The Southern African Power Pool

www.sapp.co.zw

By

Willem Theron
Eskom
GM Business Development, Southern Africa
CC Board Member
SAPP MANCO Member

2012
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6. SAPP LEARNINGS FROM SARI / ENERGY
1. INTRODUCTION TO THE SAPP

1.1 Geographic

- 12 Countries
- 250 Million people
- Average Electricity growth rate 3% p.a.

✓ For South Africa demand growth was 4.9% in 2007 and for whole region 4.6%.
1.2 Historic

1950s: DRC – Zambia
1 x 220kV, 210MW

1960s: Zambia – Zimbabwe
2 x 330kV, 1,400MW

1975: Mozambique – South Africa
500kV HVDC, 2,000MW
The two networks were linked by weak lines 220kV & 132kV via Botswana until 1995 when the 400kV was constructed.
The interconnection of the northern and southern networks created a platform for **regional trade and cooperation**.

In **1995**, the Ministers responsible for energy in the Southern African Development Community (SADC) signed an Inter-Government MOU that lead to the creation of a power pool under the name, **Southern African Power Pool (SAPP)**.
1.3 SAPP Creation and Aim

- The SAPP was created in **August 1995** through the signing of the Inter-Governmental MOU.

- The Aim was to **optimise** the use of available energy resources in the region and support one another during emergencies.
1.4 Governing Legal Documents

- **Inter-Governmental MOU**
  - Established SAPP
  - Signed by SADC Member Countries in 1995
  - Revised document signed on 23 February 2006

- **Inter-Utility MOU**
  - Established the Management of SAPP
  - Revised document signed on 25 April 2007

- **Agreement Between Operating Members**
  - Signed by Operating Members only.
  - Revised document was signed in April 2008

- **Operating Guidelines**
  - Under Review and to be finalized in 2012
The SAPP Vision is to:

- Facilitate the development of a **competitive** electricity market in the Southern African region.
- Give the end user a **choice** of electricity supply.
- Ensure that the Southern African region is the region of choice for **investment** by energy intensive users.
- Ensure sustainable energy developments through sound economic, environmental & social practices.
To promote her vision, the SAPP is

- Changing from a **co-operative pool** to a **competitive power market**.

- **Reviewing membership** to allow for more players.

- Expanding both **transmission & telecommunication links** between members.

- Expanding **generation capacity** and attract high intensive energy users.

- Enhancing **Human Capacity development and expansion**

A Coordination Centre was established in **Harare, Zimbabwe**, in February 2000.
# 1.6 Membership

<table>
<thead>
<tr>
<th>No</th>
<th>Full Name of Utility</th>
<th>Status</th>
<th>Abbreviation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Botswana Power Corporation</td>
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<td>BPC</td>
<td>Botswana</td>
</tr>
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<td>OP</td>
<td>EDM</td>
<td>Mozambique</td>
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<tr>
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<td>Hidro Electrica Cahora Bassa</td>
<td>OB</td>
<td>HCB</td>
<td>Mozambique</td>
</tr>
<tr>
<td>4</td>
<td>Mozambique Transmission Company</td>
<td>OB</td>
<td>MOTRACO</td>
<td>Mozambique</td>
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<tr>
<td>5</td>
<td>Electricity Supply Corporation of Malawi</td>
<td>NP</td>
<td>ESCOM</td>
<td>Malawi</td>
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<tr>
<td>6</td>
<td>Empresa Nacional de Electricidade</td>
<td>NP</td>
<td>ENE</td>
<td>Angola</td>
</tr>
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<td>7</td>
<td>ESKOM</td>
<td>OP</td>
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<td>LEC</td>
<td>Lesotho</td>
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<td>OP</td>
<td>Nam Power</td>
<td>Namibia</td>
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<td>Societe Nationale d’Electricite</td>
<td>OP</td>
<td>SNEL</td>
<td>DRC</td>
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<td>Swaziland Electricity Board</td>
<td>OP</td>
<td>SEB</td>
<td>Swaziland</td>
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<td>NP</td>
<td>TANESCO</td>
<td>Tanzania</td>
</tr>
<tr>
<td>13</td>
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<td>OP</td>
<td>ZESCO</td>
<td>Zambia</td>
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<td>Copperbelt Energy Corporation</td>
<td>ITC</td>
<td>CEC</td>
<td>Zambia</td>
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<td>15</td>
<td>Lunsemfwa Hydro Power Company</td>
<td>IPP</td>
<td>LHPC</td>
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<tr>
<td>16</td>
<td>Zimbabwe Electricity Supply Authority</td>
<td>OP</td>
<td>ZESA</td>
<td>Zimbabwe</td>
</tr>
</tbody>
</table>

