



SAPP GUIDELINES FOR NEW ENTRANTS



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ACRONYMS

| Acronym | Definition |
|----------|---|
| AC | Alternating Current |
| AGC | Automatic Generation Control |
| BPC | Botswana Power Corporation |
| CEC | Copperbelt Energy Corporation |
| DAM | Day-Ahead Market |
| EDM | Electricidade de Moçambique |
| EEC | Eswatini Electricity Company |
| ESC | Environmental Sub-committee |
| ESCOM | Electricity Supply Commission of Malawi |
| ESI | Electricity Supply Industry |
| EXCO | SAPP Executive Committee |
| FPM (M) | Forward Physical Market (Monthly) |
| FPM (W) | Forward Physical Market (Weekly) |
| HCB | Hidroelectrica de Cahora Bassa |
| IDM | Intra-Day Market |
| IGMOU | Inter-governmental memorandum of understanding |
| ITC | Independent Transmission Company |
| IPP | Independent Power Producer |
| kV | Kilo-Volt |
| LEC | Lesotho Electricity Company |
| LHPC | Lunsemfwa Hydro Power Company |
| MANCO | SAPP Management Committee |
| MCP | Market Clearing Price |
| MSC | SAPP Market Sub-committee |
| MW | MegaWatt |
| NamPower | Namibia Power Corporation |
| NP | Non-operating member |
| OP | Operating member |
| ORE | Office de Regulation de L'electricite |
| OSC | SAPP Operating Subcommittee |
| PSC | SAPP Planning Subcommittee |
| RERA | Regional Electricity Regulatory Association |
| RNT | Rede Nacional de Transporte de Electricidade |
| SADC | Southern African Development Community |
| SAEP | Southern Africa Energy Program |
| SAPP | Southern African Power Pool |
| SAPP CC | Southern African Power Pool Coordination Centre |
| SNEL | Société National d'Electricite |

| | |
|---------|---|
| TANESCO | Tanzania Electric Supply Company Limited |
| TSO | Transmission System Operator |
| ZESCO | ZESCO Limited (Zambia national electricity utility) |
| ZESA | Zimbabwe Electricity Supply Authority |

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I. CONTEXT

This New Entrant Guideline has been developed to assist parties interested in becoming members of the Southern African Power Pool (SAPP) to understand the Power Pool operations, governance, rules, benefits and obligations to support decision-making on membership. It provides background information on SAPP and lays out specific details on the path forward for membership for new entrants.

This guideline has been developed with support from the USAID-funded Southern Africa Energy Program (SAEP), a Power Africa initiative. SAEP's objective is to increase electricity availability and access in Southern Africa by facilitating transactions and strengthening the enabling environment for public and private sector investment in the power sector.

2. INTRODUCTION

The national utilities across the Southern African Development Community (SADC) region formed the SAPP in 1995, with the aim of achieving the mutual benefits that could be derived from the synergy between the large hydro resources in the northern areas of the region and the large thermal resources in the southern areas of the region.

The membership has remained relatively static since inception despite the SAPP governing documents providing for the inclusion of additional members. This is changing as the electricity industry evolves away from vertically integrated monopoly organizations with large-scale centrally controlled power plants to privately-owned generation, and often smaller and distributed generation power plants.

These new owners need access to markets and a number have expressed an interest in becoming members of the SAPP to enable participation in cross-border electricity trading. This document provides insight for potential new members to understand the operations, structures, governance, benefits and obligations of being a SAPP member.

3. WHAT IS THE SAPP

The 12 mainland SADC countries formed the SAPP in 1995. Of these, Angola, Tanzania and Malawi are not yet electrically interconnected and are called “Non-Operating Members.” The remaining nine member states are electrically interconnected and together make up the original “Operating Members” of the SAPP.

Cahora Bassa Hydro, an Independent Power Producer (IPP) in Mozambique, and Motraco, an Independent Transmission Company (ITC) between South Africa, Eswatini and Mozambique, joined the SAPP as observers given their significant potential impact on the interconnected power system and later Copperbelt Energy Corporation, an ITC in Zambia, also joined. Recent additions include two IPPs in Zambia, namely Lunsemfwa Hydro and Ndola Energy.

The full membership list as of August 2021 is as follows:

| No. | Full Name | Membership category | Abbrev | Country |
|-----|--|---------------------|----------|--------------|
| 1 | Botswana Power Corporation | NU - I | BPC | Botswana |
| 2 | Copperbelt Energy Corporation | OM | CEC | Zambia |
| 3 | Electricidade de Mocambique | NU - I | EDM | Mozambique |
| 4 | Electricity Supply Commission of Malawi | NU - NI | ESCOM | Malawi |
| 5 | Eskom | NU - I | Eskom | South Africa |
| 6 | Eswatini Electricity Company | NU - I | EEC | Eswatini |
| 7 | Hidroelectrica de Cahora Bassa | OM | HCB | Mozambique |
| 8 | Lesotho Electricity Corporation | NU - I | LEC | Lesotho |
| 9 | Lunsemfwa Hydro Power Company | OM | LHPC | Zambia |
| 10 | Mozambique Transmission Company | ITC | Motraco | Mozambique |
| 11 | NamPower | NU - I | NamPower | Namibia |
| 12 | Ndola Energy Corporation | OM | Ndola | Zambia |
| 13 | Rede Nacional de Transporte de Electricidade | NU - NI | RNT | Angola |
| 14 | Societe National d'Electricite | NU - I | SNEL | DRC |
| 15 | Tanzania Electricity Supply Company Ltd | NU - NI | TANESCO | Tanzania |
| 16 | ZESCO Limited | NU - I | ZESCO | Zambia |
| 17 | Zimbabwe Electricity Supply Authority | NU - I | ZESA | Zimbabwe |

NU – I: National Utility Interconnected; NU – NI: National Utility Not Interconnected;
OM: Operating Member

The SAPP's vision is to:

- Facilitate the development of a competitive electricity market in the SADC region
- Give the end user a choice of electricity supplier
- 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 and social practices

The SAPP's role is to facilitate and support the development and operations of the interconnected power system. The generation, transmission and distribution electrical infrastructure are owned by the members.

While this guideline focuses on the SAPP, it is important to understand the other role players in the region relevant to the SAPP, as laid out below.

4. OTHER REGIONAL ROLE-PLAYERS

4.1 SADC¹

SADC is an inter-governmental organization headquartered in Gaborone, Botswana. Its goal is to further socio-economic cooperation and integration as well as political and security cooperation among 16 Southern African states.

The main objectives of SADC are to achieve development, peace and security, and economic growth to alleviate poverty, enhance the standard and quality of life of the people of Southern Africa, and support the socially disadvantaged through regional integration, built on democratic principles and equitable and sustainable development.

4.2 RERA²

The Regional Electricity Regulators Association (RERA) was established by the SADC Council of Ministers in 2002, with the following objectives:

- Capacity Building and Information Sharing
- Facilitation of Electricity Supply Industry (ESI) Policy, Legislation and Regulations
- Regional Regulation Cooperation

RERA's mission is to facilitate the harmonization of regulatory policies, legislation, standards and practices and to be a platform for effective cooperation among energy regulators within the SADC region.

Of the 15 SADC member states, 13 have energy/electricity regulators and 11 are members of RERA (the exceptions are Office de Regulation de L'electricidade (ORE) of Madagascar and the Energy Commission of Seychelles). The DRC and Mauritius are yet to complete the establishment of a regulator. The 13 regulators are classified as follows: three are electricity regulators, seven are energy regulators and three are multisector (energy/water) regulators.

RERA has no direct regulatory role; its members regulate their respective industries independently. Each country's regulatory environment needs to be assessed individually for its potential impact on existing or new industry participants. As such, all regulations related to new members entering the SAPP must be developed and adjudicated within each member's regulatory frameworks. RERA can support to share lessons across the countries, but it does not regulate directly. RERA does have plans to transition to a regional regulator, but this process will take time and the specific roadmap for this transition has not been determined or decided by the regional ministers who govern SADC.

