High Voltage AC Overhead Power Transmission Lines

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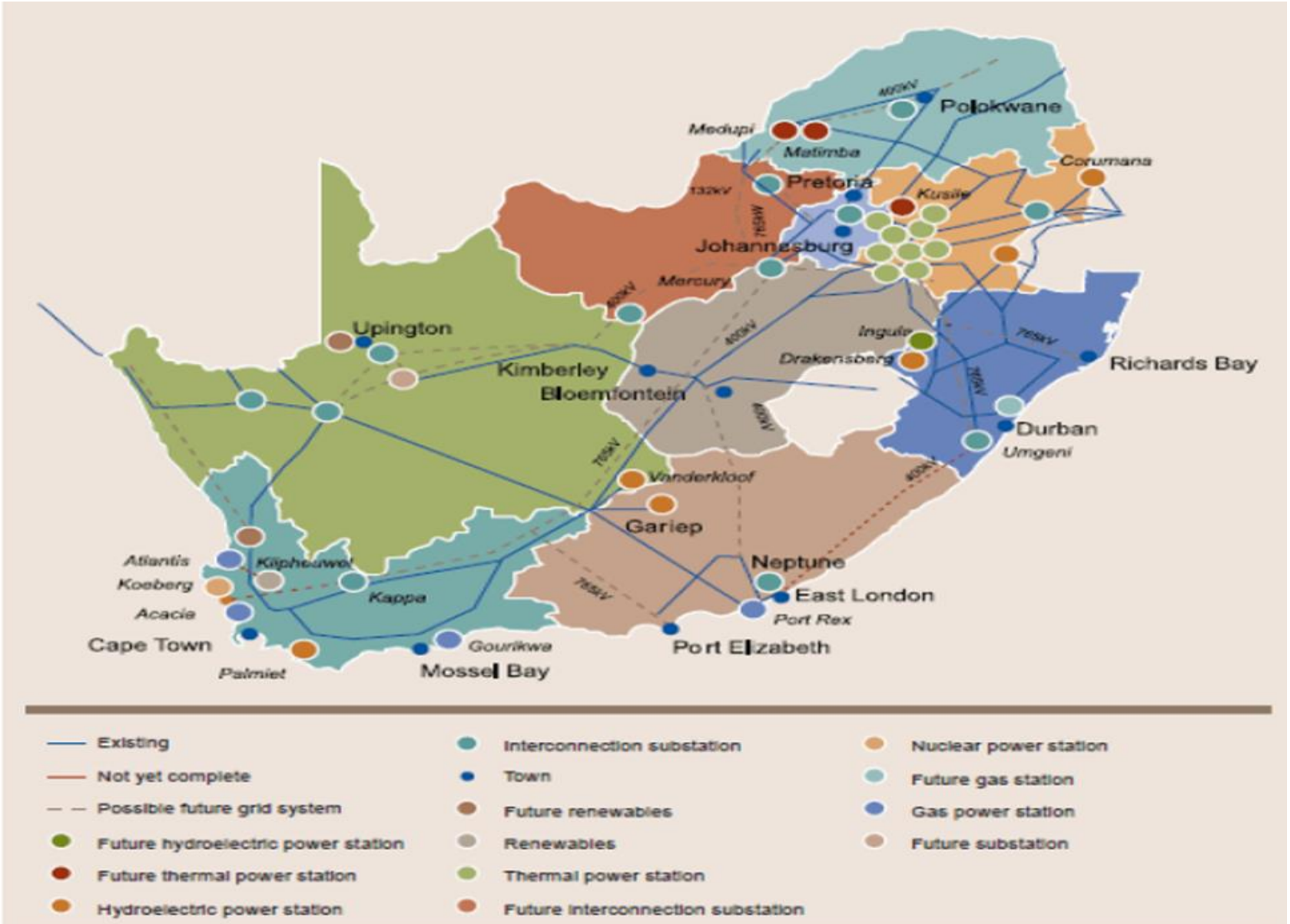
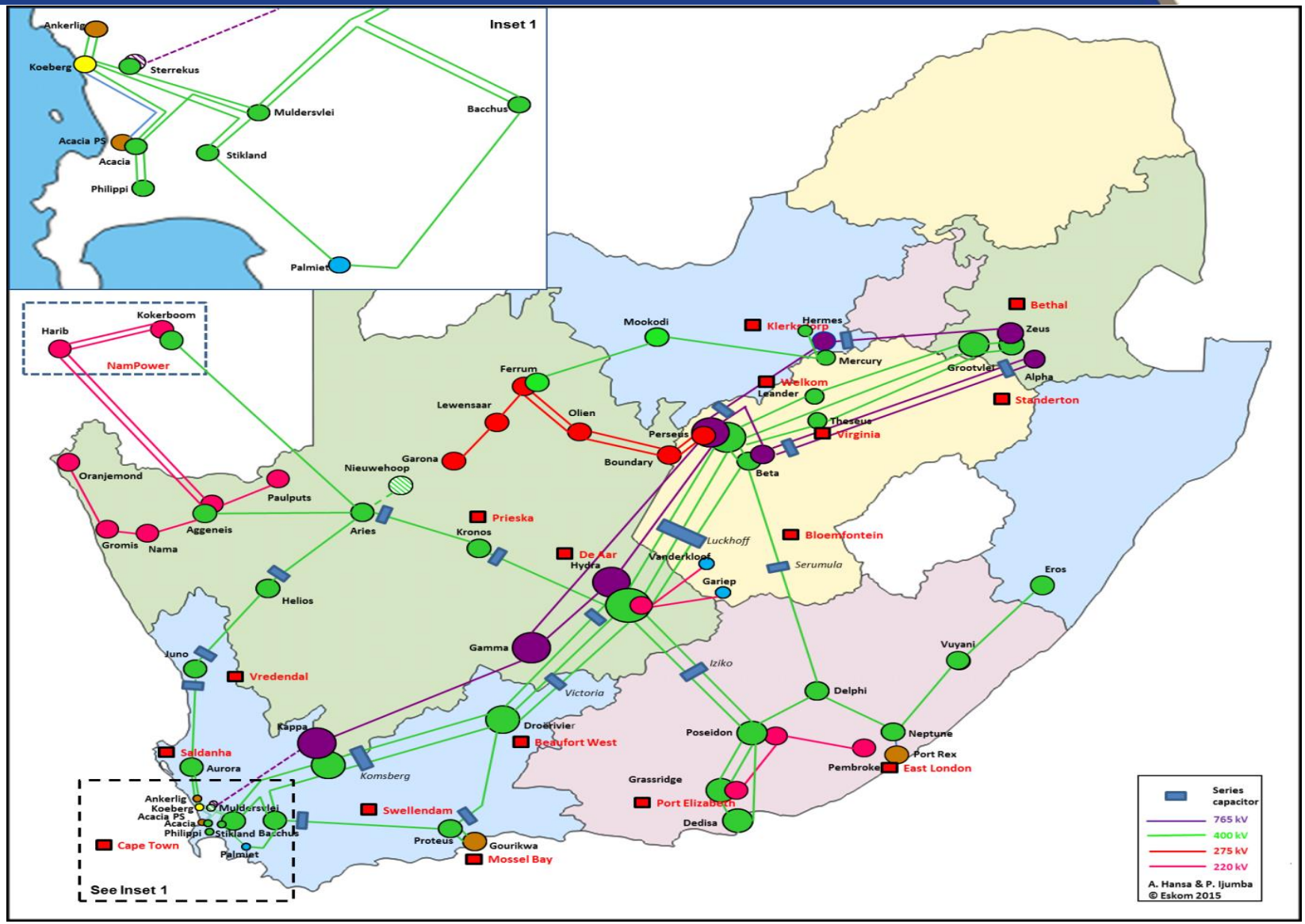
Department: Eskom - Line Engineering Services

