The Infrastructure Consortium for Africa
Le Consortium pour les infrastructures en Afrique

REGIONAL POWER STATUS IN AFRICAN POWER POOLS

REPORT

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Infrastructure Consortium for Africa (ICA)

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The Infrastructure Consortium for Africa Secretariat
c/o African Development Bank
BP 323-1002 Tunis Belvédère, TUNISIA
www.icafrica.org

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FOREWORD

ICA has undertaken production of a series of knowledge products, including documents on the Energy Sector. The present report on "Regional Power Sector Status" focuses on regional developments, particularly in the Regional Power Pools.

Regional power generation and interconnection projects play a significant role in the strategies for increased access to electricity in Africa. The Regional Economic Communities (RECs) promote regional power projects and trade through their respective power pools.

Against this background, the Infrastructure Consortium of Africa (ICA) has taken the initiative of conducting a study with the objective of providing a synthetic overview of the African power sector at the regional level. The target audience for this report is primarily the general public, DFIs (including ICA members), private sector entities and other key stakeholders involved in the power sector in Africa.

With this report, the Infrastructure Consortium for Africa (ICA) provides an overview of power pools in Africa as of end 2010, including the most recent key data and relevant information. The report covers current infrastructure and institutional status in addition to key investment trends. By design, the report does not provide analytical view nor does it discuss the current challenges, forecast the future but gives an overview of the modalities of power generation and specific conclusions and recommendations for each of the power pools.

The report shows that all the power pools are experiencing concrete achievement in the process of implementing interconnection projects and generation projects with regional dimension.

As far as power trade is concerned (primarily within power pools), electricity traded is still low (less than 1%) for CAPP and for EAPP. It is relatively higher (approx. 7%) in COMELEC, SAPP and WAPP. SAPP is in a more advanced stage of development with an active role played by the Short Term Electricity Market (STEM) and more recently by the Day Ahead Market (DAM).

Institutional set up and market rules and regulations have already been implemented in SAPP, are being implemented in WAPP and under design in EAPP. However CAPP and COMELEC have still to design and develop their power market institutions and rules.

This report highlights the contribution of multilateral agencies (such as AfDB, WB, EU) and bilateral agencies in building the institutional set up and funding power pool investment requirements.

For future regional projects, the report has commended that the power pools have formally adopted their priority projects at the regional level through Regional Master Plans Studies and are mobilizing funding.

Nevertheless, despite the progress achieved, significant contribution from development partners is still required for promoting the funding of regional priority projects and for sustaining the development of the institutional and trade framework.

I would like to thank CAPP, COMELEC, EAPP, SAPP and WAPP for making this report possible by providing the ICA Secretariat with their support in compiling and analyzing the selected data.

KEY MESSAGES AND FINDINGS

1. There are primarily five power pools acting as specialized agencies of their respective RECs: (i) the Central Africa Power Pool (CAPP) for the Economic Commission for Central Africa States (ECCAS), (ii) the Comité Maghrébin de l'Electricité (COMELEC) for the Union of Maghreb Arab (UMA), (iii) the Eastern Africa Power Pool (EAPP) for COMESA, (iv) the Southern Africa Power Pool (SAPP) for SADC, and (v) the West Africa Power Pool (WAPP) for ECOWAS.

2. Changes in the development of power pools have been rapid in recent years. Through this report, the Infrastructure Consortium of Africa (ICA) aims to provide an overview of power pools in Africa as of end 2010, including the most recent data and information. The report covers both current status on data and information as well as on key investments trends. By design, the report does not provide analysis, discuss current issues, or forecast the future. Therefore, the report provides also specific conclusions and recommendations for each of the power pools.

3. Installed capacity is 6073 MW for CAPP (2009), 27 347 MW for COMELEC (2009), 28 374 MW for EAPP (2008), 49 877 MW for SAPP (2010) and 14 091 MW for WAPP (2010). The installed capacity per thousand habitants is the highest in North and South Africa in terms of kW per thousand habitants: COMELEC (319), SAPP (311), followed by EAPP (74), WAPP (54) and CAPP (49).

4. As far as electricity mix is concerned, at Africa level, most of the existing capacity is thermal (75%) due to the size of the COMELEC and SAPP systems, which are predominately thermal. Hydropower is predominant in CAPP (86%). In EAPP and in WAPP, the present share of hydro is 24% and 30%, respectively, but this share is expected to grow rapidly as ongoing and future generation investments are mainly in hydropower projects (e.g. Ethiopia: Gibe III with 1870 MW).

5. Access to electricity is still very low: 31% of the countries have an electrification rate below or equal to 10%. Nearly 70% have an electrification rate below or equal to 30%.

6. The electricity consumption per capita is still very low: 54% of the countries have an average consumption below 200kWh/capita, with only 18% having an average consumption over 1000 kWh/capita.

7. As far as power trade is concerned (mainly within power pools), electricity traded is still low for CAPP (0.2% in 2009) and in EAPP (0.4% in 2008). It is relatively higher respectively in COMELEC (6.2% in 2009), in SAPP (7.5% in 2010) and in WAPP (6.9% in 2010). SAPP is at a more advanced stage with 28 bilateral contracts already signed between the member countries and with an active role played by the Short Term Electricity Market (STEM) since 2001 and by the Day Ahead Market (DAM) since 2009. Further development of the regional market is however constrained by the lack of generation capacity linked with congested and insufficient interconnections capacity.

8. Institutional set up and market rules and regulations have already been implemented in SAPP, are being implemented in WAPP and under design in EAPP. However, CAPP and COMELEC have still to design and develop their power market institutions and rules.

9. As for regional projects, all power pools are experiencing concrete achievement in implementing interconnection projects. Up-to-date regional master plans are available for all power pools. Except for COMELEC, the four other power pools have formally adopted their priority projects at the regional level and are mobilizing funding.

10. Given the level of investment required, private sector participation is requested with possible public participation (under PPP set up). However, so far, the pace of mobilizing funding is slow for various reasons and innovative approach is required for mobilizing funding for regional projects.

11. For interconnection projects, some solutions are already initiated: as these projects are benefiting to various countries, their funding could be developed through specific vehicle project (SVP) where the concerned utilities/players could contribute to the assets, provided that proper wheeling charges are agreed upon. This solution is already considered in SAPP for ZIZABONA interconnection project (Zimbabwe-Zambia-Botswana-Namibia). It could be also considered in other power pools such as EAPP for the interconnection Ethiopia-Sudan-Egypt.

12. For Generation projects with regional dimension, they could be developed through a PPP/IPP arrangement with an innovative approach, providing a minimum set of guarantee for investors and securing an acceptable level of competition between the operators of the regional market. This could lead to the following propositions:

- The regional market could constitute a sufficient guarantee for future investments,
- An alternative option could have two main components: (i) the first component could consist in establishing a PPA between the PPP/IPP and the national TSOs through the power pool for part of the generation output (for example, 50%). This would secure a minimum revenue guarantee for the promoter, (ii) the second component would consist in establishing bilateral contracts or in selling on the short-term market the rest of the generation output (remaining 50%). This would secure a minimum level of competitiveness in the regional power market.

  The same approach could apply for WAPP with all coastal zones already connected (7 of 14 countries).

GLOSSARY OF ACRONYMS

ACDI	Agence Canadienne de Développement International
AfDB	African Development Bank
AFD	Agence Française de Développement
CAPP	Central Africa Power Pool
CAR	Central African Republic
COM	Conference of Ministers
COMELEC	Comité Maghrébin de l'Electricité
COMESA	Common Market for Eastern and Southern Africa
CTC	Central Transmission Corridor
cUS$/kWh	United States cents per kilowatt hour
DAM	Day Ahead Market
DBSA	Development Bank of Southern Africa
DRC	Democratic Republic of Congo
DSO	Distribution System Operator
EAC	East African Community
EAPP	Eastern Africa Power Pool
EAPP-PS	Eastern Africa Power Pool Permanent Secretariat
EAPP-SC	Eastern Africa Power Pool Steering Committee
EC	European Commission
ECD	European Commission Delegation to Ethiopia
ECOWAS	Economic Commission for West African States
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESIA	Environmental and Social Impact Assessment
ENSAP	Eastern Nile Subsidiary Action Programme
ENTRO	Eastern Nile Technical Regional Office
EU	European Union
GWh	Gigawatt hour
IE	Incidental Expenditures
IPPF	Infrastructure Project Preparation Facility
ISO	Independent System Operator
KfW	Kreditanstalt für Wiederaufbau
KV	Kilovolts (=103 Volts)
kWh	Kilowatt hour
MOU	Memorandum of Understanding
MW	Megawatts (=106 Watts)
MV	Medium Voltage
NBI	Nile Basin Initiative
NEPAD	New Partnership for Africa's Development
NEPAD-IPPF	NEPAD Infrastructure Project Preparation Facility
NELSAP	Nile Equatorial Lakes Region Subsidiary Action Programme
PIM	Project Information Memorandum
PIPES	Planning, Investment, Programming & Environmental Safeguards
PSC	Project Steering Committee
PTC	Power Trade Committee
RAP	Resettlement Action Plan

RFP	Request for Proposals
ROW	Right of Way
RPTP	Regional Power Trade Project
RSA	Republic of South Africa
SADC	Southern African Development Community
SAPP	South Africa Power Pool
STEM	Short Term Energy Market
SVP	Shared Vision Programme/Specific Vehicle Project
TOR	Terms of Reference
TSO	Transmission System Operator
WAPP	West Africa Power Pool
USD/US$	United States Dollars

REGIONAL POWER STATUS IN AFRICAN POWER POOLS

I. EXECUTIVE SUMMARY

1. OBJECTIVE OF THE STUDY

Considering the important contribution of regional power generation and interconnection projects to the development of access to electricity in Africa and the increasing contribution of the Regional Economic Communities (RECs) through their respective power pools in promoting regional power projects and trade, the Infrastructure Consortium of Africa (ICA) has taken the initiative of conducting a study with objective to provide a synthetic overview on the status of the African power sector at the regional level.

As far as regions are concerned, there are primarily five power pools acting as specialized agencies of their respective RECs: (i) the Central Africa Power Pool (CAPP) for the Economic Commission for Central Africa States (ECCAS), (ii) the Comité Maghrébin de l'Electricité (COMELEC) for the Union of Maghreb Arab (UMA), (iii) the Eastern Africa Power Pool (EAPP) for COMESA, (iv) the Southern Africa Power Pool (SAPP) for SADC, and (v) the West Africa Power Pool (WAPP) for ECOWAS.

Changes in the development of the power pools have been so rapid in recent years that perceptions of their status can lag behind the reality. This report captures that reality and provides an overview of power pools in Africa as early 2010. The report covers both current status and key trends. By design, the report does not provide analysis, discuss current issues, or forecast the future.

More specifically, for each of the power pools (section 2 to 6), the report seeks to provide a synthetic presentation on (i) the main characteristics of the power sector (e.g. installed capacity, energy mix, consumption, imports/exports, electricity tariffs), (ii) investment programs in regional generation and transmission projects, and (iii) institutional set up and regulations governing the development of regional investment and power trade, and (iv) main findings and recommendations by power pool.

2. OVERVIEW OF THE SITUATION IN THE POWER POOLS

Installed capacity and energy mix

Installed capacity per thousand habitants is the highest in North and South Africa, in terms of kW per thousand habitants, with COMELEC (319), SAPP (311), followed by EAPP (74), WAPP (54) and CAPP (49).

Table 1.1 Installed capacity per thousand habitants by Power Pool

	CAPP 2009*	COMELEC 2009*	EAPP 2008*	SAPP 2010*	WAPP 2010*
Installed capacity (MW)	6073	27 347	28 374	49 877	14 091
Hydropower Share (%)	86%	8%	24%	17%	30%
Thermal Share (%)	14%	91%	73%	83%	70%
Population (millions)	123.9	85.6	385.6	160.5	260.6
kW/1000 habitants	49	319	74	311	54

*Base year: most recent year for which data is available for all countries of the power pool.

Some countries are holding a dominant position in total installed capacity of their power pool: Algeria with 41% of COMELEC, Egypt with 78% of EAPP, RSA with 82% of SAPP, and Nigeria with 60% of WAPP.

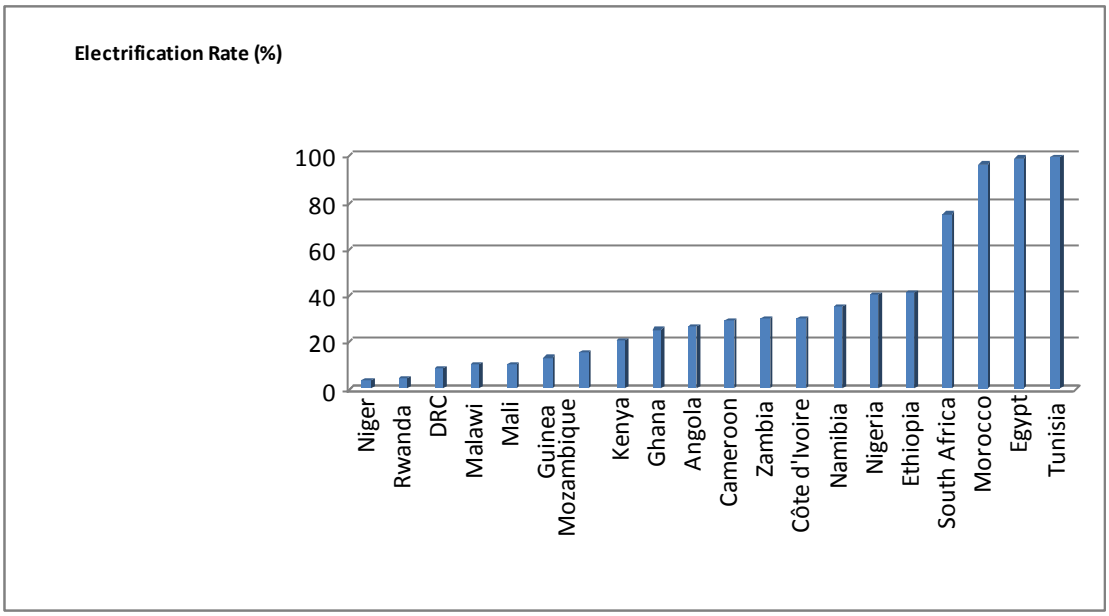
At Africa level, most of existing capacity is thermal (75%) due to the size of the COMELEC and SAPP systems, which are predominately thermal. Hydropower is predominant in CAPP (86%). In EAPP and in WAPP, the present share of hydro is 24% and 30%, respectively, but this share is expected to grow rapidly as ongoing and

future generation investments are mainly in hydropower projects (e.g. Ethiopia: Gibe III with 1870 MW). It is also the case for SAPP (80% of 13 015 MW generation priority projects are hydro). On the horizon for 2020-2025, the power generation mix within these power pools will be moving substantially toward an increasing share of hydropower.

Electrification rate

Access to electricity is still very low: 31% of the countries have an electrification rate below or equal to 10%. Almost 70% have an electrification rate below or equal to 30%. The following graph provides a sample of electrification rate distribution by country:

Graph 1.1 Electrification rate in Africa (%)

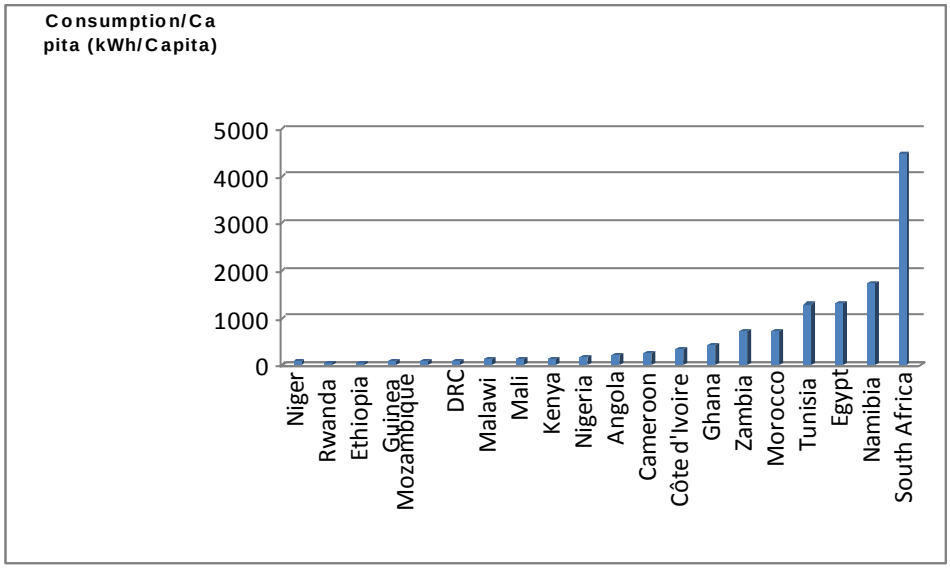


Source: Respective Power Pools data (CAPP, COMELEC, EAPP, SAPP, WAPP).
Year: 2009 (except for EAPP: 2008).

Average electricity consumption per capita

The electricity consumption per capita is still very low: 54% of the countries have an average consumption below 200kWh/capita, with only 18% having an average consumption over 1000 kWh/capita. The following graph provides a sample of countries.

Graph 1.2 Electricity Consumption per Capita in Africa



Source: Respective Power Pools data (CAPP, COMELEC, EAPP, SAPP, WAPP),
Year: 2009 (except for EAPP: 2008)

Power trade and institutional set up

It consists mainly of power trade within the power pools. Power trade between power pools consists mainly in CAPP exporting power to SAPP.

Table 1.2 Power Trade per Power Pool

	CAPP 2009*	COMELEC 2009*	EAPP 2008*	SAPP 2010*	WAPP 2010*
Consumption (GWh)	15 238	89 098	124 017	260 081	47 073
Imports (GWh)	38	5 491	513	19 565	3 247
Exports (GWh)	915	940	931	15 301	3 278
Electricity traded (%)	0.2%	6.2%	0.4%	7.5%	6.9%

*Base year: most recent year for which data is available for all countries of the power pool.

As for power trade, SAPP is at a more advanced stage with 28 bilateral contracts already signed between the member countries and with an active role played by the Short Term Electricity Market (STEM) since 2001 and by the Day Ahead Market (DAM) since 2009. Institutional set up and market rules and regulations are already implemented. Further development of the regional market is however constrained by the lack of generation capacity linked with congested and insufficient interconnections capacity.

By contrast, interconnection capacity is well developed in COMELEC, however, the trade volume is dominated by Moroccan imports from Spain (88%). Trade among COMELEC countries is very low due to lack of generation capacity, but also due to lack of a regional approach reflected by the low profile adopted by COMELEC member countries to develop regional regulation and market rules, as well as for strengthening COMELEC role as a regional institution.

Regional trade in WAPP is already significant, at nearly 7%. Trade primarily takes place between coastal countries: exports from Nigeria, Ghana and to a lesser extent from Côte d'Ivoire, with Benin/Togo as major

importers. However, WAPP is implementing an important investment program in regional generation and interconnection projects. WAPP has also developed its institutional set up and market structure. It is expected that regional trade will increase substantially when regional projects are implemented.

Regional trade in EAPP is very modest (0.4% in 2008), but the situation may change substantively with the recent operation of the Ethiopia-Djibouti interconnection and the ongoing implementation of the Ethiopia-Kenya interconnection. However, EAPP has still to design and develop its power market institutions and rules.

Regional trade is very low in CAPP (0.2% in 2009), except for power exports from Inga 1&2 mainly to Zambia. The situation is expected to change in the short term, with implementation of the vast cross-border program, and in the medium term, with implementation of regional generation and interconnection projects. However, market rules and institutions are still to be developed and institution and capacity building of CAPP are still required.

3. MAIN FINDINGS AND RECOMMENDATIONS

Findings and recommendations specific to each power pool are provided within their relative sections of this report (section 2 to 6). Synthetic comments are provided below.

Implementation of regional projects
All the power pools are experiencing concrete achievement in the process of promoting regional power trade: they are all at an advanced stage of implementing interconnection projects. In parallel, they are at different stages of adopting regional regulation and market rules, and in concluding bilateral contracts for regional trade.

Master plans and priority projects
Up to date regional master plans are available for all the power pools. Except for COMELEC, the four other power pools have formally adopted their priority projects at the regional level and are at the stage of mobilizing funding.

Funding mobilization
Given the level of investment required, private sector participation is requested with possible public participation (under PPP set up). However, so far, the pace of mobilizing funding is slow for various reasons and innovative approach is required for mobilizing funding for regional projects.

For interconnection projects, some solutions are already initiated: as these projects are benefiting to various countries, their funding could be developed through specific vehicle project (SVP) where the concerned utilities/players could contribute to the assets, provided that proper wheeling charges are agreed upon. This solution is already considered in SAPP for ZIZABONA interconnection project (Zimbabwe-Zambia-Botswana-Namibia). It could be also considered in other power pools such EAPP for the interconnection Ethiopia-Sudan-Egypt.

For Generation projects, the situation is different: For instance, SAPP experience has two major features: (i) investment projects were guaranteed in the past through a PPA with Eskom, Eskom being the major customer in the region, (ii) the increasing number of bilateral contracts and the stage of development of the Day Ahead Market (DAM) have shown that there is a substantive regional market constrained only by interconnection congestions and by the lack of generation capacity. Generation project with regional dimension could thus be developed through a PPP/IPP approach with an innovative approach, providing a minimum set of guarantee for investors and securing an acceptable level of competition between the operators of the regional market. This could lead to the following propositions:

- The long-term contract with a single utility is not the only solution,
- The regional market could constitute a sufficient guarantee for future investments,
- An alternative option could have two main components: (i) the first component could consist in establishing a PPA between the PPP/IPP and the national TSOs through SAPP for part of the generation

output (for example 50%). This is to secure a minimum revenue guarantee for the promoter, (ii) the second component would consist in establishing bilateral contracts or in selling on the short-term market the rest of the generation output (remaining 50%). This is to secure a minimum level of competitiveness in the regional power market.

The same approach could apply for WAPP with all coastal zones already connected (7 of 14 countries). The imminent implementation of the interconnection between Ivory Coast and Mali (225 kV) will first give access to Senegal. The CLSG (Ivory Coast-Liberia-Sierra Leone-Guinea) and OMVG (Guinea-Gambia-Guinea Bissau-Senegal) interconnections will soon complete network integration in the West Africa region.

II. REGIONAL POWER STATUS IN CENTRAL AFRICA POWER POOL (CAPP)

The Economic Community for Central African States (ECCAS) has a population of about 138 million and comprises of 10 member states: Angola, Burundi, Cameroon, Chad, Congo, Gabon, Equatorial Guinea, Central African Republic (CAR), Democratic Republic of Congo (DRC) and Sao Tomé.

The Central Africa Power Pool (CAPP) is a specialized agency of the ECCAS.

1. OVERVIEW OF THE POWER SECTOR IN 2009

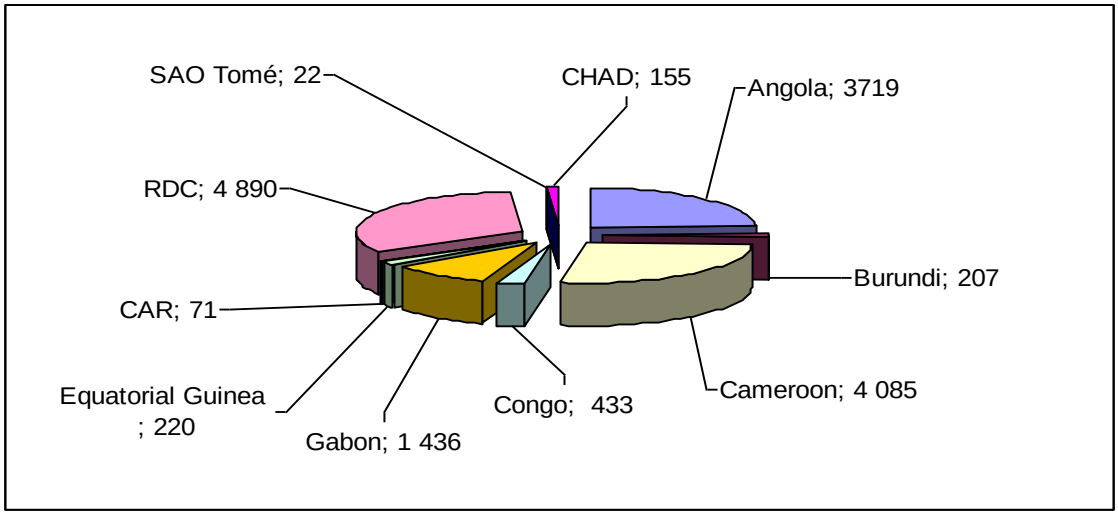
The most recent available data in CAPP are for year 2009.