¹ SADC Overview, <https://www.sadc.int/about-sadc/overview>

² RERA initiatives, <http://www.afsec-africa.org>

5. THE SAPP AREAS OF INFLUENCE

Each country's own domestic legislation, regulations and rules apply to all electricity supply entities within that country. The SAPP has no authority or direct influence over the various member country's domestic electricity industry. The SAPP's authority extends to managing operations and transactions on transmission interconnections between countries and the use of third-party countries for transactions between members.

An IPP operating in a country will have to abide by that country's rules from its plant to the delivery point (at the border for exports). If the exports are made to a direct neighboring country, the importing country's rules would apply from the point of receipt (at the border). In such a transaction, the SAPP wheeling rules would not apply, but the balancing of the transaction and other requirements would.

Figure 1 below illustrates the applicability of each country's domestic rules and the SAPP rules.

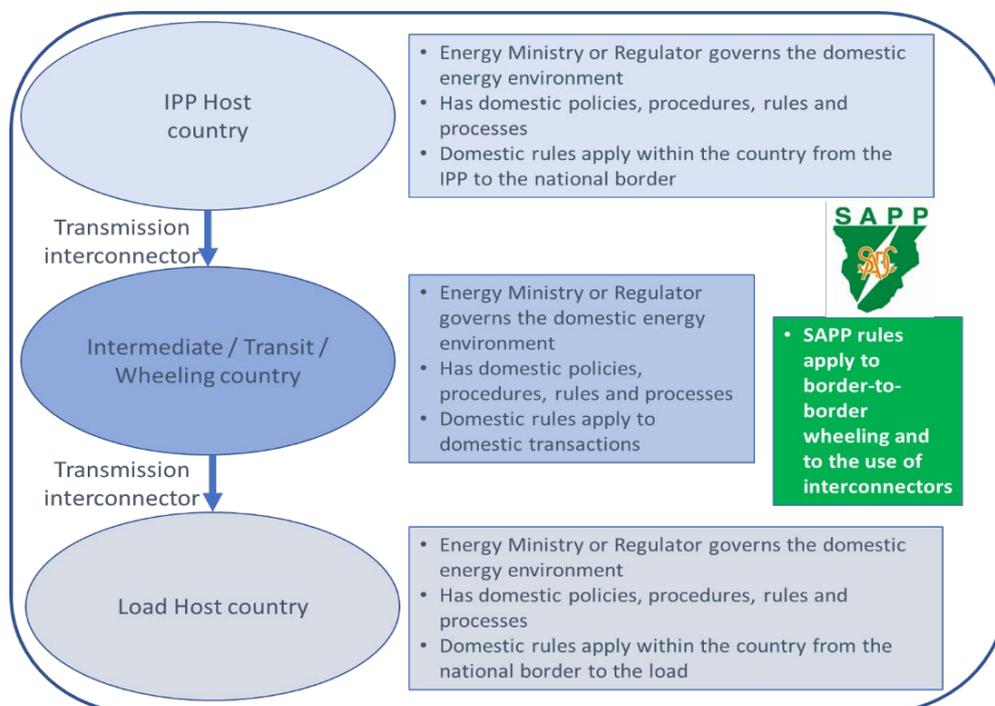


Figure 1 – SAPP areas of influence

6. SAPP DOCUMENTS AND GOVERNANCE

The SAPP is ultimately accountable to the SADC Integrated Council of Ministers and reports its activities to the SADC Energy Ministers.

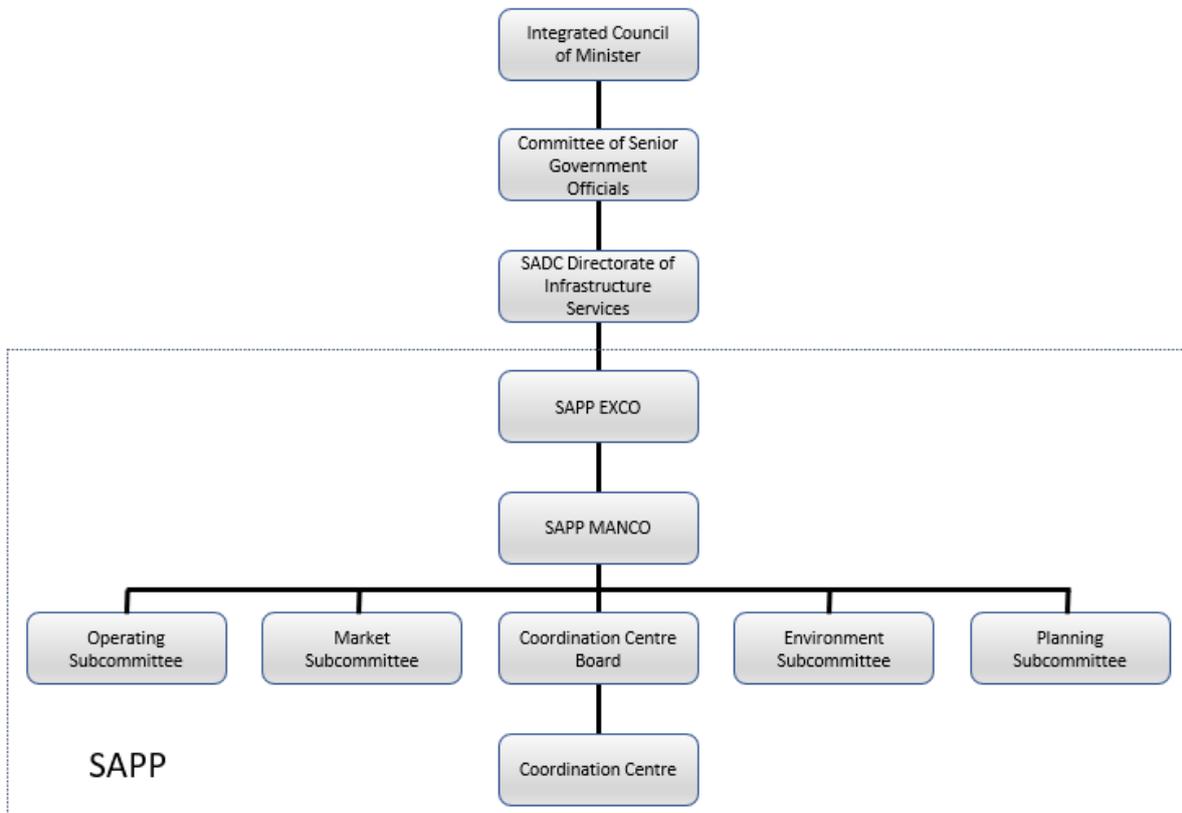


Figure 2 – SAPP Governance and SAPP Structure³

The SAPP is governed through a number of agreements, which have the following order of precedence:

- **The Inter-Governmental Memorandum of Understanding (Revised 23 February 2006) (IGMOU)**

The original founding document, the IGMOU, was signed in 1995 by representatives of each SAPP member country and confirms their establishment of a framework that commits them to enhancing regional power co-operation and trade through the development and operation of the SAPP.

It confirms the respective governments' commitment to allowing both their national power utility/ies and other electricity supply enterprises to participate as members of SAPP subject to domestic laws, the terms and conditions stipulated by SAPP and approval by the SAPP Executive Committee. The IGMOU was revised in February 2006.

³ Source: About SAPP, www.sapp.co.zw

- **The Inter-Utility Memorandum of Understanding (Revised April 2007) (IUMOU)**

The IUMOU seeks to facilitate sustainable development and expansion of the SAPP and to enhance the basic principles under which the SAPP operates.

It was signed by the national utility members and provides their commitment, amongst other items, that any electricity supply enterprise situated in a SADC country and any non-SADC country is eligible to become a member of the SAPP subject to it following the admission process.

