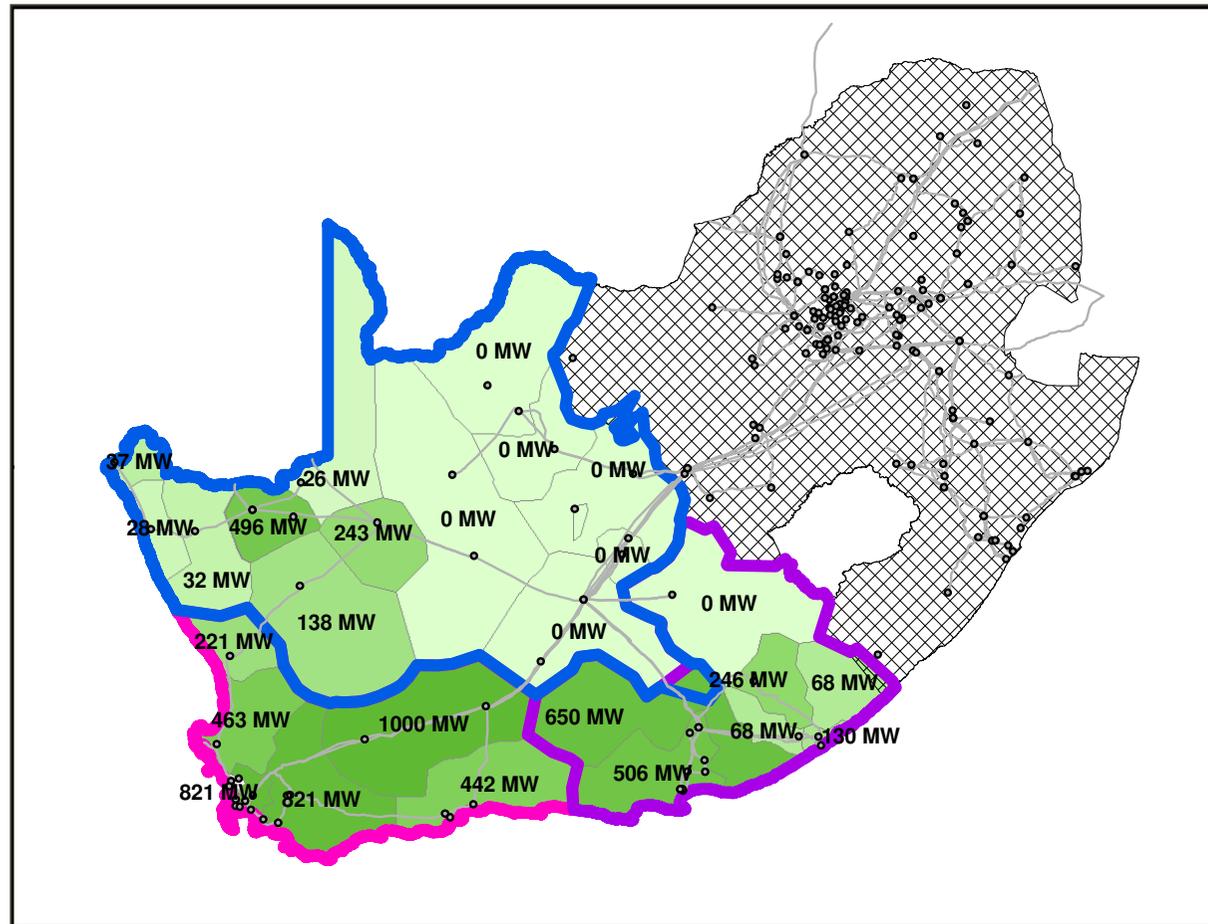
## System N-1 Generation Capacity per Zone



Area	Level 2
Western Cape Zone	4 100 MW
Eastern Cape Zone	1 600 MW
Northern Cape Zone	1 000 MW
<b>TOTAL</b>	<b>6 700 MW</b>

# Map 4 – Level 2 Weighted allocation of Zonal Capacity

- 4 System N-1 Generation Capacity. This limit is calculated by increasing the local substation limit until the zone limit is met. The increased generation is weighted by the max local capacity determined in (2). To increase this limit major backbone strengthening will be required.



