Chapter 4

International Experiences: Southern African Region

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Chapter 4

International Experiences: Southern African Region

1. Historical Perspective

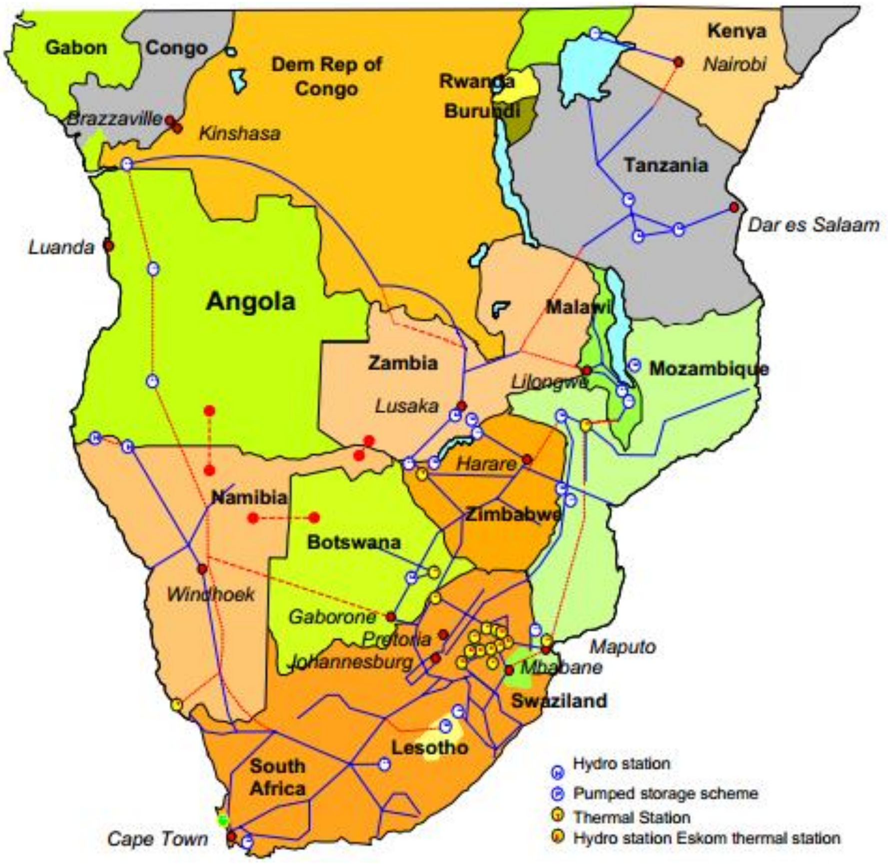
Before the establishment of the Southern African Power Pool (1995), the Southern African region operated with two exclusive but not interconnected systems. The northern part of the region comprising the Democratic Republic of the Congo, Zambia, Mozambique, and Zimbabwe operated a hydropower-dominated grid with only Zimbabwe having some thermal power. The southern part comprising Botswana, South Africa, Namibia, Lesotho, Swaziland, and Mozambique (some parts only) operated a thermal power-based grid with Eskom of South Africa being the main supplier. Countries/utilities on each network bilaterally traded power among themselves albeit with strict take or pay clauses and high contractual load factors. Long-term (5, 10, 15+ years) bilateral agreements were the trading platform. These were inherently inefficient as sometimes power was pushed onto utilities that did not need it at some periods of the day. Trade was not linked to market requirements.

When one network experienced a disturbance, the other could not assist as they were not coupled. The impact of system disturbances on the separated weaker networks was higher, resulting in higher unserved energy and negative economic impact in affected countries. The northern systems suffered power shortages whenever there were drought spells as the hydro energy resources were reduced. The south could not assist even though it had thermal power that was resilient to droughts. The drought of the early 1990s and the political change in South Africa triggered the concept of resource pooling, sharing, and mutual assistance between the two parts of the region. The formulation of the power pool started. Southern Africa remains dominated by vertically integrated national power utilities with single-buyer models in all the countries. Independent power producer (IPP) penetration increased in most of the countries in recent years. Only Zambia and Mozambique have independent transmission companies in addition to the national TSOs.

2. The Formation of the Southern African Power Pool

The SAPP is an association of 16 electricity enterprises from 12 mainland member countries operating under the auspices of the Southern African Development Community (SADC). The member countries are Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. The main objectives of SAPP are (i) pooling and sharing of resources, (ii) mutual support under emergency situations, and (iii) technical and economic efficiency benefits. Of the SAPP members, 13 are from nine countries that are physically interconnected to each other through transmission lines at various voltage levels forming the SAPP grid. These are referred to as operating members. Three countries (Angola, Malawi, and Tanzania) are non-operating members because they are not interconnected as there is no infrastructure to do so. SAPP operates through a coordination centre that is located in Harare, Zimbabwe. Electricity trade in the region is through a hybrid of bilateral agreements and a SAPP Co-ordination Centre (SAPP CC)-administered competitive market. The SAPP CC is funded by members through contributions determined using an agreed formula. Funds are also raised through fees for market administration.