- **The Agreement between Operating Members (Revised May 2008) (ABOM)**

The ABOM establishes the basic principles and rules under which the interconnected portion of the SAPP operate. These are based on the need for all Operating Members to:

- Coordinate and cooperate in the operation of their systems in a cost-efficient manner, while maintaining reliability
- Fully cover their costs
- Share equitably in the resulting benefits

- **The Operating Guidelines (Revised February 2014) (SAPP OG)**

The OG ensure that all the Operating Members of the SAPP operate the interconnected power system safely, efficiently, effectively and in an environmentally sustainable manner and that all members participate equitably in the obligations and in the benefits resulting from the Pool.

All interconnected utilities in the SAPP must comply with the requirements of the OG.

- **Any other approved guidelines**

The abovementioned documents were the original governing documents. Subsequent documents illustrate an increasing focus on markets. These are:

- The SAPP Market Guidelines (2016)
- The Day-Ahead Market (DAM) Book of Rules (2016)
- SAPP DAM Participation Agreement

SAPP as an entity is then governed and managed by the members through a structure consisting of:

- **The SAPP Executive Committee (EXCO)** – comprising the chief executives of all members
- **The SAPP Management Committee (MANCO)** – comprising senior executives of all members
- **The SAPP Coordination Centre (SAPP CC)** are full time staff appointed to manage and operate the SAPP – overseen by the “CC Board” – typically comprising senior executives of all members (often the MANCO members)
- **Four subcommittees** – these comprise senior managers and/or technical experts of all members:
 - Operating Subcommittee (OSC)
 - Markets Subcommittee (MSC)
 - Planning Subcommittee (PSC)
 - Environmental Subcommittee (ESC)
- **Working Groups** – are appointed by any of the committees or sub-committees to investigate and report back on specific topics requiring deeper analysis. Subject matter experts of selected members are appointed (these specialists are not necessarily involved with SAPP but are appointed based on their specialist knowledge). There are three permanent Working Groups that provide guidance in their area of specialization to the EXCO and MANCO and to support the operations of the SAPP CC:
 - Human Resource Working Group

- Finance Working Group
- Legal Working Group

The various SAPP committees and sub-committees meet twice a year to engage on matters affecting the operations of the SAPP. The MANCO meets together with the various sub-committees, while the EXCO meets a month or so later to consider recommendations from MANCO. The SAPP EXCO is mandated, amongst other items, to accept new members.

There is also an annual Traders and Controllers Forum, where operational staff engage on matters affecting the trading and operations of the SAPP and they can escalate issues to the SAPP Operating Subcommittee.

Each of the committees and subcommittee meetings are attended by representatives of all members and the meetings are hosted by the various members on a rotational basis.

Chairpersons are elected annually and can hold the position for a maximum of two terms. Decisions are made by consensus or, failing this, by a two-thirds majority of the members present at the meeting.

This is summarized in the figure below:

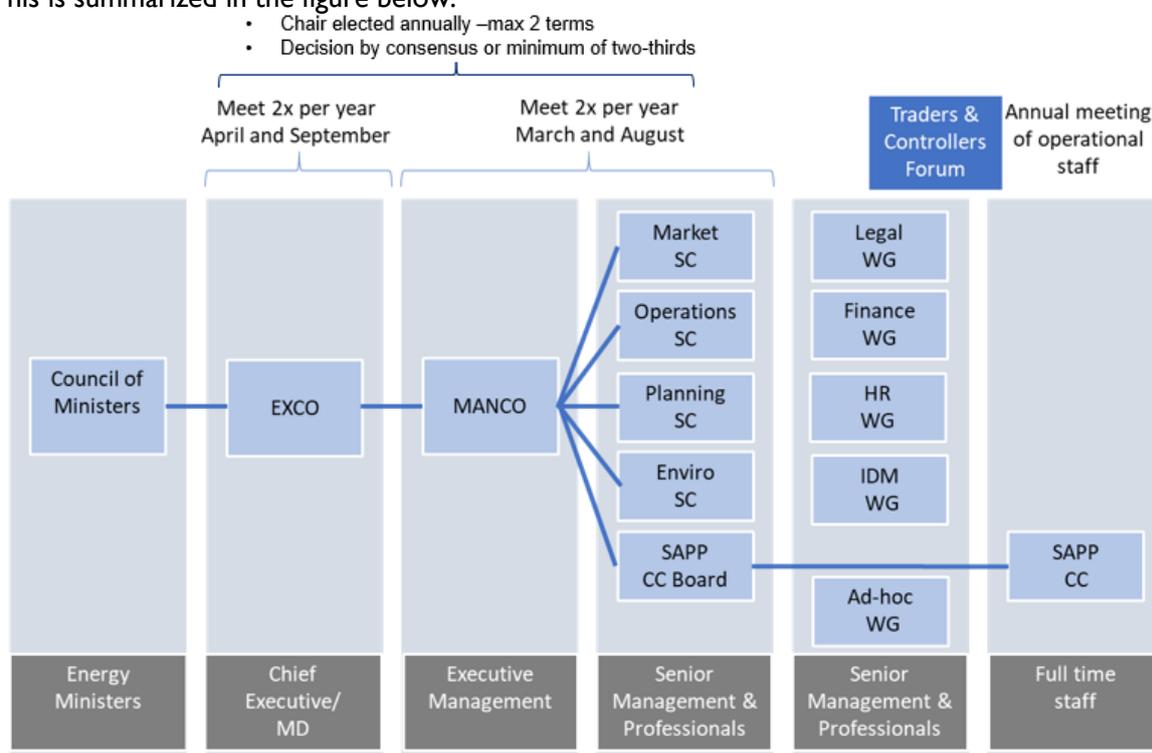


Figure 3 - SAPP Structure summary

The SAPP CC is based in Harare, Zimbabwe and consists of:

- The SAPP CC Executive Director
- A technical unit that manages and coordinates the planning, operations and environmental subcommittees, led by the Chief Engineer Planning and Operations
- A market unit that manages and coordinates the market subcommittee, administers the operation of the SAPP trading platform and markets and provides a market surveillance role, led by the Chief Engineer Markets
- A project advisory unit (PAU) that is funded by the World Bank to support project preparation to financial close
- A finance and administration unit

7. SAPP MEMBER CATEGORIES

When the SAPP was formed it provided for three types of membership:

- Operating Member – a member interconnected on the SAPP grid
- Non-operating Member – a member not interconnected on the SAPP grid
- Observer – a member that could attend and participate in SAPP proceedings, but could not vote. They were included due to their potential technical impact on the power system

The SAPP documentation and agreements also referred to other entities that could become members, namely an “electricity supply enterprise, IPP, ITC and Service Providers.” These are defined⁴ as:

Electricity Supply Enterprise is either a Power Utility, IPP, ITC and/or a Service Provider. It is an entity that:

- Operates a control center around the clock
- Owns or controls through other means, the operation of several generating units and regularly operates such units to meet a portion or all of its load obligations; or
- Owns a transmission system already interconnected internationally with neighboring Electricity Supply Enterprise(s) or which may be interconnected with such Electricity Supply Enterprise(s) sometime in the future.

Power Utility: a utility authorized by means of legislation or other consent to carry out the generation, transmission and/or supply of electricity to customers within the jurisdiction of the Member States and to participate in the SAPP.

Independent Power Producer: the operator of an independent generating facility, in a Member State connected to the SAPP grid.

Independent Transmission Company: the operator of an independent transmission facility in a Member State connected to the SAPP grid.

Service Provider: an entity authorized by means of legislation or other consent to provide generation, transmission, distribution and supply of electricity services to customers within the jurisdiction of a Member State.

Beyond these definitions there is little reference to how these entities could participate.

