A methodology for evaluation of Cogeneration applications under the Eskom Pilot National Cogeneration Project

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Background and contents

- Target of 3GW of Embedded Generation (EG) by 2012
- Initial focus on co-generation plants
- Effects of EG on the distribution network and the process involved in connecting an EG to the Eskom distribution network
- Technical challenges for large scale integration of EG in Eskom Distribution
- Financial issues will NOT be discussed

Eskom Challenges for EG connection

Lack of EG Experience:

- Distribution planners not exposed to EG

Existing networks not designed to accommodate EG:

- Planned / Designed for delivery of power to loads
- Strengthening projects may be required (high costs, long material delays, environmental approvals)

Data problems:

- Deficiencies in primary and control plant data such as single line diagrams (SLD), equipment attributes (e.g. alternator impedances) and protection settings

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Eskom Challenges for EG connection[3]

Short timeframes:

- Urgent need to connect additional generation
- Priority for EG connection applications

Operating and maintenance:

- Safety of staff and the public
- Impact on operating procedures and planned outages

Billing systems and tariff structures:

- Enhanced to support EG tariffs

Technical impact of EG on network

EG can affect:

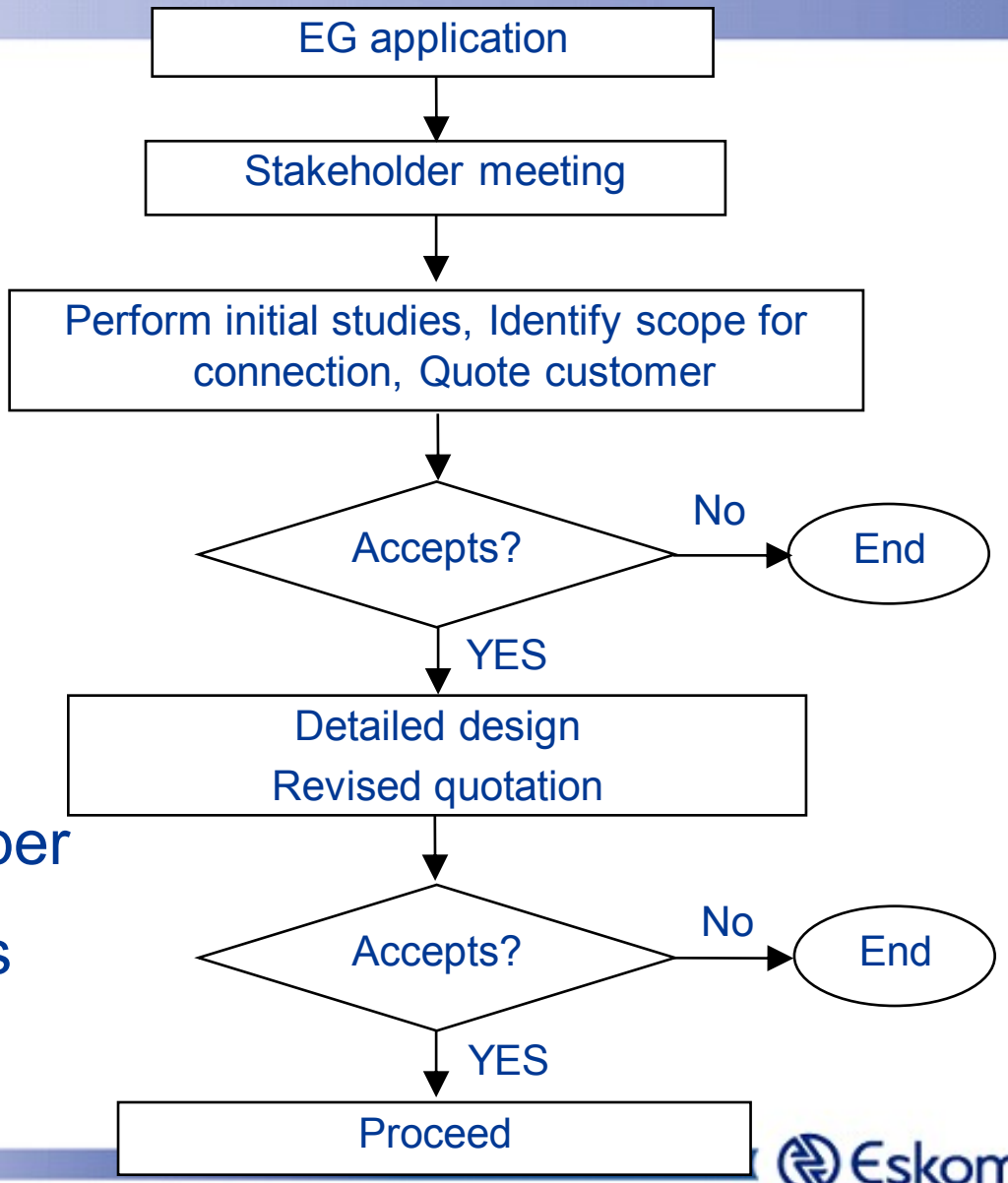
- Voltage rise
- Fault levels
- Thermal loadings
- Stability
- Protection
- Power quality