Figure 5. Interconnections among Operating Members of SAPP



Source: South African Power Pool (n.d.a). http://www.sapp.co.zw/

2.1. Enabling Documents

SAPP was conceptualized out of strong political will for regional economic and social integration through sharing of resources among the 12 mainland SADC member countries. Its governance structure, therefore, is anchored at national government-level where a founding agreement had to be promulgated to pave way for facilitative agreements to establish the organization. The intergovernmental memorandum of understanding (IGMOU) signed by SADC member ministers of energy in 1995, established SAPP as an institution in the region and paved way for the inter-utility memorandum of understanding (IUMOU) to be signed by the chief executive officers (CEOs) of all national power utilities in the same year. The IUMOU allowed the CEOs to establish the SAPP management structures. Through the use of specialist working groups, the CEOs produced and signed the agreement between operating members, which sets the SAPP functional structure, members' obligations, functional expectations, and operational modalities at high level. The operating guidelines that stipulated specific member roles, obligations, rules, standards, and procedures were then developed to guide the interconnected operations of the SAPP grid. The following is a list of the initial documentation in their order of hierarchy:

- Intergovernmental Memorandum of Understanding
- Inter-Utility Memorandum of Understanding
- Agreement Between Operating Members – signed only by interconnected members
- Operating Guidelines

2.2. Structure

To operationalize the SAPP, the structure comprised committees to enable the full participation by members and protection of their interests at all levels. At government level, a Council of Energy Ministers that meets at least once a year had to be in place to address policy issues, give political leadership, and establish institutions where necessary. At the SADC Secretariat, the Division of Infrastructure Services became the link between the ministers and the utility CEOs. An executive committee (ExCo) whose membership was CEOs of the national power utilities became the highest SAPP management decision-making body. The ExCo meets at least once a year and a Division of Infrastructure Services representative has to attend. Below the ExCo is the management committee (MANCO), which decides on issues from the subcommittees and refers matters beyond its jurisdiction to the ExCo for resolution. The MANCO directs the functions of the subcommittees. Four expert area subcommittees were established to address matters on operations, electricity trading, environment, and planning. The MANCO and subcommittees meet at least twice a year. The Co-ordination Centre Board was formed to address policy issues related to the coordination centre and to report to the MANCO.

Details of the duties and functions of the SAPP committees are contained in the IUMOU. Two-thirds of members form a quorum for meetings to proceed. Voting is based on a 'one member, one vote principle' but there are weights applied between national utilities and private entities. The following discussions provide some details on how the various entities function.

2.3. Executive Committee

The ExCo is the final decision-making body at utility-level in SAPP. It is composed of all CEOs of member utilities. The ExCo decides on issues referred by the MANCO and forms its own working groups where necessary. The MANCO chairperson sits in the ExCo without voting powers. The ExCo approves the coordination centre's budget and meets at least once a year. It interfaces with the political economy through the SADC's Division of Infrastructure

Services. It serves as the custodian of the IUMOU and upholds the IGMOU. It strategizes and gives direction to SAPP. The ExCo approves the membership of electricity enterprise applicants.

2.4. Management Committee

The MANCO is composed of a utility's senior member (normally the Director of Transmission Business but can vary with utilities) with sufficient authority to make decisions that bind the utility. An alternative member (normally one of those who sit on subcommittees) sits in the MANCO without voting powers. The MANCO meeting normally takes place on a day following subcommittee meetings to decide on reports made by chairpersons of the subcommittees and the board. The MANCO can form its own working groups. It refers all matters it cannot decide on to the ExCo. It screens the coordination centre's budget and presents it to the ExCo for approval. The composition, functions, responsibilities, and modus for meetings are specified in the IUMOU. Chairmanship of the committees rotates on a yearly basis but no member can chair for more than two consecutive years. There are no observers in the MANCO. Chairpersons of the subcommittees and the Co-ordination Centre Board sit in the MANCO without voting powers.

2.5. Subcommittees

The four subcommittees (Planning, Operating, Markets, and Environmental) comprise business area experts from the utilities – e.g. a representative to the planning subcommittee would come from a utility planning division, the one to the operating subcommittee would come from system operations, a markets representative from the trading division, and an environment representative from the environment division. Each utility must have a substantive member and an alternate. Their composition, functions, responsibilities, and modus for meetings are specified in the IUMOU, which is signed by all members as a sign of commitment to its requirements. Chairmanship of the committees rotates on a yearly basis but no member can chair for more than 2 consecutive years. Hosting of meetings also rotates. Observer status is granted to electricity enterprises that want to understand the operation of the pool before joining fully. Working groups are also formed by subcommittees, as required. The subcommittees meet at least twice a year.

Unanimity is the preferred decision-making process but committees are permitted to vote and pass motions on two-thirds majority. Voting rights are in accordance with weights allocated between national utilities and private entities.