Given the heightened interest in SAPP membership, the SAPP Legal Working Group undertook a review of its membership categories. With effect from October 2018, the membership categories and their rights have been approved⁵ as follows:

| No. | Category | Criteria | Rights |
|-----|------------------------|--|---|
| I. | National Power Utility | Any electricity enterprise that: a) Operates the National Control Center or National Grid in its country b) Carries out transmission system and/or market operations functions | Shall have the right to: a) Participate in all working groups, sub-committees and committees of SAPP b) Chair all working groups and task teams c) Chair all subcommittees of SAPP, if it is connected to the SAPP grid d) Vote (has full voting rights) e) Participate in the SAPP market |

⁴ Definitions, SAPP ABOM

⁵ SAPP membership categories, criteria and rights, SAPP

| | | | |
|----|--------------------|---|---|
| | | c) Is a SADC state-owned entity or is mandated by a SADC member government | |
| 2. | Operating Member | Any electricity enterprise that: a) Operates a permanent generation facility of total capacity of at least 300 MW physically connected to the SAPP grid at a voltage level of at least 110 kV and/or b) Operates a transmission system of 110 kV and above, which is physically connected to the SAPP grid at a voltage level of at least 110 kV and c) Must have capability to provide ancillary service | Shall have the right to: a) Participate in all task teams, working groups, subcommittees, and committees of SAPP b) Chair working groups and task teams of SAPP c) Vote at SAPP executive committee according to the SAPP IUMOU d) Vote at working group and subcommittee levels and at MANCO |
| 3. | Market Participant | Any electricity enterprise or company that: a) Operates or contracts generation capacity or a load of at least 5 MW that is physically connected to the SAPP grid at a voltage level of at least 110 kV b) Must comply with respective national legislation on cross-border trading c) Must not be tied to a single buyer contract; or, where such contract exists, must have counter-party consent to trade the contracted power on the market d) Must have capability of balancing agreed schedules or must have a contract for balancing agreed schedules with a SAPP operating member | Shall have the right to: a) Be represented in the SAPP Traders and Controllers Forum b) Vote at the SAPP Traders and Controllers Forum c) Participate in the SAPP market |

8. SAPP OBLIGATIONS AND BENEFITS

The Agreement Between Operating Members provides detail on the various obligations and benefits a SAPP member is exposed to. These are in place to ensure the safety and integrity of the interconnected power system and to ensure fair and consistent treatment of members. The main obligations and benefits discussed here are Control Area Services, System Balancing, Wheeling, Incremental Losses, Emergency Support and Relationships, and capacity building opportunities.

8.1 CONTROL AREA SERVICES

The technical integrity of the interconnected power system is paramount. Three of the SAPP members currently operate as Control Areas,⁶ which requires them to provide frequency control and tie line control on behalf of all the other members – effectively ensuring the technical integrity on a continuous basis.

Control Area: an electrical system with borders defined by Points of Interconnection and capable of maintaining continuous balance between the generation under its control, the consumption of electricity in the area and the scheduled interchanges with other Control Areas.

The three control areas and their various members are illustrated in Figure 3:

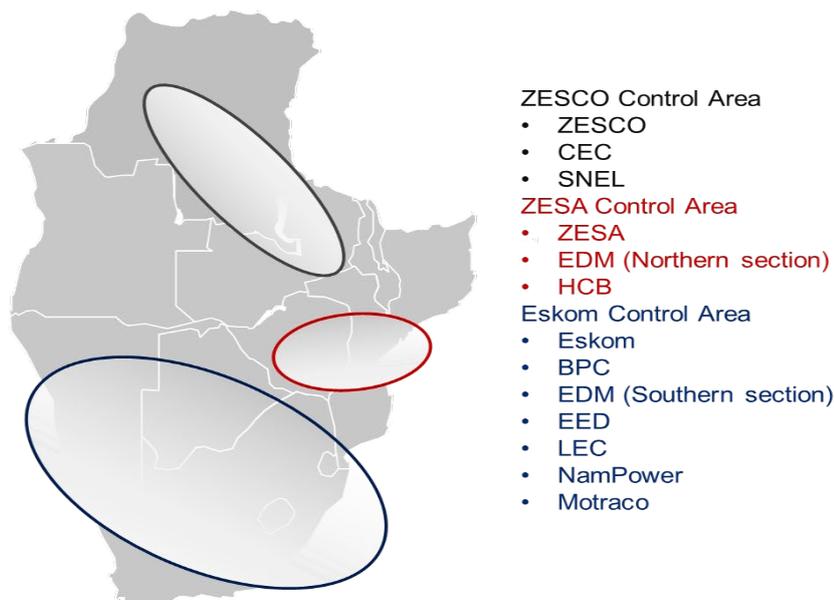


Figure 4 - SAPP Control Areas

The identified tie lines or lines connecting Control Areas to each other from a control point of view are therefore:

1. Phokoje substation (Botswana) to Insukamini substation (Zimbabwe)
2. Kariba South (Zimbabwe) to Kariba North (Zambia)

The Control Areas are required to provide Regulating Reserves⁷ and Automatic Generation Control⁸ to enable them to respond accurately to any changes in frequency resulting from system conditions such as sudden changes in the status of generating plant, customer loading or transmission interconnection.

Regulating Reserves: the provision of generation and load response capability, including capacity, energy and maneuverability that respond to automatic generation control signals issued by the System Operator. This includes generation that is under Automatic Generation Control (AGC) and can respond within 10 seconds and be fully active within 10 minutes of activation. This reserve is used for second-by-second balancing of supply and demand. The reserve is also used to restore instantaneous reserve within 10 minutes of the disturbance.

Automatic Generation Control: supplementary automatic regulation of generation output responding to combinations of frequency, time error, source loading, tie line power flow and area generation.

⁶ Definitions, SAPP ABOM

⁷ Definitions, SAPP ABOM

⁸ Definitions, SAPP ABOM

Control Areas also provide an energy scheduling service to other members. Numerous bilateral and SAPP market transactions take place simultaneously in both directions through the various meters monitoring the power flow on the transmission interconnectors and tie lines. It is not possible to identify the energy flow related to each of the individual agreements. The various flows are summed and flows in opposite directions are netted off, providing a net aggregated energy schedule. This is done for each hour of the day and the Energy Schedules⁹ are used by national control centers to control actual energy flows in real time. This is done by managing the supply/demand balance within their area of responsibility.

Energy Schedules: energy in the SAPP is delivered according to energy schedules. These are hourly-integrated energy volumes for each hour of the day, normally concluded on a day-ahead basis for the following day. The net energy volume is determined at each cross-border interconnection (and most specifically at the tie lines between control areas). There is an opportunity for changes to the day-ahead schedules in the SAPP Intra-Day market (discussed in the SAPP Markets section).

The remaining major obligation of a control area is for the technical and/or financial settlement of energy imbalances between themselves (see Section B).

Energy Imbalances: the difference between the scheduled energy volumes and the actual energy volumes as measured by the meters.

The various members compensate the control areas through the levying of a Control Area Service Charge. This charge consists of a fixed component and a regulating reserve component.

- The fixed component is set by the cost of providing the infrastructure associated with the provision of Automatic Generation Control in the control center and at power stations as well as the cost of SCADA and communications equipment necessary to provide the service.
- The cost of the regulating reserve is also determined by the Control Areas (it would be part of their ancillary services budget).
- The two components are then allocated to the various members in relation to their capacity (MW) relative to the total Control Area capacity (MW).

⁹ Definitions, SAPP ABOM

8.2 SYSTEM BALANCING

Each SAPP national utility member or transmission system operator (TSO) is required to have a 24-hour operational national control center. This center is equipped to monitor real-time power flows to manage the supply-demand balance, in addition to its network configuration and switching duties.

Each member has an obligation to maintain its own system in balance and to prevent any disturbances or imbalances which may affect other members. This is done by carrying the level of operating reserves¹⁰ as prescribed by the SAPP.