**Legend:**
- **OP** = Operating Member
- **OB** = Observer
- **NP** = Non-Operating Member
- **IPP** = Independent Power Producer
- **ITC** = Independent Transmission Company

**Note:** CEC & LHPC (Zambia) are new Members of SAPP.
1.7 Funding of SAPP Activities

SAPP-CC activities are funded as follows:

1. **Annual Contribution** from all Members using an agreed formula defined in the IUMOU.

2. **Administration Fees** levied on Market participants.

3. **Projects are mostly funded by Donors:**
   - The Government of Norway (NORAD)
   - Sida (Sweden)
   - The World Bank
   - Development Bank of Southern Africa
   - Others such as USAID, DFID and DANIDA
1.8 Conclusion on SAPP Overview

- The SAPP was initially an Association of National Power Utilities residing in the SADC region.

- SAPP Membership has now been extended to include all the eligible Electricity Enterprises residing in the SADC region.

- Electricity Enterprises outside of the SADC region have to be approved by the SADC Energy Ministers.

- Participation in energy trading is open to all SAPP Members and Observers residing in the SADC region.
2. SAPP MANAGEMENT, GOVERNANCE & REPORTING STRUCTURE

- The management & governance of SAPP is described in the Inter-Utility Memorandum of Understanding.

![Diagram]

- SADC-DIS
  - Executive Committee
    - Management Committee
      - Planning Sub-Committee
      - Operating Sub-Committee
      - Coordination Centre Board
      - Environmental Sub-Committee
      - Markets Sub-Committee
      - Coordination Centre
2.2 SAPP Management & Governance

- The SADC Government Ministers and Officials are responsible for policy matters normally under their control within the national administrative and legislative mechanisms regulating the relations between the Government and the national power utility.

- The chief executives of the members and a representative from the SADC Secretariat form the Executive Committee.
  - The Executive Committee will refer matters such as requests for membership by non-SADC countries and major policy issues that may arise to the SADC Energy Ministers.
  - A country with more than one utility would need to designate one utility to represent it on the Executive Committee.
2.2 SAPP Management & Governance

The **Management Committee** oversees and decides on the recommendations of the Sub-Committees and the Coordination Centre Board.

The **Operating Sub-Committee** consists of representatives from those power utilities already interconnected and exchanging power on a major scale (**Operating Members**):

- Presently Botswana, South Africa, Zambia, Zimbabwe, Democratic Republic of Congo, Lesotho, Mozambique, Namibia and Swaziland.

The duties of the Committee i.a. include the establishment and updating of methods and standards to measure technical performance, operating procedures including operating reserve obligations.
2.2 SAPP Management & Governance

The Planning Sub-Committee establishes and updates:

- Common planning and reliability standards
- Review integrated generation and transmission plans
- Evaluate software and other planning tools
- Determine transfer capability between systems etc.

The Environmental Sub-Committee:

- Develops Environmental Guidelines for SAPP
- Liaise with Governments to keep abreast of world and regional matters relating to air quality, water quality, land use and other environmental issues.
- Where Governments have in place related Environmental Organisations, the Committee has to liaise with them to assist one another on specific issues.
2.2 SAPP Management & Governance

- The Markets Sub-Committee shall i.a. contribute to the design and continued development of the electricity market in the region and determine criteria to authorise this trade.