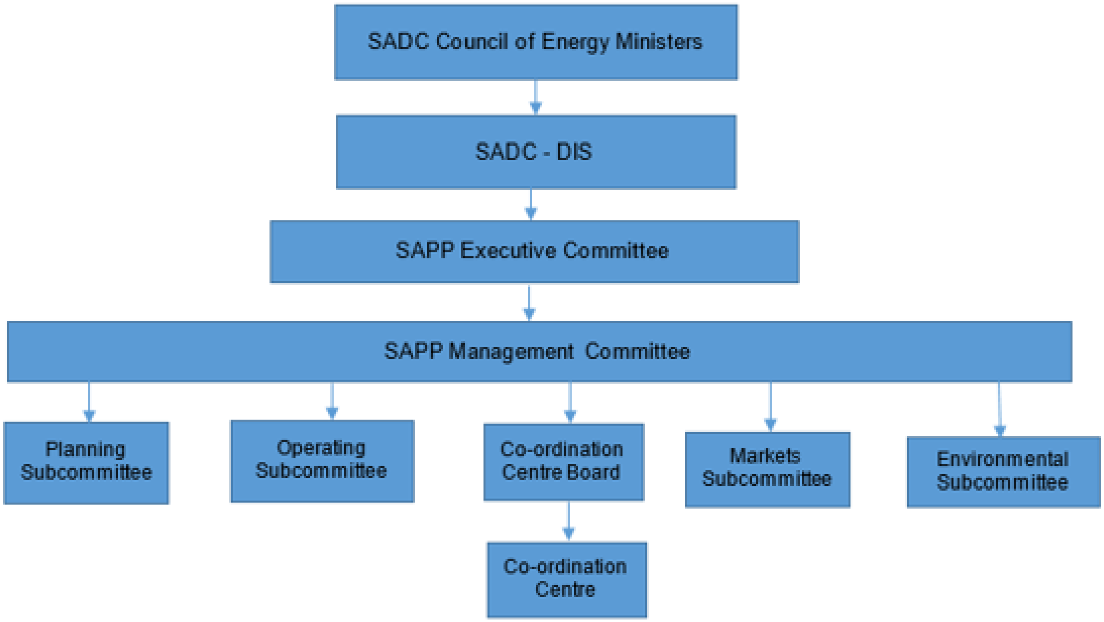
2.6. Co-ordination Centre Board

Each utility nominates a substantive and an alternate member to the Co-ordination Centre Board, which makes policy decisions on conditions of service, the running of the coordination centre, budget, and engagement/disengagement of the top three officials (the manager, chief engineer, and chief market analyst) with approval of both MANCO and ExCo. The members must be senior enough to make decisions that bind their utility in board meetings. The requirements are contained in the IUMOU. Chairmanship of the board is by voting. The board meets at least twice a year and it has its own constitution.

The SAPP Coordination Centre

The coordination centre is SAPP's legal entity that implements its projects, undertakes researches, and advises committees on expert matters. It operates the competitive market, monitors system operations, and carries out studies that may be required. The SAPP CC reports on member performance/compliance according to set criteria. It keeps records and exchanges of information among members. The centre acts as the face of SAPP, regionally and internationally. Figure 6 presents the SAPP governance structure.

Figure 6: SAPP Governance Structure



SADC-DIS = Southern African Development Community-Division of Infrastructure Services, SAPP = Southern African Power Pool.
Source: SADC Energy Monitor (2016).

3. Open Access and Transmission Capacity Calculation of the SAPP

3.1. Allocation of Transmission Capacity in SAPP

SAPP operates on an open access principle where all parties have access to the available wheeling capacity. However, available capacity depends on prevailing asset ownership and trade arrangements. All transmission assets within utilities were built to serve internal (domestic) requirements. Trans-network trade only utilizes surplus capacity. Investment in interconnectors between countries is normally anchored by trade transactions protected in power purchase agreements. These take precedence on the interconnector transmission capacity. A transmission equipment solely for wheeling purposes in the SAPP is yet to be built.

Due to these ownership rights and anchor contracts, available third-party wheeling capacity needs to be determined so that third-party trade may happen on the various interconnectors. The SAPP CC is tasked with determining available wheeling capacities on a daily basis to facilitate day-ahead market (DAM) and its derivative operations. The guiding principle is that the transmission infrastructure must first serve the purpose for which it was created. To determine surplus capacity, the SAPP CC needs to know transfer limits on each interconnector. The capacity allocated to bilateral contracts must also be known so that surplus capacity is determined after removing the bilateral capacity from the transfer limit. Basically, SAPP CC needs to know the available capacity and committed capacity to compute surplus capacity. Once determined, the surplus capacity is shared according to an established methodology. Since SAPP intends to increase IPP participation in the market, it has issued rules on the prioritization of access to transmission capacity for fairness and transparency purposes. Prioritization in wheeling capacity starts with bilateral contracts (firm then non-firm) on a grandfather rule basis, before competitive market transactions are cleared for transport.

There is a procedure for determining the capacities and declaring availabilities for day- ahead trade. On the day of trade, emergency power supply overrides non-firm and DAM transactions. Below is the summary of prioritization.

3.2. Transmission Capacity Prioritization for SAPP Use

Tables 4 and 5 are applicable to transmission capacity available to SAPP wheeling, after taking into account the asset owners' dedicated use.