Operating Reserve Obligation: every Operating Member in the SAPP shall be obliged to maintain their calculated portion of Operating Reserve sufficient to cover 150% of the loss of the sent-out capacity of the largest generating unit in service in the interconnection at that time.

Operating Reserve: the unused capacity above System Demand which is required to cater for regulation, short-term load forecasting errors, and unplanned outages. It consists of Spinning and Quick Reserve. It can also be classified as the sum of instantaneous, regulating and 10-minute reserves. The Operating Reserve should be fully activated within 10 minutes.

Quick Reserve: the capacity readily available from non-spinning reserve which can be started and loaded within 10 minutes or load that can be interrupted within 10 minutes.

Spinning Reserve: the unused capacity which is synchronized to the System and is readily available to assume load without manual intervention.

New SAPP entrants will have a duty to minimize any negative impact on the system and will be required to conclude arrangements with their host TSO to provide balancing support. This arrangement could differ from member to member as each country's domestic rules will apply. At present none of the countries have balancing rules in place and this has caused a delay in processing new applications. Regulators and other authorities will have to develop rules specifically to allow new entrant participation.

Any remaining imbalance within a TSO is settled between that TSO and its Control Area in terms of their bilateral arrangement (SAPP agreements do not provide for intra-control area settlement, but as at the time of writing SAPP is considering including intra-control area settlement in the same mechanism employed for inter-control area settlement).

A mechanism for inter-control area imbalance settlement¹¹ is in place. The SAPP CC determines the imbalance on each tie line and allocates it between the three control areas.

- The first 25 MW of imbalance is deemed "Inadvertent Energy" and is settled "in kind" – i.e., the same volume of energy can be scheduled and returned in a similar time period.
- Energy imbalances in excess of 25 MW per hour are settled financially where the base price is set at the SAPP DAM clearing price and this price increases as the system frequency deteriorates to a maximum of the cost of diesel generators.

Since a new entrant is unlikely to form a Control Area, it will be required to compensate its TSO and its Control Area using an agreed mechanism. These mechanisms are not currently governed by the SAPP rules, so are to be negotiated.

¹⁰ Definitions, SAPP OG

¹¹ SAPP OG

The requirements to be able to schedule transactions accurately in advance and to ensure that energy imbalances are limited, favors membership by dispatchable generation rather than renewables with large potential variability (wind and solar without storage). The domestic rules for balancing are essential to determine the ability of such variable generators to successfully participate in SAPP trading. Any new entrant is advised to engage early with their TSO to assess the impact of balancing on new projects.

8.3 WHEELING

The SAPP grid provides for non-discriminatory or open access and as such SAPP members are obliged to provide wheeling¹² services to each other. This obligation is limited to the extent “where this is technically and economically feasible” to do so. This limitation recognizes that the primary intention of the transmission assets is to provide for domestic power transfer requirements, but there is typically some additional or surplus capacity. This surplus capacity is then used for SAPP wheeling. SAPP wheeling only applies to members who are neither the buyer nor the seller. The transmission costs in the exporting network (from the IPP to the border) and within the importing country (from the border to the load) are subject to the domestic rules and rates, which are set by the relevant authorities in each country.

Wheeling: transmitting a contractual amount of power over specified time periods through the system of an Operating Member who is neither the Seller nor the Buyer of this power.

The surplus capacity is determined as the difference between the installed/transfer capacity of a line or grid and the domestic load transfer requirements. The buyer in an energy transaction is responsible for securing (and paying for) a wheeling path for SAPP transactions and requests the path on a day-ahead basis. Wheeling is therefore only confirmed on a day-ahead basis.

While SAPP wheeling only uses surplus capacity and its availability is confirmed only one day in advance, there have been some statements of intent to guarantee a wheeling path through the conclusion of bilateral agreements. In such a case, the buyer and/or seller of the energy transaction will contract with the wheeler outside of the SAPP rules at a mutually agreeable negotiated rate. This approach is likely to be preferred by funders of new power stations and transmission infrastructure to underwrite new investments in the future.

The grids throughout the SAPP have limited capacity and the demand is often higher than the available capacity. An allocation method is in place to ensure a fair and consistent allocation. The general principle is that older agreements take precedence over newer agreements and the wheeling capacity is allocated in the following order:¹³

- First priority – Firm Power Bilateral agreements (in order of age)
- Second priority – SAPP Forward Physical Market (Monthly)
- Third priority – SAPP Forward Physical Market (Weekly)
- Fourth priority – SAPP DAM
- Fifth priority – Non-firm Power Bilateral agreements (in order of age)
- Sixth priority – SAPP Intra-Day Market
- Emergency Energy (see section 8.5) takes precedence in real-time over all non-firm agreements

¹² SAPP ABOM

¹³ SAPP ABOM

Firm Power: contracted capacity and associated energy intended to be available at all scheduled times for the duration of the transaction

Non-firm Power: can be curtailed or interrupted based on technical and economic considerations for its system without any penalty

The SAPP CC provides an annual list of all possible transactions and the associated wheeling charges for each leg of the transaction, according to the approved methodology. The SAPP wheeling rates are relatively low and do not reflect the full cost of providing a transmission service as only surplus capacity is used. The average rate is approximately USD 0.352 c/kWh but the actual charge varies dependent on which and how many networks are traversed. This will also increase as new infrastructure is commissioned to increase the capacity, redundancy and reliability of the interconnected SAPP transmission grid.

Transmission pricing is evolving and the SAPP has been engaging for a number of years to change the current wheeling charge methodology to a more cost reflective zonal transmission pricing method. It is unclear when this new method will be introduced, but it could have a significant impact on the cost of wheeling and the SAPP should be engaged on this aspect when a project is being considered.

In bilateral transactions, the buyer pays for the wheeling and the cost is shared equally between the buyer and seller in the SAPP market transactions.

8.4 INCREMENTAL LOSSES

An important concept often misunderstood in SAPP operations is the application of incremental losses.

Technical losses across the grid cannot be avoided and need to be recognized in all transactions. 100 MW exported in the north of the SAPP grid will not deliver 100 MW at the other end of the grid.

The option exists for parties to contract for a selling volume, understanding that they will receive less power than what they are contracting.

An alternative utilized by the SAPP is that each wheeler generates power above its own requirements to “make good” these losses – thus ensuring that the power received at its one border is delivered in full to its other border. This ensures the underlying energy contract is delivered in full regardless of the distance or number of wheelers involved in the transaction.

The SAPP CC uses load-flow software to estimate the system losses under normal operating conditions to meet its own national requirements. Various wheeling volumes are then modelled and the change in the system losses is calculated. A matrix of losses is developed for each level of wheeling. The SAPP CC calculates the hourly losses from the wheeling volumes and communicates these to the members. The SAPP DAM Clearing Price per hour is applied to the losses and Wheelers raise a monthly charge for providing the service.

The payment for losses differs between bilateral agreements (where the buyer pays for losses) and the SAPP markets (where the cost is shared between the buyer and seller). New SAPP members will be liable for these charges but will have the comfort of knowing their sales or purchase volumes will be delivered in full.

8.5 EMERGENCY SUPPORT

All SAPP members are obligated (subject to technical limitations) to provide support to one another in the event of an emergency¹⁴ – typically an unplanned event affecting generation or transmission capacity which limits its ability to service its full demand.

Emergency Energy: energy supplied from other Operating Members to an Operating Member who experiences a loss of generating or transmission facilities as the result of an unscheduled outage (or outages) or any cause not reasonably foreseeable. Such energy shall be available for a period of six hours starting from the occurrence of the emergency, after which the Operating Member must obtain other types of services or shed load.

An Emergency Situation: a situation where a member is faced with an unplanned loss of generation or transmission facilities or another situation beyond its control, which impairs or jeopardizes its ability to supply its System Demand, adjusted for imports and exports of Firm Power. Such emergency situation shall be deemed not to exceed six hours per event.

