Electricity trading in regional markets

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Tashkent
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INTRODUCTION TO SAPP

SAPP Key Facts

- 12 SADC Member Countries
- 16 SAPP Members
- 280 Million people
- Installed Generation Capacity 62 GW
- Available Generation Capacity 47 GW
- Planned Generation 2015-19 is 23,585 MW
- Peak Demand - 55 GW
- Consumption - 400TWh
- 22 HV interconnections (29 single circuits)
- 9 (out of 12) countries interconnected
- 5.2 TWh of exports for the member states from April 2013 to March 2014 (3.6% of energy consumed in the Power Pool)
- The cumulative transfer capacity amounts to 7000 MW
INTRODUCTION TO SAPP

SAPP system structure

Unlike other power pools in Africa, SAPP is mostly physically integrated.

Originally, there was a Southern part, former South African Union, where ESKOM was the main utility, while the Northern part relied mostly on Congo DR hydro generation.
Cross Border Links and Available Transmission Capacity
Capacity and generation mix

SAPP Installed Generation Capacity - April 2018
- Coal, 62.05%
- Solar PV, 2.94%
- Landfill, 0.03%
- Wind, 4.03%
- Solar CSP, 0.97%
- Nuclear, 3.01%
- OCGT, 1.51%
- Distillate, 4.38%
- Biomass, 0.07%
- Hydro, 21.02%

- Coal, 36%
- Hydro, 26%
- Gas, 10%
- Wind, 10%
- Solar, 7%
- Biomass, 1%
- Diesel, 1%

GENERATION MIX FOR 2017 COMMISSIONED PLANTS
- Hydro, 38.5%
- Coal, 23.5%
- Gas, 22.3%
- Solar, 15.6%
- Diesel, 0.2%
SAPP main objectives

SAPP was created in 1995 with the following Objectives:

• To cooperate and coordinate in the planning and operation of the electricity business in SADC

• Facilitate cross border electricity trading in SADC

• Promote regional cooperation in power projects development (Generation and Transmission Infrastructure Development) – economies of scale

• Increase Access to Electricity in Rural Areas

• Ensure that the region Attracts Investment for large energy intensive electricity users (attractive tariff)
One of the main objectives of SAPP is to facilitate Electricity Trading among the SADC Member Countries.

In light of this, SAPP’s vision has been crafted as follows:

- “To Facilitate the development of a competitive electricity market in the Southern African region.”
- A “learn as you go” approach was adopted
- The SAPP Coordination Centre is the Market Operator for the SAPP Competitive Markets
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SAPP MARKET DEVELOPMENT

Evolution

INITIALLY

- Bilateral contracts

CURRENT PHASE

- Bilateral contracts
- Day-ahead Market (DAM)
- Forward Physical Market s (MA &WA)
- Intra Day Market
- Balancing Market – under development
- Financial Markets – under development

FIRST PHASE

- Bilateral contracts
- Short-Term Energy Market (STEM) - 2001
- Post STEM (Balancing Market) – 2002
- Day-ahead Market (DAM) – 2009
- Post Day Ahead Market (PDAM) - 2013
Conditions to trade in the SAPP - MTP

Participants can only trade directly on the SAPP market upon:

• Having been licensed or given permission by the host country to undertake cross border trading
• Acceptance as a Market Participant by SAPP Executive Committee
• Being party to a TSO connected to a SAPP Control Area and have arrangements for Balance Responsibility
• Signing the SAPP Market governance documents
• Have arrangements for Balance Responsibility
• Have at least two trained Traders
Bilateral trading in SAPP – Key Features

• Trading arrangements mutually agreed between bilateral parties
  – Volumes and Prices are the key parameters
  – Transmission path to be secured in advance
  – Bilateral parties directly invoice and settle each other

• Can be firm or non firm
  – Firm contracts; Generally not interruptible – hence there is reliability premium
  – Non firm contracts; Are interruptible with notice. If notice given, no penalties
Forward physical market – Monthly (FPM-M)

• Base load product – market result will have same volume & price for all hours in a month

• Off Peak (same volume & price for all off peak hours) and Non Off Peak (same volume & price for all non off peak hours in a month)
  – Above products cannot overlap in a given month i.e either select Base load or Off Peak and Non Off Peak in a single month
  – Bids can have different volumes for different prices as is the case in DAM
  – SAPP decided to start with Off Peak and Non Off peak products
Forward physical market – Weekly (FPM-W)

1. **Off Peak product** – market result will have same volume & price for all off peak hours in a week

2. **Standard product** – market result will have same volume & price for all off peak hours in a week

3. **Peak product** – market result will have same
   - Bids for above products will be entered independently
   - Trading in FPM-W will be done on a Thursday every week
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
  - Price discovery
- Provides a neutral reference price
  - Open and competitive market
  - Provides platform to manage demand & supply fluctuations
  - Gives price signals to policy makers
  - Stable & Liquid market will give investor confidence
Intra Day Market (IDM) Principles