Power consumption and generation

In 2009, power consumption by CAPP member countries is estimated at 14 307 GWh as compared to 15 238 GWh in 2008. This decrease is mainly due to the non-served energy originated from non regular availability of power.

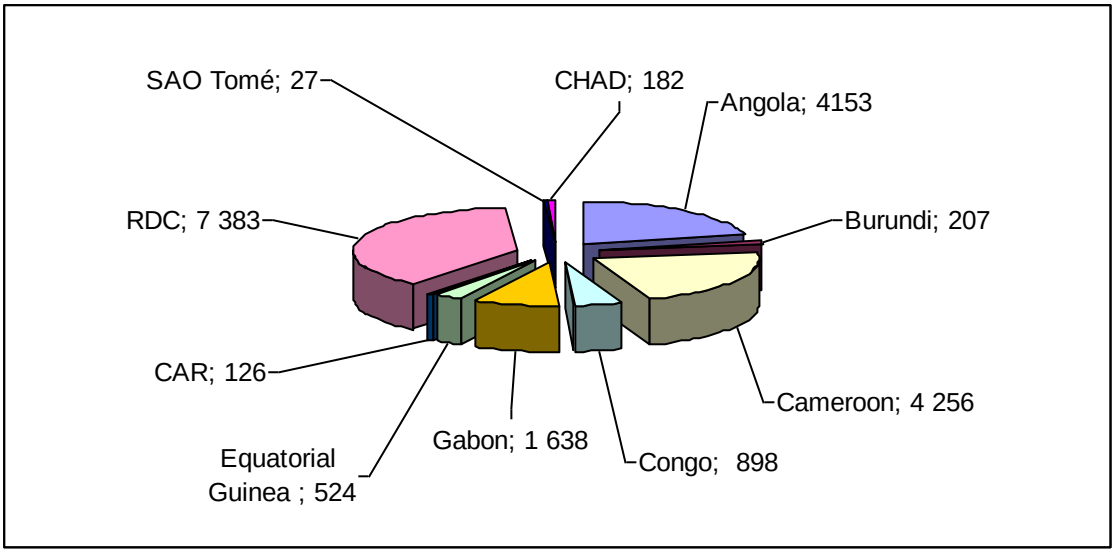
Three countries represent 83% of total consumption, respectively with 24% for Angola, 27% for Cameroon and 32% for DRC.

Graph 2.1 CAPP-2009 Power Consumption by Country (GWh)



Source: (1) Pool Energétique de l'Afrique Centrale (PEAC.). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 01 May 2011.

Graph 2.2 CAPP-2009 Power Generation by Country (GWh)



Source: (1) Pool Energétique de l'Afrique Centrale (PEAC.). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

Imports/Exports

In 2008, exports from DRC have reached 1230 GWh, as compared to the imported 660 GWh during the same year. A limited regional power trade is taking place among few countries through the following interconnections between:

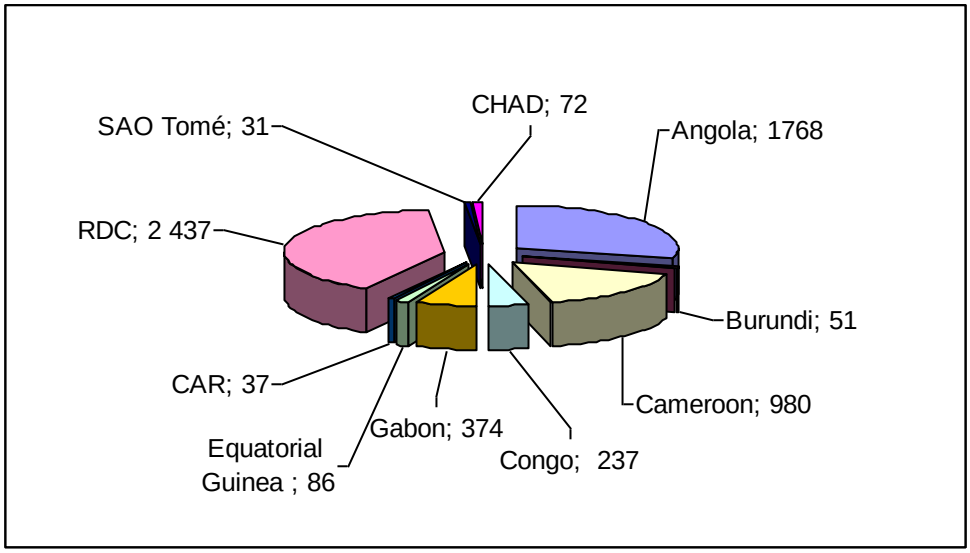
- DRC and Congo (60 MW capacity),
- DRC and Zambia to SAPP (150 MW capacity), and
- DRC to Burundi, CAR, Rwanda and Angola with MV cross-borders sales.

The commissioning end 2010 of Imboulou hydropower plant in Congo has substantially decreased its imports from DRC.

The installed capacity

CAPP installed capacity has reached 6250 MW in 2009. Hydropower represents the major part with 4730 MW and 79%, as compared to 1405 MW for thermal power (19%). The remaining 2% consist of local sales and imports (1). Three countries, DRC, Angola and Cameroon, represent 83% of the total installed capacity. This data does not include self generators, which represent a significant share of thermal power plants in countries like Cameroon, Chad and DRC.

Graph 2.3 CAPP- 2009 Installed Capacity by Country (MW)



Source: (1) Pool Energétique de l'Afrique Centrale (PEAC.). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

Peak load

It was not possible to have data on peak load for 2009 and 2008. However, the study on power interconnection in ECCAS region (4) has made the following estimation of peak load for 2008 in MW:

Table 2.1 CAPP-2009 Peak Load by Country (MW)

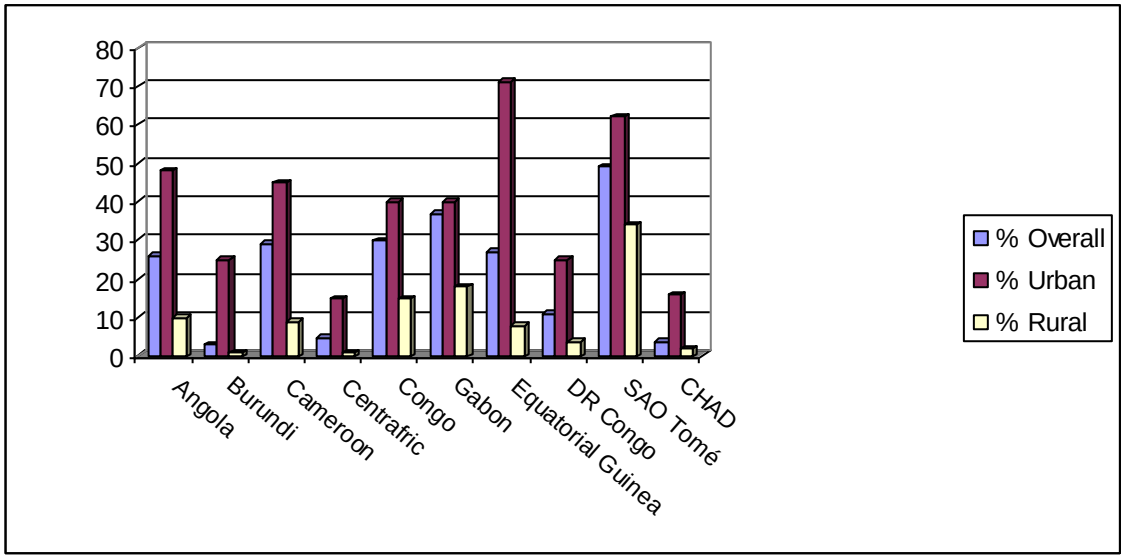
Angola	Burundi	Cameroon	Central African Republic	Congo	Gabon	Equat. Guinea	DRC*	Sao Tomé	Chad
820	42	708	55	192	197	80	760		24

*West DRC (DRC Kivu: 56 MW)

Electrification rate

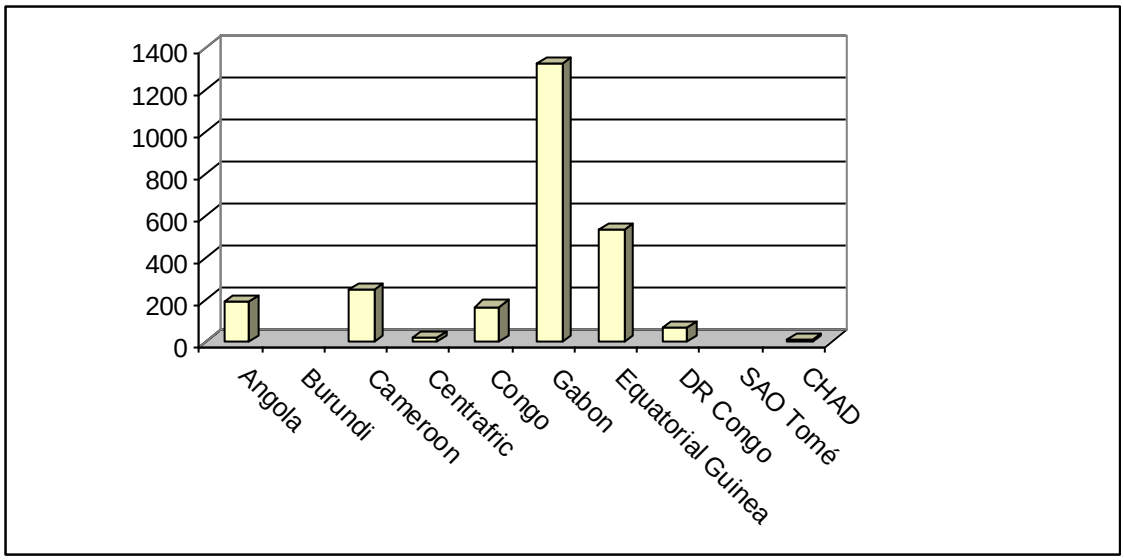
In 2009, access to electricity in CAPP is still low with however differences among countries: 4% for Chad, 26% for Angola and 37% for Gabon. DRC, with an estimation population of 66.5 millions (52% of CAPP population) has an access rate estimated at 11%.

Graph 2.4 CAPP-2009 Electrification Rate (%)



Source: (1) *Pool Energétique de l'Afrique Centrale* (PEAC). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

Graph 2.5 CAPP- 2009 Electricity Consumption per Capita (kWh/capita)



Source: (1) *Pool Energétique de l'Afrique Centrale* (PEAC). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

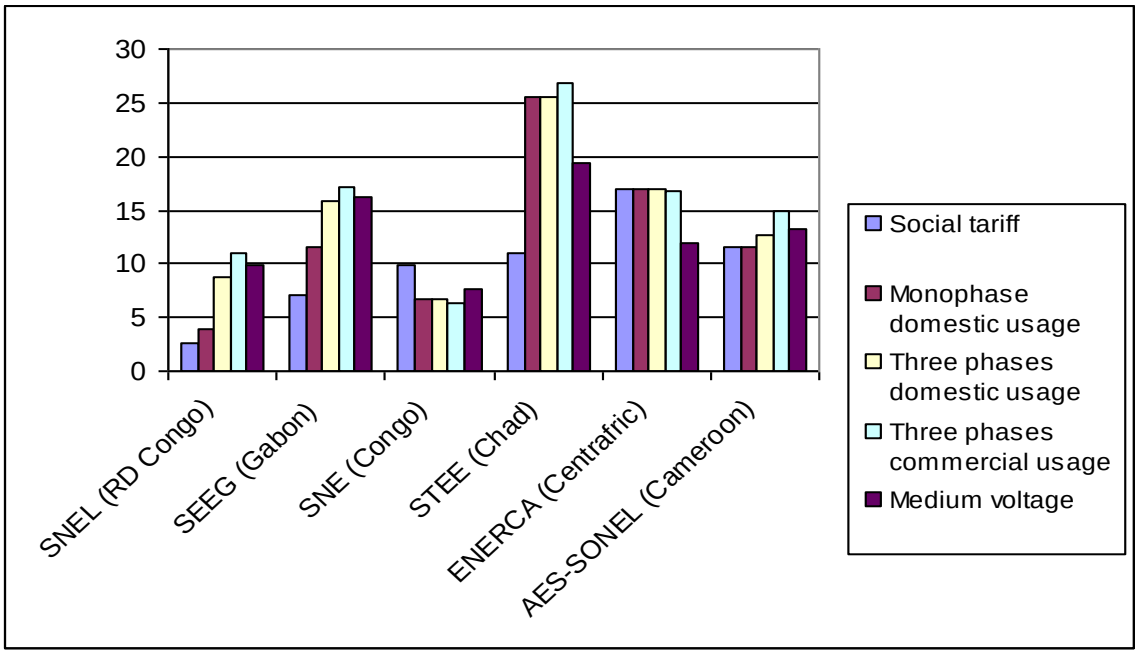
Wide disparities exist also among the countries regarding electricity consumption per capita: It varies from 1326 kWh for Gabon, to 532 to Equatorial Guinea down to 9 kWh/ capita for Chad.

Average electricity prices

A study conducted in 2009 by the Union of Producers, Transporters and Distributers of Electricity in Africa (UPDEA) (3) has produced the following results for CAPP member utilities. The prices are expressed in US cents/kWh.

Graph 2.6 below compares the following tariffs:
- Social tariff (E=100 kWh/month)
- Single-phase domestic usage 2 kW
- Three phases commercial usage 12 kW
- Medium voltage (E = 35000 kWh/month)

Graph 2.6 CAPP-Electricity Tariffs by Country (cUS$/kWh)



Sources: (3) UPDEA: *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.
(1) Pool Energétique de l'Afrique Centrale (PEAC.). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

2. CAPP INVESTMENT REQUIREMENTS

Since the adoption in 2006, the first CAPP Regional Power Plan, the Secretariat General of CAPP regularly reports on investment status and funding requirements (5). Investment activities in CAPP primarily concern the following types of projects:
- generation capacity mainly in hydropower projects;
- power transmission priority projects; and
- trans-boundaries priority projects.

2.1 INVESTMENT AND STUDIES IN GENERATION PROJECTS

They concern mainly the development of the following priority hydropower projects:

- **Inga III (3500 MW) hydropower plant**: A pre-feasibility study was conducted in 2008 under ACDI funding. The various attempts to mobilize funding for both detailed feasibility study and for investment by private promoters have not been materialized. The present approach consists in considering this option in light of the results of the study being conducted under ADB funding on "Development of the Inga site and of related interconnections" (c.f. para. below).

- **Chollet 2x320 MW hydropower site located on Cameroon-Congo borders** and its associated transmission lines. Its objective is to secure power supply to South Cameroon and to North Congo. An inter-States MoU was signed in October 2010 between Cameroon and Congo. The project is to be developed through partnership with China.

- **Mem'vele 220 MW hydropower plant located in Cameroon** and the construction of two transmission lines linking respectively Cameroon-Gabon and Cameroon-Equatorial Guinea. A tri-partite agreement between Cameroon-Gabon-Equatorial Guinea is still to be signed. The project implementation started in November 2010. It is being developed through partnership with China.

- **Grand Poubara 320 MW hydropower site located in Gabon** and of its transmission lines. The project is being implemented under China funding.

- **Djiploho 90 MW hydropower sites in Equatorial Guinea**. The project is being implemented under China funding.

For each of these four projects, the information on the investment costs and on the capacity building component of the project was not available with CAPP.

- **Bendera hydropower plant located in CAR** (rehabilitation and structural reinforcement) and construction of the associated lines: (i) Bendera-Uvira-Kiliba-Bujumbura; (ii) Bendera-Kalemie. The investment costs will be provided by the studies being finalized under EU funding.

- **Ruzizi 3 (145 MW) & Ruzizi 4 (287 MW) hydropower sites in Eastern DRC**. The project will supply at least the three Grand Lac Countries (including Rwanda): For Ruzizi 3, the feasibility study was conducted. A Transaction Advisor has been recruited to assist EGL/countries to select a developer (IPP/PPP). Funding of the project is still required. The pre-feasibility of Ruzizi 4 is being conducted under EIB funding.

- **ZONGO II Hydropower plant (120 MW) in DRC**: The power plant is being constructed in cooperation with China with a total cost estimated at US$360m.

- **Kakobola hydropower plant (80 MW) in DRC**: The power plant is being constructed in cooperation with India with a total cost estimated at US$90m.

- **Development of the Inga Site in DRC (45 000 MW to 60 000 MW) and of the related** interconnections: A study funded by AfDB is being conducted since January 2011 on rehabilitation and expansion of the Inga hydropower site which covers rehabilitation of Inga 1 &2, Inga III and Grand Inga and related transmission lines for supplying power to DRC and to the 5 African Power Pools (CAPP, EAPP, SAPP, WAPP and COMELEC). The final draft report presenting priority investment for the development of the site is expected for end 2012.

2.2 INVESTMENT AND STUDIES IN TRANSMISSION LINES

The investment projects have to be considered within the overall interconnection strategy adopted in light of the Study on Interconnection Projects in Central Africa Region, which was finalized in November 2010. It is coordinated by ECCAS with AfDB funding. It contributed to define the overall development of interconnection schemes up to 2030 and to select the priority projects to be developed on the medium term. These priority projects consist of "the coastal backbone" linking Angola to Chad including connection with DRC, Congo, Equatorial Guinea, Gabon and Cameroon and of two other interconnections linking respectively Cameroon to CAR and DRC to CAR. The overall study covered the detailed feasibility study and prepared the bidding documents of the mentioned priority projects. A Roundtable targeting funding institutions is to be organized end of 2011.

The following Table 2.2 summarizes the list of priority projects:

Table 2.2 CAPP Transmission Priority Projects

Interconnections	Sub-station	Voltage kV (AC)	Capacity MW	Length km	Total cost US$m
Angola-DRC	Maquelo do Zombo – Inga 3	400	800	192	187.29
Congo - Gabon	Mongo Kamba –Bongolo – Chutes de l'Impératrice	400	600	482.1	435.13
Gabon – Equatorial Guinea	Ntoum - Bata	400	600	271.4	296.65
Equatorial Guinea - Cameroon	Bata – Menve'ele	400	600	95.4	146.22
Cameroon - Chad	Maroua – N'Djamena	220	125	205.8	115.71

However, the following interconnection projects (not included in ECCAS study) are also priority projects covered by other studies or to be developed by the concerned countries, namely:

- DRC (Inga)-Angola (Cabinda)-Congo (Pointe Noire) interconnection,
- Gabon: Chute de l'Impératrice-Ntoum transmission line
- Cameroon: Memve'Ele-Maroua transmission line.

The following is the status of some of CAPP transmission investment and studies projects:

- **DRC (Inga)-Angola (Cabinda)-Congo (Pointe Noire) interconnection**: The detailed studies are being conducted under funding from ADB, DBSA, AFD and promoting countries. The Inter-States and Inter-Utilities MoU were signed. The funding of investment estimated at 175 MEUR is still to be mobilized. According to CAPP, this link is a critical constraint to exporting generation capacity available respectively in Angola (Moanda) and in Congo (Pointe Noire).

- **Cameroon-Chad interconnection**: A pre-feasibility study was conducted (EU funding) and a feasibility study has been conducted within the framework of the Study on Interconnection Projects in Central Africa Region (AfDB funding). An Inter-Government MoU was signed. The funding of investment estimated at 89 MEUR is still to be mobilized.

- **Inga – Calabar Interconnection linking Cameroon, Congo, DR Congo, Equat. Guinea, Gabon, Nigeria**: A feasibility study (FS) of the project was conducted to establish an interconnection between CAPP (ECCAS) & WAPP (ECOWAS). The draft TOR of studies is ready and an Inter-Government MoU was signed by eight concerned states. Funding gap for undertaking the study is estimated at US$3.1m.

- **Inga-Burundi and Inga-Est DRC interconnections**: It aims at securing power supply to Burundi and to East DRC. The TORs are being prepared and the funding of studies is still requested.

2.3 INVESTMENT AND STUDIES IN DISTRIBUTION/CROSS-BORDER LINES

A set of 13 projects is being promoted (c.f. Annex 1, Table 1.9). They are at different stages of development. For 10 of them, the feasibility studies are being conducted and are expected to be finalized end 2011. These studies were funded, respectively, by AfDB (five projects), EU (four projects) and Gabon-Equatorial Guinea (one project).

The remaining three require funding for undertaking the studies. The total cost of these projects is estimated at US$201m with US$4.3m for conducting studies and US$197m for investments (c.f. Annex 1, Table 1.10).

3. POLICY FRAMEWORK IN CAPP

3.1 LEGAL AND REGULATORY FRAMEWORK

Created in 2003, the Central African Power Pool (CAPP) was mandated in 2004 as a Specialised Institution of ECCAS with goal to implement ECCAS energy policy.

ECCAS' mandate is to improve upon regulatory and contractual legislations related to the exchange of energy within the 10 countries in the region. CAPP seeks to secure energy supply within the ECCAS and achieving socio-economic development of Central Africa through the regional electricity market.

Electricity Market Code

It aims at implementing a regulatory framework for promoting and securing power investments and regional trade. The Code was adopted in October 2009 by head of States and Government Conference held in Kinshasa. It was later published in November 2010 by ECCAS gazette.

3.2 SYSTEM PLANNING

The first CAPP Regional Power Master Plan for Central Africa was prepared in 2005 and adopted in 2006. A Study on Interconnection Projects in Central Africa Region was finalized in November 2010. It is coordinated by ECCAS with AfDB funding. It contributed to define the overall development of interconnection schemes up to 2030 and to select the priority projects to be developed on the medium term.

3.3 MOBILIZATION OF FUNDING

The following approaches have been adopted so far by CAPP for mobilizing funding:

(i) Organizing ad hoc forums to also be attended by national and regional stakeholders involved in the implementation of priority projects (utilities, funding agencies, specialized institutions, Ministries). The first forum was held in June 2011.

(ii) Convening specific donors meetings for examining a particular regional project.

3.4 OPERATION

The Operational Manual for CAPP interconnected Power system is still to be prepared.

3.5 COMMERCIAL FRAMEWORK

The methodology for establishing templates for power purchasing and transport contracts is still to be developed by CAPP.

3.6 CAPACITY BUILDING

In terms of capacity building, CAPP has mainly benefited successively from USAID and European Union (EU) technical assistance programs.

- USAID program has assisted CAPP in preparing the Regional Power Master Plan as well as the Electricity Market Code of Central Africa

- The ongoing three years (2009/2011) EU technical assistance program is strengthening the capacity of CAPP through a team comprising four senior experts. They are assisting CAPP and member countries in all the phases of implementing trans¬boundary electrification projects. Assessment reports have been also prepared analyzing performance indicators of the various member utilities. CAPP website has been improved. It is expected that this program will cover also the following main areas:

- Operation of HV interconnected systems,

- Regulation of the power systems,
- Methodology for designing power trade tariffs.

However, the present phase of EU program is ending at a critical time when some key positions of CAPP management staff are not yet filled (ICT Director) and during a transitional period when the present Permanent Secretary is to be retired.