The support that must be provided is up to each member's Available Accredited Capacity¹⁵ and it replaces any non-firm energy transactions. It must be made available for a maximum of six hours during which period alternative arrangements need to be put in place or load shedding must be implemented.

Accredited Capacity Obligation: An Operating Member's Monthly System Peak Obligation plus its Reserve Capacity Obligation minus Interruptible Load Capacity based on its Annual System Peak Obligation.

Members required to wheel emergency power are also obliged to do so for the duration of the emergency, up to a maximum of six hours.¹⁶

The SAPP publishes Emergency Energy rates which are applicable to energy delivered during emergencies. It is the greater of 150% of a coal-fired power station or 115% of the highest SAPP DAM clearing price on the day. Members are also entitled to declare their own rates and most members involved in providing emergency support prefer to do so. These rates typically reflect their own marginal cost of generation assuming worst case situations i.e., diesel or other emergency generation technologies.

New SAPP IPP or Service Provider entrants are unlikely to be able to provide support during emergency conditions, unless they maintain additional capacity to enable them to do so. If they are exporting, they would, however, be required to declare an emergency in the event of the unplanned loss of capacity and they would be required to inform their buyers, TSO and Control Area. Should their buyers not conclude other arrangements and continue to consume power, they will be liable for emergency energy charges in line with SAPP conditions. The IPP or Service Provider is advised to provide for this eventuality and to identify accountability in their agreements.

¹⁴ SAPP ABOM

¹⁵ SAPP ABOM

¹⁶ SAPP ABOM

8.6 RELATIONSHIPS AND OPPORTUNITIES FOR CAPACITY BUILDING

SAPP membership also offers less obvious and direct benefits such as relationships with other SAPP members and the opportunity to attend capacity building initiatives. This has in the past included exposure tours to other power pools and entities.

9. SAPP MARKETS

Trading in the SAPP is done either through bilateral agreements or the SAPP competitive markets. Bilateral agreements are negotiated and concluded directly between a buyer and seller. The agreements can be long-term or short-term and may be for firm power or non-firm energy.

The SAPP market platform competitive markets were introduced in 2016, with the following markets currently available:

- The Forward Physical Market (Monthly) – Hourly contracts are concluded for a month ahead. The hourly contracts can be set up to provide for different values in each hour of the day, during specific time periods or the same value for every hour of the contract period
- The Forward Physical Market (Weekly) – Hourly contracts are concluded for a week ahead. The hourly contracts can be set up to provide for different values in each hour of the day, during specific time periods or the same value for every hour of the day of the contract period
- Day-Ahead Market – Hourly contracts are concluded for each hour of the following day or a future day
- Intra-Day Market – A continuous market where trades are concluded up to one hour before delivery. Prices are based on a first come, first served basis.

The bulk of the current trade volume is conducted through bilateral agreements but as illustrated in Figure 4, the trend is towards increasing SAPP competitive market trading.

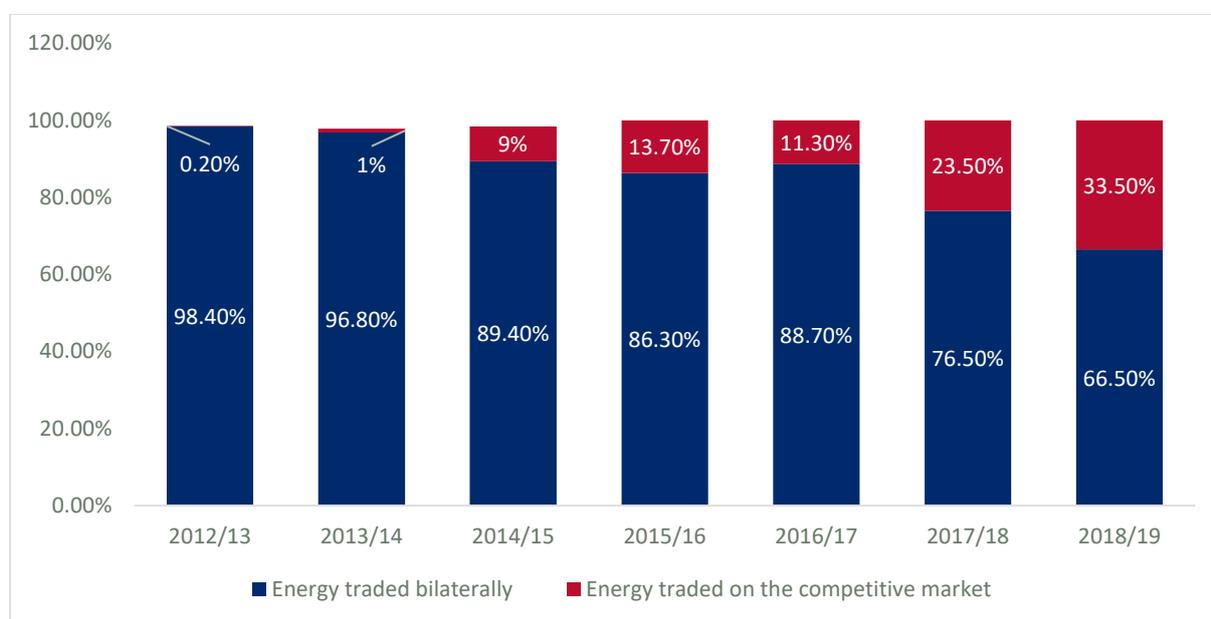


Figure 5 - Share of total energy traded in SAPP¹⁷

¹⁷ SAPP ETG presentation, Gaborone, Botswana, 16 April 2019

SAPP competitive market trading offers several benefits such as:

- The counterparty is the SAPP Market Operator and not the Buyer
- There is no need to identify a counterparty and negotiate an agreement
- Once the trade is closed it becomes a firm commitment
- Market transactions receive a higher priority than non-firm bilateral agreements for wheeling
- Members are required to deposit and retain sufficient funds in a SAPP security account before being allowed to trade – hence eliminating credit risk
- Wheeling fees and losses are shared equally by the buyers and sellers (unlike bilateral agreements, where the Buyer pays)

Trading is conducted via a strict timeline:

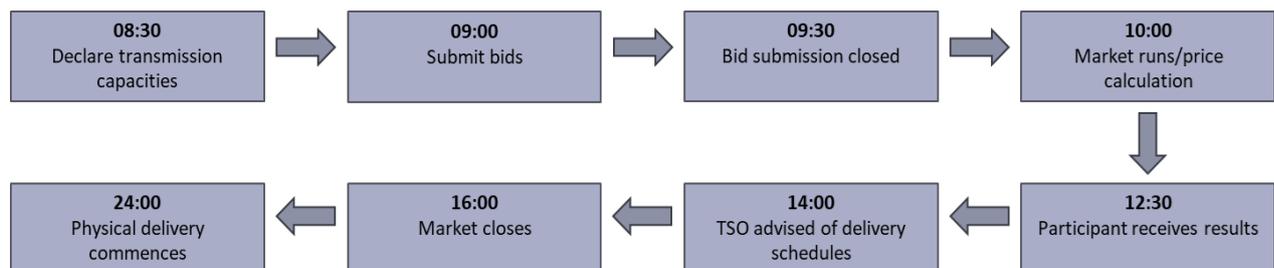


Figure 6 - SAPP trading timelines

Members can trade in United States Dollars (USD) or South African Rand (ZAR). The market operator provides the daily exchange rate applicable to transactions.