Table 4. Transmission Capacity Priority for Day-Ahead Scheduling

Priority for day-ahead scheduling	Transaction	
	Type	**Remarks**
First (1)	Firm Power Bilateral Transaction as confirmed a day ahead	When competing, the oldest firm transaction takes priority.
Second (2)	Non-Firm Power Bilateral Transaction(s), (including energy un-banking) as confirmed a day ahead	When competing, the oldest non-firm transaction takes priority.
Third (3)	DAM transactions (DAM is run over and above bilateral transactions)	After DAM is closed, DAM transactions shall be firm and shall take priority over non-firm transaction(s).
Fourth (4)	Pay-back of inadvertent energy in kind	Spare capacity after bilateral and DAM transactions may be utilized in paying back inadvertent energy to reduce accumulation.

DAM = day-ahead market.

Source: Southern African Power Pool, operating guidelines (2012),

Table 5. Transmission Capacity Priority on the Day of Delivery

Priority for day-ahead scheduling	Transaction	
	Type	Remarks
First (1)	Firm Power Bilateral Transaction as confirmed a day ahead.	When competing, the oldest firm transaction takes priority.
Second (2)	Emergency Energy support	Includes any energy sourced for alleviating an emergency situation in the asset owner's system.
Third (3)	Non-Firm Power Bilateral Transaction(s), (including energy un-banking) as confirmed a day ahead.	When competing, the oldest non-firm transaction takes priority.
Fourth (4)	DAM transactions (DAM is run over and above bilateral transactions)	After DAM is closed, DAM transactions shall be firm and shall take priority over non-firm transaction(s).
Fifth (5)	Pay-back of inadvertent energy in kind.	Spare capacity after bilateral and DAM transactions may be utilized in paying back inadvertent energy to reduce accumulation.

DAM = day-ahead market.
Source: Southern African Power Pool, operating guidelines (2012).

3.3. Transmission System Operations

To enable smooth interconnected system operations, each TSO needs system control and data acquisition (SCADA) equipment to monitor power flows, dispatch generation, control loading, and configure the network as required. TSOs operate with 24-hour control centers staffed with specialists for this purpose. In an interconnected network like that of SAPP, internal utility load changes can cause disturbances and hardships on neighboring utilities due to relative responses of generators to system frequency, faults, or poor performance. To minimize such occurrences, utilities must install automatic generation control (AGC) equipment at its control center and form a control area that is capable of monitoring and controlling frequency and power interchanges with neighboring control areas. The AGC calculates the area control error (integrated frequency control and scheduled tie line flow errors) and takes corrective action automatically by sending portions of the area control error to selected generators so that local changes are corrected by local generators. Utilities without AGC must contract control area services from those that have. The basic requirements for control area operations are as follows:

- Control area operator must have AGC installed at its control centre.
- Each control area must be able to measure and transmit power flows at points of interconnection to the control centre and compare with scheduled flow to determine error level.
- Each control area must be able to measure system frequency and compare with scheduled frequency to determine error level.
- Each control area operator must have generation capacity on AGC that is capable of receiving control error signals and make required adjustment.
- Neighbouring control areas must measure interconnector power flows from the same meter.
- The AGC must be run in tie line bias mode.
- There must be telemetering and telecommunications to enable AGC functionality.

Area Control Error is defined mathematically as

Area Control Error = (NIA-NIS)-10β(FA-FS)-IME

where:

NIA = is the actual net interchange. It is the algebraic sum of tie line flows between the control area and neighbouring control areas.

NIS = is the net scheduled interchange. It is the net of all scheduled transactions with other control areas.

β = is the control area frequency bias

FA = is the actual frequency

FS = is the scheduled frequency

IME = is interchange (tie line) metering error

3.4. Transmission Congestion

Power flows across participating transmission equipment along a wheeling route are limited by established transfer limits. When transfer limits are reached, trade is curtailed. Along a wheeling corridor there is normally a piece of equipment or condition that limits transfer. For example, a transformer whose rating is below that of the associated line can limit transfer for equipment safety reasons, or when one line out of two or three operating in parallel is taken out of service, transfer must be limited to the capacity of the remaining line(s), or when increased wheeling volumes cause instability in a network, or generation levels at critical points are outside required levels. In SAPP, transmission limitation has resulted along the central corridor in Zimbabwe and Botswana – mainly due to voltage and system stability concerns. In Zimbabwe, transmission capacity is mainly dependent on generation availability at the Hwange thermal power station. Poor generation availability increases southward power flows within Zimbabwe and limits southward third-party transactions towards Botswana. On the same corridor, transfer is also limited by the Zimbabwe Electricity Supply Authority (ZESA) system stability when its net imports reach 450 MW. The 350 MW southward transfer limit on this corridor is lower than the northward transfer limit of 600 MW. Pn either side of Zimbabwe, the transfer limits are higher.