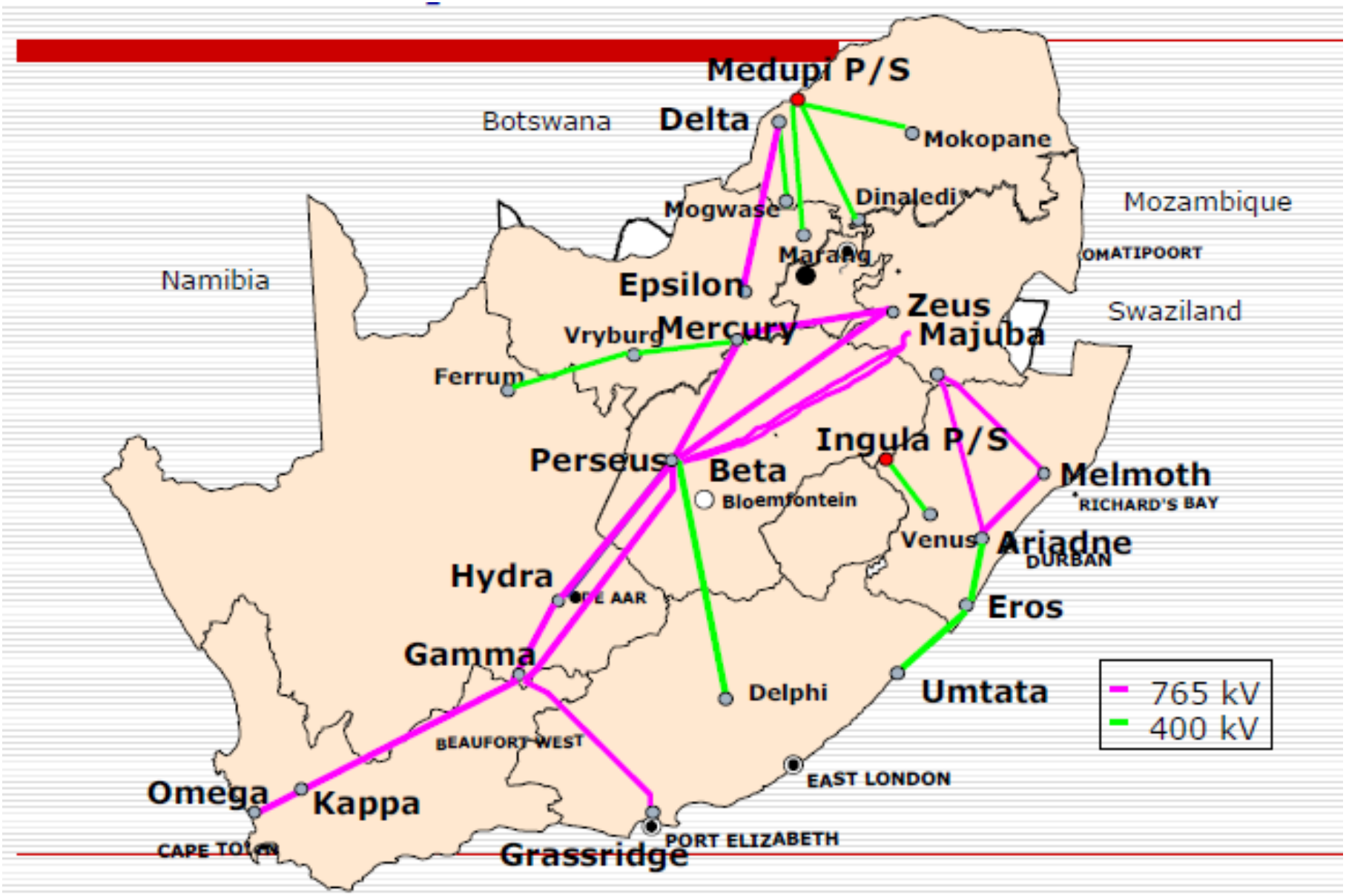
Eskom Interconnected System



Dominated by long lines that require reactive power compensation



Future 765kV Supergrid / Backbone



Kms per Voltage level

31 982 km of OHL

132 kV = 882 km

220 kV = 1 217 km

275 kV = 7 344 km

400 kV = 18 872 km

533 kV DC = 1 035 km

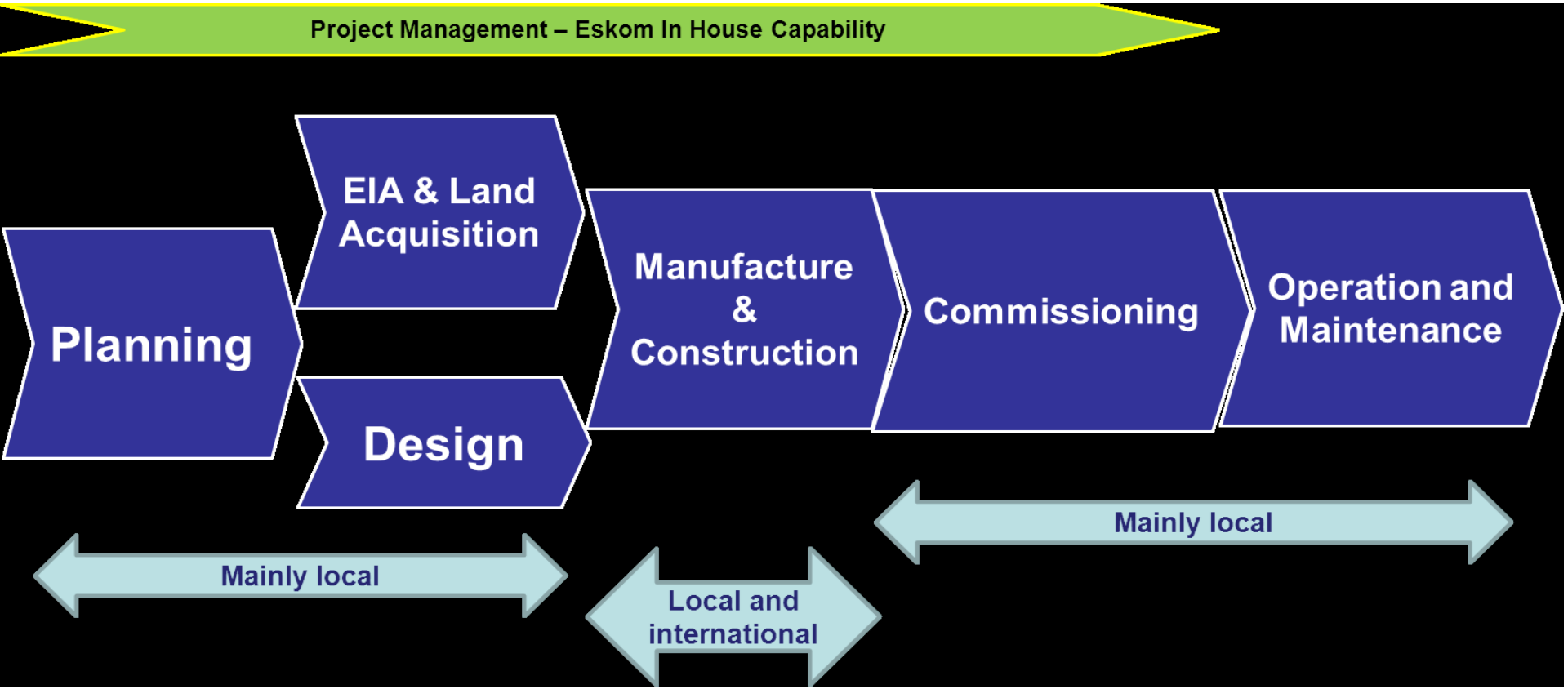
765 kV = 2 608 km

Consisting of:

- 80 % Glass cap and pin insulators
- 20 % Composite insulators
- Multi bundle phase conductor (up to 6)