4 MAJOR FINDINGS AND CONCLUSIONS

4.1 APPROACH FOR TAPING THE REGION HYDROPOWER POTENTIAL

For some time, the development of Inga site (Inga III, Grand Inga) has dominated the debate about harnessing Central Africa hydropower potential. Recent developments have seen the promotion of hydropower projects with a size varying from 80 MW (Kakobola hydropower plant located in DRC) to 320 MW (Grand Poubara hydropower site located in Gabon). This shows the need for adopting a complementary approach for taping the development of hydropower potential of the region. The option of developing small hydro for promoting rural electrification in isolated area could be further investigated. This is to be considered in parallel with the following ongoing options:

- Medium to large size hydro (50 to 150 MW) for providing power mainly to national grids (and to province grid for the case of DRC),
- Larger size hydro like Inga site in DRC, Grand Poubara in Gabon and Chollet in Cameroon-Congo borders for meeting national and regional demand.

An adapted and specific approach is to be adopted for developing each of these options.

Development of small hydro potential as component of rural electrification policy

This action is to be developed mainly at CAPP member countries level. Good examples of developing small hydropower projects exist all over the world (Asia, Latin America). This is to be considered within the framework of the development of rural electrification of isolated areas not scheduled in the medium term to be connected to the national grid. In that case, the cost of generating power from these projects cannot be compared with the cost of the kWh from larger size equipments, but with the socio-economic impact of providing power to the isolated regions. This may contribute to the viability of integrating these communities to the national grid on the longer term. Although some successful cases of projects developed by private communities exist, isolated initiatives alone will not be enough for tapping the potential. A specific policy is to be designed integrating promoting mechanism for developing small hydropower projects. This voluntary approach would include facilitating projects evaluation and project development with contribution to investment costs within an overall policy of promoting rural electrification.

Development of medium to large size hydropower projects

Recent years have seen the positive acceleration of developing medium to large size hydropower projects more fitted for targeting national needs. This acceleration was made through making an economic deal between the concerned country and the funding institution (primarily from China, but also from India) by which the concerned country offers natural resources (mainly minerals) in counterpart of building power plants and associated infrastructure. This solution was adopted by the countries concerned, most probably in part as reaction to the lengthy procedures and conditions linked to mobilizing funding primarily from multilateral agencies.

However, given the potential for development of this type of infrastructure, there is a need to analyze this type of approach in more detail. Sharing the lessons learnt from this set up will guide the way for the development of future projects. So far, little information has been published or made available in particular on the costs, on capacity building components and on impact on national economy. An independent study on these issues will allow better understanding of their implications.

Development of larger scale hydropower projects: Case of Inga

Funding and institutional issues faced by this project are well recognized by the concerned stakeholders. The study being conducted under ADB funding is aiming at analyzing these issues. The remaining issue is the perception by some stakeholders about whether the development of Inga site is an alternative or a complementary solution to smaller hydropower sizes. An information effort is required for explaining and addressing some concerns that the development of smaller sizes are not jeopardizing the development of the Inga site, and this project will be still in demand for meeting both national and regional markets. Besides securing power needs, the Inga project will be a renewable financing source to the government of DRC through the export of a renewable source of energy.

4.2 INVESTMENT IN TRANSMISSION AND PRE-CONDITIONS FOR PROMOTING REGIONAL POWER TRADE

As indicated under section 2, some of the interconnection projects are either ready for investment or at an advanced stage of preparation. For the regional power trade to be progressively achieved, the following steps require to be taken:

- **Funding "missing" links**:
  The following examples could be cited of projects ready for investments and with direct impact on developing regional trade: (i) DRC (Inga)-Angola (Cabinda)-Congo (Pointe Noire) interconnection, and (ii) Cameroon – Chad interconnection.
- **Organizing periodic donors meetings**
  With the ongoing interconnections and trans-boundary projects and with the priority projects adopted through the Study on Interconnection Projects in Central Africa Region, a critical mass of regional projects exists in Central Africa investment pipeline. Beside ad hoc meetings, there is a need for organizing periodic donors meetings with a systematic follow up of the projects by the various stakeholders, as it is practiced by WAPP.
- **Preparing the commercial and regulatory framework**
  For the regional trade to be effective, there is a need for adopting: (i) regional template for designing bilateral contracts; (ii) defining wheeling charges; and (iii) adopting a mechanism of regional regulation. These various aspects are included in the present scope of EU technical assistance program ending in 2011. There is a need for building on what this program has achieved.

4.3 CROSS-BORDER PROJECTS

As indicated in §2.3 "Investment and studies in distribution/cross-border lines", at least 10 projects will be ready before end of 2011, there is a need for showing concrete results by taking the following steps: (i) effectively mobilizing the required funding of these projects, (ii) shortening the time for processing future studies and projects implementation, learning from previous experiences, and (iii) mobilizing technical assistance for implementing the various projects. To support CAPP staff, there is also need for medium term experts and for multilateral development banks assistance in strengthening CAPP and member countries capacity in preparing and processing projects in conformity with the banks requirements.

4.4 CAPITALIZATION ON INSTITUTIONAL STRENGTHENING OF CAPP

Although CAPP has progressively established itself as regional institution promoting regional trade, however it is still fragile in terms of institutional set up, in terms of sustaining its financial resources and in terms of strengthening its capacity as well as the capacity of its member countries. More specifically, the following issues require to be tackled:

- **Increase ownership by stakeholders**
  The following example could be cited for illustrating this issue: At present, CAPP is depending on staff seconded by national stakeholders (utilities or government agencies). It happens that these institutions call back their staff. This situation weakens CAPP, which cannot rely on permanent and stable staff. Stakeholders could provide longer terms and additional benefit for the seconded staff and/or increase contributions to the CAPP budget to allow the hiring of permanent staff.

- **Sustain funding of CAPP**
  At present, CAPP depends on utilities contributions which are not always paid in due time. This constrains CAPP to be pro-active in terms of project preparation and processing, and in mobilizing and motivating its staff. A study was conducted for addressing this issue. The recommendations of this study are still to be adopted.

- **Secure the transition by TA**
  CAPP is facing the situation where: (i) its regional project portfolio is becoming substantial, (ii) its staffing needs are not yet ready to be fulfilled in the short and medium terms, given the present mild commitment from the stakeholders, and (iii) the present TA program with EU is coming to its end. It is crucial to ensure the transition and continuity toward a more sustainable financial situation of CAPP. In the short term, this would require renewing TA programs with firm commitments from the concerned stakeholders to adopt a business plan securing CAPP sustainable development.

- **Sustain the development of CAPP Information System**
  The present information system is generated from ad hoc studies. Some information is either lacking or inconsistent. There is no systematic approach for collecting and updating the information. This is illustrated by the quality of technical information published on CAPP website. It is key for CAPP to have an Information System Unit, monitoring systematically together with member utilities the required information on the development of the power sector in the region. Building this Unit could be launched through a technical assistance program that may include the following modules: (i) design of a common methodology for collecting data; (ii) organizing training sessions at regional level for CAPP Unit Staff and for utilities focal points dealing the information; (iii) organizing periodic regional annual meetings aiming at consolidating the information at the regional level.

REFERENCES

1. Pool Energétique de l'Afrique Centrale (PEAC). *Présentation générale du secteur électrique en Afrique Centrale*, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011
2. Pool Energétique de l'Afrique Centrale (PEAC). *Indicateurs de Performance des Sociétés Electriques du P.E.A.C. Tendances de 2000 à 2009*, Europe Aid/126679/C/SER/CG; WYG International, 1 June 2011.
3. UPDEA: Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique; December 2009.
4. EIRE CEEAC- *Etude sur l'Interconnexion des Réseaux Electriques des Pays Membres de le Communauté Economique des Etats de l'Afrique Centrale*-RSWI/SOGREAH, December 2009.
5. Pool Energétique de l'Afrique Centrale (PEAC). *Projets du PEAC: Etat d'Avancement et Besoins de Financement*. Bruno Kapandji kalala, Secrétaire Permanent du PEAC, May 2011.
6. Pool Energétique de l'Afrique Centrale (PEAC). *PROFIL DU PEAC*, Secrétariat Permanent du P.E.A.C. May 2011.

III. REGIONAL POWER STATUS IN COMITE MAGHREBIN DE L'ELECTRICITE (COMELEC)

The Union of Maghreb Arab (UMA) is comprised of five member states: Algeria, Libya, Mauritania, Morocco, and Tunisia. In 1989, COMELEC has been designated as specialized agency of UMA.

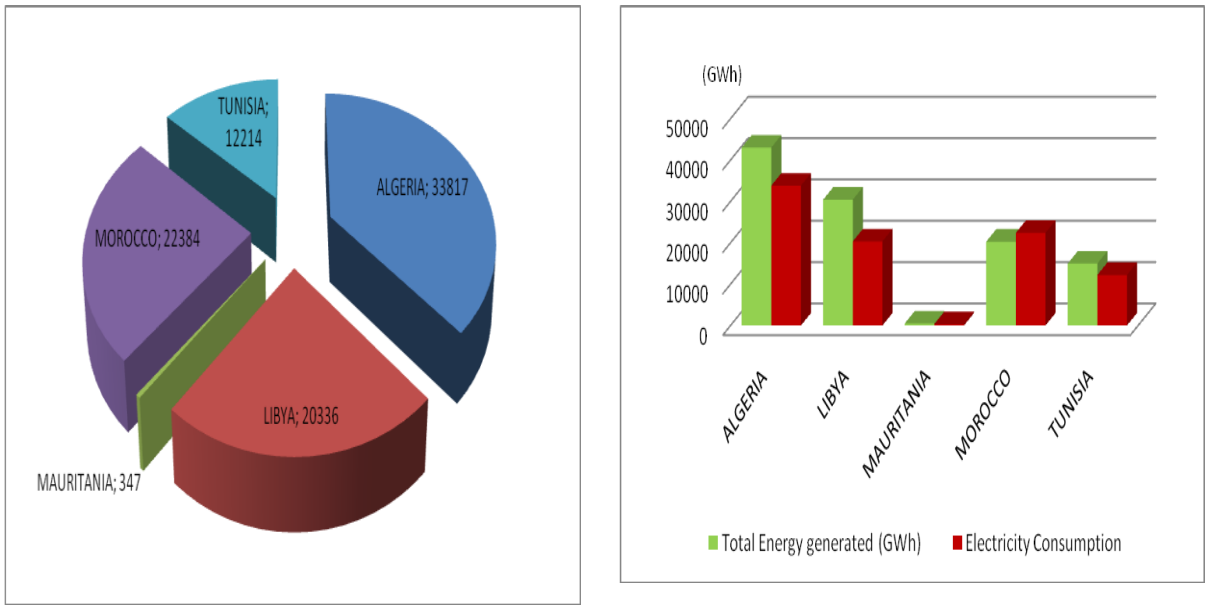
1. OVERVIEW OF POWER SECTOR IN 2009

Power consumption and generation

In 2009, power consumption by COMELEC member countries grids is estimated at 89 097 GWh as compared to 84 865 GWh with 5% growth [1].

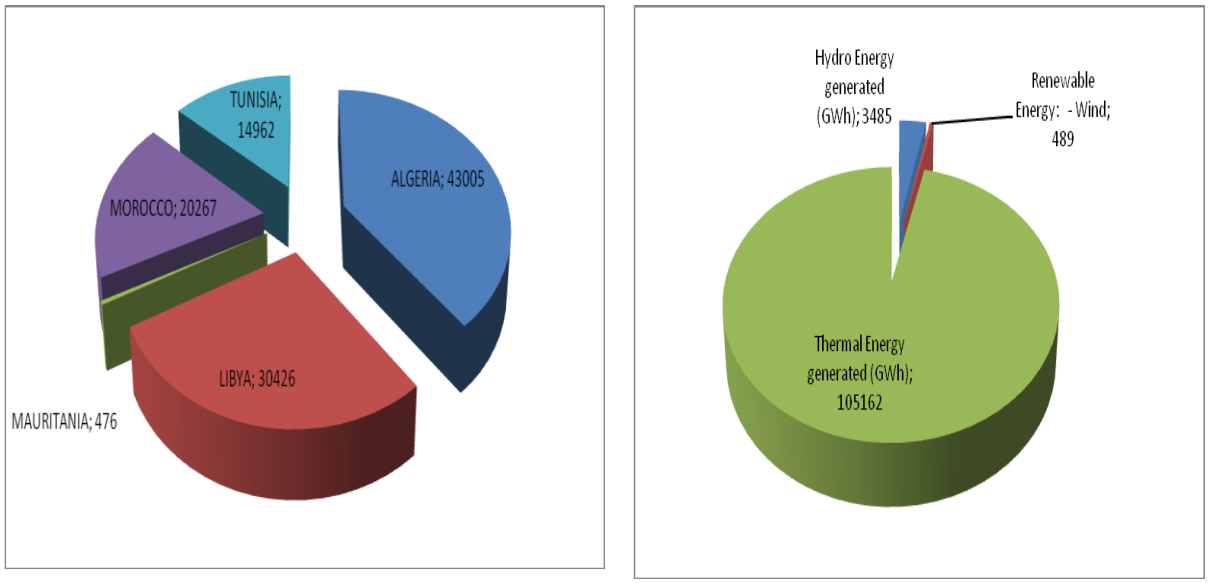
Three countries represent 86% of total consumption, with 38% for Algeria, 25% for Morocco and 23% for Libya. The remaining two are Tunisia with 14% and Mauritania with 0.4%.

Graph 3.1 COMELEC-2009 Power Consumption by Country (GWh)



Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009

Graph 3.2 COMELEC-2009 Power Generation by Country and by fuel (GWh)



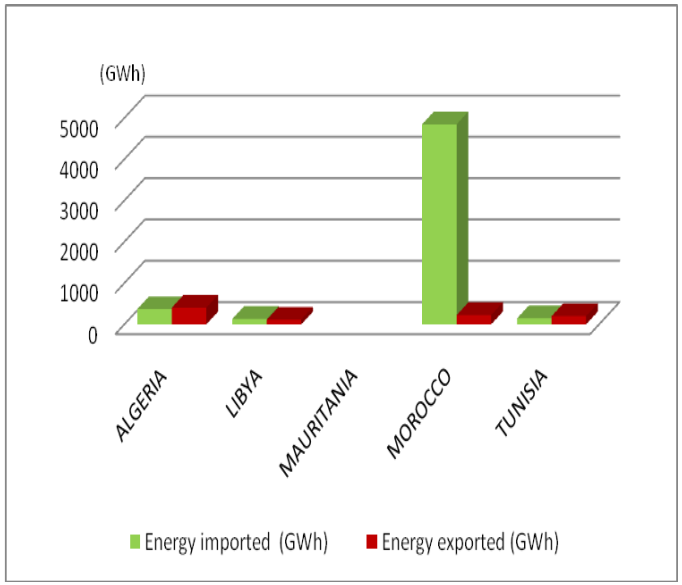
Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009.

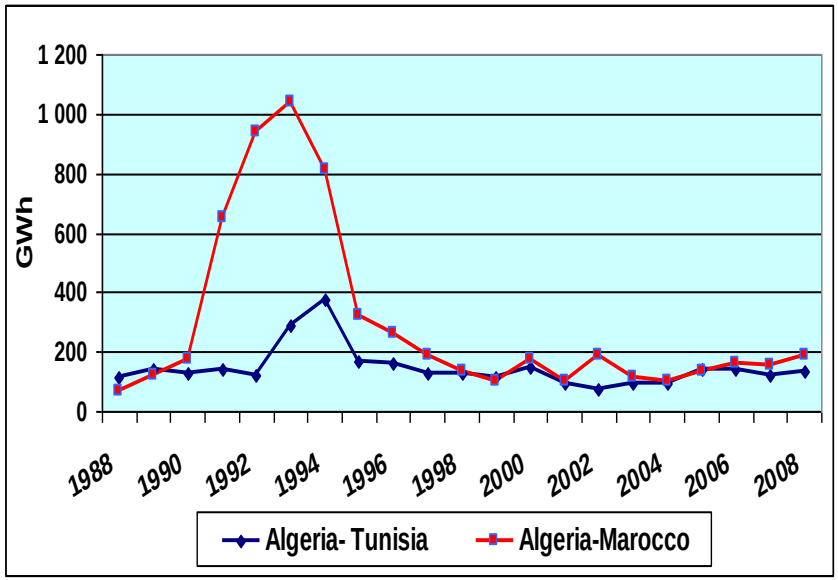
Imports/Exports

COMELEC countries (except Mauritania) are connected to a regional electricity network in the Maghreb Region (Morocco-Algeria-Tunisia-Libya). There is presently a number of: (i) 400 kV connections between Spain, Morocco, Algeria and Tunisia, and (ii) 220 kV connections between Algeria-Tunisia-Libya and Egypt.

Interconnections among Maghreb countries have provided substantial technical and economical gains: mutual and instantaneous back up to national grids when needed, reduction in reserve margin. Although a number of interconnections are running in the region, the actual level of power exchange is often far below the nominal value. Except for power exports from Spain to Morocco, regional power trade between Algeria-Morocco and Algeria-Tunisia was on average only 5%-16% of interconnections capacities [6].

Graph 3.3 COMELEC-2009 Imports and Exports by Country (GWh)



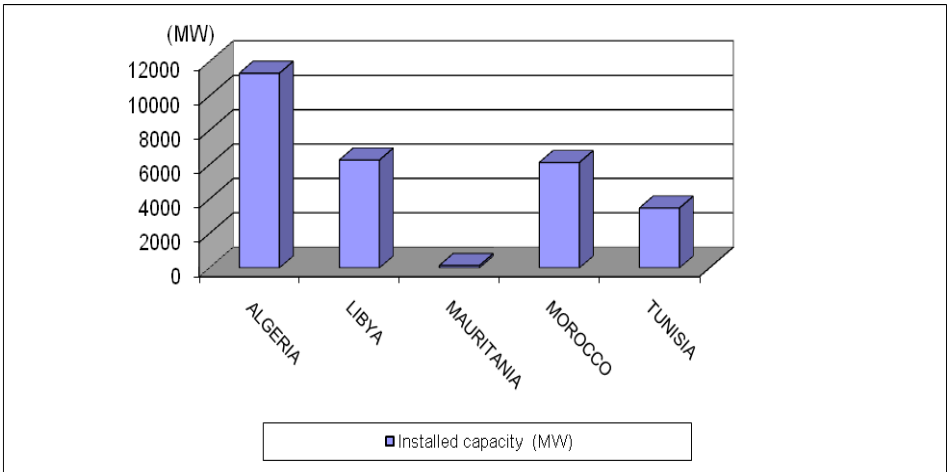


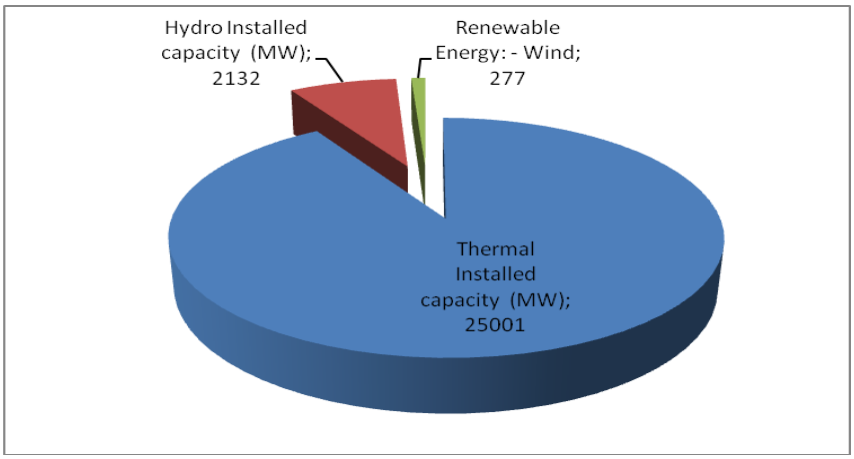
Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009.

The installed capacity

COMELEC installed capacity has reached 27 347 MW in 2009. Thermal power represents the major part with 25 000 MW (91.4%), as compared to hydropower with 2132 MW (7.8%) and wind energy with 277 MW (0.8%) [1].

Graph 3.4 COMELEC- 2009 Installed Capacity by Country (MW)





Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009

The peak load

COMELEC member countries peak load for 2009 in MW is as follows:

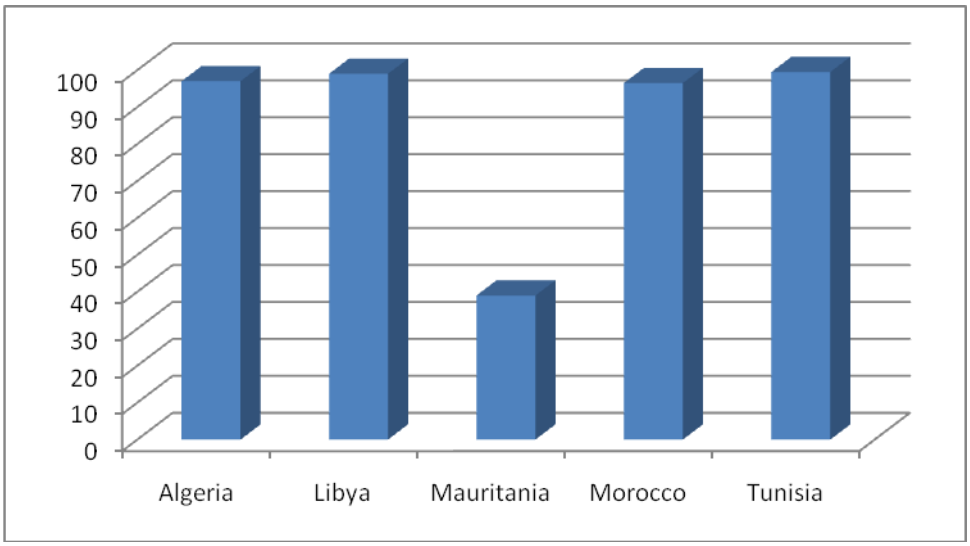
Table 3.1 COMELEC-2009 Peak Load by Country (MW)

Algeria	Libya	Mauritania	Morocco	Tunisia
7 280	5 282	71	4 375	2660

Electrification rate

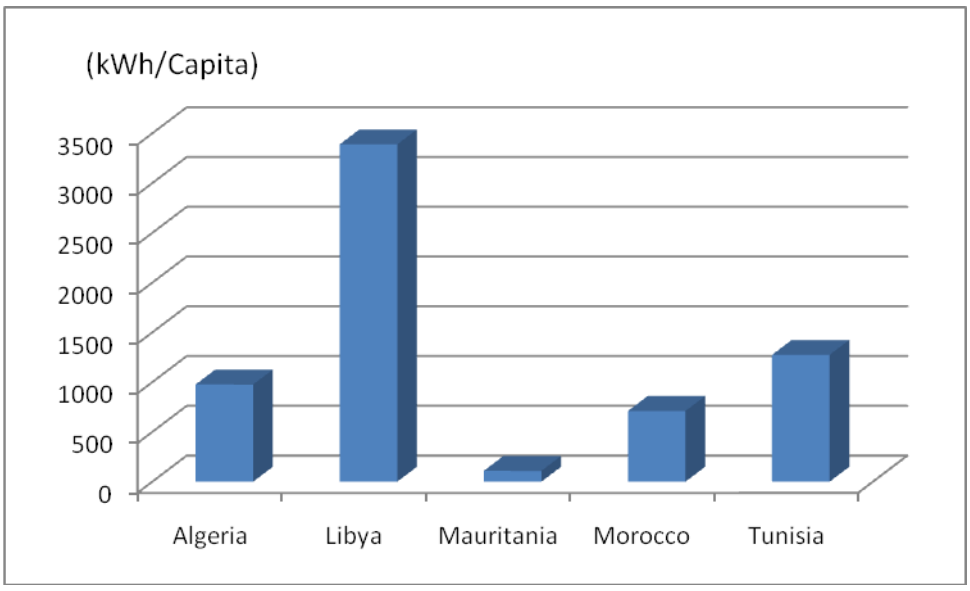
In 2009, access to electricity in COMELEC countries (except for Mauritania) was over 90%: with 99.5% for Tunisia, 99% for Libya, 97% for Algeria and for Morocco. For Mauritania, electrification rate is available only for Nouakchott: 39%.