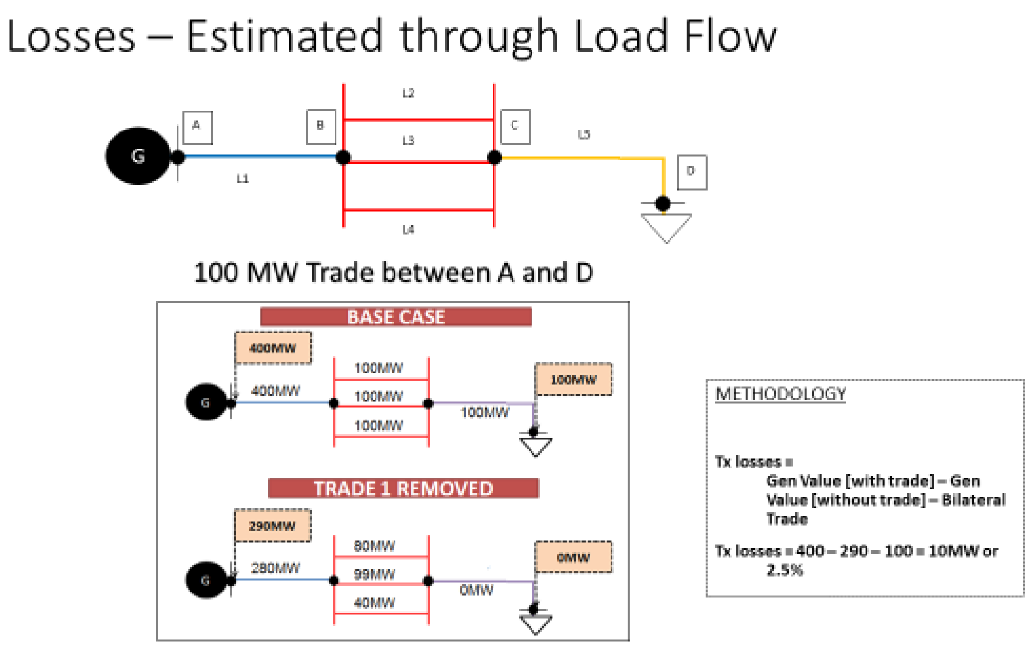
In South Africa, a transfer restriction normally occurs along the 2 x 765 kilovolt (kV) transmission lines from Mpumalanga to Cape Town when generation at the Koeberg nuclear power station in Cape Town is reduced. Outage of one generator (930 MW) causes a corresponding increase of power flow on the lines leading towards overload and instability. Exports to Namibia along this route necessarily have to be curtailed. Power flows from Namibia northward would reduce the transfer limitation.

3.5. Transmission Losses

Power system losses are the difference between power sent out into the system i.e. generation sent out + imports less exports, and power metered at the customer end. Transmission losses are the losses that occur on the transmission network between points of power/energy injection and points of delivery to transmission-connected customers or distribution off takers. Figure 7 demonstrates the principle. Losses associated with a wheeling transaction are better estimated through a load flow study where generation sent out is noted and then a transaction is floated and the change in generation is noted again. The transaction losses will be as follows:

- **Transmission technical losses** = Power sent out (gen + imports - exports) – power received at delivery point.
- **Transaction losses** = Generation with transaction – generation without transaction – transaction

Figure 7. Calculation of Transaction Losses



MW = megawatt.
Source: Author.

4. SAPP Markets

4.1. Pre-SAPP Period

Before the establishment of SAPP in 1995, countries/utilities bilaterally traded power among themselves albeit with strict take or pay clauses and high contractual load factors. Long-term bilateral agreements (5, 10, 15+ years) were the trading platform. These were inherently inefficient as sometimes power was pushed onto utilities that did not need it at some periods of the day. Trade was not linked to market requirements. The inefficient and uncoordinated market did not maximize opportunities nor produced accurate and consistent investment signals to utilities and investors alike. The drought of the early 1990s triggered the need for an exchange of power between the coal thermal-based Eskom and the drought-stricken hydro-based ZESA and the Zambia Electricity Supply Corporation (ZESCO). The 400 kV Matimba–Insukamini interconnector was built for this purpose.

4.2. Cooperative Power Pool Period

After establishing the SAPP in 1995, the northern and southern grids were interconnected in 1996 via a 400 kV AC transmission line between South Africa and Zimbabwe. Botswana was connected to the same line in 1997. All the power utilities (nine countries) could now trade electricity among themselves. The immediate relief came from the supply of thermal power from Eskom to the drought-stricken northern utilities – averting economic disruption from load shedding. The expanded interconnected grid became stronger and impacts of system disturbances lessened as the grid became more resilient to perturbations. Less expensive surplus power from Eskom became available to the northern utilities and trade expanded. When the drought lifted, cheaper hydropower from the northern utilities became available to southern utilities, further increasing trade and opening opportunities for short-term trade contracts. Due to cost advantages, utilities optimized their power supply options and increased both supply reliability and profitability. Shorter bilateral power contracts became possible. Trading efficiency increased somewhat. Utilities that were captive to one supplier for a long time started diversifying their supply portfolios.

During the short 'teething problem' period, there were technical and quality of supply issues, which the Operating Subcommittee resolved. What caused concerns were the quality of supply issues associated with frequency control on a grid dominated by thermal power in South Africa, and medium-sized hydro plants in the north without good experience in control area concepts. A small signal oscillation caused by the reaction of northern to southern generators caused blackouts in some countries and negatively affected trade. The Operating Subcommittee investigated and resolved these issues by tuning some control gear, and trade was normalized. A retired but seasoned power pool operations person from the New York Power Pool assisted in resolving many of the initial problems that resulted in increasing trade.