The following clarifications are presented:

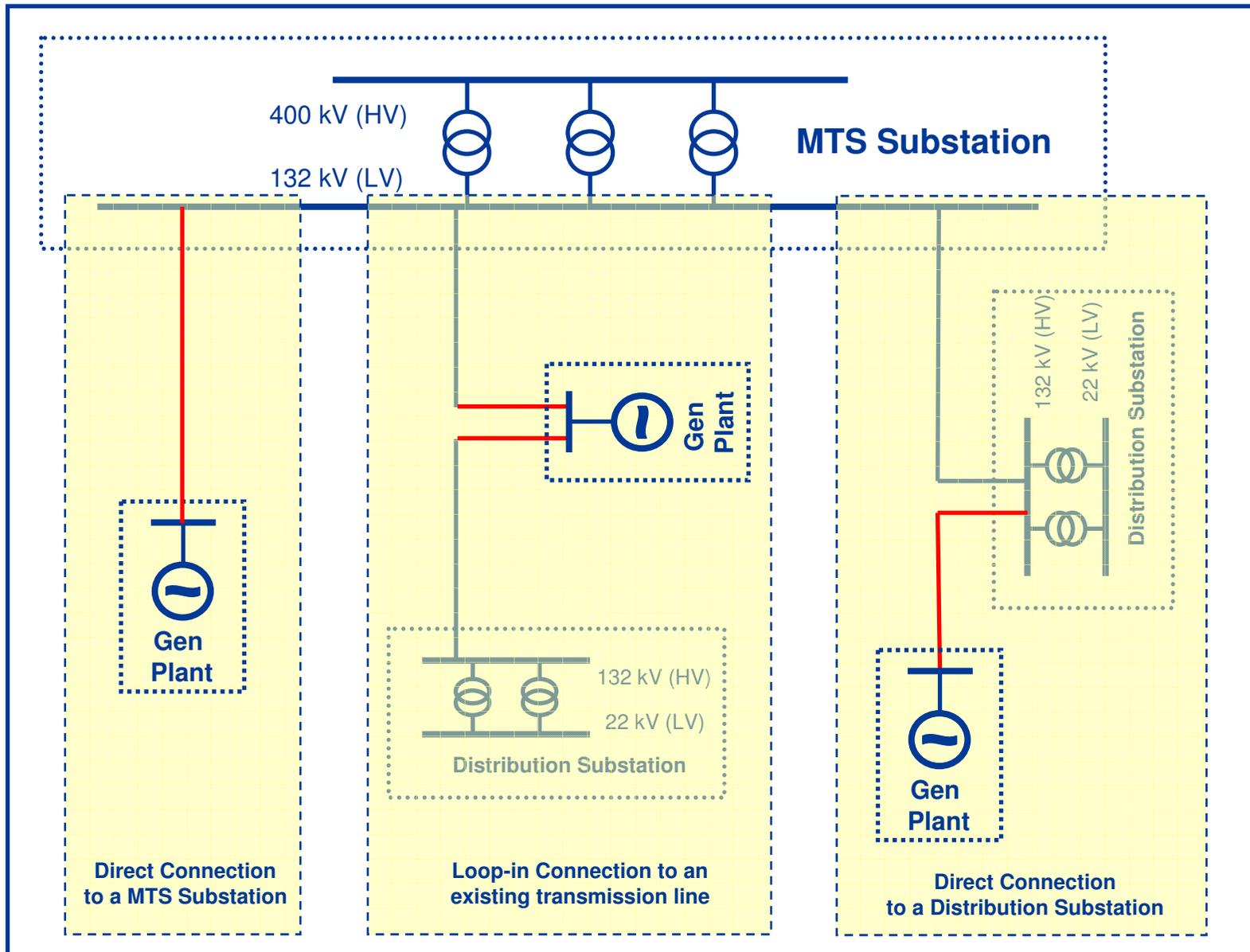
- The connection capacity values presented in the GCCA-2012 are only a guideline and not a specific criteria.
- All RE generation for the REFIT or otherwise will be connected at Distribution level, i.e. at 132kV or lower.
- This means that security of supply is only N-0 not N-1 as this is the Distribution standard.
- Once the power reaches a Transmission level substation only then it is on a N-1 system.
- If a N-1 level of supply is requested by the generator then they will have to pay for a second direct connection with sufficient capacity to the Transmission substation.

Large thermal generation IPPs may connect at 275kV or 400kV and this will require detailed study which is considered a long term integration project.

Most IPP generation plant other than large thermal plant will connect in one of three ways to the Transmission network:

- Direct connection from the generation plant substation to the MTS substation via a dedicated sub transmission line.
- Looping in an existing distribution line which is connected to the MTS substation into the generation plant substation.
- Direct connection from the generation plant substation to a Distribution substation which is supplied by the MTS substation.

