Power pools in Africa

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In the last decade, a number of power pools have been set up in Africa, starting with the Southern African Power Pool (SAPP) created in August 1995 through a Southern African Community Development (SADC) treaty and aimed at optimising the use of available energy resources in the SADC region. Since then, other power pools have been created such as the West African Power Pool (WAPP), Central African Power Pool (CAPP), East African Power Pool (EAPP), and the Nile Basin Initiative (NBI).

The NEPAD initiative in the power sector is based on the development of regional power markets that allow economies of scale through the pooling of resources by interconnecting national power systems. A power pool is a group of organisations that operate their power systems jointly to obtain net benefits for each organisation. There are many different kinds of power pools some of which are illustrated in Table-1 [1].

The main arguments for the creation of power pools in Africa, taking the example of the Southern African Power Pool (SAPP) include:

- Economies of scale - The creation of power pools in Africa would lead to the creation of larger and regional power markets. African markets are generally considered to be individually small, but a regional power market is bigger and better. Larger power markets provide a large customer base resulting in economies of scale that could easily justify the costly investment generally required in the power sector. The motivation is that a bigger market can reduce the risk of investment in the African power sector.

- Increased system reliability and security of supply - An interconnected power system provide a better system reliability and security of supply compared to a single system. A number of member countries in the SAPP that have lost power generation for a short while due to a system fault have been temporarily supported by their neighbours through emergency support agreements within the pool. The availability of emergency support has ensured a continuous supply of power to customers in the southern African region.

- The advantage of a generation mix - Power generation in the SAPP is a mixture of thermal (74%), hydro (21%), nuclear (4%) and gas (1%). A good generation mix helps to mitigate the effects of drought in the pool. The drought of 1992 that took place in southern Africa is a good example. The predominantly southern thermal network of South Africa supplied the predominantly hydro network of the north, consisting of the DRC, Zambia and Zimbabwe.

- Reduction in planning and operating reserves - In the SAPP the reserve margin was 20% up to the year 2002. From then onwards, the members agreed to reduce planning and operating reserve to 10.2%.

- Improved delivery service to customers - The results of the performance of members of the pool in the SAPP are published on an annual basis. This has given rise to competition in the delivery service and is encouraging members to deliver a better service to customers.

Overview of existing power pools in Africa

The SAPP was the first regional initiative to be launched in August 1995 through a Southern African Development Community (SADC) treaty. The Economic Community of West African States (ECOWAS) followed by the creation of the West African Power Pool (WAPP) in 1999. In North Africa, cooperation between utilities started with COMELEC but the driving initiative is now the Euro-Mediterranean ring, which will interconnect all the North African countries to the European and Middle East power systems [2]. Two other major initiatives have been launched, the Central African Power Pool (CAPP Brazzaville, April 2003) and the Nile Basin Regional Power Trade Project developed under the Nile Basin Initiative (NBI, 2003 Dar es Salaam Ministerial Declaration).

The SAPP is a good example of a cooperative pool that is now in transition to a competitive power market. SAPP is an association of twelve member utilities from the SADC countries. There are four legal documents covering the rights and obligations of the SAPP participants:

- Inter-governmental memorandum of understanding (IGMOU), which grants permission for the utilities to participate in the SAPP and enter into contracts, and guarantees the financial and technical performance of the power utilities;

- Inter-utility memorandum of understanding (IUMOU) between participants, defining ownership of assets and other rights, e.g. provision for change in status from participating to operating member;

- Agreement between operating members (ABOM), which determines the interaction between the utilities with respect to operating responsibilities under normal and emergency conditions;

- Operating guidelines (OG), which defines the sharing of costs and functional responsibilities for plant operation and maintenance including safety rules.

In case of inconsistency, the first document has precedence over the second document; the second document over the third document and the third document over the fourth document. No other document can
be construed as governing the establishment and administration of the SAPP.

A Coordination Centre based in Harare and established in February 2000 is now responsible for coordinating the activities of the SAPP. A major feature of the SAPP is the combination of long- and short-term arrangements, providing increased scope for reduction in supply costs to participating members. Such contracts govern the specific commercial arrangements, within the SAPP framework. The basis for the SAPP as defined in the IGMOU is the need for all participants to [3]:

- Co-ordinate and co-operate in the planning and operation of their systems to minimise costs while maintaining reliability, autonomy and self-sufficiency to the degree they desire; and
- Fully recover their costs and share equitably in the resulting benefits, including reductions in required generating capacity, reductions in fuel costs and improved use of hydroelectric energy.

The intergovernmental agreements and the bilateral contracts between the utilities form the basis and foundation for cross border electricity trading in the SAPP. The prices for the bilateral energy contracts are negotiated between the buyer and the seller. The pricing structure for bilateral contracts is diverse with some contracts having capacity rates and energy rates which take cognisance of the time of use, peak or off peak. Other contracts have flat energy rates [4].