Graph 3.5 COMELEC-2009 Electrification Rate (%)



Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009

Graph 3.6 COMELEC- 2009 Electricity Consumption per Capita (kWh/capita)



Source: [1] *Statistiques de l'Electricité du COMELEC*, 2009

Wide disparities exist also among the countries regarding electricity consumption per capita: It varies from 108 kWh for Mauritania, to 3 384 kWh for Libya, with Algeria, Morocco and Tunisia having respectively 976 kWh, 710 kWh and 1274 kWh per capita [1].

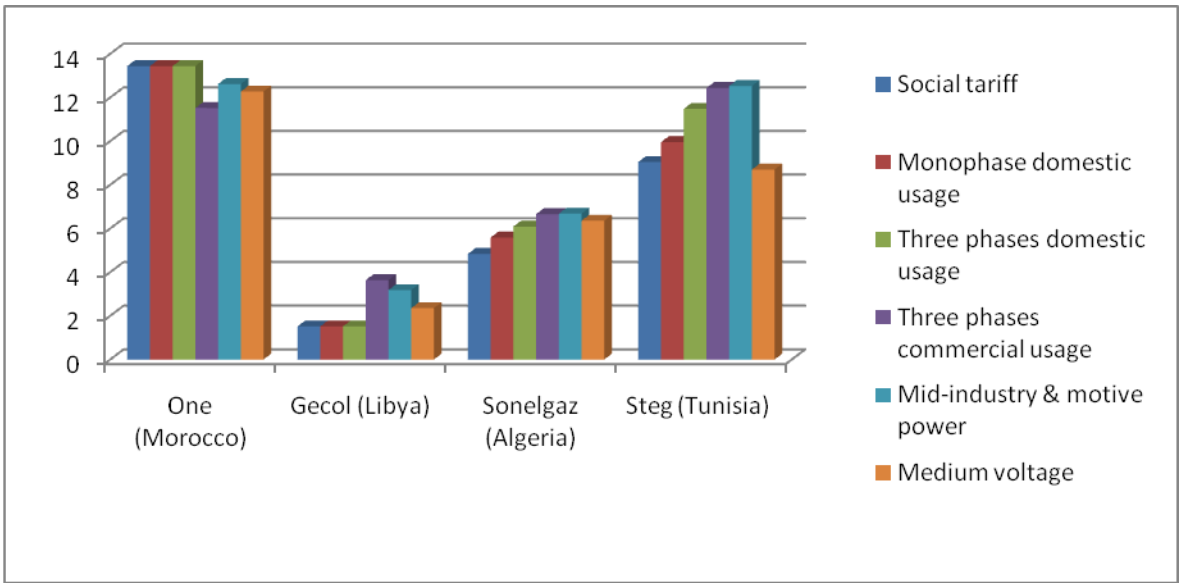
Average electricity prices

A study conducted in 2009 by the Union of Producers and Distributers of Electricity in Africa (UPDEA) has produced the following results for COMELEC member utilities. The prices are expressed in US cents/kWh (3).

Graph 3.7 below compares the following tariffs:

1. Social tariff (E=100 kWh/month)
2. Single phase domestic usage 2 kW
3. Three phases commercial usage 12 kW
4. Medium voltage (E = 35000 kWh/month)

Graph 3.7 COMELEC-Electricity Tariffs by Country (cUS$/kWh)



(3) UPDEA: *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009

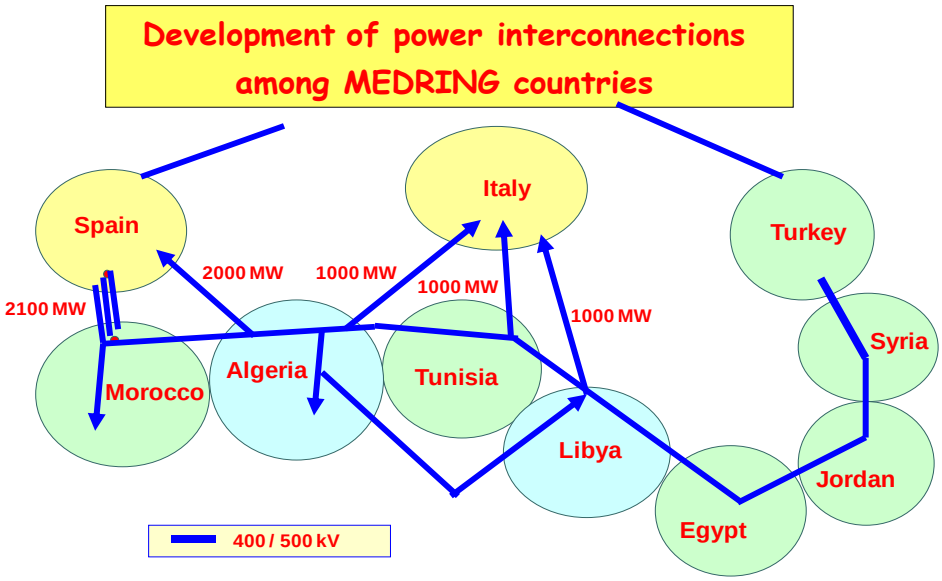
2. COMELEC INVESTMENT REQUIREMENTS

Two major studies have been conducted for the development of interconnection projects between North African countries (ELTAM Study) and between Mediterranean countries (MEDRING Study).

ELTAM stands for Egypt-Libya-Tunisia-Algeria-Morocco. The study was conducted in 2002-2004. It consisted mainly in linking the five countries with a 500/400 kV transmission line. The results of the study were adopted by the five countries, who agreed on an implementation plan over the period 2010-2015.

MEDRING stands for Mediterranean Ring or interconnection loop connecting the countries around the Mediterranean basin. The study was initiated by MEDELEC, the association of electric companies of the Mediterranean countries. It was funded by the European Commission and conducted between 2001 and 2003.

Graph 3.8 Planned power interconnections among MEDRING countries (4)



2.1 INVESTMENT AND STUDIES IN GENERATION PROJECTS

They concern mainly the development of the following priority thermal power project:

- ELMED Project: 1200 MW generation cluster in Tunisia (Pôle de Production ELMED) of which 400 MW for the Tunisian utility STEG and 800 MW for export to the Italian electricity market through an interconnection of 1000 MW- 400 kV DC that will be achieved in partnership between STEG and TERNA (major Italian electricity transmission grid operator). Investment cost is estimated at 2000 million Dinars (1Euro=1.91 TDN as of October 2011). The generation cluster will be composed by a thermal component and by renewable energy component of at least 100 MW. The commissioning date of the generation cluster is planned for 2016/2017 at the same time of Tunisia-Italy interconnection

2.2 INVESTMENT AND STUDIES IN TRANSMISSION LINES

- Implementation of 400/500 kV transmission lines between ELTAM countries (Egypt-Libya-Tunisia-Algeria-Morocco) and preparation for reliable synchronous management of interconnected power: 400 kV interconnection is already operational between Algeria and Morocco. Algeria-Tunisia (up to Jendouba) is implemented in 400kV but being operated in 225 kV. Its operation in 400 kV is scheduled for 2011/2012. The interconnection Tunisia-Libya in 400 kV is scheduled for 2015. At present, Libya is connected to Tunisia and to Egypt through a 220 kV. Morocco-Algeria-Tunisia transmission system is already operating under synchronous mode with the European grid (UCTE). The synchronisation of the Libyan system with UCTE is still to be achieved (last test conducted in April 2010).

- Interconnection Southern and Northern Mediterranean grids: In addition to the interconnection Tunisia-Italy presented earlier, the following interconnection projects are considered between Southern and Northern Mediterranean countries:

- **Interconnection Algeria-Spain**: Algeria has launched the project “Algeria 2000 MW” consisting in 2000 MW generation capacity with 1200 MW to be exported to Spain. The interconnection between Algeria and Spain will consist in two cables of 1000 MW each. The investment cost was estimated at US$1080m, to be equally owned (50% each) by RED Electrica (Spain) and by SONELGAZ (Algeria).
- **Interconnection Algeria-Italy**: The project consists of two cables of 500 MW each linking Algeria to Sardinia in Italy, with an estimated investment cost of US$945m.

- **Interconnection Libya-Italy**: The project consists of two cables of 500 MW each linking Libya to Sicily in Italy, with an estimated investment cost of US$1215m.

The implementation dates of these projects have not been yet decided.

Table 3.2 COMELEC Interconnection Projects

Name Project	Country	Charac-teristics	Estimated cost US$m	Comments
Interconnection between ELTAM	Egypt, Libya, Tunisia, Algeria, Morocco	400/500 kV	N.A.	Project implementation between 2010 and 2015
Sub-Marine Cable (El Haouaria-Partana/Favara)	Tunisia - Italy	HVDC 400 kV 1 000 MW 200 km/670 m	N.A.	- Feasibility Study 2006 - Project being implemented
Sub-marine cable	Algeria - Spain	HVDC 400 kV 2 000 MW 250 km	1080	Feasibility Study 2003
Sub-marine cable	Algeria - Italy	HVDC 400 kV 1 000 MW 330 km /2000 m	945	Feasibility Study 2004
Sub-marine cable	Libya - Italy	HVDC 400 kV 1 000 MW 520 km/550 m	1 215	Feasibility Study 2007
Interconnection Ghadames – H. Messaoud	Libya - Algeria	HVAC 400 kV	N.A.	Planned project

N.A. : Not Available.

3. POLICY FRAMEWORK

3.1 LEGAL AND REGULATORY FRAMEWORK

Already in 1972, three North Africa Utilities, the Office National de l'Electricité of Morocco (ONE), the Société Nationale de l'Electricité et du Gaz of Algeria (SONELGAZ) and the Société Tunisienne de l'Electricité et du Gaz of Tunisia (STEG) decided to create the Comité Maghrébin de l'Electricité (COMELEC). Two other utilities joined COMELEC later: SOMELEC of Mauritania and GECOL of Libya. When the Union of Maghreb Arab (UMA) was created in 1987 as a Regional Economic Commission (REC) covering Northern Africa countries (Algeria, Libya, Mauritania, Morocco and Tunisia), it adopted COMELEC as its specialized agency.

COMELEC has as main objective to study issues faced by member utilities and to share best practices through the following actions:

- To promote regular exchange of information among member utilities,
- To coordinate generation and transmission investments programs as well as capacity building activities,
- To follow up on interconnections developments and related issues, and
- To promote power industry integration in Maghreb region.

The Euro-Maghreb Electricity Market

Despite the high level of interconnections between the various COMELEC member countries, the Maghreb electricity market is limited: the countries have no excess of generation capacity, although countries like

Algeria and Libya are major producers and exporters of hydrocarbons. However, within Barcelona process initiated in the 1990's, a Memorandum of Understanding has been signed in 2003 in Rome by Algeria, Morocco and Tunisia with the European Union for establishing the Euro-Maghreb Electricity Market. It aims at progressively integrating electricity market of Algeria, Morocco and Tunisia into the European Union internal electricity market.

3.2 SYSTEM PLANNING

COMELEC member countries are addressing system planning issues within its internal COMELEC commissions: (i) Planning and Studies Commission, (ii) Technical Commission, and (iii) Interconnections Commission.
COMELEC member countries have also participated to the regional planning studies:

- ELTAM study (interconnection Egypt-Libya-Tunisia-Algeria-Morocco) conducted between 2004 and 2005. COMELEC five member utilities have signed in 2005 projects implementation convention,
- The MEDRING study conducted in 2003: joint planning and management of the interconnected power loop amongst Mediterranean countries.
- In 2010 an update of the MedRing study carried out in 2003 has been fulfilled, the study has the following scope:
  - To provide an updated overview of the present status and future perspectives of the electricity sector in the countries of the Mediterranean Basin.
  - To highlight the possible technical solutions for closing the Mediterranean Ring.
  - To highlight the possible technical solutions for South-North electricity corridors for the export to Europe of bulk quantity of power generated from Renewable Energy Sources (RES), considering the constraints on the South Mediterranean Countries (SMC) grids and the impact on European grids.
  - To formulate a series of recommendations on how to progress the ring.

3.3 MOBILIZATION OF FUNDING

Mobilization of funding is initiated at the national level by the concerned countries and COMELEC has no official mandate for conducting this process. However, it is associated when organizing technical forum for presenting and following up on regional interconnection studies.

3.4 OPERATION

Interconnection between Morocco-Algeria-Tunisia is operating under synchronous mode with the European grid since the operation of the sub-marine cable between Spain and Morocco in 1997. A second cable has been implemented in 2006 for strengthening the interconnection between these countries. A Maghreb Interconnection Commission has been created for studying and defining management conditions and coordinating cross-border power exchanges between Tunisia, Algeria and Morocco, taking into account the Maghreb-Europe interconnection via Spain.

Regarding the eastern part of the interconnection with Libya and Egypt, efforts are ongoing for reaching reliable synchronous management of interconnected power systems of ELTAM countries. Due to inter-area oscillation between Libya and Tunisia, closure test for their interconnection in 2005 has been failed. Another test, after taking the tuning actions, was carried out in April 2010. The test outcome was not fully successful. Further studies or use of new approaches are needed.

3.5 COMMERCIAL FRAMEWORK

The exchange of power among COMELEC countries is still low and is based on the principal of having balance returned to zero at the end of the year.

In 2008, ONE (Morocco) and SONELGAZ (Algeria) have signed two contracts related to (i) the exchange of power, and (ii) the transit of power to Spain via the Moroccan transmission grid. Algeria is already registered as an operator in the Iberian electricity market but the volume of trade is still modest.

3.6 CAPACITY BUILDING

In terms of capacity building, COMELEC member countries have benefited from two major programs funded by European Union (EU) technical assistance program: (i) MEDA Institutional Building Program, and (ii) the Study on Algerian, Morocco and Tunisian gradual integration electricity markets in the internal market of EU.

3.6.1 MEDA INSTITUTIONAL BUILDING PROGRAM

MEDA II Energy Training Program was implemented during 2000-2006. It consisted in strengthening the capacity of the institutions dealing with energy (ministries and utilities) in the field of undertaking energy sector reform and in the management of competitive electricity and gas markets.

3.6.2 THE STUDY ON ALGERIAN, MOROCCO AND TUNISIAN GRADUAL INTEGRATION ELECTRICITY MARKETS IN THE INTERNAL MARKET OF EU:

- The progressive integration of the Algerian, Morocco and Tunisian electricity markets in the internal EU electricity market project is a follow-up to the Protocol Agreement signed by the three Maghreb countries and the EC in 2003.
- The General objectives of the project are as follows:

  – Harmonizing the legislative and regulatory framework as well as the industrial structure of the beneficiary countries to create a market of electricity

  – Make them compatible, in a second time, with European standards to integrate this market in the EU one.
- The specific objectives include: (i) Supporting development of a Maghreb Electricity Market, (ii) Building skills through the dissemination of technical knowledge, (iii) Ensure the institutional development and (iv) Supporting mechanisms for trade.
- The service contract was for a period of 36 months from the date of its signature on April 23, 2007.

4. MAJOR FINDINGS AND CONCLUSIONS

The major findings could be summarized as follows:

- COMELEC countries are well interconnected (except for Mauritania), and electricity is generated mainly by fossil fuels (natural gas for Algeria, Tunisia and Libya; coal, fuel oil and natural gas for Morocco). The share of hydropower is very low, however renewable energy is being developed mainly wind in Morocco and Tunisia.

- The COMELEC regional electricity market is modest and the power exchange with Europe consists mainly on massive power imports by Morocco from Spain. However, COMELEC countries have actively cooperated in terms of mutual back up during emergency situation, and also in terms of sharing reserve margin and in terms of scheduling introduction of new power plant on the grid,

- Although the study on Maghreb Electricity Market has been finalized, the regional regulatory framework, the market structure and rules are still to be defined and to be implemented.

- Programs for producing electricity (from fossil fuels and from renewable energy mainly solar) in Maghreb countries and exporting it to Europe are being considered, however the associated interconnections with Europe are still to be developed.

- COMELEC as institution is a very light structure with the Secretary General as the only technical staff coordinating the work of the various technical commissions, each of them headed by a member utility.

At this stage of development, the major challenge for UMA/COMELEC is to move from a market driven by national policies and actions to a market driven by a common regional framework consisting in (i) a coordinated regional planning, (ii) regional market structure and rules, (iii) regional regulatory framework and (iv) strengthened regional institution with an adapted mandate and structure for COMELEC.

4.1 ADOPTION OF A COORDINATED REGIONAL PLANNING

An update of MED-RING study has been launched in 2010. It is aimed to provide an updated overview of the present status and future perspectives of the electricity sector in the countries of the Mediterranean Basin. As far as COMELEC countries are concerned, a Master Plan is required for evaluating the interconnections between South and North Mediterranean sea (including feasibility studies covering technical, economical, financial and institutional aspects of interconnection options). The result of such a Master Plan is to be discussed at regional level by the concerned stakeholders. The outcome would be the adoption of a regional investment plan indicating regional priority projects.

4.2 DEFINE A REGIONAL STRATEGY FOR DEVELOPING RE FOR EXPORT TO EUROPE

This requires addressing in particular the following issues (i) Systematic evaluation of RE potential in the region by technology (wind, solar, other), (ii) highlighting the possible technical solutions for South-North electricity corridors for the export to Europe of bulk quantity of power generated from Renewable Energy Sources (RES), considering the constraints on the South Mediterranean Countries (SMC) grids and the impact on European grids, (iii) defining a road map for developing RE for national use and for export to Europe, (iv) addressing the pre-conditions required for exporting RE to European market (interconnection capacity, feed in tariffs, other regulatory issues).

4.3 DESIGN AND IMPLEMENTATION OF REGIONAL MARKET STRUCTURE AND RULES

The study on the progressive integration of the Algerian, Morocco and Tunisian electricity markets in the internal EU electricity market project has already raised the major issues and proposed options for addressing them. COMELEC countries are prepared for adopting common regional market rules in particular in terms of third party access, wheeling charges and congestion management for developing regional trade among them and with Europe. Experiences have already been developed by other power pools (SAPP, WAPP). A workshop could be organised by COMELEC for preparing a formal document or for commissioning its preparation by a specialized consulting firm.

4.4 ADOPTION OF A HARMONIZED REGULATORY FRAMEWORK

Developing regional trade requires having harmonized regulatory framework between the concerned countries. Algeria has already established a regulatory body. In other COMELEC countries, respective ministries are playing this role. As for the case of the regional market, COMELEC could organise a workshop on practical actions required for harmonizing regulatory framework in view of preparing a formal document or for commissioning its preparation by a specialized consulting firm.

4.5 ADAPT AND STRENGTHEN COMELEC INSTITUTIONAL SET UP

If regional trade within COMELEC and with Europe has to develop, the concerned countries will need to develop further COMELEC functions, prerogatives and staff and to provide it with the necessary budget for allowing it to coordinate more efficiently the preparation and follow up of regional priority projects, the development of regional market structure and of regional harmonized regulatory framework. A study is required on COMELEC institutional strengthening and its capacity building.

REFERENCES

1. *Statistiques de l'Electricité du COMELEC*, 2009.
2. *Le COMELEC en Bref*, M. CHOUIREB Lakhdar. Secrétaire Général du COMELEC.
3. ELTAM Project Egypt-Libya-Tunisia-Algeria-Morocco, 500/400 kV Interconnection Feasibility Study: Summary of the study and Global Recommendations. Tractebel Engineering and CESI. 16 March 2005.
4. MEDRING: Discussion on the proposals for closing the ring, including South-North corridors, Bruno Cova – CESI spa- MED EMIP: Second MEDRING-Update Meeting, Tunis, 13th December 2009.
5. ELMED: Power Generation Project in Tunisia for Tunisian and Italian Market, Ministry of Industry and Technology, Republic of Tunisia, International Request for Candidature for Prequalification. June 2010.
6. *La Boucle Electrique et le Marché Euro-Méditerranéen de l'Electricité, Abdenour Keramane, Medenergie*, Les Notes IPEMED, N°11, September 2010.
7. Electricity Markets in the MEDREG Area, Hafez A. El-Salmawy, Executive Director, Egyptian Electric Utility and Consumer Protection Regulatory Agency, Florence (Italy), May 2011.

IV. REGIONAL POWER STATUS IN EASTERN AFRICA POWER POOL (EAPP)

The Eastern Africa Power Pool (EAPP) is a specialized agency of the COMESA.

EAPP Member Countries
Current Members Countries are Burundi, DRC, Egypt, Ethiopia, Kenya, Libya, Rwanda, Sudan and Tanzania. Potential Member Countries are Uganda, Djibouti, Eritrea.

EAPP Member Utilities
They are formed by REGIDESO (Burundi), SNEL (DR Congo), EEHC (Egypt), EEPCO (Ethiopia), KenGen and KPLC (Kenya), GECOL (Libya), EWSA (Rwanda), NEC (Sudan), Tanesco (Tanzania) and SINELAC (DR Congo-Rwanda-Burundi).

1. Overview of the Power Sector in 2008*

Power consumption and generation

In 2008, power consumption by EAPP member countries grids is estimated at 122 811 GWh.

Egypt alone represents 86.8% of total consumption, followed respectively by Kenya 4.4%, Sudan 3.5%, Tanzania 2.7% and Ethiopia 2.6%.

EAPP-2008: Power Consumption by Country (GWh)

Graph 4.1

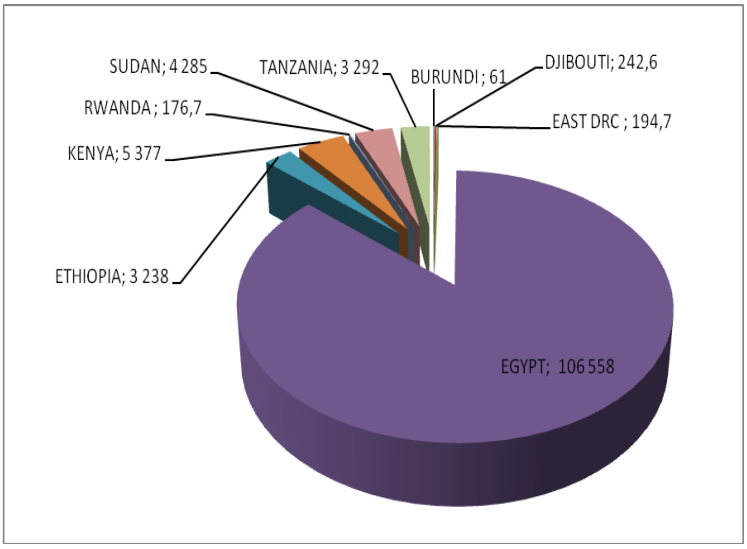


Table 4.1

Country	Consumption (GWh)
Burundi	61
Djibouti	242.6
East DRC	194.7
Egypt	106558
Ethiopia	3238
Kenya	5377
Rwanda	176.7
Sudan	4285
Tanzania	3292
Uganda	1206

Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

(*) For EAPP, 2008 was adopted for two main reasons: It is the base year of EAPP Regional Master Plan and also because some countries have historic data only up to 2008.