# Connecting to the Transmission Network



- Any developer is entitled to an indicative cost estimate and Part 1 of the Generation Connection Application form must be completed to apply for this.
- Eskom will provide an (non-binding) indicative cost estimate to all applicants provided the required Part 1 information is submitted with the application.
- All applications are assumed to be the only project integrated at the point of connection and the estimate is subject to this condition.
- Applications will first be considered at the Distribution level to determine if the generator plant can be integrated before forwarding to the Transmission level.
- Every generator plant integration configuration is very dependant on location and the existing Distribution and Transmission network infrastructure.

- With the indicative cost estimate will be a letter confirming the agreed point of connection and expected integration configuration for the generation project.
- Eskom will only provide a ‘Budget Quote’ (85% accuracy) once it is shown that applicant is either a preferred bidder or has other acceptable proof that project is in line with the future IRP requirements. (Will need proof of EIA initiation including lines)
- When the REFIT “Request for Projects” is released there will be a deadline for accepting connection applications in order to provide the indicative estimates in time for submission to REFIT.
- If project is at a reasonable stage of readiness and the required information is available it is recommended that the application for an indicative cost estimate (Part 1) be submitted.
- The Generation Connection Application form can be found at [www.eskom.co.za](http://www.eskom.co.za) under the following sub-section headings: *“About Electricity / Tariffs and Charges / Embedded Generators”*

One important principle that Eskom is recommending is one of ***Geographic Diversification*** of the RE Generation connections.

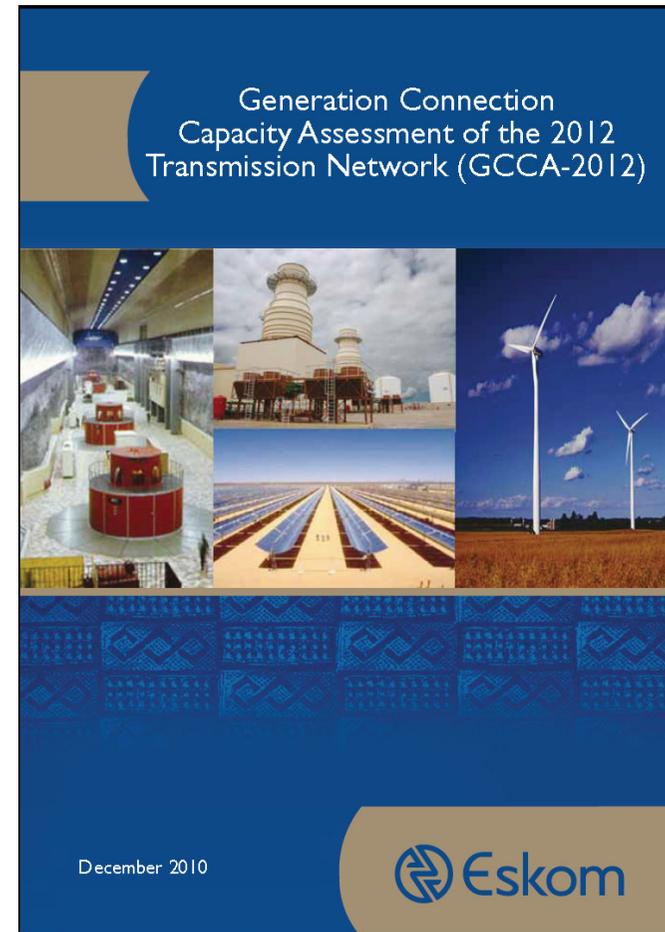
Reasons for this:

- The collection of actual real time data of the RE resource performance over different geographic areas (specifically Wind).
- Minimise any potential negative impact of RE generation on the overall system performance.
- Allow System Operator to gain experience operating with RE generation with minimal risk and develop the necessary procedures to enable connection of larger amounts of RE generation.
- Maximise the use of the existing transmission infrastructure before investing in new infrastructure.
- Facilitate the quicker roll out of RE connections if they are sized within the existing connection capacities.