The SAPP vision is to develop a competitive electricity market for the SADC region where the end users have a choice of supply. The start of the short-term energy market (STEM) in April 2001 was the first step towards the development of a regional competitive market. The primary objective of the STEM is to offer attractive economical energy through competition. STEM complements the existing long-term bilateral contract among members.

In terms of membership, the SAPP has two types of members; Operating and Non-Operating Members. Operating Members are those members that have signed the ABOM and OG on top of the IUMOU and are connected to the SAPP grid. Non-Operating Members have signed the IUMOU, but are not yet connected to the SAPP grid and are not signatories to the ABOM and OG.

The WAPP

The West African Power Pool (WAPP) was launched after the persistent energy crisis in the West African region in the late 1990s. ECOWAS is putting in place the legal and institutional framework as well as the infrastructure for the power regional trade in West Africa. A Memorandum of Understanding was signed by the governments in 2000 followed by a protocol of cooperation between the electric utilities in 2001. ECOWAS undertook many studies, which led to the adoption by the Heads of States and Government of the different decisions relating to [2]:

- The WAPP organizational structure and a regional regulatory agency;
- The ECOWAS Energy Protocol
- The ECOWAS Energy Observatory
- The WAPP Master Plan
- A capacity building program.

The priority projects are under implementation. It is planned to complete the interconnection between all the countries by 2010 and upgrade the capacity of the existing interconnections. The governance and regulatory institutions are still in the implementation phase. The Energy Observatory, which is the embryo of the information and Coordination Centre, started in 2004 in Cotonou, Benin. WAPP is also developing a regional planning exercise based on a specific regional planning optimisation model. Even though the WAPP is using lessons learned from the SAPP, the WAPP is building its own strategy compatible with its own regional constraints.

The CAPP

The countries of Central Africa created the Central African Power Pool (CAPP) in April 2003. The CAPP is a body of the Economic Community of Central African States (ECCAS) and is headquartered in Brazzaville, Republic of Congo.

The vision of the CAPP is to use the enormous Central African hydroelectric potentialities, estimated at more than 650 TWh/year (52 % of all the African potential), to satisfy all the demands for electricity, in favor of households, States and industries of Central Africa through systems of interconnection of national networks, and an open market for the electric energy exchanges. The main objectives of CAPP are to [5]:

- Enforce energy policy at the regional level,
- Promote and develop power trade and ancillary services,
- Increase access to electricity to populations and reduce poverty,
- Improve electricity system reliability and quality of supply in the whole region, and
- Create a free regional electricity market.
In terms of membership, any public, private, and/or semi-public electricity supply enterprise of ECCAS member states may become a member of CAPP. Presently CAPP has eleven members: AES-SONEL (Cameroon), ENE-EP and EDEL (Angola), ENERCA (Central African Republic), SNE (Republic of Congo), SEEG (Gabon), SEGESA (Equatorial Guinea), SNEL (Democratic Republic of Congo), EMAE (Sao Tome & Principe), and STEE (Chad). The expected members in the near future include ELECTROGAZ (Rwanda) and REGIDESO (Burundi). It is interesting to note that two members of SAPP (ENE of Angola and SNEL of the DRC) are also members of CAPP.

The EAPP

An MOU for the creation of the East African Power Pool (EAPP) was signed in Dar es Salaam in November 2003. The main objectives of the EAPP are to [6]:

- Optimise the usage of energy resources in the region by working out regional investment schemes in power generation, transmission and distribution areas, taking into account the environmental effects.

- Increase power supply in the region in order to increase the access rate of the population to electricity in Eastern Africa.

- Reduce electricity production cost in the region, using power systems interconnection and increasing power exchanges between countries.

- Provide an efficient co-ordination between various initiatives taken in the fields of power production and transmission as well as exchanges in the region.

- Create, in the framework of NEPAD, a conducive environmental for investments, in order to facilitate integration projects financing in the fields of power generation and transmission in the region, and facilitate the development of competitive electricity market in the EAPP region.

The Coordinating Office for the EAPP has been set up in Dar es Salaam, Tanzania. The EAPP has two types of members: Active Members and Affiliate Members. In total the pool has twelve members. Active Members are public or concessionary utilities in charge of electric power production, transmission and/or distribution in the region and who have fulfilled membership conditions. Affiliate Members are Independent Power Producers operating in the region and who have fulfilled the membership conditions.

The current members of the EAPP include REGIDESO (Burundi), ELECTROGAZ (Rwanda), EEPDO (Ethiopia), KPLC (Kenya), KENGEN (Kenya), UEGCL (Uganda), SNEL (DRC), TANESCO (Tanzania), NEC (Sudan), UETCL (Uganda), UEDCL (Uganda), UEB (Uganda).

Two members of the SAPP (SNEL of the DRC and TANESCO of Tanzania) are also members of the EAPP. The EAPP also covers part of the Nile Basin Initiative. The ten countries of the Nile have agreed through the Nile basin Initiative “to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources”.