- IDM is a continuous market, and trading takes place 24/7 every day until [one hour] before delivery
- Trading is based on a first-come, first-served principle
- The orders are either matched automatically by the system on price or a buyer / seller can accept and “hit” an order in the market
- Participants will only see counter party orders which have an available transmission path
- An open order can be traded at any time without any further confirmation
Objectives of SAPP Trading Portfolios

1. Bilateral Trading Objectives are mainly
   – To meet long term demand and supply balance
   – To underpin Generation and Transmission Investments

2. Month and Week Ahead Markets
   – To meet short term demand and supply balance

3. DAM & IDM Trading Objectives are mainly
   – To optimize supply & demand portfolios in a bid to minimize cost of supply and maximize participants profits
   – Assists in managing load and generation fluctuations

Bilateral and competitive markets (DAM, FPM & IDM) trading complement each other and are not meant to compete against each other
All Transmission equipment used for wheeling is identified in Country C.
Transmission Pricing in the SAPP

Transmission Pricing in SAPP went through the following stages:

• At inception a Postage Stamp Approach was used
  – 7.5% of energy costs for one wheeler and
  – 15% of energy costs for more than one wheeler
• The MW-KM Approach adopted from 2003
  – All assets that wheel at least 1 MW are identified on the wheeler’s network and are compensated in proportion to the level of usage
  – This was developed and implemented from 2003
• Transit Key Usage methodology
  – Developed but not implemented
• Nodal pricing methodology
  – Developed and is going through trials
Transmission Capacity Allocation

SAPP agreed to the following Transmission Capacity Allocation Criteria:

• On the Trading Day, Firm Transactions (from bilateral and competitive markets) will be given priority ahead of Non Firm Transactions

• On the Delivery Day, Emergency Energy transactions will be given priority ahead of all trades (bilateral contracts & competitive markets trades)

• On the Delivery Day, Non Firm bilateral transactions will be given priority ahead of IDM

• Transmission capacity created through flows of earlier markets (counter flows) will be utilized in the calculation of Available Transmission Capacity (ATC) on the Trading Day for each of the markets
SAPP Trade Areas & Interconnections

SAPP Area Model

- dash line: Power line for open for DAM
- d bang line: Power line not built
- dash dash dot: Eskom internal power line
- Inter-control Area Interconnectors

Diagram showing various power entities and their interconnections.

Key entities include:
- ANG ENE
- ZAMZ ZESCO
- DRC SNE
- TAN Tanesco
- MAL ESCOM
- MOZN EDM
- MOZN HCB
- NAM NamPower
- ZIM ZESA
- ZIMA
- BOT BPC
- RSAN Eskom
- MOZS EDM
- SWA SEC
- LES LEC
Ancillary Services Provision

- Reactive power/voltage control
- Instantaneous reserves
- 10-minute reserves
- Regulation reserve

- Frequency control services
- Black start
Handling of Energy Imbalances

• Current charges are Pool Average Generation cost (Block C), Highest Gen. cost (Block A) and Zero (Block E).

• Above costs are currently based on generic price data.

• SAPP is reviewing the energy imbalance charges prices in order to link them to market prices.

<table>
<thead>
<tr>
<th>Block</th>
<th>Imbalance Energy Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2x Block C prices</td>
</tr>
<tr>
<td>C</td>
<td>DAM MCP (max. daily ave. MCP)</td>
</tr>
<tr>
<td>E</td>
<td>Zero (0)</td>
</tr>
</tbody>
</table>

![Chart showing energy imbalance rates and corresponding blocks.](chart.png)
Handling Outages and Non Delivery

Financial Settlement of all SAPP-MTP Physical Markets (FPM-M, FPM-W, DAM, IDM) – All confirmed trades on the SAPP-MTP shall be firm contracts and shall be settled on scheduled volumes and prices and not on actual flows

• Any deviation between scheduled and actual volumes are handled through the SAPP imbalance settlement procedure

• This rule shall apply for imbalances caused by non-delivery of a generator, non-consumption from a buyer, as well as non-performance by a wheeler

• During emergency situations, communication between players is key in a market environment

• Trade cancellations or revisions are done if both seller and buyer did not deliver and receive power
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SAPP Governing Documents

• Inter-Governmental MOU
  – Established SAPP.
  – Signed by SADC Member Countries in 1995
  – Revised document signed on 23 February
• Inter-Utility MOU
  – Established the Management of SAPP
  – Revised document signed on 25 April 2007
• Agreement Between Operating Members
  – Signed by Operating Members
  – Revised document signed May 2008
• Operating Guidelines
  – Reviewed and approved in 2014
• Market Guidelines (New in the SAPP Hierarchy)
  – Developed and approved in 2014
Governance structure

SADC

Executive Committee

Management Committee

RERA

Planning Sub-Committee

Operating Sub-Committee

Coordination Centre Board

Coordination Centre

Environmental Sub-Committee

Markets Sub-Committee
SAPP Governing Institutions

• SAPP’s organization includes an Executive Committee and a Management Committee that can make decisions on the “Agreement between Operating Members” and on the “Operating Guidelines”.