# Obtaining a GCCA-2012 document

Request for a GCCA-2012 document must be submitted as follows:

- Go to Eskom website  
[www.eskom.co.za](http://www.eskom.co.za)
- Go to the following sub-sections: *“Media room/Publications”* to find the *“GCCA Report”* option
- Complete the details as requested and submit to the email address
- Organisation / Entity will be entered in database
- Copies can be either sent electronically or posted (CD or book)
- Only one copy per organisation / entity



# WEB Location



**Eskom**

- About Eskom
- Investors
- New build programme
- Underground coal gasification
- About electricity
- ECSF
- Media room
- Knowledge centre
- Corp. social investment
- A Career at Eskom
- Customer services
- Tender bulletin
- PAIA
- Terms & conditions

**Building new power stations**

- New build programme
- Nuclear energy
- Guide to independent power producer processes

**Contact centre number**  
08600ESKOM  
(0860037566)

**Sustainable development**

- Eskom's memorandum to NGO
- Eskom promotes open communication about environmental issues
- Status and process of land acquisition and resettlement
- Procedure for the involuntary resettlement of legal and illegal

**Annual Report 2010**

**Awards roll in for 2010 Eskom Integrated Annual Report**

**Eskom** Search: [ ]

► Eskom Home ► Content ► Media room ► Publications

**About Eskom**

- Investors
- New build programme
- Underground coal
- About electricity
- ECSF
- Media room
- Knowledge centre
- Corp. social investment
- A Career at Eskom
- Customer services
- Tender bulletin
- PAIA
- Terms & conditions

**GCCA Report**

**Generation Connection Assessment of the 2012 Transmission Network (GCCA-2012)**

Eskom is the biggest producer of electricity in South Africa; it is also the sole transmitter of electricity via a transmission network which supplies electricity at high voltages to a number of energy intensive customers and distributors. Eskom is a vertically integrated company licensed to generate, transmit and distribute electricity. The transmission licence provides that the planning of the transmission network is the responsibility of Transmission System Planning (TSP).

The purpose of the Generation Connection Assessment of 2012 Transmission Network (GCCA-2012) document is to provide an indication of the available capacity for the connection of new generation projects at the Main Transmission System (MTS) substations on the transmission network that will be in service by 2012. The values provided are not intended to be fixed specific connection capacities as each connection is unique, but rather to be used as a guideline to indicate the potential for connecting to a specific point on the transmission network.

In this version of the document only the available capacity at the MTS substations in the Western Cape, Eastern Cape and Northern Cape provinces are presented. The detailed studies that have been undertaken have only considered these provinces based on the significant potential for renewable energy (RE) generation in these areas and the timing of the REFIT process. Future generation capacity connection studies will be extended to include the rest of the country and the results will be published in a later version of this document.

If you wish to request a copy of the GCCA-2012 document you will have to submit an electronic request in order to keep a record of who has been sent a copy and inform them of any updates or modifications of the document. Only one copy will be sent per organisation or individual.

The GCCA-2012 document can be sent in one of the following ways:

- Electronically – this will be sent within 3 working days of request
- Posted CD of document - should arrive within 3 weeks of the request
- Posted printed report - should arrive within 3 weeks of the request

Kindly provide the information below, in an e-mail to the following address:  
[GCCA@eskom.co.za](mailto:GCCA@eskom.co.za)

*(Copy the section below and paste it into the content area of the e-mail address above)*

(\* = Required information)

- \* Name of your organisation or Individual
- \* Name of contact person
- \* Contact telephone number
- \* Contact e-mail address
- Physical address
- Postal address
- \* Nature of your organisation
- \* Document preference

Search: [ ]

**Report 2010**

- 2009
- 2008
- 7
- 6
- 5 (Including Eskom Holdings and Eskom Development)
- 03 (including Eskom Holdings/Eskom Development Enterprises)
- Annual Report 2002/Eskom Development Foundation Annual Report 2002
- Enterprise Annual Report 2002
- Foundation Report 2001
- 1
- Working Information for 2001
- 0
- Report 2000
- 9
- 1996 (The National Electricity Regulator has been publishing electricity industry since 1997. Their web address is
- 8
- 7
- Report 1999

**Reports - Eskom Research Group**

- Electricity?
- 2
- Rate electricity
- and power station
- Assessments
- precious resource
- ogy: Pressurised water reactors
- ogy: What is Nuclear energy?
- ogy: What is Nuclear Waste?
- ogy: What is Radioactivity?

- Next study will cover connection capacity on the transmission network for the entire country
- Appropriate year of study to be selected (possibly 2015)
- New GCCA document will be compiled
- On the Eskom website a new section for Generation and IPPs is under development which will centralise all information related to this area, including:
  - the application process
  - the generation connection application forms
  - the GCCA documents
- Update information will be notified via database contact details

**End of  
GCCA-2012  
presentation**

# Questions and Clarifications Session

**Thank you**

