EXECUTIVE EXCHANGE ON DEVELOPING AN ANCILLARY SERVICE MARKET

Overview of Mozambique Electricity Sector: Opportunities and Challenges
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- Electrification Developments
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  - New Connections; Electricity Access; Maximum Demand; Load Growth
- Priority Projects:
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  - Transmission
- Other Energy Resources
- Conclusion
Overview of Mozambique Electricity Sector

Key Players in the Electricity Sector Industry

- **Government of Mozambique/Ministry of Energy**: Police making and overall supervision of the electricity sector;

- **CNELEC/National Regulatory/advisory Board**

- **FUNAE**: Mainly involved with off-grid electrification

- **Electricidade de Moçambique (EDM)**: 100% owned by the State, with the responsibility to generate, transport, distribute and commercialize electricity throughout the country.

- **Hidroeléctrica de Cahora Bassa (HCB)**: an IPP owned by Moçambique Government (92.5%) and REN / Portugal (7.5%).

- **Moz Transmission Company (MOTRACO)**: an ITC, Owned by EDM, ESKOM and SEB, 33.33% each, responsible to supply electricity to MOZAL aluminium smelter in Moz and wheeling of power to EDM in Moz and SEC in Swaz.
Overview of Mozambique Electricity Sector

Electrical Infrastructure Vs Demand

- Large country: generation sources distant from load centers
- HCB is the main source of generation
- Power transmission is mainly ensured through three high voltage corridors
- Supply to Southern Region/Maputo via South Africa through an HVDC line
- Cahora Bassa power plant is the main source
Overview of Mozambique Electricity Sector

Electrification Development: Generation & Transmission

No NTG/RNT

All provincial capitals connected to the NTG/NRT

New power stations and new lines to be built as part of National Grid
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Electrification Developments: Areas Covered

2005: 55 Districts
2012: 110 Districts
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New connections and Customers

Average new connections per year in the last 5 years: 120 000
Overview of Mozambique Electricity Sector

Electricity Access

<table>
<thead>
<tr>
<th>Year</th>
<th>Access Rate</th>
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<tbody>
<tr>
<td>2005</td>
<td>8%</td>
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<td>2006</td>
<td>10%</td>
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<td>2007</td>
<td>12%</td>
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<td>2008</td>
<td>14%</td>
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<td>2009</td>
<td>16%</td>
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<td>2010</td>
<td>18%</td>
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<tr>
<td>2011</td>
<td>21%</td>
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<tr>
<td>2012</td>
<td>23%</td>
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Overview of Mozambique Electricity Sector

Maximum Demand (Excluding MOZAL) [MW]

The average load growth during the last 3 years was 80 MW per year
The average load growth is 14% being the highest in the SAPP Region (where the average is 3%).
Overview of Mozambique Electricity Sector

Generation Projects: Geographic location

- Cahora Bassa North (1245 MW)
- Mphanda Nkuwa (1500 MW)
- Moatize (2400 MW)
- Benga (2000 MW)
- Cahora Bassa North North (1245 MW)
- Mavuzi 2 & 3 (60 MW)
- Mavuzi 2 & 3 (60 MW)
- Massingir (25 MW)
- Kuvaninga (40 MW)
- Ressano Garcia (160 MW)
- Lúrio (180 MW)
- Alto-Malema (50 MW)
- Boroma (200 MW)
- Lupata (600 MW)
- Temane (50 MW)
- Gigawatt (200 MW)
- Aggerko (100 MW)
- CTM (100 MW)
# Overview of Mozambique Electricity Sector

## Generation Projects: Planned Commissioning date

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<td>Ressano Garcia</td>
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<td>Kuvaninga</td>
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<td>Red</td>
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<td>Mavuzi e Chicamba</td>
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<td>CTM (JICA)</td>
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<td>Moatize</td>
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<td>Mphanda Nkuwa</td>
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<td>HCB Norte</td>
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Comissioning date: Red = 2013, Blue = 2015, Black = 2017
Overview of Mozambique Electricity Sector

Mozambique Transmission Backbone

- Aims to evacuate the power to be generated in the Central/Tete Region, a Transmission Backbone is required.
- The system to be strong enough to evacuate around 9200 MW potential generation.
- The Backbone shall be implemented in a synchronized way with the generation projects.
Overview of Mozambique Electricity Sector