The daily timeline for energy delivery and settlement is:

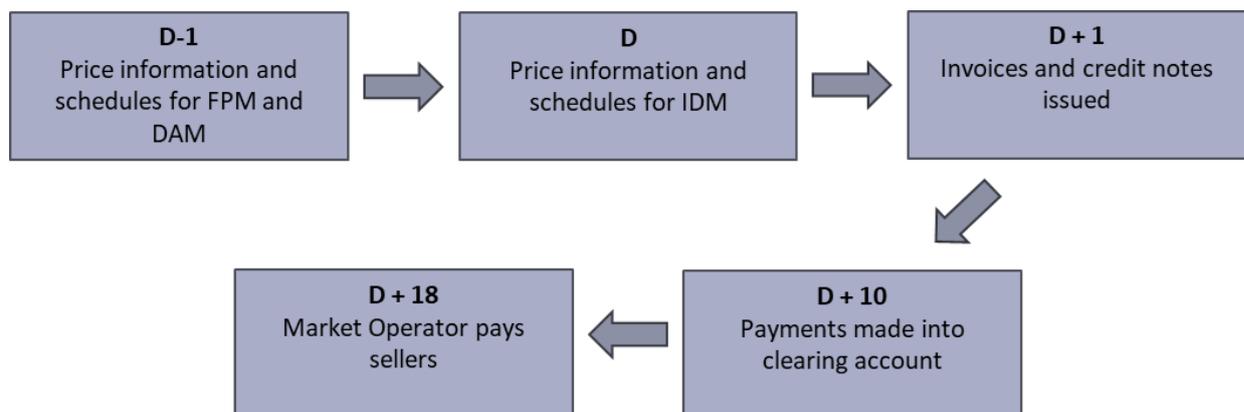


Figure 7 - SAPP settlement timelines

Participants can only trade directly on the DAM market upon:

- Obtaining all required licenses and necessary permissions by the host country authorities to undertake cross-border trading
- Being accepted as a SAPP member by the SAPP EXCO
- Having the required agreements with the host TSO for balancing responsibilities
- Signing the SAPP Market governance documents
- SAPP opening of the requisite trading accounts for trading purposes and the new member having the requisite security for trading purposes
- Having at least two SAPP Market Operator trained and certified traders (training of new traders takes one week and once competence is illustrated the trader is certified)

To trade on the markets the Trading Governing Documents must be signed:

- Market Book of Rules (set of rules governing SAPP Market Operations)
 - Agreement between all participants and the Market Operator
 - A living document but binding
- Participation Agreement
 - Agreement between each participant and Market Operator

Fees of 0.5% of the transaction value are levied on each transaction.

10. COST OF SAPP MEMBERSHIP

The SAPP receives three sources of funding:

- Member contributions – determined using an agreed formula as set out below
- Market administration fees
- Donor funding – generous funding by donors has allowed the development of the power pool operations and markets as well as project preparation

Any new member is required to pay all costs associated with the process of becoming a member. Member annual contributions are paid up front for the financial year based on the approved budget of the SAPP CC and the following allocation method:

- Each Market Participant will pay a fixed annual fee equivalent to twenty thousand dollars (USD 20,000)
- The National Power Utilities will contribute seventy-five percent (75%) of the remaining budget after subtracting the Market Participants’ contributions. The non-interconnected power utilities will pay seventy percent (70%) of the National Power Utility contributions
- The Operating Members will pay twenty-five percent (25%) of the remaining budget after subtracting the Market Participants’ contributions.

This is illustrated as follows:

The current membership is as follows:

- 9 National Utility members which are interconnected
- 3 National Utility members which are not interconnected
- 5 Operating Members (note existing members have been retained at an Operating Member level regardless of size in order to recognize their current rights and obligations)
- Zero Market Participants

During the 2019 SAPP financial year, the member contributions totaled USD 1,084,815. Using the allocation method described the individual contributions would be:

| | | Contribution | No. of members | Individual contribution |
|--------------------------------|------|--------------|----------------|-------------------------|
| Budget | 100% | 1,084,815.00 | | |
| Market Participants | | 20,000.00 | 0 | - |
| Balance from other members | | | 5 | 1,084,815.00 |
| National utility Connected | 75% | 813,611.25 | 9 | 73,298.31 |
| National utility not connected | | | 3 | 51,308.82 |
| Operating member | 25% | 271,203.75 | 5 | 54,240.75 |

There are other costs incurred by members such as appointing traders, allocating staff to serve on the various SAPP committees, sub-committees and working groups and the flights, accommodation, and other costs of attending these sessions.

As indicated in section 6, the committee and subcommittee meetings are attended by representatives of all members and the meetings are hosted by the various utility members on a rotational basis. There would be an expectation that other members in the host country would support the host utility with the organization (financially and physically) when the meetings are held in their country.

11. CONNECTION AND OPERATION OF IPPS

The SAPP Operating Guidelines has a detailed set of technical requirements for an IPP to connect to the SAPP Grid.

These are reflected in Annexure I to this guideline.

12. APPLICATION PROCESS

The SAPP has a defined process for new membership applications.

The first step, even prior to engaging the SAPP, is to meet all domestic requirements and secure all domestic approvals. The SAPP will not consider an application that is not fully sanctioned by the host country authorities. The host country requirements will differ from country to country, but typically include:

- Copy of connection agreement from host TSO
- Evidence of grid code compliance from host TSO
- Copy of generation license and if applicable export license and/or trading license from the ministry of energy or regulator
- Agreement with host National Utility/TSO for balancing services

Obtaining SAPP membership timing depends on when applications are submitted; membership applications must be submitted via the SAPP officials to the SAPP MANCO for recommendation, who in turn submit it to SAPP EXCO for approval. The MANCO meetings are held in late February/March and September/October and the EXCO in April and November each year. The recent delays in processing new membership applications are related to the need for all domestic approvals being received, which in turn is due to the absence of rules (note specifically the lack of balancing rules discussed in section 8.2).

All costs associated with the application are for the applicant's account.

The requirements are illustrated as follows:

1. To become a SAPP Member:
 - a. Complete prescribed form
 - b. Provide:
 - i. Licenses and/or authorizations from host country
 - ii. Payment of application fee
 - iii. Map showing position of proposed plant and interconnection to the SAPP and a single line diagram of technical layout of each
 - iv. Any other technical detail as specified by the SAPP
 - v. Proof of balancing agreement with host TSO
2. To become an Operating Member:
 - a. Meet the criteria specified for an Operating Member

- b. Sign the ABOM and OG to indicate commitment to comply with both
- c. To trade – complete the process below for a Market Participant
- 3. To become a Market Participant:
 - a. Sign the DAM Book of Rules and Market Participation Agreement
 - b. Obtain Central Bank approval for cross-border transactions
 - c. Lodge required security
 - d. Pay the required fees to the Market Operator

SAPP has approved an “Application Guideline,” which together with associated forms for membership are freely available to prospective members from the offices of the SAPP CC and on the SAPP website. The process is summarized as follows:

1. Enquiries and completed applications shall be submitted to the SAPP CC Manager who shall be responsible for communication concerning membership applications.
2. The SAPP CC shall verify completeness of an application.
3. The SAPP CC may request additional information, invite applicant for meetings and/or request for inspection of the applicant’s facilities. Where a physical inspection of the applicant facilities is necessary, the applicant shall be required to pay the associated costs in advance, which will be payable within 21 days of SAPP submitting an invoice.
4. The applicant shall pay a non-refundable application processing fee as specified by the SAPP from time to time.
5. An application shall be considered and a response provided in writing within a period of 12 months from the date of receipt. Where the application process exceeds the said period, the applicant will be advised accordingly.
6. Where the application is successful, the applicant must accept the offer and fulfil any conditions within 90 calendar days from the date of offer.
7. An unsuccessful application shall be communicated to the applicant in writing stating the reasons thereof. The applicant can appeal within 30 days. Following an appeal, a committee appointed by the SAPP shall make a decision within 90 days, which decision shall be final and binding.

13. CONCLUSION

The SAPP is keen to grow membership in order to support its mission, which is “to provide the least cost, environmentally friendly and affordable energy and increase accessibility to rural communities.”