EAPP-2008: Power Generation by Country (GWh)

Graph 4.2

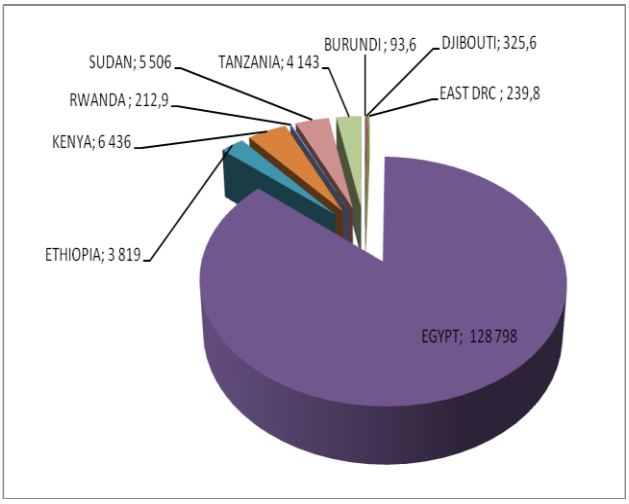


Table 4.2

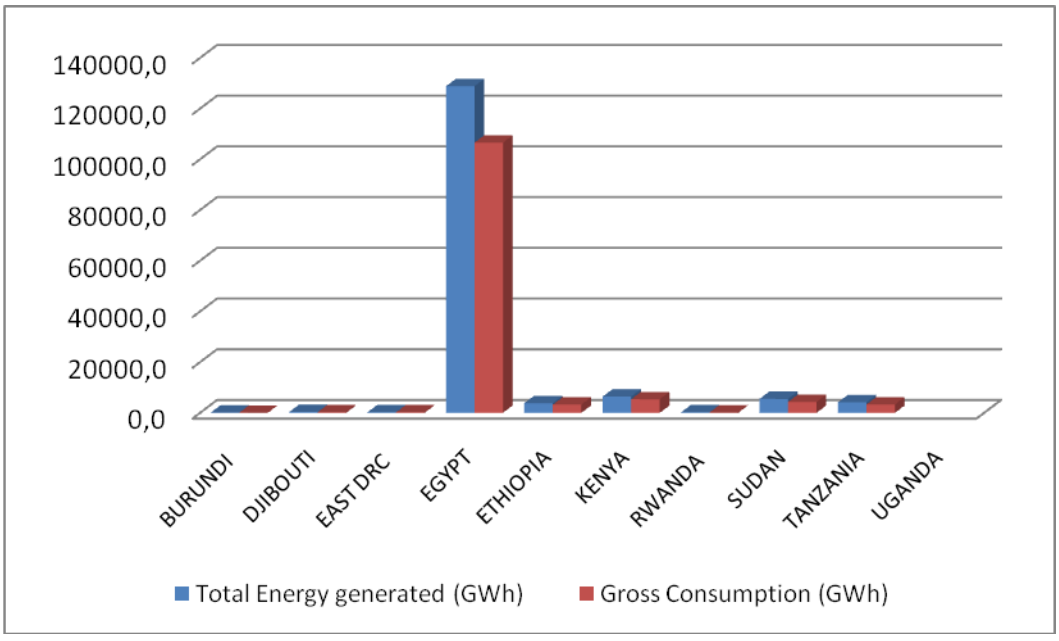
Country	Generation (GWh)
Burundi	93.6
Djibouti	325.6
East DRC	239.8
Egypt	128798
Ethiopia	3819
Kenya	6436
Rwanda	212.9
Sudan	5506
Tanzania	4143
Uganda	2069

Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011

In 2008, power generation in EAPP member countries grids is estimated at 148 700 GWh.

Egypt alone represents 86.6% of total generation, followed respectively by Kenya 4.3%, Sudan 3.7%, Tanzania 2.8% and Ethiopia 2.6%.

Graph 4.3 EAPP-2008: Power Consumption & Generation by Country (GWh)



Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

Imports/Exports

Burundi is interconnected with DRC, and Rwanda through a jointly developed hydropower station Ruzizi II, (capacity 45 MW) operated by a joint utility, the *Société Internationale d'Électricité des Grands Lacs* (SINELAC).

Burundi is also interconnected with DRC through the 70 kV line to the Mururu substation belonging to DRC, and with Rwanda through the 110 kV line to Mururu II substation belonging to Rwanda.

As far as Egypt is concerned, the following interconnections have been implemented:

- Electrical Interconnection Egypt-Libya 28/5/1998 (220kV)
- Electrical Interconnection Egypt-Jordan 21/10/1998 (400kV)
- Electrical Interconnection Syria-Jordan 8/3/2000 (400kV)

These interconnections have been serving Egypt both to export and import energy based on agreements reached with the respective countries.

EAPP-2008: Imports & Exports of Electricity per Country (GWh)

Graph 4.4

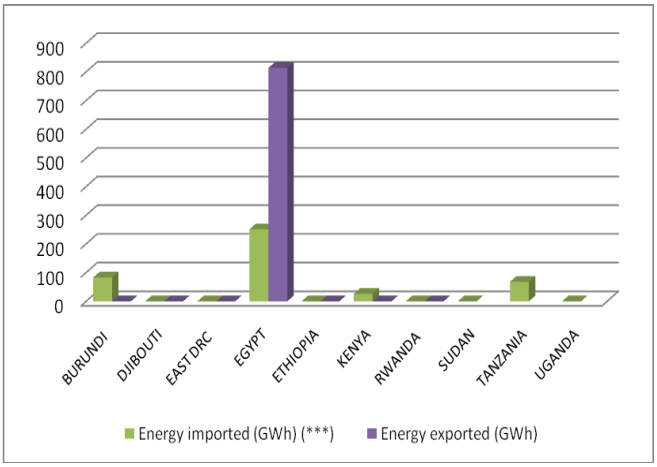


Table 4.4

Country	Imports (GWh)	Exports (GWh)
Burundi	83	-
Djibouti	-	-
East DRC	-	44.3
Egypt	251	814
Ethiopia	-	-
Kenya	26	-
Rwanda	84.7	-
Sudan	-	-
Tanzania	68	-
Uganda	-	73
Total	512.7	931.3

Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

Until 2008, Ethiopia had no interconnection with any other country and it did not import or export electricity. However, the interconnection with Djibouti is to be commissioned in 2011, with Sudan is under completion and with Kenya is under preparation.

Kenya is interconnected with Uganda through a 132 KV double circuit line. There is also a transmission project between Kenya and Uganda consisting of 255 KM, 220 KV double circuit line to be commissioned in 2013. It aims to strengthen the interconnection between Uganda and Kenya with the main purpose of providing transmission capacity for power exchanges between the two countries and forms part of the NELSAP regional interconnection project linking Kenya, Uganda, Rwanda, Burundi and Eastern DRC.

The Rwandan power network has cross-border interconnections with the part of the networks of DRC and Uganda. Bilateral power trade is taking place through medium voltages interconnection.

As for Sudan, in 2008 power network was not interconnected with any power system. However, ongoing work is progressing to interconnect the Sudanese and Ethiopian power networks via a 220 kV with 120 MW maximum capacity.

In 2008, Tanzania imported mainly from Uganda and also from Zambia 68 GWh, or 1.6% of its total energy demand.

The installed capacity

In 2008, EAPP installed capacity has reached 26 374 MW. Thermal power represents the major part with 20 759 MW (73%), as compared to 6725 MW for hydropower (24%). The remaining consists of 2% for other renewables and 1% for isolated capacity. Egypt alone represents 78% of total capacity, followed by Ethiopia 7.1%, Kenya 4.8%, Tanzania 4.1% and Sudan 3.8%. As far as renewable energy is concerned, Egypt had 425 MW wind and Kenya and Ethiopia had respectively 187 MW and 7 MW of geothermal energy.

EAPP-2008 Installed Capacity by Country (MW)

Graph 4.5

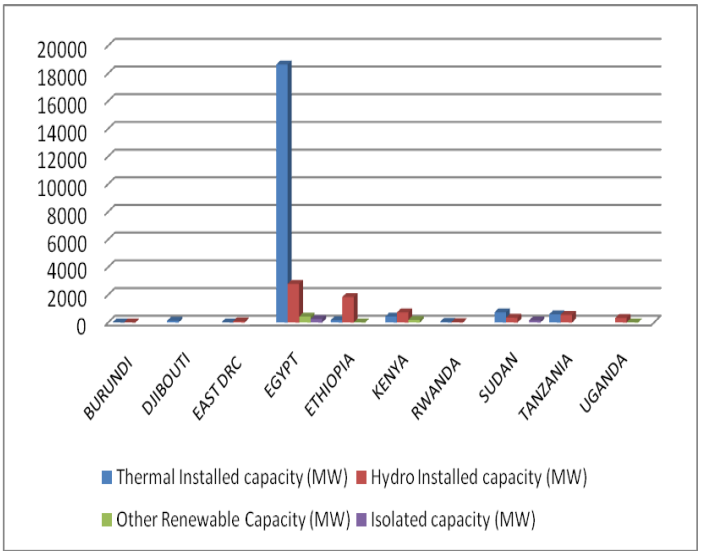


Table 4.5

Country	Installed Capacity (MW)
Burundi	36.5
Djibouti	123
East DRC	103
Egypt	22118
Ethiopia	836
Kenya	1354
Rwanda	79
Sudan	1083
Tanzania	1150
Uganda	342

Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011

The peak load

In 2008, there were mainly three families of peak load range: Egypt has the highest value with 21 000 MW. It is by far followed by a second group formed by Kenya, Sudan, Ethiopia and Tanzania. The third group is characterized by a low level of peak load: Djibouti, East DRC, Rwanda, Burundi and Uganda.

Table 4.6 EAPP Peak load (MW)

Year	Burundi	Djibouti	East DRC	Egypt	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
2008	29	56.9	56.9	21 000	747	1 072	42.2	985	694	310

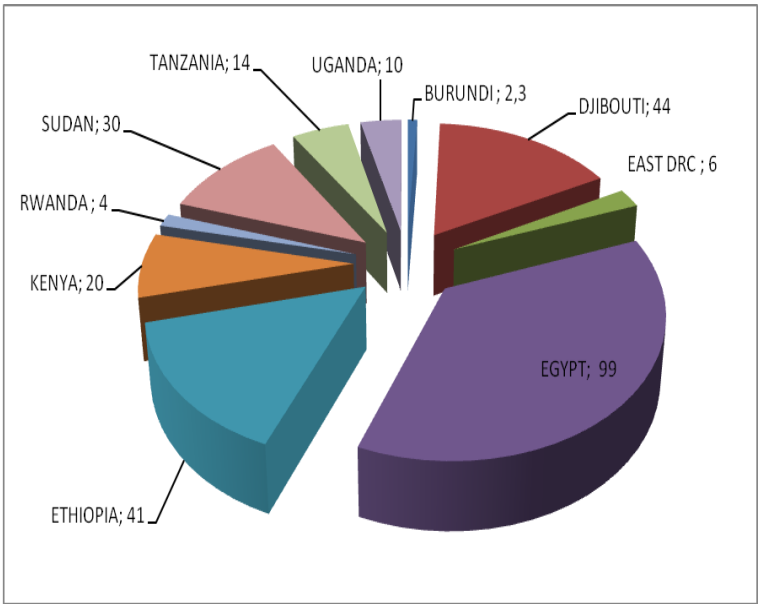
Peak Load: EAPP Master Plan Projections-Base Case

2009	37.4	69	59	22330	810	1205	48.5	1151	722	561
2010	43.4	75	62	23729	881	1278	52.7	1357	767	596

Electrification rate

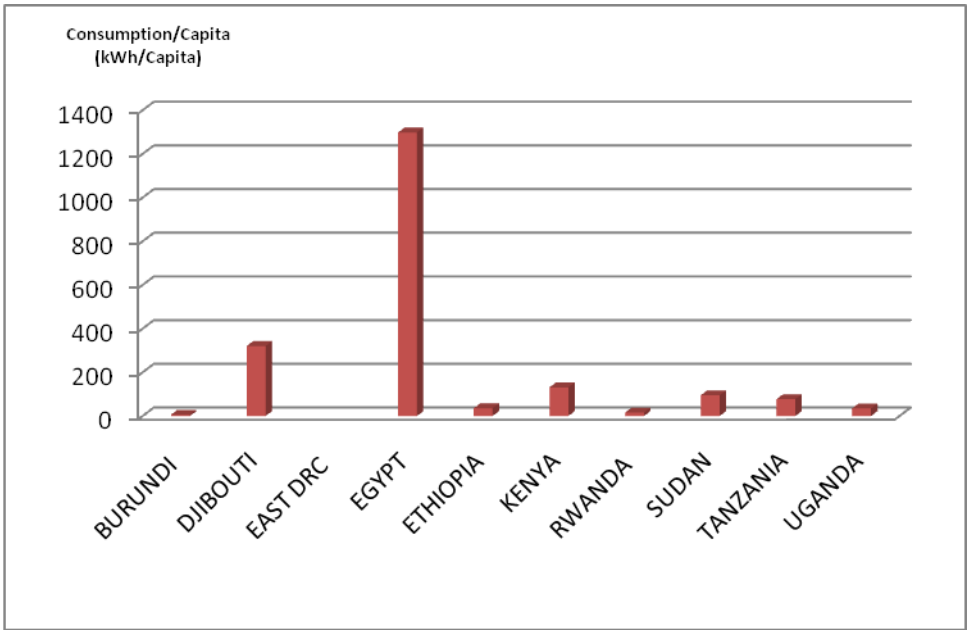
In 2008, access to electricity in EAPP is still low with however differences among countries: 99% for Egypt, 44% for Djibouti, 41% for Ethiopia, 30% for Sudan and 20% for Kenya. For the other countries, the access rate varies from 14% in Tanzania to 2.3% for Burundi.

Graph 4.6 EAPP-2008 Electrification Rate (%)



Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

Graph 4.7 EAPP- 2008 Electricity Consumption per Capita (kWh/capita)



Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

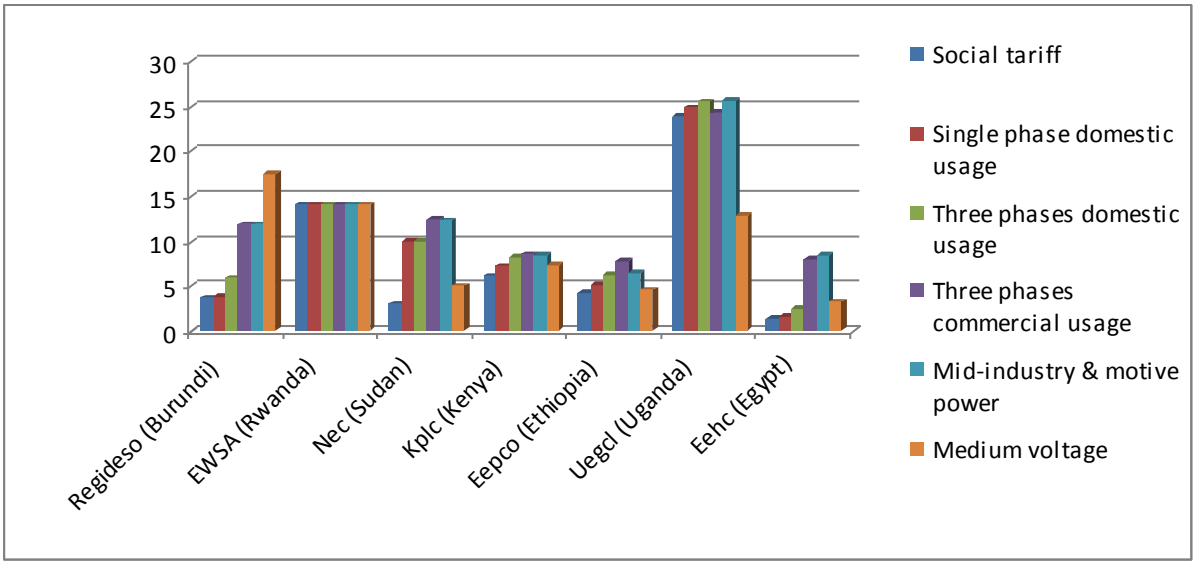
Average electricity prices

A study conducted in 2009 by the Union of Producers and Distributers of Electricity in Africa (UPDEA) has produced the following results for EAPP member utilities (c.f. annex III). The prices are expressed in US cents/kWh (3).

Graph 4.8 below compares the following tariffs:

- Social tariff (E=100 kWh/month)
- Single phase domestic usage 2 kW
- Three phases commercial usage 12 kW
- Medium voltage (E = 35000 kWh/month)

Graph 4.8 EAPP-Electricity Tariffs by Country (cUS$/kWh)



(3) UPDEA: *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.

2. Investment and outstanding financing requirements for the Power Pool

2.1 EAPP INVESTMENT PROGRAM AND OVERALL FINANCING REQUIREMENTS

The EAPP Regional Power System Master Plan and Grid Code Study was launched in 2009 and its final report was submitted in May 2011. The priority projects to be adopted by EAPP Conference of Energy Ministers are articulated around the following main subprograms namely:

- Generation capacity mainly in hydropower projects;
- Power transmission priority projects;

2.2 STATUS OF GENERATION PROJECTS

The identified regional generation projects up to 2025 have a total installed capacity of 10 870 MW. Hydropower represents 97% and the remaining 3% are thermal using methane from lake Kivu in Rwanda. Ethiopia alone is expected to contribute with 6938 MW (64%) all of them are hydro. The remaining contributions are respectively 18% for Uganda, 11% from Tanzania, 4% for East DRC and 3% for Rwanda. The list of regional generation priority projects and their estimated cost and status is provided in Annex III, Table 3.2.

The following projects are expected to be in operation from 2013 to 2019 at the earliest.

- GIBE III (1870 MW) hydropower site in Ethiopia. The project is being implemented. The contract was signed in 2009 and is expected to be operational in 2013.

- GIBE IV (1468 MW) hydropower site in Ethiopia. A preliminary report was produced by Pietrangeli-Salini in 2008. A MoU was signed with a Chinese company in 2010. A feasibility study is required as well as securing the funding of the project.

- Ruzizi 3 (145 MW) & Ruzizi 4 (287 MW) hydropower sites in Eastern DRC. The project will supply at least the three Grand Lac Countries (Burundi, DRC and Rwanda): For Ruzizi 3, the feasibility study was conducted. A Transaction Advisor has been recruited to assist the countries to select a developer (IPP/PPP). Funding of the project for construction is still required. The pre-feasibility of Ruzizi 4 is being conducted under EIB funding.

- Kivu I (100 MW) thermal project in Rwanda. It is expected to use the methane from lake Kivu. The project includes gas gathering system, supply pipeline, Diesel generation plant, road access and development of port facility at Kibuye. It is expected to be operational in 2013. A second phase is expected to be developed later: Kivu II with 200 MW capacity.

- Karuma (700 MW) hydropower project in Uganda: It was initially conceived as a run of the river scheme. The project is included as a preferred option in Uganda Generation Plan. Its implementation is scheduled for 2016.

2.3 STATUS OF TRANSMISSION PROJECTS

As mentioned in paragraph 3.2 prior to EAPP Master Plan, various studies and projects were initiated in the region (Eastern Nile Power Trade Investment Project, Opportunities For Power Trade In The Nile Basin Final Scoping Study, the Vision And Strategy Framework For Management And Development of Lake Victoria Basin, and the East Africa Power Master Plan Study). The EAPP Regional Power System Master Plan and Grid Code Study took stock of these previous studies conducted by the other sub-regional institutions. As a result, we have various categories of regional projects: (i) regional transmission projects already implemented or with funding secured, (ii) ongoing regional projects, (iii) regional priority interconnection projects identified by the present EAPP Master Plan Study which include also some of the ongoing regional projects. A detailed list of all these regional projects with their status is provided in annex III, table 3.2.2. The following is a presentation of category (iii) with a breakdown between ongoing regional projects confirmed by the Master Plan and new regional interconnection projects.

2.3.1. ONGOING INTERCONNECTION PRIORITY PROJECTS

They concern mainly the following four projects to be implemented during the next five years with a total estimated cost of US$2507 m. They are all in advanced stage of preparation with FS ready or being finalized.

Table 4.7 Ongoing interconnection priority projects

Interconnection	Voltage	Capacity (MW)	Earliest Year of Operation	Cost (US$ m)	Status	Comments
Tanzania-Kenya	400kV	1520	2015	117	Ongoing FS, detailed design and tender documents preparation	- Funding secured -Bidding for line construction may start at the end of 2011
Ethiopia-Sudan	500 kV	3200	2016	511	FS completed	Funding required
Ethiopia-Kenya	500 kV	2000	2016	845	Design and tender document preparation study have started early 2011	Funding required
Egypt-Sudan	600 kV	2000	2016	1034	FS completed	Funding required

F.S.: Feasibility Study
Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

2.3.2. IDENTIFIED ADDITIONAL INTERCONNECTION PRIORITY PROJECTS

They concern eight projects with a total investment cost estimated at US$3635m. For these projects the EAPP Master Plan Study is preparing the TORs of the design and tender document preparation study. Therefore, the funding of these studies is required, except for Kenya-Ethiopia project which requires funding for investment.

Table 4.8 Identified additional interconnection priority projects

Interconnection	Voltage	Capacity (MW)	Earliest Year in Operation	Cost (US$ m)	Status	Comments
Tanzania-Uganda	220 kV	700	2023	30		- Funding required for FS
Uganda-Kenya	220 kV	440	2023	71		- Funding required for FS
Kenya-Ethiopia	500 kV	2000	2020	845	FS exists	- Funding required for investment
Ethiopia-Sudan	500 kV	1600	2020	255		- Funding required for FS
Sudan-Egypt	600 kV	1600	2020	1034		- Funding required for FS
Ethiopia-Sudan	500 kV	1600	2025	255		- Funding required for FS
Sudan-Egypt	600 kV	2000	2025	1034		- Funding required for FS
Uganda-Tanzania & Kenya	2x220 kV	1140	2023	101		- Funding required for FS

F.S.: Feasibility Study

Source: EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

3. Institutional Set up and Policy framework

3.1 LEGAL AND REGULATORY FRAMEWORK

The East African Power Pool (EAPP)

EAPP was conceived in May 2003 under the guidance of UPDEA, AFREC, UNECA and COMESA. In 2005, Intergovernmental MOU (IGMOU) and inter-utilities MoUs were successively signed and the Steering Committee became operational.

Article 3 of the Inter-Governmental MOU sets the objectives for EAPP, which include among others:

a. to optimise the usage of energy resources available in the Region by working out regional investment schemes in Power Generation, Transmission and Distribution, taking into account the socio-economic and environmental aspects;
b. to reduce electricity cost in the Region by using power systems interconnection and increasing power exchanges between countries;
c. to provide efficient co-ordination between various initiatives taken in the fields of power production, transmission as well as exchanges in the Region.

In November 2006, EAPP has subsequently been adopted as a COMESA specialized institution and as a vehicle for the enhancement of energy Interconnectivity in the Region by the Heads of State and Government at the 11th Summit of COMESA in Djibouti.

EAPP has also signed cooperation MOUs with EAC, SAPP and WAPP. Negotiations on draft MOUs with CAPP and IGAD are ongoing.

Regulatory framework

In March 2009, COMESA formally established an Association of Energy Regulators for Eastern and Southern Africa (RAERESA), which is anticipated to have a positive impact on the development of a Regional Regulatory Body.

Institutional, Regulatory and Cooperative Framework Model for the Nile Basin Power Forum and Power Trade Study were conducted by MERCADOS EMI and NORD POOL Consulting in November 2007. The clients were Nile Basin Initiative countries.

An Independent Regulatory Board is expected to be established and composed by nominees of national regulatory boards in the Member Countries. It will be responsible for enforcing standards, procedures and specifications as set out by the Steering Committee; organising power markets in the EAPP and to settling any disputes which may arise between the Members or related to the exchange and transactions within EAPP.

3.2 SYSTEM PLANNING

EAPP Planning Sub-Committee is responsible for the coordination of Master Plans and development programmes for member utilities.

As mentioned in 2.3, the first EAPP Regional Power System Master Plan and Grid Code Study was launched in 2009 under AfDB funding and was finalized in 2011. It has defined power generation and transmission priority projects in the region. The report was approved in June 2011 by Steering Committee formed by the Executives of member utilities. It is expected to be approved by the Energy Ministers during their next meeting. Its implementation is to be coordinated by EAPP through its 3-year business plan being prepared with EC support.

3.3 MOBILIZATION OF FUNDING

The only approach adopted so far by EAPP for mobilizing funding was the donors meeting organized in June 2011 on Ethiopia-Kenya Interconnection project which was attended also by national and regional

stakeholders involved in the implementation of the project (utility officials, funding agencies, specialized institutions, Ministries).

3.4 OPERATION

The Operations Sub-Committee's duties include the definition of the operation and maintenance rules for power plants and networks in EAPP.

The EAPP Interconnection Code, which provides the rules and standards for technical planning and operation of the EAPP Interconnected Transmission System was adopted in June 2011 by the EAPP Steering Committee consisting of the CEOs/MDs of EAPP Active Utility Members. It is expected to be adopted by the Conference of Ministers during their next meeting in 2011.