• The chief executives of the various members and a representative from the SADC Secretariat form the Executive Committee.
  – The Executive Committee refers matters such as requests for membership by non-SADC countries and major policy issues that may arise from SADC Energy Ministers.
  – A country with more than one utility needs to designate one utility to represent it on the Executive Committee.

• The Coordination Centre is the market operator and was established in Harare, Zimbabwe, in February 2000.
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Rational for Power Trading in SAPP

• Three technical building blocks that provide opportunities for Energy Trading in the SAPP
  – Varied generation mix
  – Transmission Interconnection
  – Some utilities have excess generation…
  – …others are in deficit

• In addition there is good:
  – Political support through SADC
New installed capacity (MW)
Thermal Capacity vs Effective Capacity of some Critical Lines

<table>
<thead>
<tr>
<th>Line</th>
<th>Connecting</th>
<th>Thermal limit MW</th>
<th>Voltage limit MW</th>
<th>Stability Limit MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Songo-Bindura</td>
<td>HBC-ZESA</td>
<td>700</td>
<td>230</td>
<td>200</td>
</tr>
<tr>
<td>Insukamini - Phokoje</td>
<td>ZESA-BPC</td>
<td>700</td>
<td>230</td>
<td>200</td>
</tr>
<tr>
<td>Kariba South - Insukamini</td>
<td>ZESA</td>
<td>700</td>
<td>230</td>
<td>200</td>
</tr>
<tr>
<td>Phokoje - Matimba</td>
<td>HBC-ESKOM</td>
<td>650</td>
<td>200</td>
<td>190</td>
</tr>
</tbody>
</table>
Traded Energy – Total and Bilateral (GWh)

![Graph showing traded energy total and bilateral from 2012/2013 to 2017/2018]
Energy traded on competitive markets (GWh)
Energy traded in each market as a share of total market (2017/2018)
Energy Matched and Energy Traded (MWh)

Period: 2015/2016
- Energy Matched (MWh): 1,291,150.2
- Energy Traded (MWh): 1,059,154.8

Period: 2016/2017
- Energy Matched (MWh): 2,779,772.7
- Energy Traded (MWh): 1,023,056.0
Average DAM prices (US cents/kWh)
Key Achievements of SAPP

SAPP achievements in the area of electricity trading are:

- Governance documents revised to accommodate other players in the SAPP and to allow for the creation of a competitive market
- Developed its own trading platform for the competitive markets (FPM, DAM, IDM) – First of its kind in Africa
- Developed a mechanism to handle energy imbalances
- Provides a learning curve for other regional electricity markets
- Minimized the impact of load shedding as a result of trading
- Provides trading opportunities that incentivize investment in generation and transmission in the region, also taking advantage of the synergies between generation mix potentials in different countries.
- Allowed variable costs reduction. The large volume of matched but not traded energy during some years suggests important further potential savings.
Trading Challenges

- **Member Country Market Models** – dominated by single buyer model – a more closed or limited market
- **Lack of generation capacity** - This pushed prices up in 2014-2016
- **Mismatch between buying and selling profiles** - Sellers want to sell off peak; buyers need power during standard and peak periods
- **Transmission Constraints** - On some corridors, existing contracts are more than double the available transmission capacities
KEY LESSONS

• Political support is a necessary condition
  – Critical especially with sovereign countries like in the SAPP. Inter-governmental agreements gave positive support to the launching of the SAPP. But the extent to which this support still exists is unclear, at least in some of the countries. For instance, the delay by the isolated members in developing interconnections clearly represents a (lack of) political decision.

• Design simple and effective Power Pool Governance and Operational Rules
  – The simple but effective institutional framework, based on the organization and responsibilities allocated to SAPP. Has been a success factor for trade development.
  – SAPP has progressively developed regulations that work for trading, settlement, wheeling tariffs, etc.

• Attract new players and focus on infrastructure planning
  – The dominance of one market player and the Incapacity to attract new investors and develop alternative energy sources lead to the capacity crisis of 2014-2016.
  – The absence of an adequate integrated transmission system to evacuate the power and trade it regionally was another key factor that limited the development of the regional mix.

• Transmission Capacity remuneration is key
  – Clear and consistent rules on how to allocate and compensate network owners are required. Regional transmission projects may not necessarily be required by the respective countries where the lines would transit, but are needed mainly for regional transactions as opposed to national requirements.
  – It is difficult to mobilize financing for regional transmission projects on a limited recourse basis due to the absence of long term anchor transactions/contracts that can commit to the required revenue flows for loan repayments and operational costs. The use of congestion rents and the development of dedicated financial facilities should be carefully considered.
Q&A