4.3. Transformation into a Competitive Power Pool

In 1999, the ExCo aimed to improve trade benefits and efficiency through competition among members. The SAPP had to create the enabling environment by reviewing pertinent documents and formulating others. The coordination centre was not originally envisaged to participate in electricity trading activities among members but now it was required to operate the market. A new set of rules had to be developed, and a trading system and platform had to be set up. Risks around security for trade settlement and mechanisms for transaction management had to be addressed. A domicilium of trading transaction accounts had to be determined by members. Roles, powers, and authorities of different players had to be allocated.

The SAPP CC constitution had to be reviewed to permit the centre to participate and operate the market. A Legal Agreement and Book of Trading Rules had to be produced to bind and guide market participants in their operations. The centre's structure had to be reviewed to accommodate the new trading functions. A trading system with strict timelines for the submission of bids; a publication of matched buyers, sellers, and prices; gate closure times; and a settlement process were all developed. A trading platform to match buy-and-sell bids, with invoicing capabilities, had to be developed and implemented. The centre's manager had to be empowered to invoice participants, make trade settlements from member bank accounts, and manage security deposits. Penalties for non-compliance had to be formulated. Cooperation was replaced with competition as buyers and sellers bid into the market.

4.4. The Short-Term Energy Market

The initial competitive trade market that commenced operation in 2001 was called the short-term energy market (STEM). It was based on matching buy-and-sell bids that are submitted hourly, for the following day. Participants whose buying price matched a sale price would equally share the matched energy. This would start with the lowest price match and ascend until the last matched energy is cleared. Unmatched bids would be posted on a bulletin board where participants would see available trade volumes and prices. From there, they could engage in short-term bilateral negotiations if required. Matched bids are considered firm contracts for delivery the following day, commencing at hour ending 01:00 and terminating at hour ending 24:00. Payment is based on schedule and not delivery. Mismatches between scheduled energy and actual delivery are settled through inadvertent energy management procedures. The buyer paid for wheeling services and the supplier paid for losses, in kind. Initially, wheeling was based on postage stamp principle, but it later changed to MW/km.

For the market to take effect, SAPP negotiated that bilateral contracts be relaxed to permit trade volumes and release transmission capacity on wheeling paths. Members responded positively and renegotiated some conditions in their bilateral contracts. Specifically, Eskom in the Republic of South Africa, and Botswana Power Corporation and ZESA in Zimbabwe agreed to allocate capacity to the 400 kV interconnectors for STEM trading.

Trade volumes increased, trade tariffs reduced, bilateral contracts shortened in tenor, and time of use tariffs were introduced that resulted in the reduction or elimination of high load factor take or pay contracts. Previously, net importers began to sell during some time periods of the day e.g. off peak. The value of each megawatt to a trader and system operator increased as people could immediately relate to money value of trade. For the first time, most utilities separated electricity trading from system operations to remove bi-faculty and sharpen focus separately on technical and economic efficiency.

4.5. Current Electricity Trading in SAPP

The ExCo decided to increase trade competition and permit more players into the market sometime in 2004. The SAPP's MANCO was directed to create an enabling environment for such a market. The IGMOU, the IUMOU, the Agreement Between Operating Members, the Operating Guidelines, and the trading's Book of Rules had to be reviewed and approved by the ministers and the utility CEOs.

SAPP decided to establish the DAM, which commenced operation and superseded STEM in 2009. This trading platform came with a new trading tool that was more sophisticated and capable of more functions. The market-clearing price principle, in which a market price is determined based on the price at the crossing point of demand and supply, was implemented. All participants pay the market-clearing price for market-enabled supply. Buyers and sellers do not know who they are matched to, reducing the risk of market manipulation. Access to the transmission network is fair and open to all. The market- clearing price principle took into account transmission availability and congestion management. The market provides for short-term future (10 days) trade schedules and block bidding. Market splitting, with unconstrained and constrained pricing, became possible. Accurate investment locations and pricing signals for transmission infrastructure development could be sent as market prices were a clear indication of market forces and participant's willingness to pay for services. Since the trading platform was web-based, traders could make their bids into the market from any location in the world. Automated invoicing and settlement systems are incorporated, providing alarm and alert on security deposits, settlement defaults, and delivery mismatches. A new transmission pricing methodology (flow-based MW/km) was adopted. Transaction administration became easier.

There are prospects for setting up an ancillary services market, a balancing market, and a financial market.

The SAPP regional trading currently operates with bilateral market, DAM, post-day-ahead market (PDAM), intraday market, and the soon-to-be introduced short-term forward market. The bilateral market consists of firm, long-term bilateral contracts and short-term contracts that may be firm or non-firm with the latter being prevalent due to shortage of supply. The DAM is the main market operated by the SAPP Co-ordination Centre in Harare, whilst the PDAM is a DAM derivative. Trade bids that are not matched during the DAM process are posted on a bulletin board where members can view and engage in negotiation for short-term bilateral supply (PDAM) with the assistance of the SAPP trader. The intraday market facilitates trade gap closure and smoothing close to real time (i.e. on the day of trade) through negotiations for surplus power from the PDAM by buyers and sellers.The short-term forward market is in its formation stage. It is aimed at week-ahead and month-ahead trade contracts. A new market trading platform with more functionality than the previous one became operational in 2014/2015. Details of each type of trade are discussed below.