The SAPP has defined processes, procedures and the necessary rules to accommodate new entrants. It is, however, a relatively new focus and is likely to evolve over time. Perhaps the single largest risk to new entrants is the host country approvals and their need to set up enabling frameworks to support applicants. Few, if any, of the countries have rules in place for an IPP to contract for system balancing or criteria for licensing for exports.

Prospective members of SAPP are encouraged to engage their local authorities early in the process to ensure the domestic requirements can be met.

Further guidelines and application forms are available at the SAPP CC offices in Harare and on the SAPP website. SAPP CC management are always available to meet with prospective members.

Annexure I: Connection and Operation of Independent Power Producers

EXTRACT FROM SAPP OPERATING GUIDELINES: SECTION 2.G.

Section 2.G. CONNECTION AND OPERATION OF INDEPENDENT POWER PRODUCERS

Background:

The deregulation of the Electricity Supply Industry (ESI) and the opening up of SAPP membership to players who are not national power utilities has enabled a few Independent Power Producers (IPPs) to connect their power facilities to the SAPP. Some IPPs connect to the transmission network while others connect to the distribution network. The trend shows that the number of IPPs connecting to the SAPP is growing rapidly. With a few IPPs having large-capacity generation facilities using liquid fuel, gas fuel, or coal fuel, most potential IPPs have small-capacity generation facilities using renewable energy such as solar, wind or hydro.

Criteria:

To realize maximum benefits from IPPs such as mitigation of power shortages, optimization of energy resources in the region, promotion of sustainable environmentally friendly energy sources, it is imperative that every IPP plays its part in making the SAPP interconnected system reliable, stable, secure and safe and also plays a part in minimizing energy losses. In doing this, the IPP shall conform to SAPP technical requirements for connection and coordinate its operations with the System Operator to which it is connected. Further, the IPP shall be required to meet the contracted performance in availability of its power facilities.

Requirements:

1. Prior to commissioning, an IPP shall provide all necessary information to its System Operator to enable the System Operator carry out system studies using appropriate software to determine the IPP's impact on the following:
 - a. System conditions (voltage levels, power flow etc.) before and after selected contingencies,
 - b. System fault levels,
 - c. System steady state, transient and dynamic stability,
 - d. Any other condition required by the System Operator.
2. The System Operator shall carry out necessary system studies to determine reliable, stable and safe condition(s) for connection and operation of the IPP. The System Operator, if satisfied, shall then give the IPP an official approval for connection and operation of the IPP.
3. Prior to commissioning, the IPP and the applicable System Operator shall engage in a connection agreement. The Connection Agreement shall specify detailed technical and commercial terms and conditions for connection and operation of the IPP power facilities.
4. The IPP's generating unit with nameplate rating of 5 MVA or greater shall be equipped with operational governors with droop settings for frequency response stated in the Connection Agreement.
5. The IPP's generating unit with nameplate rating of 5 MVA or greater shall be equipped with operational automatic voltage regulators.

6. The IPP facility at the Point of Connection shall be equipped with a device capable of isolating the IPP's electrical system from that of the System Operator in the event of a fault on either side. The controlling circuit breaker shall be capable of interrupting the maximum short circuit current. There shall be provision for disconnection of the IPP by sending a trip signal from remote to the controlling circuit breaker. In addition, isolators shall be provided to adequately isolate the controlling circuit breaker at the Point of Connection for maintenance purposes.
7. The IPP facility at the Point of Connection shall be equipped with adequate automatic protection relays as stated in the Connection Agreement. Settings of the protection system shall be agreed upon between the IPP and the System Operator.
8. The connecting transformer between the IPP and the System Operator shall be of agreed upon winding connections and type of grounding (earthing) and shall be sized to deliver rated real and reactive power at an agreed upon range of power factor.
9. The IPP shall have adequate facilities for starting, synchronizing and dispatching of its generators. Procedures for starting (whether black start or otherwise), synchronizing (whether manual or automatic) and dispatch (whether independent or central) of the IPP generators to the interconnected system, shall be agreed upon between the IPP and the System Operator and shall not adversely affect the quality of power supply.
10. The IPP shall make the following signals available at an appropriate terminal unit at its site for a telecommunication gateway to the Control Centre of the System Operator:
 - a. Megawatt sent-out (MW) at the Point of Connection
 - b. Forecast Active Power Estimate (MW) at the Point of Connection
 - c. Reactive Power Import/Export (+/-MVar) at the Point of Connection
 - d. On/Off status indications for all Reactive Power devices exceeding 5 MVar
 - e. Circuit-breaker positions indication. These shall include indications from circuit-breakers on individual generating units
 - f. Status of power system stabilizer
 - g. Any other signals requested by the System Operator and agreed by both parties
11. The IPP shall have a communication gateway facility that can communicate with the Control Centre of the System Operator. The necessary telecommunications links, telecommunications protocol and the requirement on analogue or digital signals shall be specified by the System Operator as appropriate in the Connection Agreement
12. The IPP shall provide to the System Operator accurate real power and reactive power forecasts. These forecasts shall be provided at 09:00 a.m. on a daily basis for day-ahead for each one (1) hour time-period, by means of an electronic interface in accordance with the reasonable requirements of System Operator's data system.
13. The IPP shall submit real power and reactive power availability declarations whenever changes in availability occur or are predicted to occur. These declarations shall be submitted by means of an electronic interface in accordance with the requirements of System Operator's data system.
14. The IPP's control system shall be able to receive an active-power control set-point signal from the Control Centre of the System Operator. This set point shall define the maximum Active Power output permitted from the IPP. The IPP shall be capable of receiving this signal and acting accordingly to achieve the desired change in Active Power output. The IPP shall make it possible for the System Operator to remotely enable/disable the Active-Power control function in the IPP control system. When this remote control is disabled, the IPP shall be capable of operating at agreed reduced levels if required to do so by the System Operator for system security or other reasons.
15. The IPP generators shall supply its registered capacity of real and reactive power and remain synchronized to the interconnected system within the bands of system frequency variation, voltage level variation, voltage unbalance variation, and power factor variation stated in the Connection Agreement. In doing so, the IPP shall participate in system frequency control, system voltage control and power factor control both during normal and abnormal system conditions as stipulated in the Connection Agreement.

16. Any tripping of individual generation units due to frequency excursions shall be staggered and the power-frequency response curve and philosophy for tripping shall be agreed between the IPP and the System Operator.
17. The IPP shall comply with all SAPP rules on equipment maintenance and system disturbance reporting.
18. The IPP shall comply with all SAPP rules on interchange energy scheduling, energy delivery, metering standards, handling of inadvertent energy, and handling of energy losses; provided that where a special agreement exists between the IPP and the System Operator, the System Operator shall carry out all interchange energy scheduling, energy accounting and handling of energy losses with other SAPP Operating Members on behalf of the IPP.
19. Voltage quality distortion levels caused by the IPP at the Point of Connection shall not exceed the apportioned levels as stated in the Connection Agreement. The calculation of these distortion levels shall be based on the SAPP Quality of Supply Standard or approved international standards.

Recommendations:

1. The IPP should provide operational diagrams showing the electrical circuitry of the existing main features, bus bar arrangements, phasing arrangements, earthing arrangements, switching facilities and operating voltages to the applicable System Operator.
2. The IPP should provide its safety rules and a list of authorized system operations personnel to the Operating Subcommittee (OSC) representative of the applicable System Operator.
3. Operations personnel of the IPP should be authorized and certified based on national or international accepted criteria.
4. Where there have been major replacements or changes in the system design and configuration of the facilities of the IPP, new system studies should be carried out between the IPP and the System Operator and conditions of connection and operation should be revised accordingly.
5. The System Operator through its OSC representative shall share reports of system studies and commissioning of the IPP and any relevant technical data about the IPP with the SAPP Coordination Centre.