- Vast family of conventional and cross rope structures
- Operating in various environments

95 % of preventative and corrective maintenance performed live !!

Line Design Cycle



Line Engineering Services

- Full detail design of HVAC lines up to 765kV and HVDC up to 800kV
- Providing support to over
  - ✓ 31 000 km of transmission lines (220kV,275kV,400kV, 533kV-HVDC, 765kV)
  - ✓ 340 000 km of Distribution Lines (11kV, 22kV,66kV, 88kV,132kV,)
- Busy with designs for over 8 000km of new transmission lines to be built in next 10 years
- Complemented by training and testing facilities, labs and advanced software

Overhead Line Design Phases

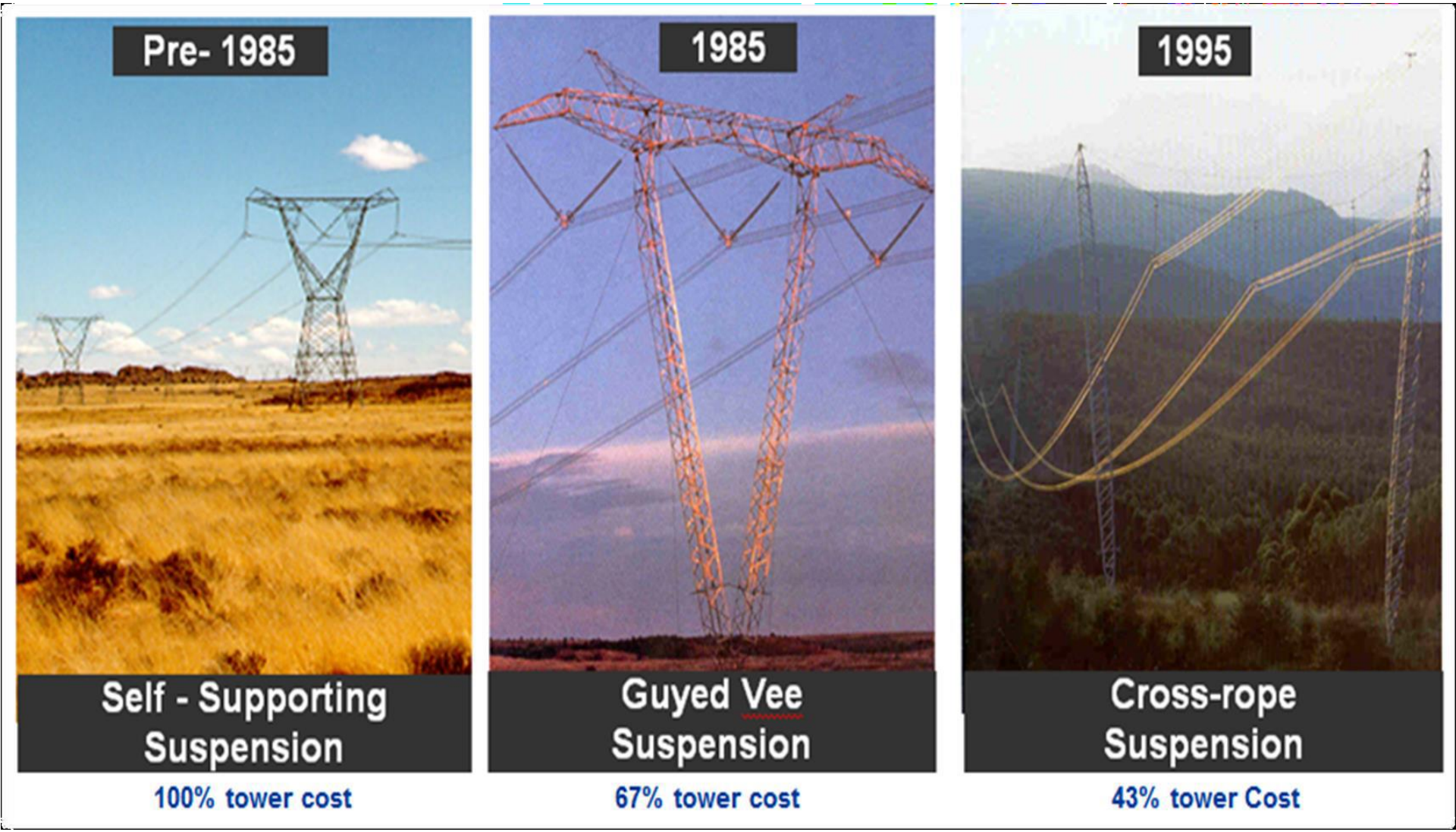
- Planning & Load Forecast
- Environmental Study and Route selection
- Conductor Optimisation and Tower Selection
- Electrical Studies (Corona, Rating, Power Transfer)
- Insulation Design
- Hardware Selection
- Foundation design
- Groundwire and OPGW
- Earthing