Cross border interconnections

Cross-border interconnections and power trade started in Africa in the early 1950s when Algeria and Tunisia first linked their electricity networks to exchange power in emergency cases, followed by the interconnection between the former Zaire (presently The Democratic Republic of Congo, DRC) to Zambia. In the following decades, many other projects were completed and most of them were generally associated with the development of hydropower projects (Akosombo, Owens Falls, Kariba, Inga, Manantali, etc.). Power trade was limited to bilateral contracts and emergency support even though the utilities had signed agreements relating to cooperation in the energy sector.

Currently, only the SAPP has more than three-quarters of its members interconnected to the power grid and energy trading is taking place. EAPP and WAPP have both developed master plans for cross border interconnections. The biggest challenges is structuring the projects and make them affordable for funding. It is important to realise that cross border interconnections that aim to benefit two or more parties tend to sell faster than those that look like internal reinforcements. Some examples of cross border interconnections that received good attention in the SAPP include the following:

- The 400 kV Matimba-Phokoje-Insukamini transmission line linking Eskom of South Africa, BPC of Botswana and ZESA of Zimbabwe. This line was commissioned in 1995 and was structured to benefit the three countries.

- The 330 kV transmission line between Songo in Mozambique and Bindura in Zimbabwe was commissioned in 1997 and linked ZESA of Zimbabwe to EDM of Mozambique.

The above two lines were driven by the increased ZESA import requirements to supply customers in Zimbabwe. In both cases, ZESA played a crucial role in the structuring of finance to fund the construction of the lines. There was a ready market in Zimbabwe and both South Africa and Mozambique had excess power to meet the demand in Zimbabwe.

In 2001, the SAPP Pool Plan was completed. The Pool Plan identified four cross border interconnectors and classified them as priorities. The four interconnectors identified were:

- The Malawi-Mozambique interconnector aimed at interconnecting Malawi to the SAPP grid at 330 kV. This would make ESCOM of Malawi become an Operating Member of the SAPP. The proposal is to construct the line at 330kV, but initially operate it at 220 kV. It is hoped that this project will be completed in 2007.

- The Zambia-Tanzania interconnector - The project has now been extended to include the Tanzania-Kenya interconnector making it more viable. Different technical solutions are being considered including HVDC. A feasibility study is underway and
the recommendations would be made known once the study is completed. The scope of the feasibility study includes funding options for the interconnector.

- The DRC-Zambia interconnector - This project aims to upgrade the existing 220 kV interconnector from a transfer capacity of 210 MW to 500 MW in the medium term and later to 850 MW in the longer term. The longer-term solution includes the 330 kV interconnection linking Kolwezi in the DRC to Solwezi in Zambia.

- The interconnection of Angola to the SAPP grid - This project is now under the Western Power Corridor Project (Westcor). Westcor aims to develop the hydro potential of the DRC at Inga-3. Inga-3 is expected to generate 3500 MW of power and this will be transferred to southern Africa through Angola, Namibia, Botswana and South Africa. Other members of the SAPP are expected to benefit as well. The five governments of Angola, Botswana, the DRC, Namibia and South Africa signed an MOU on 22 October 2004. At the same time, the five utilities making up Westcor (ENE, BPC, SNEL, NamPower and Eskom) also signed an MOU paving the way for the creation of Westcor. Westcor, a Joint Venture Company, has an office in Botswana and will develop Inga-3 and the associated transmission and telecommunications infrastructure.

The Zambia-Namibia interconnector though not in the priority list of the SAPP Pool Plan transmission projects is under construction and is expected to be completed before end of December 2006. This interconnector will increase the north-south transfer capability of the SAPP.

Energy trading

One of the major benefits of interconnections and power pools is energy trading and competition. In the SAPP two trading mechanisms have been established and these are bilateral contracts and the short-term energy market (STEM).

Bilateral contracts are generally of a long-term duration. They provide for the assurance of security of supply but are not flexible to accommodate varying demand profiles and varying prices. The pricing of electrical energy defers for periods of peak and off peak consumption. A review of energy trading in the SAPP carried out by the SAPP Coordination Centre in April 2004 showed that bilateral contracts accounted for almost ninety five percent of the total energy traded in the SAPP.

In April 2001, the SAPP started the short-term energy market (STEM) with two participants, Eskom and ZESA. By the end of the year, two more members had joined the market. Designed to be day-ahead market, the STEM compliments the bilateral market and provides another technique for the pricing and sourcing of electrical energy. Its primary objective is to offer attractive economical energy through competition and is now increasingly viewed as a first stage towards full competitive electricity trade in the region.

Conclusion

The African initiative for creating investment opportunities in Africa is via Nepad, the New Partnership for Africa's Development. Nepad is a holistic, comprehensive and integrated strategic framework for the social-economic development of Africa. The primary objective of Nepad is to eradicate poverty in Africa and to place African countries on a path of sustainable growth and development. It is also Nepad's top priority to make Africa attractive to both domestic and foreign investors. One of the conditions in the Nepad for sustainable development is the promotion of sub regional and continental economic integration. Therefore, the creation of power pools in Africa is in line with the Nepad initiative of sub regional integration.

References


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