- The Coordination Centre reports to a Co-ordination Centre Board consisting of a maximum of two representatives of each National Power Utility (i.e. the signatories of the IUMOU).

**Note**: All Sub-Committees consists of a maximum of two representatives per Member who are of sufficient seniority in their own organisation to make all relevant decisions.
2.3 SAPP Reporting Structure

- Council
- Integrated Council of Ministers
- Committee of Senior Government Officers
- SADC Directorate of Infrastructure and Services
- SAPP
3. SAPP TRADING ARRANGEMENTS

3.1 Rational for Power Trading

- **Three technical building blocks that provide opportunities for Energy Trading in the SAPP**
  - Good generation mix
  - Good Transmission Interconnection
  - Some utilities have excess generation capacities, others are in deficit

- **In addition there is good**
  - Political support through SADC
  - Regulatory support through RERA
3.2 Generation Mix & Contributions – Year 2009

- 74.3% Coal
- 20.1% Hydro
- 4.0% Nuclear
- 1.6% Gas/Diesel

- 80.4% South Africa
- 5.0% Mozambique
- 4.1% Zimbabwe
- 3.6% Zambia
- 2.6% DRC
- 4.4% Rest
### Some Members are in Excess and others in Deficit

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<td>287</td>
<td>-</td>
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<td>59</td>
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<td>41,074</td>
<td>3,096</td>
<td>36,664</td>
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<td>9</td>
<td>Swaziland</td>
<td>SEC</td>
<td>70</td>
<td>70</td>
<td>-</td>
<td>200</td>
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<td>128</td>
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<td>1,215</td>
<td>597</td>
<td>1,660</td>
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<td>12</td>
<td>Zimbabwe</td>
<td>ZESA</td>
<td>2,045</td>
<td>1,320</td>
<td>725</td>
<td>2,029</td>
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<td>TOTAL SAPP</td>
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<td></td>
<td></td>
<td></td>
<td>45,557</td>
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<td>(327)</td>
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<tr>
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<td>Total Interconnected SAPP</td>
<td></td>
<td>55,996</td>
<td>49,877</td>
<td>6,119</td>
<td>50,204</td>
<td></td>
<td>(214)</td>
</tr>
</tbody>
</table>

**Potential Buyers**

**Potential Sellers**

Managed to meet peak due to Load Management Programs
3.3 SAPP Trading Markets

**EARLY YEARS**
- Bilateral contracts

**CURRENT AND FUTURE**
- Bilateral contracts
- Day-Ahead Market (DAM) – From 2009
- Energy Imbalance Settlement – From 2010
- Ancillary Services Market – From 2013/14
- Balancing Market – From 2014
- Financial Markets – From 2014/15

**FROM YEAR 2001**
- Bilateral contracts
- Short-Term Energy Market (STEM) - 2001
- Post STEM (Balancing Market) - 2002
3.4 Bilateral Market

- The bulk of cross border trading in electricity is governed by fixed co-operative bilateral contracts.

- Generally cover a period from 1-5 five years, could be longer.

- The agreements provide for assurance of security of supply but are not flexible to accommodate varying demand profiles and prices.

- The pricing of electricity depends on the consumption period; Peak, Standard and off-peak.

- Essential for financing of new generation & transmission projects.

- Price: Negotiated between willing buyer & seller.
2008 Bilateral Contracts in SAPP

- HCB-EdM: 270 MW
- Eskom-MOZAL: 950 MW
- EdM-SEC: 40 MW
- EdM-NamPower: 40 MW
- EdM-BPC: 45 MW
- ZESA-NamPower: 40 MW
- SNEL-Eskom: 150 MW
- SNEL-ZESA: 100 MW
- HCB-Eskom: 1370 MW
- HCB-ZESA: 250 MW
- Eskom-LEC: 100 MW
- Eskom-EdM: 120 MW
- Eskom-NamPower: 200 MW
- Eskom-BPC: 210 MW
- Eskom-SEC: 96 MW