Corona cage, Tower test station and Netfa

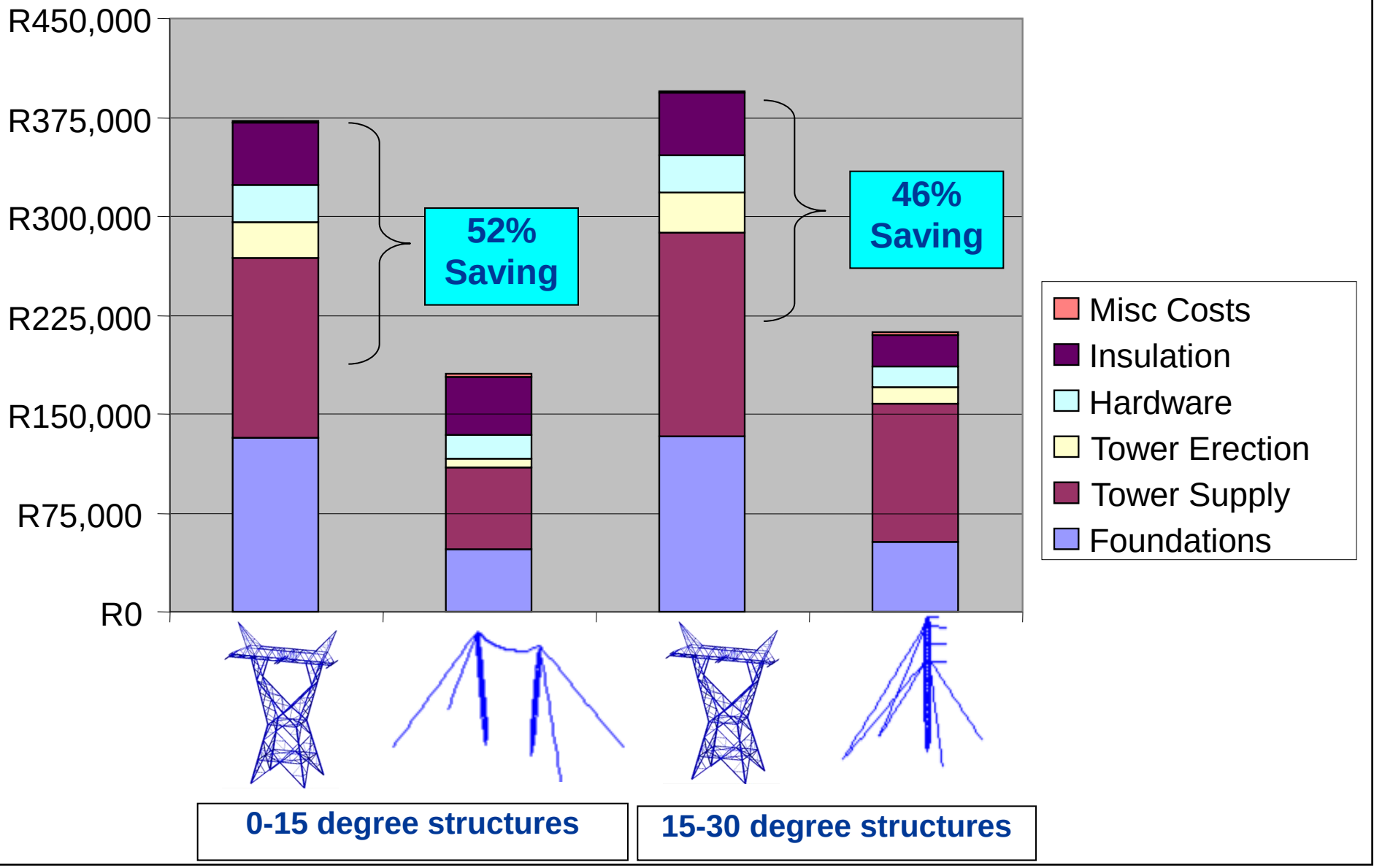
- Netfa is situated at 1500m above sea level and is used to do the following tests: Short Circuit, High Voltage and Materials Installations accredited to ISO 17025:2005 by SANAS