The implementation of the operational guidelines is to be coordinated at EAPP level by its planned Coordination Center (CC).

3.5 COMMERCIAL FRAMEWORK

Regarding the design of the electricity market, EAPP has benefited from The EC 'Technical Assistance and Capacity Building to Eastern Africa Power Pool' project. Two reports have been submitted successively in November 2010 and in June 2011 proposing respectively (i) EAPP Regional Market Design, and (ii) EAPP Regional Market Rules.

(i) A phased approach to regional market design was proposed, with transition between stages dependent on the deployment of generating capacity and cross border interconnectors over time. The design of the market concerns itself with commercial agreements and transactions between participants.
(ii) The Regional Market Rules governs the commercial trading of all electricity that flows across international borders between participating countries through designated transmission lines connected to the participating countries' transmission network in compliance with the standards and procedures defined in the Eastern Africa Power Pool (EAPP) and East Africa Community (EAC) Interconnection Code.

At this stage, the regional market design has been adopted by the EAPP Steering Committee. It is to be adopted by the Conference of Ministers during their next meeting. The Regional Market Rules are still being discussed.

3.6 CAPACITY BUILDING

In the last 3 years, EAPP has benefited from the following programs:

(i) EC Technical Assistance and Capacity Building Program to EAPP (2009- 2011),
(ii) Master Plan and Grid Code project financed by NEPAD/IPPF –AfDB (2009-2011),
(iii) USAID/UNDESA program on Bilateral and Transmission Wheeling Agreements – Negotiations and Adoption (2010-2011),
(iv) Ministry of Foreign Affairs (MFA) Norway program related to Development of Coordination and Dispatch Centre Infrastructure and also the Independent Regulation framework (2009-2011).

Within that framework EAPP has organized various training sessions with funding by AfDB, the European Commission, USAID and Norway Technical Assistance. From 2010-2011, the sessions cover the following modules: Planning, projects appraisals, power pool agreements, contracts, policy, operation, cross-border trading and climate change.

4. CONCLUSIONS AND MAIN RECOMMENDATIONS

Since its inception, EAPP has succeeded to progressively mainstream and build on what have been initiated at the regional level by the various sub-regional institutions and initiatives to achieve an operational power pool.

This is illustrated by the progressive development of interconnections at the level of EAC and of COMESA between: (i) Uganda, Kenya and Tanzania, (ii) East DRC and Rwanda, Burundi, and recently (iii) Ethiopia-Djibouti, with soon Ethiopia-Kenya and Ethiopia-Sudan. As indicated in section 3, the priority projects proposed by EAPP Master Plan are aiming at strengthening existing interconnections and also at taping into important Ethiopia hydropower program (additional 6900 MW up to 2017) for developing interconnections up to Egypt through Sudan.

With the active assistance of the EC, AfDB, Norwegian MFA and USAID, EAPP has implemented a set of studies and training programs aiming at putting the required foundations to its business plan and at strengthening the capacity of its staff as well as its member utilities staff.

Sustaining these efforts would require addressing the following issues:
- implementing its planned database and information system,
- mobilizing the required funding for its investment program and related studies;
- preparing the required pre-conditions for developing regional power trade (see section 4.3),
- strengthening the capacity of EAPP and utilities staff and securing funds required for the development of EAPP management activities.

4.1. IMPLEMENTATION OF DATABASE

The database and information system framework has been already defined under EC and Norwegian programs. Important information has been gathered through preparation of the EAPP Master Plan. However this information is not yet filled within an integrated information system. At least four major actions are required besides filling in the existing information:
- Upgrading EAPP website by allowing access to information and including updating procedures by the utilities;
- Defining and adopting common definition for the energy statistics to be collected (such as definition used by UNSO, IEA, or UPDEA);
- Undertaking necessary actions to regularly update the database (e.g. organizing regularly/every 2 years regional training sessions/workshops for utilities staff and other energy data providers on energy statistics and EAPP database management; the opportunity of organizing such workshops could be taken for updating EAPP database);
- Providing technical assistance to utilities for organizing and updating their database. This could be achieved through short-term missions by EAPP Coordination Centre staff to the utilities at their request. The services of an Energy Statistics consultant could be used the first year for assisting the utilities in implementing their database.

4.2. MOBILIZING THE REQUIRED FUNDING

EAPP priority projects development reached a stage where a set of measures needs to be considered for promoting the funding of the mature projects: (i) organizing periodic donors meetings, (ii) building on regional experiences for developing IPPs (Kenya) and PPP (Bujagali), (iii) considering the option of funding major interconnection projects by a Specific Vehicle company associating the concerned countries (example of WESTCOR & ZIZABONA in SAPP, Latin America Power Pool), and (iv) adopting innovative approach for mitigating perceived risks in investing in regional projects.

4.3. PRE-CONDITIONS FOR DEVELOPING REGIONAL POWER TRADE

For regional power trade to be effective when EAPP regional projects are implemented, the following major pre-conditions need to be addressed: (i) to prepare the utilities for handling technical operation issues to be raised by new regional interconnections; (ii) strengthening the capacity of the various stakeholders in terms of

design and negotiation of bilateral contracts; (iii) progressive implementation of the regional regulation function; and (iv) at country level, up grading and sustaining financial and commercial management mainly of distribution companies with objective to enable them of being strong actors in regional power trade.

4.4. SUSTAINING EAPP MANAGEMENT ACTIVITIES

In future, EAPP has to cope with the development of activities linked with the operationalization of the interconnections. This will require: (i) strengthening the capacity in targeted topics as detailed below, and (ii) securing required resources for EAPP management.

(i) Targeted capacity building programs

As mentioned in section 4, EAPP and members utilities have benefited from various batches of capacity building program providing an overview on a comprehensive set of subjects (including planning, projects appraisals, power pool agreements, contracts, policy, operation, cross-border trading and climate change). In the future, there is a need for in depth training for (a) technicians dealing with system and interconnections operation, (b) financiers dealing with market operation and contract preparation and negotiation, and (c) staff dealing with implementation of market rules and with specific issues such as design of wheeling tariffs. Given the experience already gained by SAPP particularly in these three fields; it is recommended to organize study tours for EAPP staff to SAPP.

(ii) Securing required resources for EAPP management

In the past, EAPP has relied on its own resources generated from member utilities contributions and on technical assistance programs for development of its activities.

As is the case for other power pools, the flow of utilities contributions to the EAPP budget is uneven, whereas EAPP activities are developing. In the medium to long run, additional contributions deriving from a levy on regional market trade could be considered. However, for the next 2 to 3 years, a contribution from the technical assistance will be still required for sustaining EAPP activities.

REFERENCES

1. EAPP, Presentation to EAPIC, by Jasper Oduor, August 2010, Nairobi, Kenya.
2. EAPP- Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.
3. Technical Assistance and CAPACITY BUILDING TO the Eastern Africa Power Pool (EAPP),
4. Prepared for EAPP and financed by ACP-EU Energy Facility 9.ACP.RPR.59, Prepared by: Mercados – Energy Markets International Deliverable 1 to 19.
5. EAPP Powering Progress Project, Work Plan 2010-2011, NEXANT-USAID, June 2010.
6. *Présentation du Projet Ruzizi III: Etudes Techniques et Organisationnelles dans les Secteurs de la Coopération Energétiques, dans la Région des Grands Lacs*, [BEI-2008/S 186 245623]; RSW-SOFRECO-MERCADOS, Kigali, 7 July 2011.

V. REGIONAL POWER STATUS IN SOUTHERN AFRICA POWER POOL (SAPP)

The Southern African Development Community (SADC) includes 12 countries on the mainland African region, namely: Angola, Botswana, the DRC, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The other three members of SADC, namely Mauritius, Madagascar and Seychelles, are not on the mainland African region, but islands in the Indian Ocean. SAPP membership currently does not include the Seychelles, Madagascar and Mauritius.

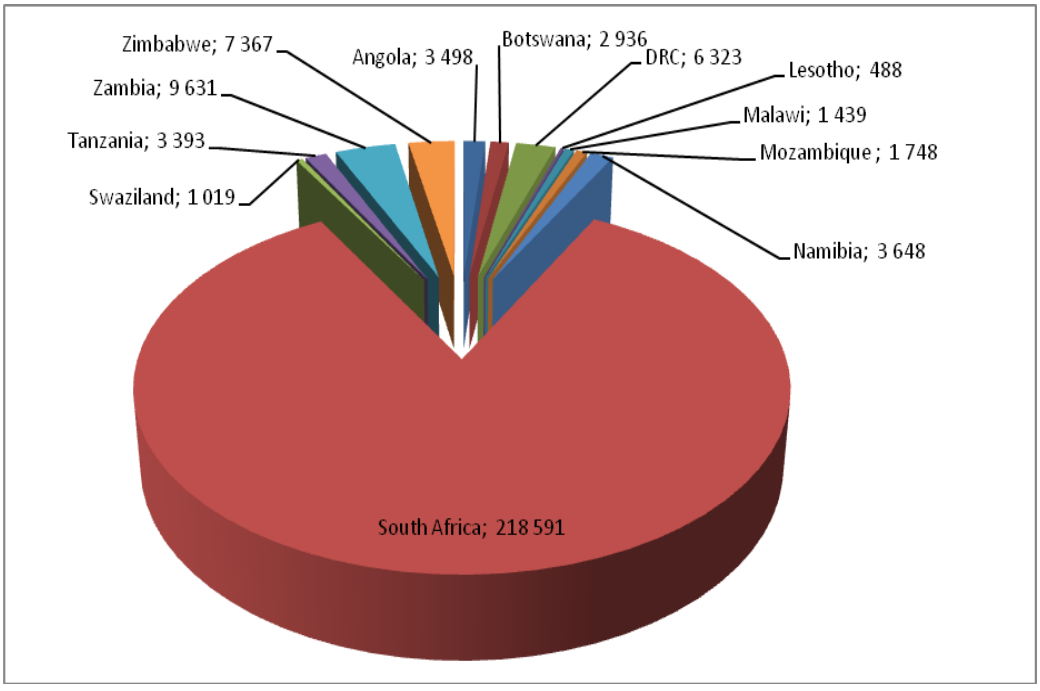
SADC aims to promote regional integration and the Southern African Power Pool (SAPP) has been mandated by SADC to promote electricity trading amongst SADC Members States so that all Members share in the available energy resources in the region.

1. Overview of the Power Sector in 2010

Power consumption and generation
In 2010, power consumption by SAPP member countries grids is estimated at 260 081 GWh.

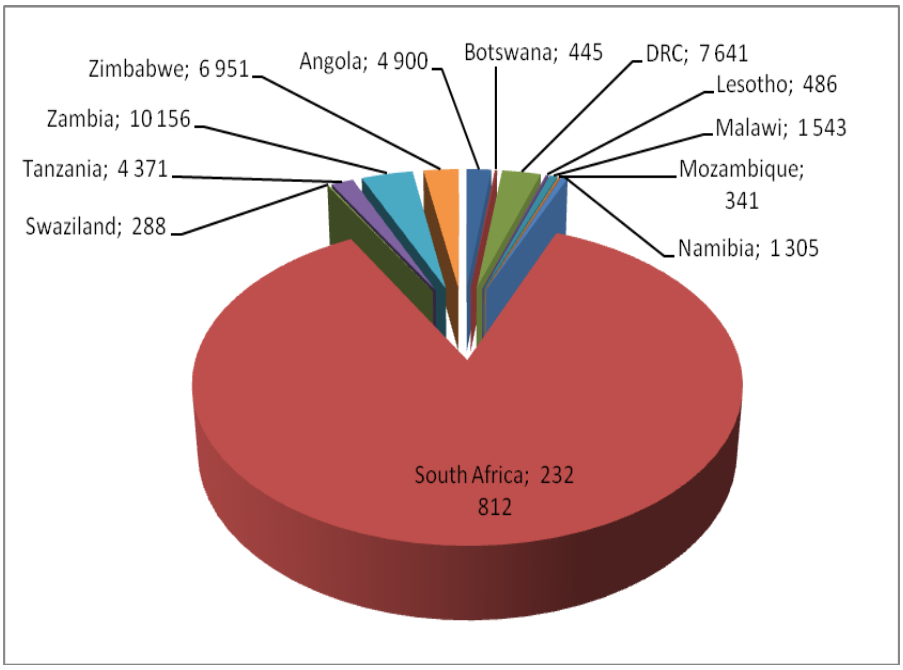
South Africa alone represents 84% of total consumption, and the rest is respectively mainly shared by Zambia (4%), Zimbabwe (3%) with about 1% each for the other countries [1][2].

Graph 5.1 SAPP-2010: Power Consumption by Country (GWh)



Source: SAPP Utility General Information, 2010 Statistics.

Graph 5.2 SAPP-2010 Power Generation by Country (GWh)



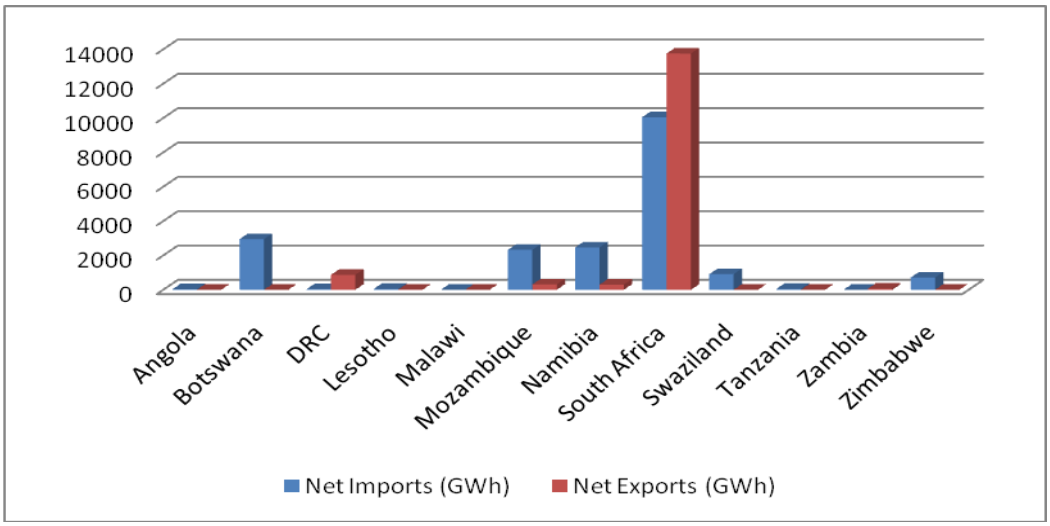
Source: SAPP Utility General Information, 2010 Statistics.

Imports/Exports

In 2010, exports from SA have reached 13754 GWh, as compared to the imported 10047 GWh during the same year. SA is by far the major exporter of power, followed by DRC with 871 GWh. The following countries are major importers of power[1][2]:

- Botswana is importing almost all its consumption (2945 GWh),
- Mozambique is importing back from SA the power generated for SA by HCB (*) (located in Mozambique), and
- Namibia is importing 67% of its consumption (2462 GWh).
- Swaziland and Zimbabwe are also respectively importing 909 GWh and 710 GWh.

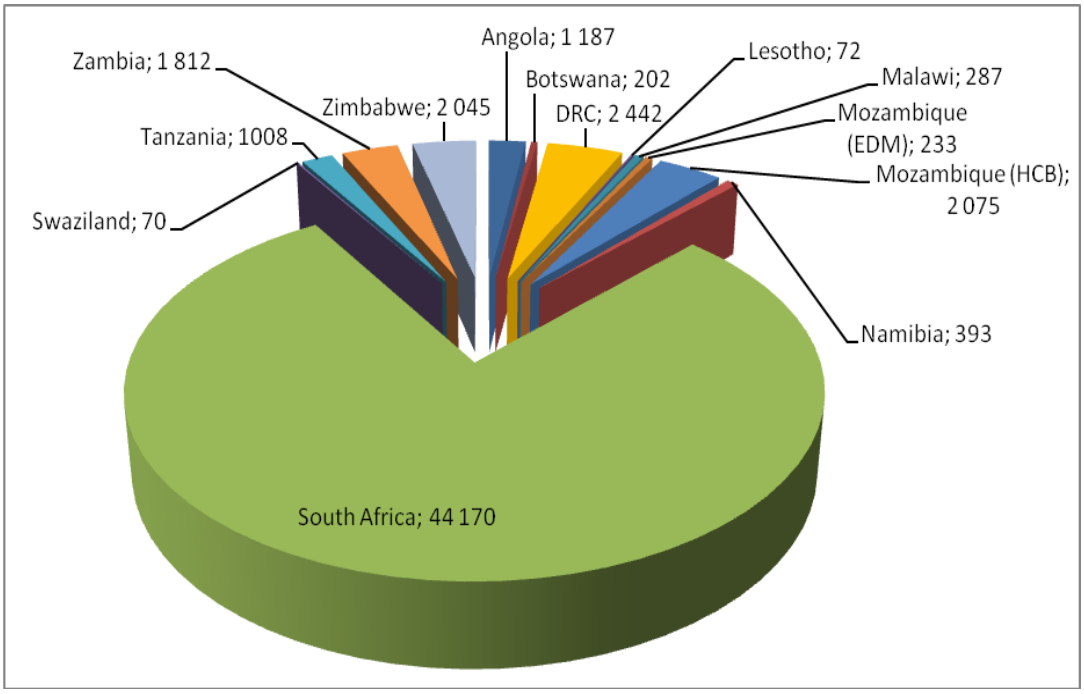
Graph 5.3 SAPP-2010 Imports & Exports of Electricity per Country (GWh)



(*)The clients of the Hidroélectrica de Cahora Basa's (HCB) electricity in the regional market have the following repartition order: Eskom (South Africa), 65%; ZESA (Zimbabwe), 19%; EDM (Mozambique), 15%; Southern African Power Pool (SAPP) and BPC (Botswana), less than 1%.
Source: SAPP Utility General Information, 2010 Statistics.

The installed capacity
SAPP installed capacity has reached 56 000 MW in 2010 with SA representing 82.5% of the available capacity[1][2].

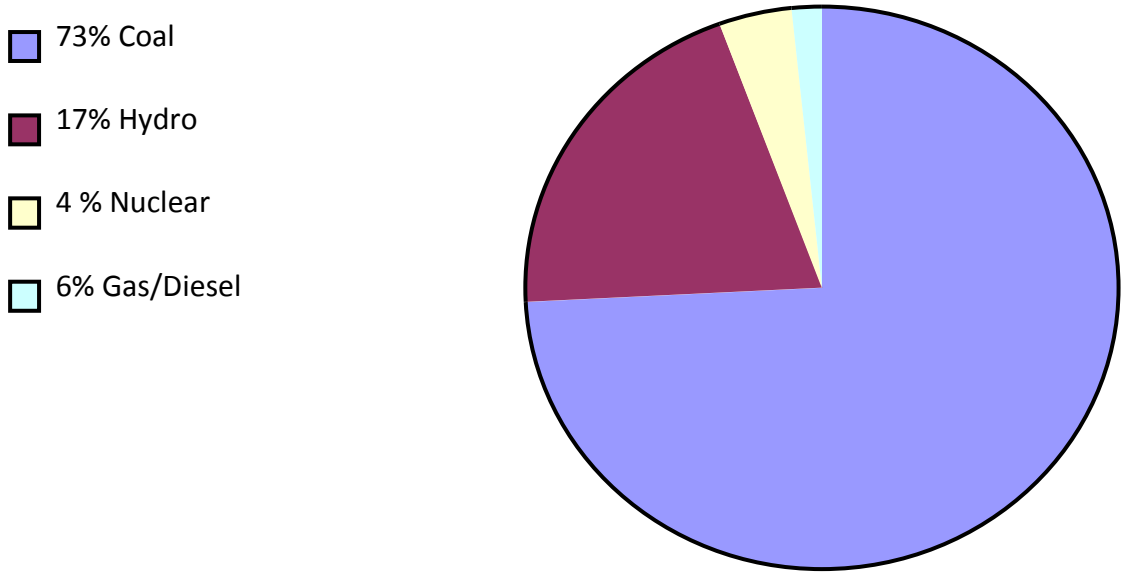
Graph 5.4 SAPP-2010 Installed Capacity by Country (MW)



Source: SAPP Utility General Information, 2010 Statistics.

Coal represents the major part of SAPP generation mix with 39 666 MW (73%, as compared to 9474 MW (17%) for hydropower, 2639 MW (5%) for distillate, 1930 MW (4%) for nuclear and 646 MW (1%) for natural gas.

Graph 5.5 SAPP-2010 Energy Mix of the Installed Capacity



Source: SAPP Utility General Information, 2010 Statistics.

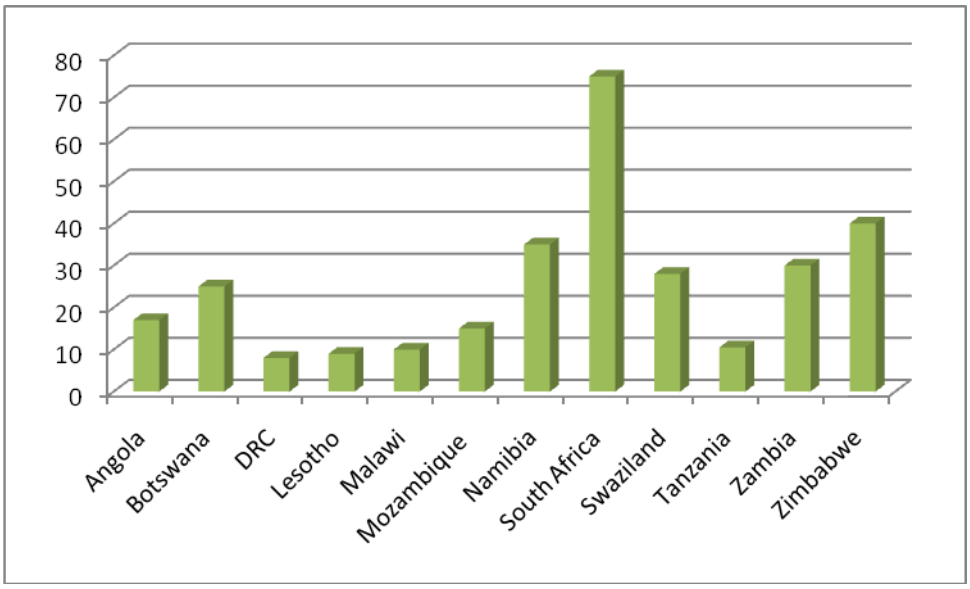
The peak load
The SAPP peak load for 2010 (in MW) is as follows:

Table 5.1 SAPP-2010 Peak Demand by Country (MW)

Country	**2010 Peak demand by country (MW)**
Angola	1100
Botswana	553
DRC	1081
Lesotho	121
Malawi	300
Mozambique	560
Namibia	564
South Africa	36705
Swaziland	204
Tanzania	833
Zambia	1640
Zimbabwe	2100

Electrification rate
In 2009, access to electricity in SAPP is ranging from 75% in South Africa, to medium level of access for respectively 40% in Zimbabwe, 35% in Namibia, 30% in Zambia, 28% in Swaziland and 25% for Botswana. A lower level of access is comprising the following countries: 17% for Angola, 15% for Mozambique, 11% for Tanzania, 10% for Malawi, 9% for Lesotho and 8% for DRC [2].