Capacity [MW]
3.5 Short-Term Energy Market

3.5.1 STEM Governance

The SAPP documents that govern the STEM are:

- Legal Agreement
- STEM Book of Rules:
  - Trading Rules
  - Financial Rules

3.5.2 Participation

- Participation was open to all Operating Members and IPPs.
- Participants were levied a 1% administration fee.
3.5.3 STEM Design Principles

**Pricing of STEM Contracts**
- Participants would send bids and offers to the SAPP-CC.
- SAPP-CC would match bids and offers.
- The prices were set based on matching sellers price.
- Once matched these became firm STEM contracts

**Billing**
- The SAPP-CC billed participants on a daily basis.
- Billing was on schedules and not on actuals.

**Metering and settlement**
- Financial settlement was on a monthly basis.
- Penalties indicated where applicable.
- Inadvertent EM was part of the overall settlement.
3.5.5 STEM Trading - Summary

![Bar chart showing STEM trading summary for 2005-2007.](chart)

- **Supply**
- **Demand**
- **Energy Traded**

<table>
<thead>
<tr>
<th>Year</th>
<th>GWh</th>
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<tr>
<td>2005</td>
<td>4000</td>
</tr>
<tr>
<td>2006</td>
<td>1000</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
</tr>
</tbody>
</table>

![Bar chart showing energy traded and monetary value for 2005-2007.](chart)

- **Energy Traded [GWh]**
- **Monetary Value [US$\times1000]**

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy Traded</th>
<th>Monetary Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>3500</td>
<td>2000</td>
</tr>
<tr>
<td>2006</td>
<td>3000</td>
<td>3500</td>
</tr>
<tr>
<td>2007</td>
<td>500</td>
<td>1000</td>
</tr>
</tbody>
</table>
3.6 The Day-ahead Market (DAM)

3.6.1 DAM Goals and Methodology

**GOALS of the SAPP DAM design:**
- Ensure an **efficient** and **competitive** marketplace
- Ensure that **consumers** benefit from the market

**METHODOLOGY:**
- Development of **consistent** market mechanisms.
- Efficient **price signals** for the procurement and transmission of electricity.
- Assurance of **fair** and **open access** to the transmission system.
- **Optimization** of generation & transmission capacity.
3.6.2 DAM Main Features

- **Market for secure, effective and non-discriminatory trade of electricity:**
  - Trading to be concluded daily for delivery next day
  - Forward bidding up to 10 days
  - Participants submit bids (purchase) & (sale) offers
  - Closed market – only market operator and participant know the details of the bid / offer

- **Provides a neutral reference price**
  - Price discovery
  - Could provide reference for bilateral contracts
3.7 Conclusion on SAPP Markets

Electricity Markets are a reality world wide. The SAPP believes that the creation of a competitive market would:

- Help to **optimise** the use of regional resources
- Assist in determining the correct electricity price in the pool
- Send signals for **investments** and real time utilization of existing assets; transmission, generation and consumption.
- Enable the demand side to respond to the supply side price signals.
- **Market Oversight is key to market confidence**
  - Requires efficient & transparent Market Surveillance
The Challenges experienced by SAPP at start of the pool:

- **Language of communication**
  - Local languages
  - Foreign languages - English, French and Portuguese

- **Dispute resolution**
  - How will disputes be resolved?
  - Who will be the referee?

- **Harmonisation Issues**
  - Different legal frameworks
  - Different technical standards
4.2 Operational Challenges

The SAPP is faced with the following operational challenges:

a. The migration from a cooperative pool to a competitive pool.

b. The implementation of a competitive market at a time that the region has run out of generation surplus capacity.

c. The provision of a reliable power supply in an environment with diminished generation surplus capacity and low tariffs.

d. The implementation of cost reflective tariffs and the adoption of regulatory principles that would enhance those tariffs.