Planners need to check (preliminary studies):

- Conductor and transformer loadings
- Voltage levels
- Fault levels
- Technical losses

EG connection process

- EG Application
- Check size
- Comply with Codes
- Conduct site visits
- Do system studies
- Send quotes back to EG developer
- Feedback from EG developer
- Do detailed System studies
- Construction



Eskom strategy to support EG grid connection

- **Interconnection standard:**
  - Boundaries of Accountability
  - Embedded Generation Requirements
  - Network Connection Points
  - Synchronizing Requirements
  - Frequency Requirements
  - Network Interfacing
  - Protection, Metering, Tele-control , DC
- **Enabling agreements with consultants** (KEC c)

Eskom strategy to support EG grid connection

- **National planning resource focused on EG**
- **Network Planning EG working group**
- **Planning guidelines on the assessment of EG:**
  - Fundamental system studies (Dec 2008)
  - Examples on steady state studies (Dec 2008)
  - Advanced system studies (2009)
  - EG data (2009)

1. Fundamental System studies guideline

Develop a network planning guideline on:

- An overview of Embedded generation technologies
- Impact on the utility networks
- Describes the possible problems and mitigating options
- EG assessment process
- Provides guidance on the technical studies to be carried out to establish the feasibility and cost of connecting a proposed embedded generator.
- Explains the steps for modelling and connection of embedded generation to the distribution network.

2. Examples on steady state studies

Document explains

- A step and step guideline on modelling of EGs
- Application examples with case studies that demonstrate the theory and
- Application of the EG planning guideline (fundamental system studies).

3. Data for EG

- Develop a master type library that contains the generic generator information needed by planners in order to model embedded generators connections to the distribution network
- Develop models for EG in planning information systems such as Smallworld GIS
- Establish what data is required for future reference and where this data should be stored

4. Advanced system studies

Develop a network planning guideline on

- Advanced system studies
- Insulation coordination analysis
- Stability analysis of embedded generators connected to the distribution network.

Gaps and issues

- **Widespread integration of numerous small EG sources e.g. home PV systems (process and standards for connection, data management)**
- **Most Eskom's sub-transmission and distribution networks voltage limited and low fault levels (may introduce additional constraints and complexities)**
- **Operation and maintenance implications:**
  - EG implications on network operating and
  - Safety to be factored into existing policies and procedures.

Way forward

- Finalise and rollout EG connection planning guidelines
- Plan networks based on EG potential in South Africa
- Enhance guidelines to accommodate all renewable energy technologies
- Liaise with int'l organisations such as CIGRE, IEEE
- Conduct training for network planners

Conclusion

- EG presents Eskom with technical, planning and human resource challenges
- Eskom is meeting these challenges by developing standards and processes based on international practices with the aid of specialist consulting resources
- EG is an important component of the future generation mix and has the potential to materially contribute to the energy and capacity shortages experienced in South Africa

Thank you