Graph 5.6 SAPP-Electrification Rate (%)

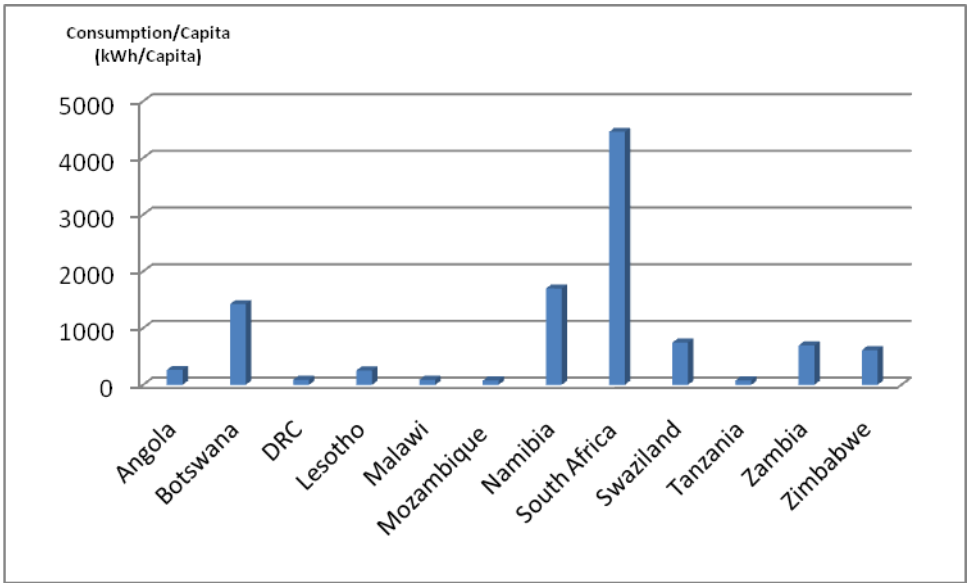


Source: SAPP Utility General Information, 2010 Statistics

Electricity Consumption per Capita

Wide disparities exist also among the countries regarding electricity consumption per capita:

Graph 5.7 SAPP- Electricity Consumption per Capita (kWh/capita) (2009)



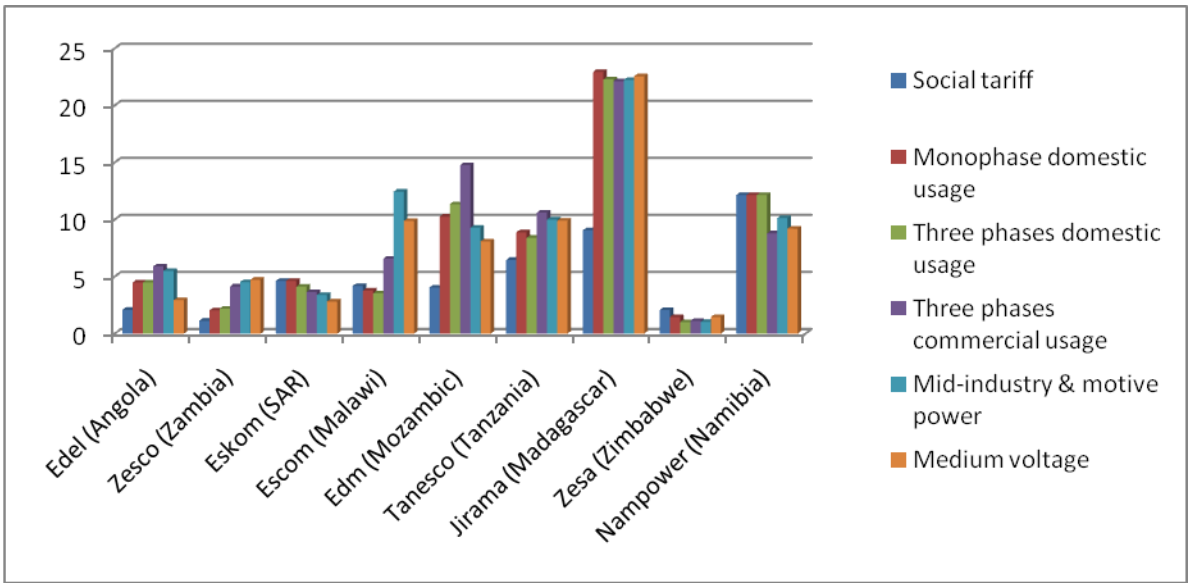
Source: SAPP Utility General Information, 2010 Statistics

Average electricity prices

A study conducted in 2009 by the Union of Producers and Distributers of Electricity in Africa (UPDEA) has produced the following results for SAPP member utilities. The prices are expressed in US cents/kWh (more details are in annex IV)[9].

Graph 5.8 below compares the following tariffs:
- Social tariff (E=100 kWh/month)
- Single phase domestic usage 2 kW
- Three phases commercial usage 12 kW
- Medium voltage (E = 35000 kWh/month)

Graph 5.8 SAPP-Electricity Tariffs by Country (cUS$/kWh)



2. Investment and outstanding financing requirements for SAPP

2.1 SAPP INVESTMENT PROGRAM AND OVERALL FINANCING REQUIREMENTS

The first SAPP Energy Plan was prepared in 2001. It was successively updated in 2005 and 2009. Criteria for prioritizing regional projects were also adopted. Once the regional priority projects are adopted by SADC Energy Ministers, its implementation is coordinated by SAPP.

A prioritized list of regional projects comprising of 14 generation plants (4 coal, 1 gas and 9 hydro) was adopted amounting a total of 13 015 MW for an estimated $21.6 billion up to 2018, in addition to $5.6 billion for 6 major regional interconnections.

2.2 SAPP PRIORITY GENERATION PROJECTS

The overall 13 015 MW identified as SAPP priority generation projects (c.f. annex 3) have the following major features:

- The dominance for future projects of hydropower with 80% as compared to coal (13.8%) and natural gas (6.2%),
- The concentration in few countries with 32% in Mozambique (3945 MW), 28% in DRC (3500 MW hydro-Inga 3), and 23% in Zambia/Zimbabwe (2870 MW),
- Almost all generation investment projects are expected to be developed in partnership with private sector ($21.5b),
- The strong complementarities between the development of these priority generation projects and the priority transmission projects is required for evacuating the generated energy: ZIZABONA, Central Transmission Corridor (CTC), Mozambique backbone and other interconnectors (Mozambique/Zimbabwe; Zimbabwe/RSA; DRC/Zambia).

Table 5.2 SAPP Generation Projects With Regional Impact

Country	Project	Capacity (MW)	Technology	Timing	Cost, US$ m
Mozambique	Benga	600	Coal	2015	1300
	Moatze	600	Coal	2015	1300
	Mphanda Nkuwa	1500	Hydro	2017	2500
	HCB North Bank	1245	Hydro	2017	2000
DRC	Inga 3	3500	Hydro	2018	5950
Zambia	Kalungwishi	220	Hydro	2016	380
	Kafue Gorge Lower	750	Hydro	2017	600
Zimbabwe	Kariba South Extension	300	Hydro	2015	510
Zambia/Zimbabwe	Batoka	1600	Hydro	2017	2720
Botswana	MDDP (former Mmamabula)	300	Coal	2015	660
Swaziland	Lubhuku	300	Coal	2015	660
Namibia	Kudu	800	Gas	2016	800
Lesotho	Kobong Pumped Storage	800	Hydro	2017	1400

Mozambique: The following projects are at structuring and development level by EdM with a potential strategic partner:
(i) Moatze and Benga are coal power plants with 600 MW each, located in the North. They are expected to be commissioned in 2015. Moatze is a Greenfield base load plant mainly for export. It has a potential of an additional 600 MW as phase II.

(ii) Mphanda Nkuwa (1500 MW) and HCB North Bank (1245 MW) are two hydropower projects, expected to be implemented in 2017: They are mainly targeting export market.

The development of all these plants is linked with the implementation of major transmission lines: Mozambique Backbone (South) and the second Mozambique-Zimbabwe interconnector. The final EIA for the Mozambique backbone was completed.

Zambia:
(i) Kalungwishi new hydropower project (210 MW) is expected to be implemented in 2013 as IPP project,
(ii) Kafue Gorge Lower hydropower project (750 MW) is expected to be implemented in 2015 by ZESCO with private partner. Discussions are underway with potential investors.

Zimbabwe:
Kariba South consists of a 2x150 MW hydro Extension. Feasibility studies are completed and project is to be commissioned in 2015 by ZESA in collaboration with a private partner. Associated 330 kV transmission line is required.

Zambia/Zimbabwe:
Batoka 1600 MW is a run off the river hydropower project on the Zambezi River with capacity to be shared equally between Zambia and Zimbabwe. The project is targeting the regional market. An agreement is needed between the two countries to proceed with the project. Existing FS is to be updated.

2.3 SAPP PRIORITY TRANSMISSION PROJECTS

There are mainly three categories of priority transmission projects:

- Transmission projects for alleviating congestion (category A): The regional trade and the development of the Day Ahead Market are presently constrained by (a) the interconnection capacity between Zambia, Zimbabwe, Botswana and Namibia (ZIZABONA), (b) by the transmission capacity within Zambia (Kafue-

Livingstone), within the existing Central Transmission Corridor (CTC) involving Zambia (ZESCO)- Zimbabwe (ZESA)-Botswana (BPC) and RSA (Eskom);

- Transmission projects to interconnect non-operating members (category B): This concerns mainly evacuating power to Tanzania, respectively from Zambia and from Mozambique and also connecting Namibia to Angola;
- Transmission projects related to new generation projects (category C): The development of Moatize (600 MW) and of Mphanda Nkuwa (1500 MW) in North Mozambique requires the implementation of Mozambique Backbone for evacuating power to the South as well as the development of the second Mozambique-Zimbabwe Interconnector. The development of new hydropower plants in Zambia (Kafue Gorge Lower 750 MW); in Zimbabwe (Kariba South 300 MW) and in Zambia/Zimbabwe (Batoka 1600 MW) would require the development of the second Zimbabwe RSA Interconnector. It will be also the case for the second DRC-Zambia Interconnector which will be required after the rehabilitation of Inga 1 & 2 and the development of Inga 3 (3500 MW).

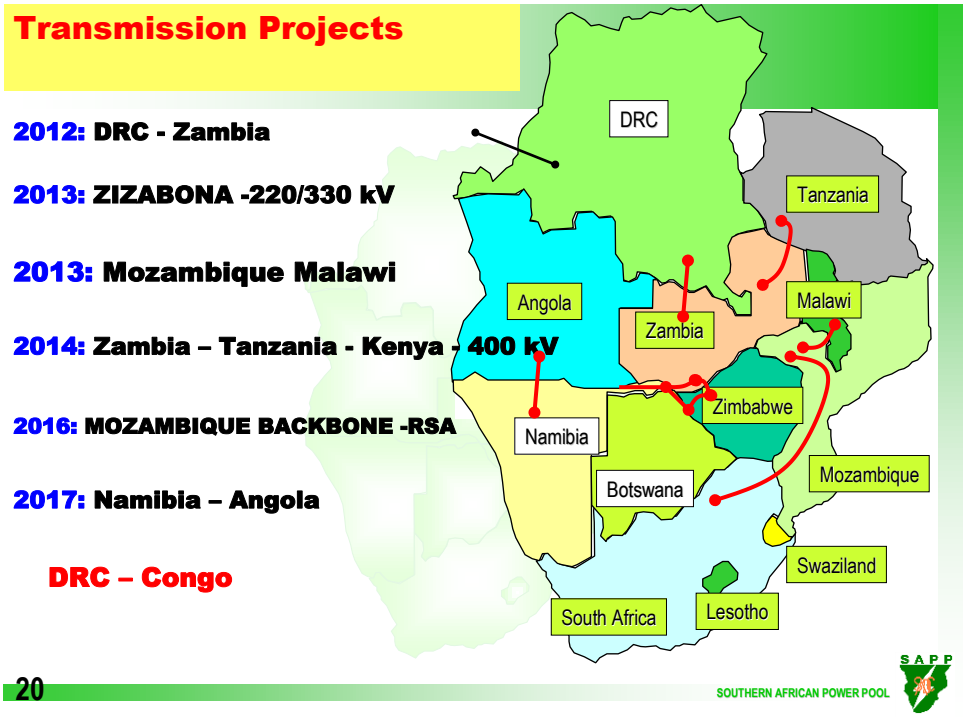


Table 5.3 SAPP transmission priority projects per category

Category	Interconnected countries	Capacity (MW)	Status	Investment Cost US$ m	Expected Date
A	Zimbabwe, Zambia, Botswana, Namibia ZIZABONA	650	Project preparation studies being processed (DBSA, NEPAD-IPPF, others). Financial structuring in progress	240	2013
	Zimbabwe, Central Transmission Corridor (CTC)	650	Project to relieve transmission congestion in Zimbabwe. FS done.	65	2013
	Zambia, Kafue - Livingstone	600	Project to increase the transfer capacity within Zambia. Project at implementation stage		2014
B	Zambia, Tanzania, Kenya	400	Project to interconnect Tanzania with the SAPP grid. Transaction Advisors appointed. Project preparation in Tanzania and project implementation in Zambia	330	2014
	Mozambique, Tanzania	600	Project to interconnect Tanzania from Mozambique. FS required		2017
C	DRC, Zambia	600	Project to increase the transfer capacity of the DRC-Zambia interconnector	29	2014

- ZIZABONA: the Zimbabwe-Zambia-Botswana-Namibia Interconnector linking Hwange substation and a proposed switching station near Victoria Falls town in Zimbabwe, proceeding to a proposed substation in the Pandamatenga area in Botswana and then terminating at the Zambezi substation in Namibia. The project includes a line from Victoria Falls town to Livingstone in Zambia. This interconnector will link the four respective countries' electricity networks. The scope of the Study shall include (i) Feasibility Study Update; (ii) Independent Technical Review; (iii) Environmental Impact Assessment; (iv) Market Study; (v) Project Documentation; and (vi) Project Packaging. The total cost is estimated at US$ 2,579,000.

3. Institutional Set up and Policy framework

SADC mandate includes improving upon the regulatory and contractual legislations related to the exchange of energy within the 15 countries in the region.

3.1 LEGAL AND REGULATORY FRAMEWORK

The Southern African Power Pool (SAPP)

Created in 1995, the Southern African Power Pool (SAPP) is a Specialised Institution of SADC with objective to improve upon energy supply within the SADC (excluding Mauritius) by integrating national power system operations into a unified electricity market. To that end, the SAPP coordinate the planning and operation of the electric power system among member utilities and provide a forum for regional solutions to electric energy problems.

SADC Protocol on Energy

The Protocol was signed at Maseru on the 24th August 1996. It aims at ensuring that sectoral and sub-sectoral regional energy policies and programmes are in harmony with the overall policies and programmes of SADC and with the strategies and programmes of other SADC sectors. Within this context, some of the guidelines adopted by SADC members for regional integration and co-operation in the electricity sector are as follows:

a) Promote electricity trading and power pooling such as that described in the Southern African Power Pool (SAPP) Intergovernmental Memorandum of Understanding, the SAPP Agreement between Operating Members.

b) Promote integrated resource planning in the electricity sub-sector to take advantage of economies of scale and optimisation of investment and equitable sharing of benefits.

c) Promote the evolution of common regional standards, rules and procedures relevant to the generation, transmission and distribution of electricity, including the standardisation of electrical manufacturing facilities, particularly in areas in which the Region holds a comparative advantage.

Regulatory framework of STEM and DAM

To ensure a proper functioning of Short Term Energy Market (STEM) and then of Day Ahead Market (DAM), the related regulation has been defined by (i) STEM Book of trading and financial Rules, and (ii) DAM Governing Document defining the rules to be followed for concluding agreement between all participants and Market Operator.

An implementation structure has also been defined comprising (i) Markets Sub Committee, (ii) Market Monitoring & Surveillance Team, and (iii) Market Operator.

The Regional Electricity Regulatory Association (RERA)

The Regional Electricity Regulators Association of Southern Africa (RERA) was established by the Southern African Development Community (SADC) as a formal association of electricity regulators in July 2002, more particularly in terms of the SADC Protocol on Energy (1996) and of the SADC Energy Cooperation Policy and Strategy (1996).

RERA's mission is to facilitate harmonisation of regulatory policies, legislation, standards and practices and to be a platform for effective cooperation among energy regulators within the SADC region. The membership to RERA is open to electricity supply industry (ESI) regulators in each country within SADC. Each country is limited to a single membership.

3.2 SYSTEM PLANNING

The first SAPP Energy Plan was prepared in 2001. It was successively updated in 2005 and 2009. Criteria for prioritizing regional projects were also adopted. Once the regional priority projects are adopted by SADC Energy Ministers, its implementation is coordinated by SAPP.

3.3 MOBILIZATION OF FUNDING

The following approaches were adopted in SADC for mobilizing funding:

- Up to 2009, the approach consisted in convening donors meeting for presenting the regional power priority projects defined by SAPP successive Master Plans. Donors meetings were convened by SAPP in 2001, 2005 and 2009. The requests for funding mobilization are then processed by the countries themselves and not by SAPP.
- In 2009, with the promotion of ZIZABONA project, SAPP was given the mandate for mobilizing funding for regional projects. A donors meeting on ZIZABONA projects is scheduled for November 2011.

3.4 OPERATION

SAPP adopted its first Operating Guidelines (OG) in 1996. In view of the development of its power system, SAPP has engaged in 2010 the following measures:

- Revision of its Operating Guidelines after completing revision of the Inter-Utility Memorandum of Understanding (IUMOU, Agreement Between Operating Members (ABOM). A first draft document was already submitted to SAPP in 2011.
- Implementation of a SCADA system at the SAPP Coordination Centre,
- Development of SAPP Quality of Supply (QOS) Standard and the SAPP QOS Meter Specification documents aiming at having common standards of power supply at points of interconnections and to monitor quality of supply,
- Adoption of resolutions for handling inter-Control Area interchange energy imbalances between the supplier and consumer. This defines the settlement modalities for paying back inadvertent energy as well as imbalance and emergency energy under the auspices of the SAPP Coordination Centre.

3.5 COMMERCIAL FRAMEWORK

The bulk of trading arrangements in SAPP is concluded under bilateral contracts. At least 28 bilateral contracts have been concluded so far between SAPP member utilities. Such a contract was already concluded in 1992 (before SAPP creation) between SNEL (DRC) and ZESA (Zimbabwe). Subsequently, this arrangement was complemented by the adoption of: (i) the Short Term Market (STEM) in 2001, (ii) the Post STEM (Balancing Market) in 2002, and (iii) the Day-Ahead Market (DAM) in 2009. Whereas pricing of STEM contracts was based on matching sellers prices, DAM pricing contracts are settled according to Real Time Market based on marginal price equating sellers and buyers bids.

For the smooth operation of STEM and later of DAM, governing documents have been established (book of rules, participation agreement) and implementation structure has been adopted (Markets Sub Committee; Market Monitoring & Surveillance Team, Market Operator).

3.6 CAPACITY BUILDING

SAPP benefited from capacity building components of the international cooperation program concluded mainly with the following partners:

- The Government of Norway and SIDA within the Supervisory Control and Data Acquisition System (SCADA),
- The World Bank through the Study on the Commercialization and Operational Assessment of selected SAPP Power Utility Members,
- The Development Bank of Southern Africa (DBSA) for the ZIZABONA technical and market study,
- The European Union (EU) within EU Capacity Building program for SAPP, covered various management and technical issues including a study tour to Europe for the Markets Sub Committee,
- The World Bank and the government of Norway through the preparation of 2009 SAPP Power Master Plan.

Within this framework SAPP has organized various workshops and training sessions. During 2010, the trainings are in particular covering the following modules: technical aspects of interconnected grid planning and operation (network reliability, integrated generation and transmission planning), management, PPP approach, commercialization of power utilities, regulation, institutional reform, revenue collection (smart metering). A course was also organized for traders on market opening.

4. CONCLUSIONS AND MAIN RECOMMENDATIONS

4.1 REGIONAL TRADE CONSTRAINED BY TRANSMISSION CONGESTION

SAPP regional power market is operating well. As mentioned earlier, at least 28 bilateral contracts have been concluded so far between SAPP member utilities. Net imports within SAPP represent 7% of total SAPP generation and DAM is already active. However, the development of the regional trade is constrained by transmission congestion within the transit countries (Zimbabwe, Mozambique) and at interconnection level (Zimbabwe-Zambia-Botswana-Namibia). This constraint is also hampering the development of available power generation capacity in countries like Mozambique (Moatze, Mphanda Nkuwa), Zambia (Kafue Gorge Lower) and Zimbawe (Kariba South). Therefore, the implementation of SAPP generation and transmission priority projects will contribute at scaling up the regional energy market by providing better energy mix (hydro represents 80% of new priority generation projects), better security of supply and grid stability (almost all SAPP countries are contributing with new generation capacity). The proposed priority transmission projects (ZIZABONA, CTC, Mozambique backbone) will be contributing significantly to alleviating transmission congestion challenge.

4.2. NEED FOR AN INTEGRATED APPROACH IN INVESTING IN SAPP GENERATION AND TRANSMISSION PROJECTS

As it has been indicated in 2.2, 2.3 and 4.1, the implementation of SAPP generation priority projects is closely dependant on the investment in associated transmission projects. Given the complementarities between regional generation and transmission projects, a comprehensive investment approach needs to be adopted by considering these projects as a package and not as isolated projects. This is in particular the case for

Mozambique Backbone and Mozambique power generation projects. It is also the case for the development of ZIZABONA and the development of generation projects within the concerned countries (c.f. annex 2).

4.3 EXPANSION OF SAPP REGIONAL TRADE MARKET IS AN ASSET AND A GUARANTEE FOR FUTURE INVESTMENTS

As mentioned earlier in 4.1, at least 28 bilateral contracts have been concluded so far between SAPP member utilities. The development of STEM/DAM and of the interconnections has shown that all the regional utilities are active on the regional power market and the demand is high. Despite existing transmission congestion, net imports reached 7% of total SAPP generation. As indicated in 2.2 and in annex 2, almost all future generation investments are considering the participation of private partners. In the past, the development of investments in regional transmission and generation projects was driven by the demand in SA and by PPA concluded with Eskom. With the positive results experienced so far and given the prospect of rapid growth of regional trade, it is no more relevant for investors to request for such a PPA from Eskom prior to concluding future investments. SAPP regional trade market is to be leveraged as valuable asset for guaranteeing future investments.

4.4 NEED FOR AN ADAPTED APPROACH FOR FUNDING MULTI-USERS REGIONAL TRANSMISSION PROJECTS

ZIZABONA project can be sited as one of the key regional priority projects. The approach adopted for its development needs to be supported: creating a dedicated SPV, promoting a PPP involving the major players and defining a wheeling tariff which secures the sustainability of the project.

4.5 NEED FOR STRENGTHENING SAPP COORDINATION CENTRE FOR COPING WITH REGIONAL MARKET DEVELOPING ACTIVITIES

In addition to its present activities mainly dominated by technical issues, SAPP needs to strengthen its existing capacity for (i) ensuring the additional role consisting in promoting the funding of SAPP priority projects, and (ii) managing the fast growing SADC power regional market.

(i) Before 2009, the requests for funding mobilization were not processed by SAPP but by the countries themselves. In 2009, with the promotion of ZIZABONA project, SAPP was given the mandate for mobilizing funding for regional projects. In the future, SAPP needs to move toward organizing periodic donors meetings associating the concerned stakeholders and for specific projects.

(ii) It is expected that the implementation of SAPP priority projects will boost considerably the regional power market by 2015/16.

For coping with the development of these two major activities, the Coordination Centre will need to adapt its capabilities at least on three levels: (i) at institutional level by providing SAPP with the required mandate for addressing these additional issues, (ii) at staff level by recruiting additional staff dealing in particular with projects/regional trade promotions and monitoring, (iii) at capacity building level by providing the necessary training/skills required for mobilizing funding and for managing the growing dynamic power market.

REFERENCES

1. The Southern African Power Pool. By Dr. Lawrence Musaba, Coordination Centre Manager; 2011.
2. SAPP Power Sector Requirements, By Alison Chikova, SAPP Coordination Centre, 13 Sept 2011.
3. SAPP Trading Arrangements, By Musara Beta Chief Market Analyst, SAPP Coordination Centre, 12-15 September 2011.
4. SAPP, ZIZABONA Project Status Update, 12-15 September 2011.
5. Status of the Generation and Transmission Projects in the SAPP, September 2011.
6. SAPP Utility General Information, 2010 Statistics.
7. The Regional Electricity Regulators Association of Southern Africa (RERA): Proposed Guidelines for Regulating Cross-Border Power Trading in Southern Africa, September 2009.
8. RERA Publication on Electricity Tariffs and Selected Performance Indicators for the SADC Region, 2009.
9. UPDEA: *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.
10. SAPP Regional Generation and Transmission Expansion Plan, Final Report, Volume 1, Executive Summary, Submitted by Nexant, July 2009.