Future – Line Training Facility (Eskom College)

Low Cost Transmission Lines (Optimisation and performance enhancement)



Cost Savings (material and construction costs)



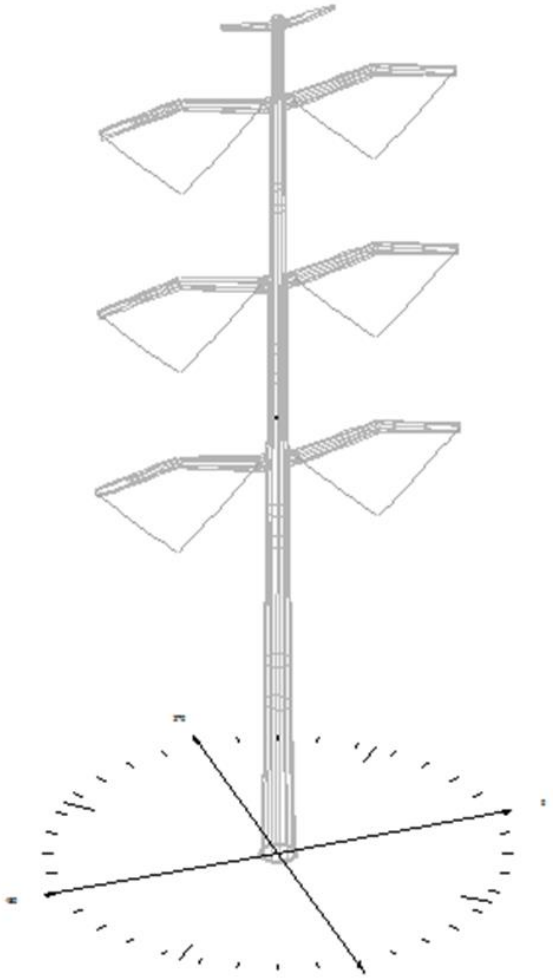
Highlights / Innovations

- Multi-Circuit Tower (servitude constraints)
- Narrow Servitude Tower (high density residential areas)
- “Sugar-Cane” Towers (prevention of faults due to sugar can fires)
- Live Line Crossings (outage constraints)
- Overhead Lines Training Facility (accelerated skill transfer)
- Micro piles (reduces environmental and physical footprint)