4.6. Bilateral Trade

Traditionally, SAPP members were locked into long-term, high-load factor, firm bilateral contracts for security of supply and captive sales reasons. Eskom was the major supplier to many countries due to the availability of its surplus power. The Société Nationale d'électricité of the Democratic Republic of the Congo, ZESCO of Zambia, and the Electricidade de Moçambique and the Hidroeléctrica de Cahora Bassa of Mozambique were net exporters. The major buyers were those countries that could not meet their peak demand like ZESA of Zimbabwe, Botswana Power Corporation of Botswana, NamPower of Namibia, Lesotho Electricity Company (Pty) Ltd of Lesotho, and *S*waziland Electricity Company of Swaziland. The importers had supply portfolios that included firm and non-firm bilateral contracts from various suppliers. For example, the Botswana Power Corporation could have long-term firm bilateral contracts with Eskom; have medium-term bilateral contracts with Eskom, Electricidade de Moçambique, Société Nationale d'électricité, and ZESCO (firm and non-firm); and also have short-term bilateral contracts with NamPower, Eskom, ZESA, and Electricidade de Moçambique. Contracts could incorporate first right of refusal clauses. From 2000, when SAPP was preparing for competitive trade, some of the bilateral contracts had to be renegotiated to pave the way for competition. Trade volumes, conditions, and to some extent, prices, were renegotiated. Member trade portfolios changed. Some traditional net importers could also export in certain trade windows. For example, ZESA could have long-term firm bilateral import contracts with Eskom; have medium-term bilateral import contracts with Eskom, Electricidade de Moçambique, Société Nationale d'électricité, and ZESCO (firm and non-firm); and also have short-term bilateral export contracts with Botswana Power Corporation and NamPower. Some first right of refusal clauses began to disappear.

This kind of trade enabled security of supply concerns to be addressed and propelled economic efficiency. However, this was only possible when there was surplus power in the region up to 2007. Post-2007, utilities tried to lock as much power as possible into bilateral contracts for security reasons. Only few managed to get short-term bilateral contracts but most were with low-load factors and clauses for curtailment of supply at short or without notice. Importers were required to show certain demand management initiatives to qualify for certain supply prioritization.

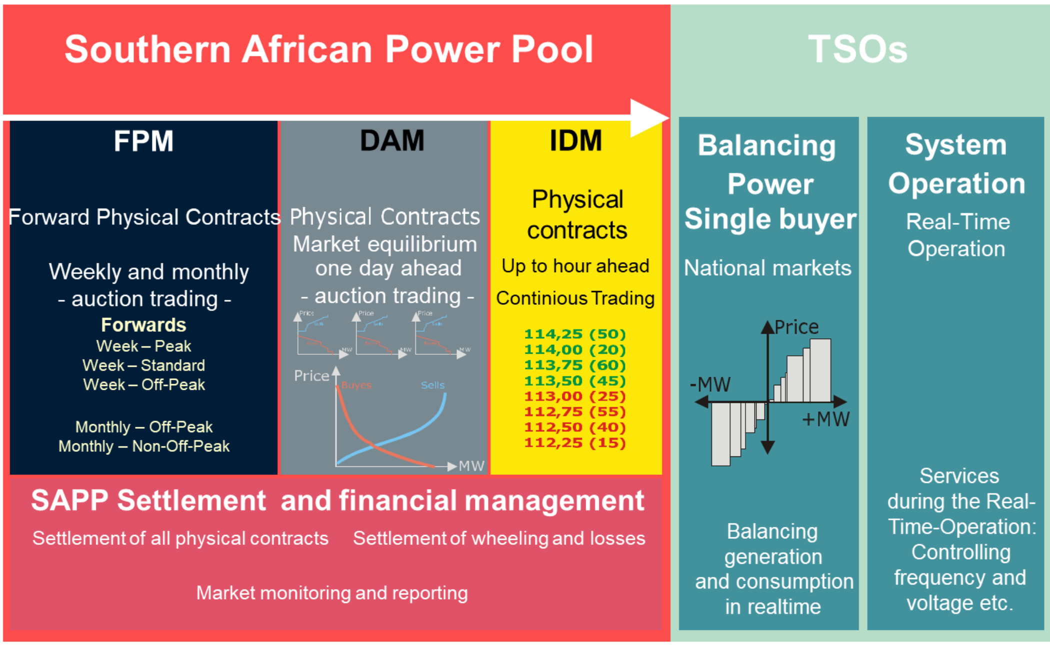
4.7. Competitive Trade (DAM and PDAM)

The STEM trading platform was not perfect and a more sophisticated day-ahead market (DAM) platform succeeded it, using NordPool donor funding and expertise in 2009 (the platform has since been upgraded during 2013–2014). There was no power to trade and where little power was available, the transmission wheeling paths were congested with bilateral contracts, which also suffered curtailments. As the deficit situation began to lift from 2012, trade volumes started to increase. The DAM platform has more sophisticated price determination (market clearing principle) and congestion management methodologies that send accurate investor signals; and manages the trade, reconciliation, and settlement processes centrally and faster. Matched participants are only known to the market operator, thus, reducing market manipulation chances. Since 2013, the DAM trend has been upward in volumes except for fluctuations on a month-by-month basis.