**Mozambique Transmission Backbone**

- **Phase 1** includes combined HVAC & HVDC solution

- HVAC solution with a 1,340 km 400 kV AC line for up to 900 MW continuous transfer and 50% series compensation of AC line

- HVDC solution (Phase 1) includes a 1,275 km ±500 kV DC bipolar transmission line and converter stations with 2,650 MW capacity

- Implementation of HVDC solution to comprise two stages:
  - **Stage 1**: ±500 kV DC line with 1,325 MW converter capacity (sufficient for realisation of Mphanda Nkuwa)
  - **Stage 2**: Additional 1,325 MW converter capacity
**Overview of Mozambique Electricity Sector**

Mozambique Transmission Backbone

<table>
<thead>
<tr>
<th>Summary CESUL Phase 1:</th>
<th>USD ('000)</th>
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<tbody>
<tr>
<td>400 kV 900 MW HVAC Transmission and ± 500 kV 2,650 MW HVDC Transmission</td>
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<tr>
<td>Total HVAC Phase 1</td>
<td>950 782</td>
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<tr>
<td>Total HVDC Stage 1 of Phase 1</td>
<td>848 663</td>
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<tr>
<td>Total HVAC + HVDC Stage 1 of Phase 1</td>
<td>1 799 445</td>
</tr>
<tr>
<td>Total HVDC Stage 2 of Phase 1</td>
<td>319 200</td>
</tr>
<tr>
<td>Total CESUL Phase 1 (incl. Owner’s Costs &amp; Physical Contingencies, but excl. Price Contingencies)</td>
<td>2 118 645</td>
</tr>
</tbody>
</table>
EDM coordinates next stage of STE development, in close cooperation with partners

Joint Development Agreement (JDA) to be concluded by April 2013

ESIA and Relocation Planning Framework (RPF) study finalised

ESIA approved obtain by MICOA

STE is now a legal entity (initially with EDM as 100% shareholder)

EDM, supported by World Bank, is preparing initial staffing plan for STE SPV, with dedicated resources
The Moatize coal basin in Tete province represents the world’s largest untapped coal reserve with an estimated resource of 6bn tonnes.

2 large scale projects already in operations (Vale and Rio Tinto);

Additional projects to come on line: Ncondezi, Jindal, Rio Tinto, Zambeze, Revuboe, etc

Most of the projects also include a power station at some stage

The coal proven reserves can produce more than 8 000 MW, base load power for 30 years
Overview of Mozambique Electricity Sector

Natural Resources: Natural Gas

- Temane gas fields in exploration since 2004 by Sasol;
- 27 MGJ are allocated for power generation in Mozambique;
- About 100 MGj is for export to South Africa;
- Currently, EDM, SASOL, Investec, Aggreko, Gigawatt and MGC are developing generation power projects;
- Around 350 MW will be installed until 2014 at Ressano Garcia/Maputo Province.
Overview of Mozambique Electricity Sector

Natural Resources: Natural Gas

- Additional gas reserves discovered in the Rovuma basin; First production expected for 2018/19.
- Such potential of natural gas identified is corresponding to 60 to 75 trillion cubit feet.
- The size of the natural gas discover will places Moz amongst the major exporters.
- Opportunity to develop medium to large scale power generation plants in the north of Mozambique (200 MW to 1000 MW) to serve the national economy and the SAPP region.
Energy Outlook for Mozambique

CONCLUSION

• Besides the progresses achieved so far adequate and massive electrical infrastructure is still required and fundamental to ensure continuos economic growth in Mozambique;

• The country has vast and largely untapped energy/mineral resources that can be used to sustain the economic growth;

• There are enormous opportunities but also challenges. Next 3 to 4 years could determine next 10 to 20 years;
MUITO OBRIGADO
Overview of Mozambique Electricity Sector

Mozambique Transmission Backbone

- HVAC operated at 400 kV (equipment designed for 550 kV) – 900 MW transfer capacity
- HVDC operated at ±500 kV – 2,650 MW transfer capacity, implemented in two stages, each with 1,325 MW converter capacity