e. Skills development and retention of trained personnel.
4.3. Other Challenges

- Reducing Green House Gas Emissions

  - SAPP’s energy mix, 70% coal fired vs. 30% others
  - Increasing Renewable Energy Projects in a situation where tariffs are largely not cost reflective
  - Different levels in implementing Environmental protection legislation in different countries
The main challenges faced in Trading include:

a. **Low Number of Market Participants**
   - The number of active participants on the DAM for most months is around four (4). This is not good enough to achieve competition.

b. **Transmission constraints**
   - Transmission constraints are response for low volumes traded on the market when compared to bids received. Energy matched could not go through in some cases due to transmission constraints.

c. **Mismatch of prices between buyers and sellers**
   - This also affects bids that are eventually matched
END OF 1-4
5. SAPP Project Prioritization Criteria
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1. INTRODUCTION
2. CLASSIFICATION OF GENERATION PROJECTS
3. CLASSIFICATION OF TRANSMISSION PROJECTS
4. PROJECT SELECTION CRITERIA
5. PRIORITY TRANSMISSION PROJECTS
6. COMMITTED GENERATION PROJECTS
7. CONCLUSION
1. INTRODUCTION

- On 20 October 2011, the SAPP Executive Committee agreed to:
  - Develop a prioritisation and selection criteria for projects in the SAPP.
  - Promote the projects so selected by the criteria to investors.
- The SAPP Executive Committee to deliberate on the way forward on the priority projects
2. Classification of Generation Projects

The following categories for generation projects were agreed to by the Management Committee:

i. Generation projects with secured funding: The inclusion was to illustrate SAPP commitment.

ii. Rehabilitation projects: It was agreed to define rehabilitation and to differentiate from expansion projects.

iii. Short-term generation projects: These projects should have completed EIA and feasibility studies.

iv. Long-term generation projects: Covers the period from 2016 onwards.
3. Classification of Transmission Projects

For transmission projects, the following categories were agreed to:

i. Outstanding transmission interconnectors whose aim is to *interconnect non-operating members* of the SAPP, SAPP priority Interconnectors.

ii. Transmission interconnectors aimed at *relieving congestion* on the SAPP grid, and

iii. New transmission interconnectors aimed to *evacuate power from generating stations* to the load centres.
The proposed criteria for generation projects had 8 primary key aspects as follows:

1. Size of the project
2. Levelised costs
3. Transmission integration
4. Economic impact
5. Project time domain
6. Percentage off-take committed
7. Regional contribution as a percent of project capacity
8. Number of participating countries
KEY FACTORS

1. Fuel diversity
2. Geographical spread of Projects
3. Regional Impact
4. Project Readiness
Projects Screening and Evaluation

- Listing of Generation Projects Capacity > 1000 MW
- Listing of Generation Projects Capacity < 1000 MW
- Projects with a score more than 50% included in priority list
<table>
<thead>
<tr>
<th>Item No</th>
<th>Key Aspects</th>
<th>Weight %</th>
<th>1 Weak</th>
<th>2 Below Standard</th>
<th>3 Standard</th>
<th>4 Above Standard</th>
<th>5 Best</th>
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<td>1</td>
<td>Size of Project, MW</td>
<td>15</td>
<td>&lt;50</td>
<td>50-200</td>
<td>200-500</td>
<td>500-1000</td>
<td>&gt;1000</td>
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<td>2</td>
<td>Levelised costs in Country (Including Transmission Lines), USD/MWh</td>
<td>25</td>
<td>&gt;=131</td>
<td>101-130</td>
<td>71-100</td>
<td>41-70</td>
<td>&lt;=40</td>
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<td>3</td>
<td>Transmission integration aspects/stability/technology</td>
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<td>&gt;750km</td>
<td>101-750km</td>
<td>50-100 km</td>
<td>&lt;50km</td>
<td></td>
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<tr>
<td>4</td>
<td>Economic impact</td>
<td>10</td>
<td></td>
<td>Little impact, limited to small area</td>
<td>National impact only - jobs, &gt;GDP</td>
<td>Mainly national impact - jobs, &gt;GDP and some</td>
<td>Balance between regional and national impact</td>
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<tr>
<td>5</td>
<td>Project Time domain (Commissioning date)</td>
<td>10</td>
<td></td>
<td>After 2019</td>
<td>2018</td>
<td>2017</td>
<td>2016</td>
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<td>6</td>
<td>Percentage off-take committed</td>
<td>10</td>
<td>&lt;20</td>
<td>21-35</td>
<td>36-50</td>
<td>51-80</td>
<td>&gt;80</td>
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<td>7</td>
<td>Regional contribution as a % of project replacement</td>
<td>15</td>
<td>&lt;20</td>
<td>21-35</td>
<td>36-50</td>
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<td>&gt;80</td>
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<td>participating member countries</td>
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</table>