Comparison of Bilateral and Competitive Market Trade

During the SAPP financial year of 2013–2014, the competitive market share of electricity trade in the region was 1%. The rest (99%) was on the bilateral market. Security of supply concerns took center stage, especially with a general power supply shortfall in the region. Most utilities meet their base load with internal generation and firm bilateral contractual supply. The competitive market is used for economic optimization. Mismatch in prices between sellers and buyers in the competitive market combined with transmission constraints to limit trade volumes. Without transmission constraints during 2013–2014, the market could immediately grow to 3% of total trade in SAPP. Figure 8 illustrates the current SAPP market structure. As explained earlier in this chapter, the market segments consist of forward market, day-ahead market, intraday market, and TSO balancing market.

Figure 8. SAPP Market Structures



DAM = day-ahead market, FPM = Forward Physical market, MW = megawatt, SAPP = Southern African Power Pool.
Source: Author.

4.8. Balancing Market

SAPP is pursuing the establishment of a balancing market. Training on methodologies is being given to stakeholders involved.

4.9. Market Surveillance

To maintain integrity, the market must function without biases and abuse of market power or unfair advantage by members. SAPP has a market surveillance function in its structures to ensure proper market operation. An interim arrangement is functional at present with the longer-term solution being processed.

5. Third-Party Access in the Southern African Power Pool

As noted earlier, the approach to TPA in the SAPP differs from the examples described for continental Europe, in that the main driver for TPA is membership to SAPP itself and the desire to trade electricity internationally. Individual SAPP member countries are at widely differing stages of electricity sector deregulation, and so the legal and regulatory arrangements permitting access to national networks vary between countries. The agreements entered into between SAPP members, including those IPPs who wish to trade with SAPP utilities, contain a number of specific provisions relating to TPA. These are outlined in the following sections.

5.1. Hierarchy of Agreements

SAPP has a hierarchy of defined documentation, which sets out primarily the roles and responsibilities of the national governments and power utilities in the participating countries. These comprise the following:

1. The Revised Inter-Governmental Memorandum of Understanding of 23 February 2006.
2. The Inter-Utility Memorandum of Understanding of 24 April 2007.
3. The Agreement between Operating Members.
4. The Operating Guidelines.
5. Other approved guidelines, including a set of Guidelines for the Admission of New Members.

5.2. SAPP Operating Guidelines

The SAPP Operating Guidelines contain a section on the Connection and Operation of Independent Power Producers. This is found in Appendix C and begins with an acknowledgement of the increasing involvement of IPPs in electricity trading in SAPP. It places the onus on IPPs to liaise closely with the system operator in their host country to ensure that each IPP 'plays its part in making the SAPP interconnected system reliable, stable, secure and safe and also plays a part in minimising energy losses'.

The requirements that the IPP should comply with are defined, including the following:

- Provision of information by the IPP to the national system operator to enable technical studies to be undertaken.

- The IPP and the national system operator are to enter into a Connection Agreement covering both technical and commercial terms for the operation of the IPP.
- A series of technical requirements for control and monitoring equipment to be fitted to the IPP's generation facilities.
- Provisions requiring compliance with SAPP rules on information sharing, energy scheduling, delivery of energy, and energy accounting.

The SAPP Operating Guidelines, therefore, effectively function not only as a document that imposes technical conditions for participation in regional trading on IPPs, but *also* contains requirements that must be adhered to within the IPPs' national electricity industries. It is important to note, however, that this guideline provides a fairly minimal set of conditions that need to be satisfied.

This guideline also contains provisions on wheeling, and obliges the member utilities to make their networks available for wheeling purposes. Once an IPP has become a member of SAPP, it has a right, through the SAPP agreement structure, to wheel power to another SAPP member.

5.3. SAPP Guidelines for the Admission of New Members

The SAPP Guidelines for the Admission of New Members (Appendix B), and the SAPP Inter-Utility Memorandum of Understanding (IUMOU) use the term 'Electricity Supply Enterprise' to define a range of participants in the SAPP trading platforms. This definition covers power utilities, independent transmission companies, service providers, and crucially for the purposes of TPA, IPPs. The definition of an IPP carries with it the assumption that the generator is connected to the SAPP Grid, i.e. the transmission network is owned and operated by the SAPP member utilities. Condition 5 of the Guidelines for the Admission of New Members sets out the General Conditions for Admission to SAPP and states that applicants:

'Must be licensed and or authorised by a competent body/authorities within their jurisdiction to engage in cross-border electricity trade'.

There is, therefore, a stated assumption that any IPP that seeks to become a member of SAPP and to trade electricity across borders should possess an appropriate licence within its own national jurisdiction. The applicant is required to provide a copy of its licence as part of the application package.