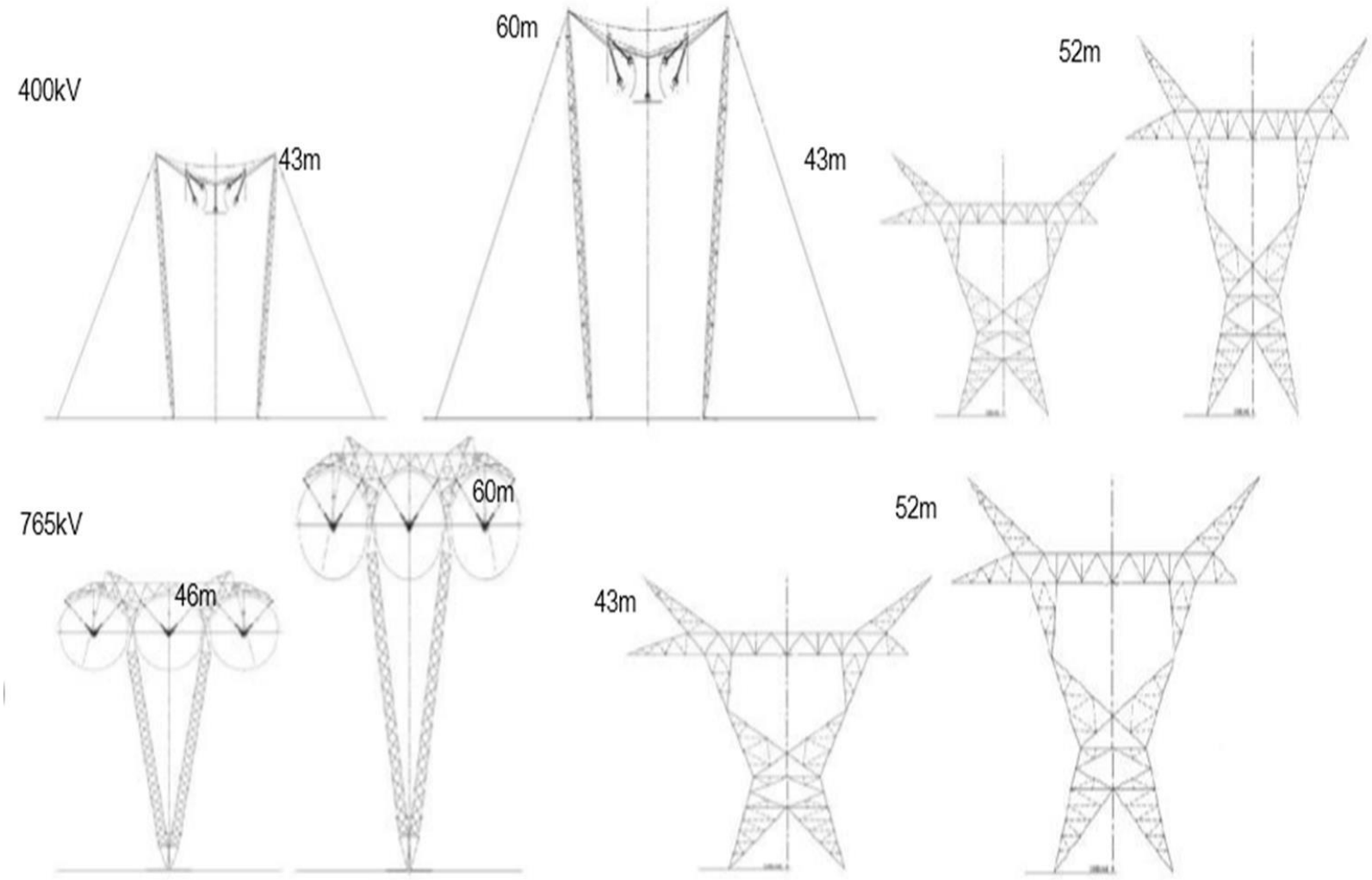
Multi-Circuit Tower - Difficulty to acquire servitudes

- Designed for 500 kV, operated at 400 kV and132 kV.