**SOUTHERN AFRICAN POWER POOL**
5. PRIORITY TRANSMISSION PROJECTS

- **Category A: Transmission Projects to Interconnect Non Operating Members**
  1. Zambia – Tanzania
  2. Mozambique - Malawi
  3. Namibia - Angola
  4. DRC – Angola

- **Category B: Transmission Project to alleviate Congestion**
  1. **ZIZABONA** (Zimbabwe- Zambia- Botswana - Namibia)
  2. Central Transmission Corridor (CTC) (Zimbabwe)
  3. Kafue Livingstone Upgrade (Zambia)
5. PRIORITY TRANSMISSION PROJECTS

- **Category C**: Transmission Project related to new Generation projects
  - 1. Mozambique Transmission Backbone – CESUL

  **Other Candidate Transmission Projects**
  a) Second Mozambique – Zimbabwe Interconnector
  b) Second Zimbabwe – RSA Interconnector
  c) Second DRC – Zambia Interconnector (Kolwezi – Solwezi)
## 6. COMMITTED GENERATION PROJECTS [2012-2016]

<table>
<thead>
<tr>
<th>No</th>
<th>Country</th>
<th>Committed Generation Capacity, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2012</td>
</tr>
<tr>
<td>1</td>
<td>Angola</td>
<td>315</td>
</tr>
<tr>
<td>2</td>
<td>Botswana</td>
<td>600</td>
</tr>
<tr>
<td>3</td>
<td>DRC</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Lesotho</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Malawi</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Mozambique</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>Namibia</td>
<td>92</td>
</tr>
<tr>
<td>8</td>
<td>South Africa</td>
<td>303</td>
</tr>
<tr>
<td>9</td>
<td>Swaziland</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Tanzania</td>
<td>160</td>
</tr>
<tr>
<td>11</td>
<td>Zambia</td>
<td>236</td>
</tr>
<tr>
<td>12</td>
<td>Zimbabwe</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>1956</td>
</tr>
</tbody>
</table>

**Note:** Projects under construction or with secured funding.
### PERIOD: 2012 TO 2016

<table>
<thead>
<tr>
<th>No</th>
<th>Country</th>
<th>Total Planned Capacity, MW</th>
<th>% Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Angola</td>
<td>1,095</td>
<td>7.6%</td>
</tr>
<tr>
<td>2</td>
<td>Botswana</td>
<td>900</td>
<td>6.2%</td>
</tr>
<tr>
<td>3</td>
<td>DRC</td>
<td>708</td>
<td>4.9%</td>
</tr>
<tr>
<td>4</td>
<td>Lesotho</td>
<td>175</td>
<td>1.2%</td>
</tr>
<tr>
<td>5</td>
<td>Malawi</td>
<td>64</td>
<td>0.4%</td>
</tr>
<tr>
<td>6</td>
<td>Mozambique</td>
<td>665</td>
<td>4.6%</td>
</tr>
<tr>
<td>7</td>
<td>Namibia</td>
<td>152</td>
<td>1.1%</td>
</tr>
<tr>
<td>8</td>
<td>RSA</td>
<td>8,382</td>
<td>58.0%</td>
</tr>
<tr>
<td>9</td>
<td>Swaziland</td>
<td>-</td>
<td>0.0%</td>
</tr>
<tr>
<td>10</td>
<td>Tanzania</td>
<td>160</td>
<td>1.1%</td>
</tr>
<tr>
<td>11</td>
<td>Zambia</td>
<td>1,671</td>
<td>11.6%</td>
</tr>
<tr>
<td>12</td>
<td>Zimbabwe</td>
<td>470</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>14,442</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
CONCLUSION

➤ SAPP has agreed on the Priority Projects and has endorsed them.

➤ The SAPP has drafted an MOU to be signed by the SADC Energy Ministers approving the priority projects.

➤ The Priority Projects will be marketed by SADC as regional projects.
END OF 5
6. SAPP LEARNINGS FROM SARI / ENERGY
HANDLING OF IMBALANCE ENERGY IN THE SAPP

Following my participation in the 2009 SARI / Energy program in NEPAL
1. **INTRODUCTION**

- **Imbalance Energy (IE) at the point of interconnection** is defined as:

  \[ IE = NI_A - NAS \]

  **Where**

  - \( IE \) is Imbalance Energy in MW
  - \( NI_A \) is the **Actual** Net Interchange in MW
  - \( NAS \) is the **Scheduled** Net Interchange in MW
2. CLASSIFICATION OF IMBALANCES

SAPP has agreed to classify the Imbalance Energy into 3 categories as follows:

i. Inadvertent Energy

ii. Declared Emergency Energy

iii. Other Energy Imbalance
3. **INADVERTENT ENERGY**

- *Inadvertent Energy is that imbalance within a tolerance band of +/−25MW*

- *This imbalance shall be settled in kind by the three Control Areas (Eskom, ZESA and ZESCO)*
4. DECLARED EMERGENCY

- Utility emergency energy rates will be used to compensate the supplier unless otherwise specified in bilateral agreements.

- Utility emergency energy rates are to be declared on a monthly basis by each Operating Member.

- The SAPP-CC has the responsibility to verify the rates.
5. OTHER ENERGY IMBALANCE

<table>
<thead>
<tr>
<th>Block</th>
<th>System frequency range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$f &lt; 49.85\ \text{Hz}$</td>
</tr>
<tr>
<td>B</td>
<td>$49.85 \leq f &lt; 49.95\ \text{Hz}$</td>
</tr>
<tr>
<td>C</td>
<td>$49.95 \leq f &lt; 50.05\ \text{Hz}$</td>
</tr>
<tr>
<td>D</td>
<td>$50.05 \leq f &lt; 50.15\ \text{Hz}$</td>
</tr>
<tr>
<td>E</td>
<td>$f \geq 50.15\ \text{Hz}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Block</th>
<th>Imbalance Energy Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pool highest generation cost</td>
</tr>
<tr>
<td>C</td>
<td>Pool average generation cost</td>
</tr>
<tr>
<td>E</td>
<td>Zero (0)</td>
</tr>
</tbody>
</table>
The aggregated SAPP system marginal generation production cost per MWh, as defined in the ABOM, shall be used as the rate for block C.

The rate shall be calculated for two seasons: winter and summer.

For each season, different rates shall apply for peak, standard and off-peak.
**BLOCK-A**
SAPP system most expensive generation cost per MWh [currently the OCGT] shall be used as the rate for block A.

**BLOCK- B and D**
These shall be *linearly* calculated as shown.

**BLOCK-E**
✓ This shall attract zero-rate.
✓ No payment shall be made to the party causing frequency to rise.
**BLOCK-A**

SAPP system **most expensive generation cost per MWh** [currently the OCGT] shall be used as the rate for block A.

**BLOCK- B and D**

These shall be **linearly calculated as shown**.

**BLOCK-E**

- This shall attract **zero-rate**.
- No payment shall be made to the party causing frequency to rise.
6. **CONCLUSION**

- **SAPP has implemented the methodology from 1 April 2009 onwards.**

- **The methodology is subject to review quarterly.**

- **SAPP-CC has been given mandate to:**
  - Monitor and receive data on daily basis
  - Run the model *monthly*
  - Prepare and send *invoices* to the 3-CAs
  - Make settlements
WE SAY
THANK YOU