Narrow Servitude Tower - Built up areas



“Sugar-Cane” Towers – Prevents production and job losses

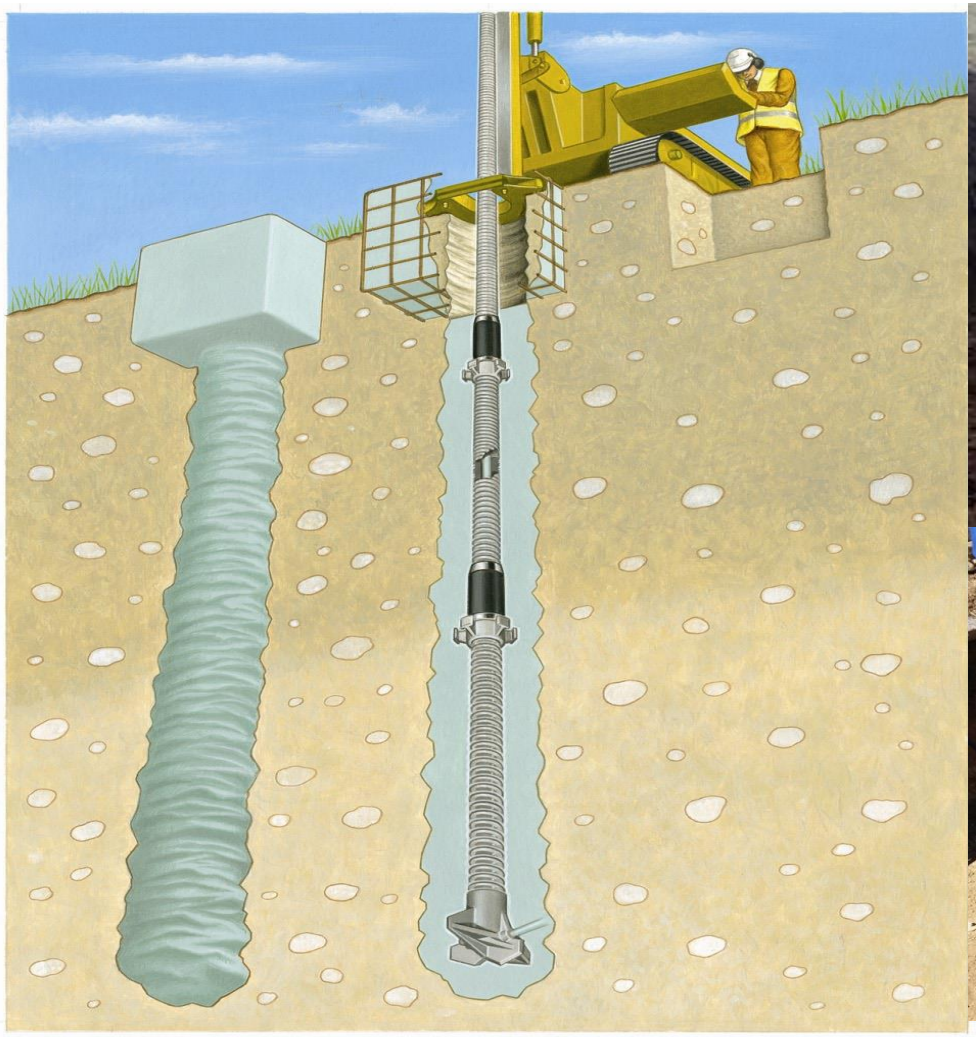


Live Line Crossings – Eliminates the need for outages

- To be utilised for : Live line crossings, Rail crossing and Major road crossings

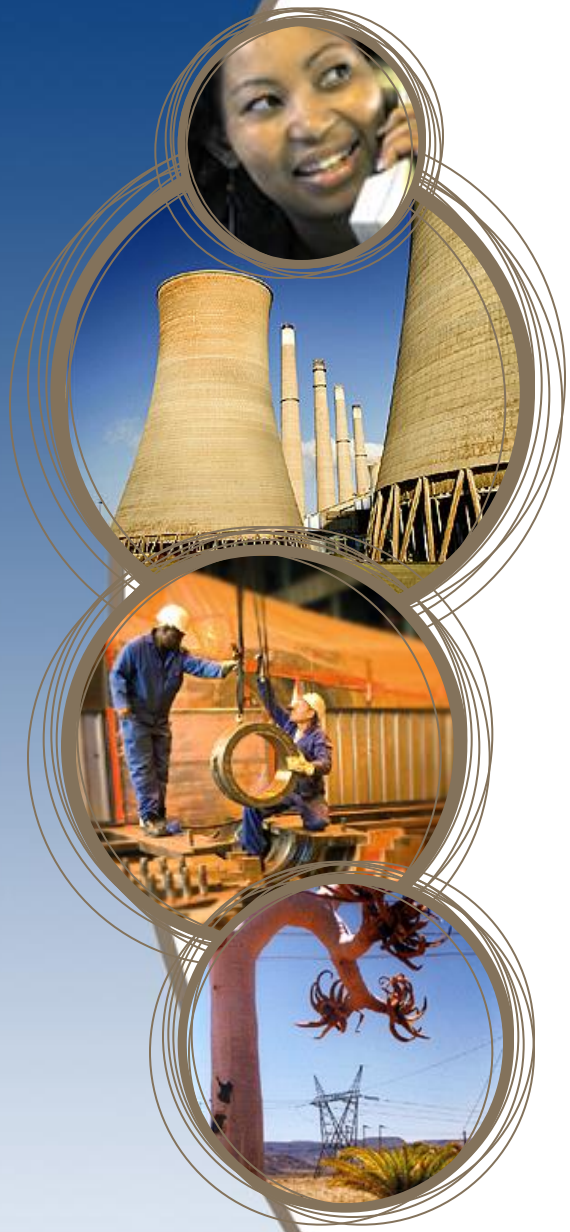
Micro piles

- This reduces environmental and physical footprint



Books

- Overhead Line Design
- Overhead Line Maintenance
- Outdoor High Voltage Insulators
- Inductive Instrument Transformers and Protective Applications
- Transformer Design & Maintenance
- Theoretical Calculations for Conductor Installations
- Theoretical Calculations for Transmission Line Towers
- Corona in Transmission Systems
- Power Quality in Electrical Power Systems
- HVDC Basic Principles & Design
- Thermodynamics for Students & Engineers
- Thermal Science for Engineers
- Basic Engineering Toolkit



Questions ???