VI. REGIONAL POWER STATUS IN WEST AFRICA POWER POOL (WAPP)

Economic Community of West African States (ECOWAS) is comprised of 15 member states: Benin, Burkina Faso, Cape Verde, Ivory Coast, Gambia, Ghana, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone & Togo.

1. OVERVIEW OF THE POWER SECTOR IN 2010

Generation

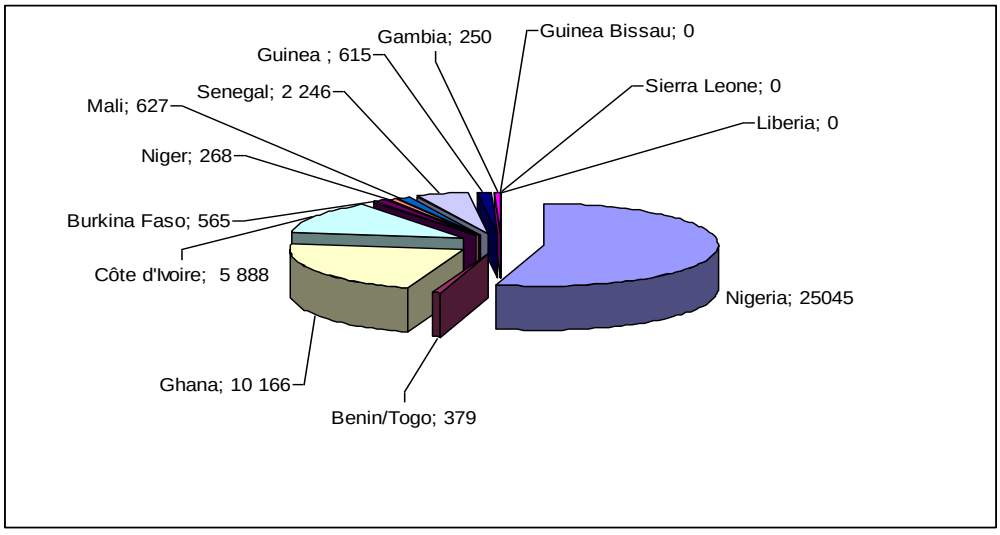
In 2010, power generation has reached 46 049 GWh (excluding Guinea Bissau, Liberia and Sierra Leone), as compared to 39 993 GWh in 2009, which represents a 15% growth in contrast with 1.2% recorded between 2008 and 2009. With 54% of total WAPP generation, Nigeria alone has experienced a 20% growth for the same period, provided mainly from its thermal generation growth (32%).

Table 6.1 WAPP-Power Sector Overview

	2010		2009		Var. 2010/2009
	GWh	%	GWh	%	%
Total energy generated	46 049	100%	39993	100%	15%
- Hydro	17090	37%	17992	45%	-5%
- Thermal	28959	63%	22000	55%	31.6%
Energy imported	3655	7.9%	2236	5.6%	63.5%
Energy exported	2844	6.2%	2871	7.2%	-1%
Gross Consumption	46435		39357		18%

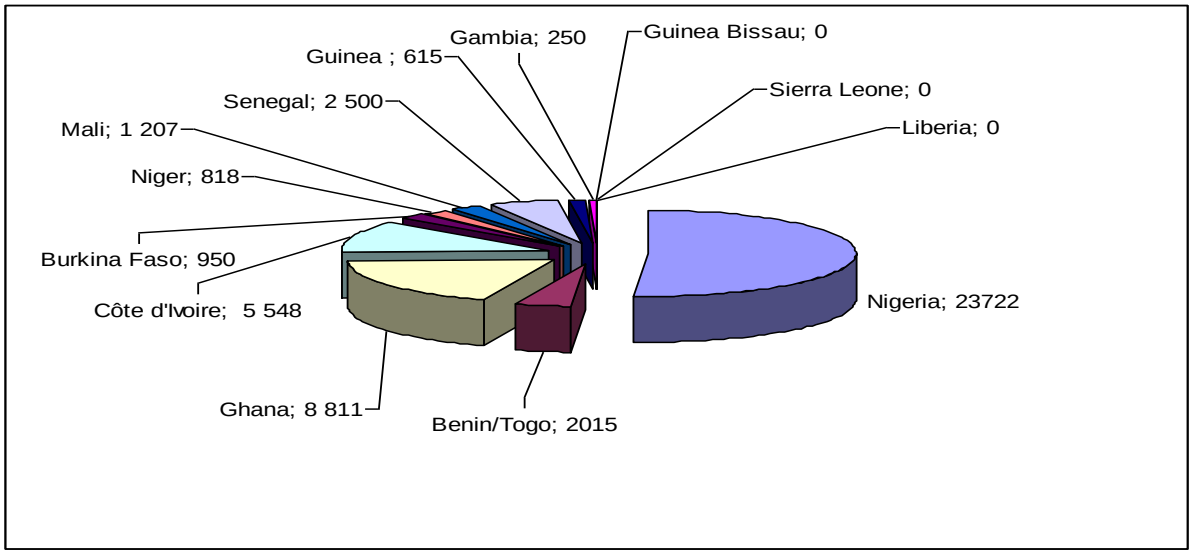
Hydropower generation is mainly dominated by Nigeria (43.4%) and by Ghana (40.9%). The remaining are shared by Côte d'Ivoire (9.5%), Guinea (2.8%), Mali (1.7%) and Burkina Faso (0.7%). Despite the increase by 24.5% of Ghana hydropower in 2010, the overall level of hydropower generation has decreased by 5% as compared to 2009.

Graph 6.1 WAPP-2010 Power Generation per Country (GWh)



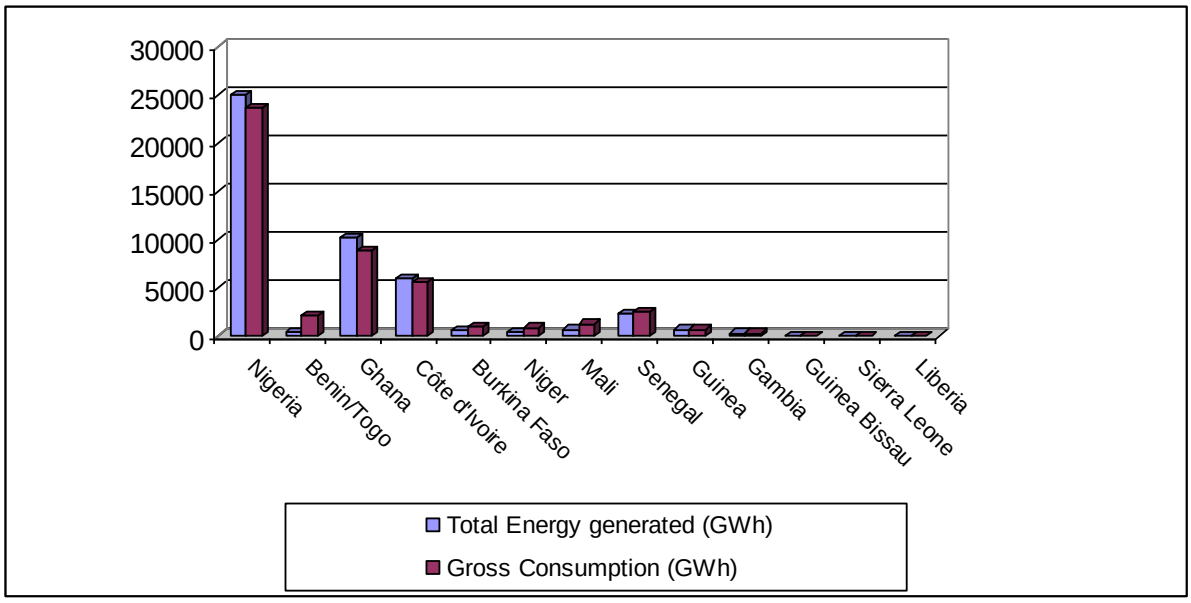
Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011.

Graph 6.2 WAPP-2010 Electricity Consumption per Country (GWh)



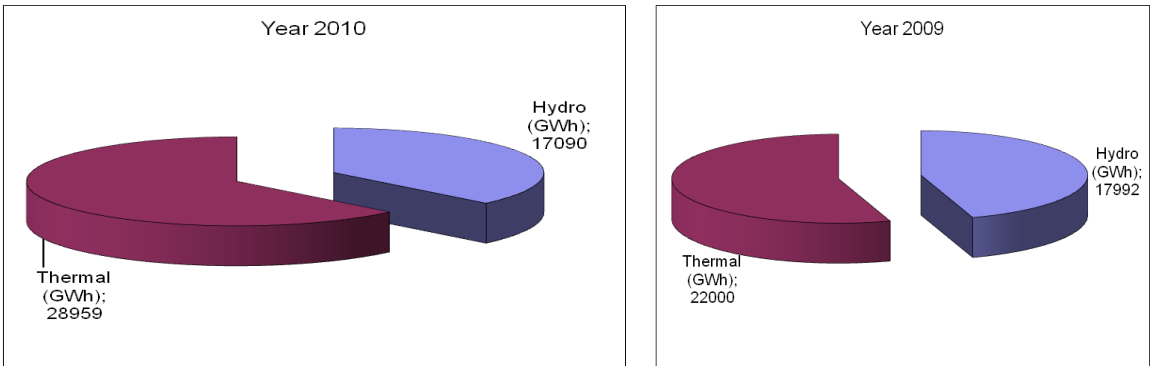
Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011.

Graph 6.3 WAPP-2010 Electricity Generation and Consumption (GWh)



Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011

Graph 6.4 WAPP Power Generation breakdown by Hydro and Thermal (GWh)



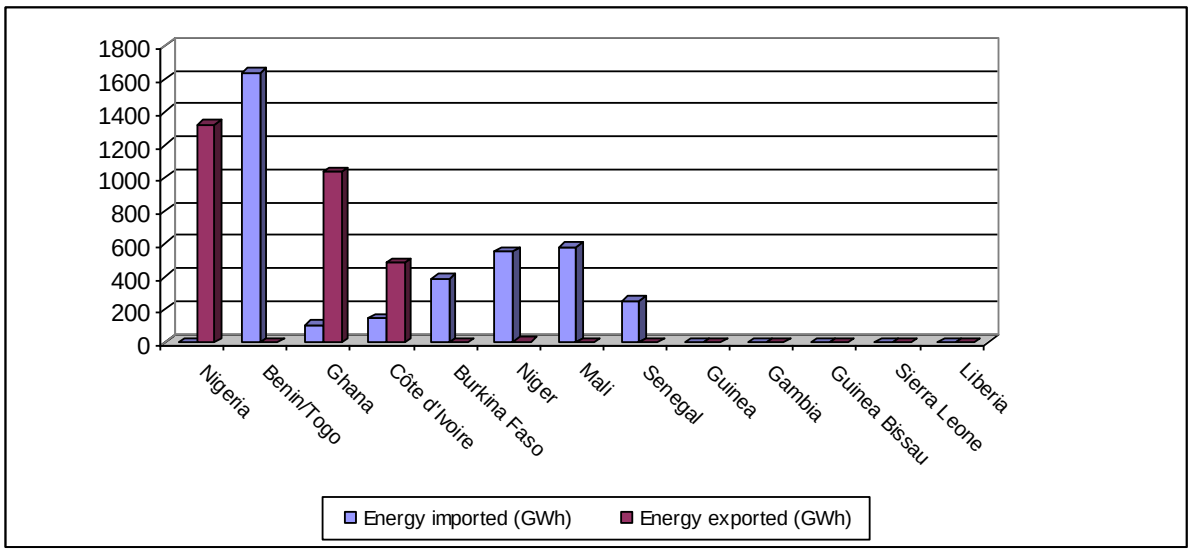
Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011.

Imports/Exports

Energy imports have drastically increased by 63.5% as compared to 2009. Benin/Togo represents the major part with 45% of total imports. The remaining is mainly shared by Mali (15.9%), Niger (15%), Burkina Faso (10.5%), Senegal (6.9%), Côte d'Ivoire (3.9%) and Ghana (2.9%).

In 2010, energy exports have slightly declined by 1% as compared to 2009. The major energy exporters are respectively Nigeria (47%), Ghana (36%) and Côte d'Ivoire (17%).

Graph 6.5 WAPP-2010 Energy Imports & Exports per Country (GWh)



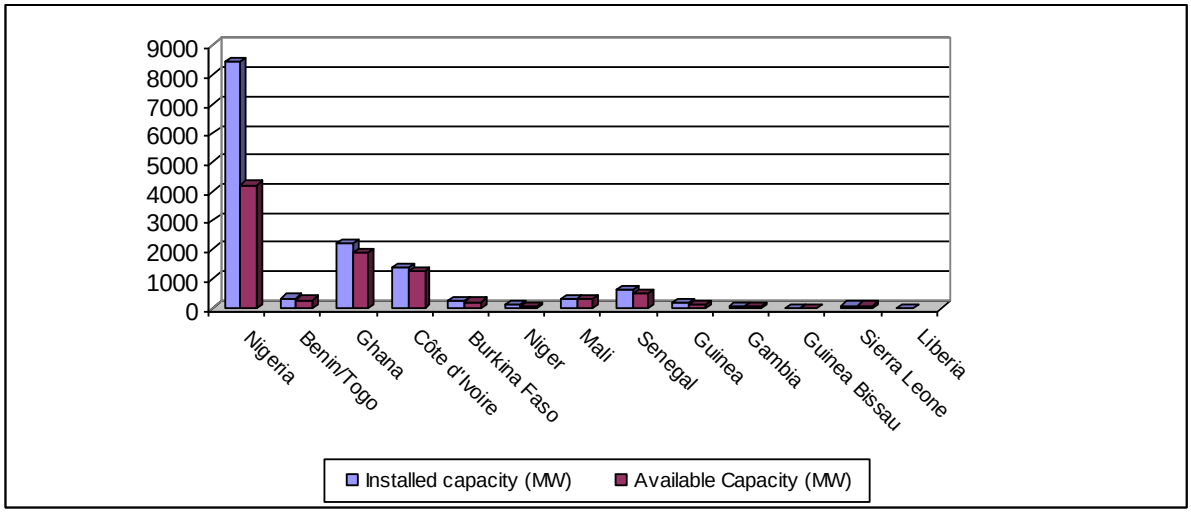
Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011.

Peak load
In 2010, peak load within WAPP is dominated mainly by three countries with respectively 3 804 MW for Nigeria, 1506 MW for Ghana and 912 MW for Côte d'Ivoire (c.f. annex 5.1). As compared to 2009, the peak growth was respectively 2.5% for Nigeria, 5.8% for Ghana and 6.4% for Côte d'Ivoire.

Unsupplied energy
In 2010, the unsupplied energy was estimated at 861 GWh.
Based on update forecast from 2009 values realized, it is recorded in 2010 a synchronal deficit of 4049 MW and an energy deficit of 3334 GWh.

Installed capacity
Total installed generation capacity equals 13 927 MW in 2010 as compared to 13 756 MW in 2009 (excluding Guinea Bissau, Liberia and Sierra Leone). Thermal installed capacity represents 70% and hydropower 30% of total installed capacity.

Graph 6.6 WAPP-2010 Installed vs. Available Capacity (MW)



Source: WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/WAPP*, Projects at a Glance, May 2011.

Renewable energy
As far as renewable energy is concerned, the ECOWAS has founded on November 2008, the ECOWAS Regional Centre for Renewable Energy and Energy Efficiency Centre (ECREEE). The official inauguration of the ECREEE Secretariat took place on 6 July 2010.

As part of its 2011 Work Plan, ECREEE is conducting a comprehensive resource assessment program covering in particular solar, wind, hydro and bio-energy. It is also worth mentioning the Regional Small Hydro Programme.

Electrification rate
Electricity access is still low, varying from 3% in Niger and Guinea Bissau to 40% in Nigeria.

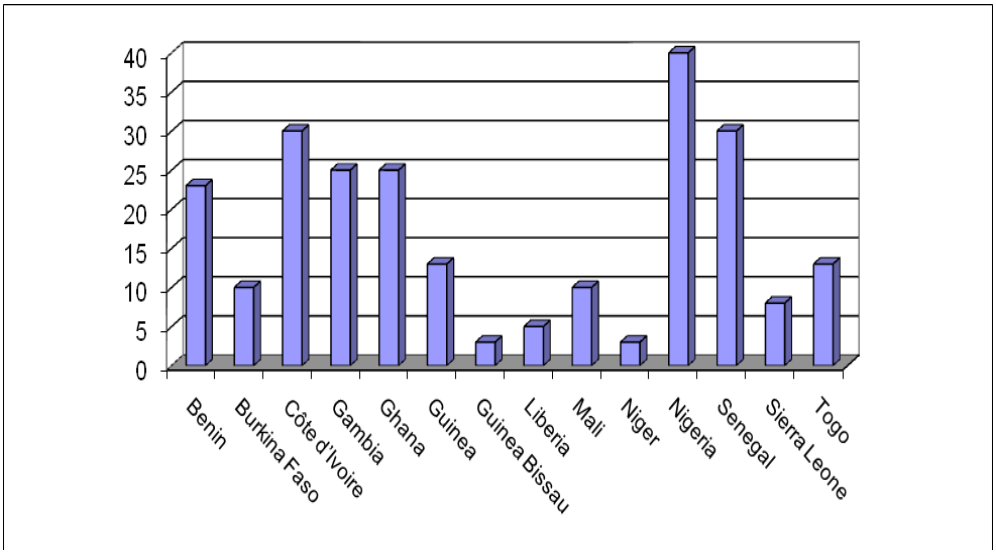
It was not possible to get reliable data on the breakdown of this ratio into urban and rural rates. Electricity access by country (1) was estimated as follows (%):

Table 6.2 WAPP- Electricity Access by Country (%) (2009)

Benin	Burkina Faso	Côte d'Ivoire	Gambia	Ghana	Guinea	Guinea Bissau
23	10	30	25	25	13	3

Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
5	10	3	40	30	8	13

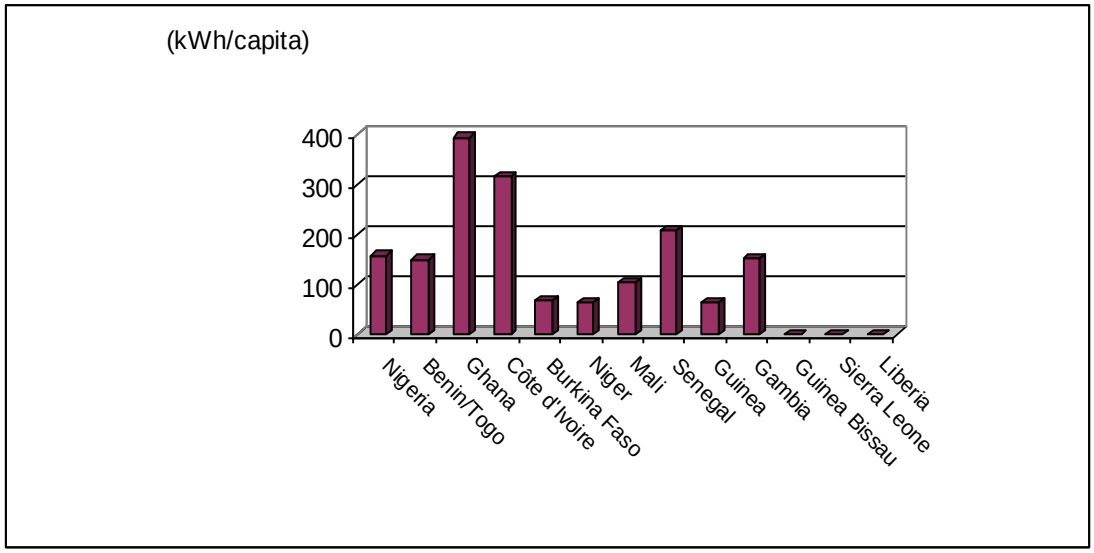
Graph 6.7 WAPP- Electricity Access per Country (%)



Source: WAPP Generation and Transmission Assets (WGTA) First Issue, September 2010

Beside the cross-borders MV electrification program being implemented by WAPP (c.f. Annex V, Table 5.5.4), ECREEE launched in 2011 its Rural and Peri-Urban Program comprising ECOWAS Renewable Energy Facility and ECOWAS Regional Rural Electrification/Microgrid program development.

Graph 6.8 WAPP Electricity consumption per capita (kWh/capita)



Source: WAPP Generation and Transmission Assets (WGTA) First Issue, September 2010.

Average electricity prices

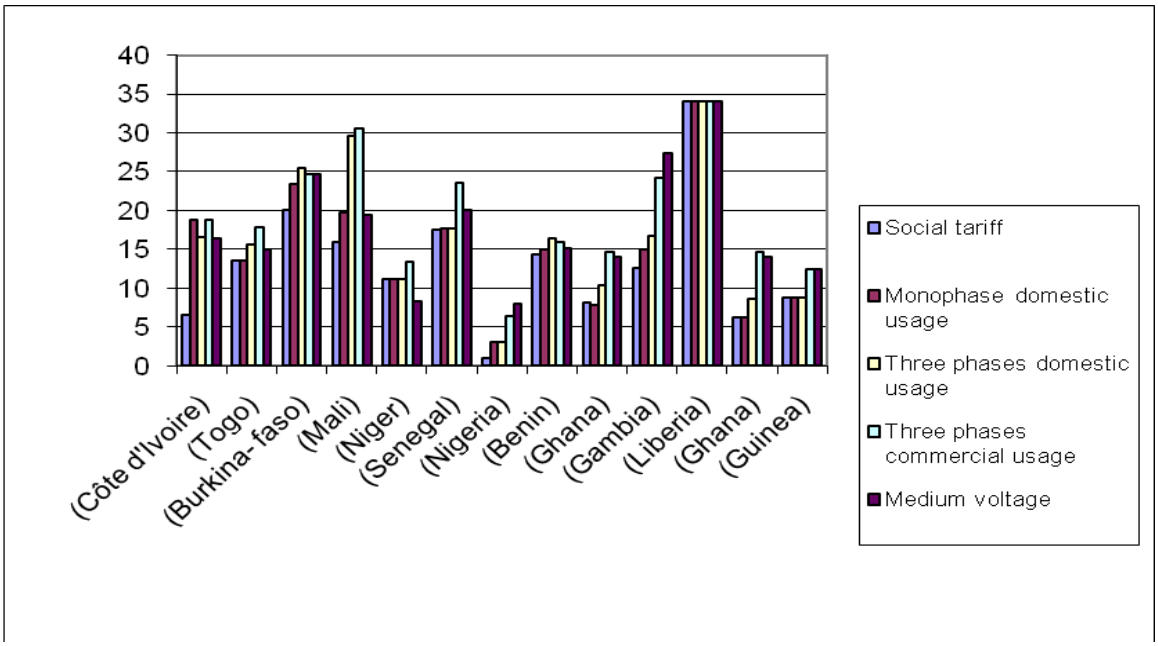
The study conducted by UPDEA on electricity tariffs in Africa (2) provides the following comparison for various types of tariffs:

- Social tariffs (corresponding to an electricity consumption of 100 kWh/month) vary from a very low level of 1.05 cUS$/kWh in Nigeria to a maximum of 20 cUS$/kWh for Burkina Faso, as compared to an average tariff of 13 cUS$/kWh for the region.
- For three phase domestic usage tariff (600 kWh/month), the average tariff is equal to 16.4 cUS$/kWh, varying from 8.7 cents in Guinea to 29.5 cents in Mali.

The following graph 6.9 provides a comparison for four types of tariffs:

- Social tariff (E=100 kWh/month)
- Single phase domestic usage 2 kW
- Three phases commercial usage 12 kW
- Medium voltage (E = 35000 kWh/month)

Graph 6.9 WAPP-2009 Electricity Tariffs by Country (cUS$/kWh)

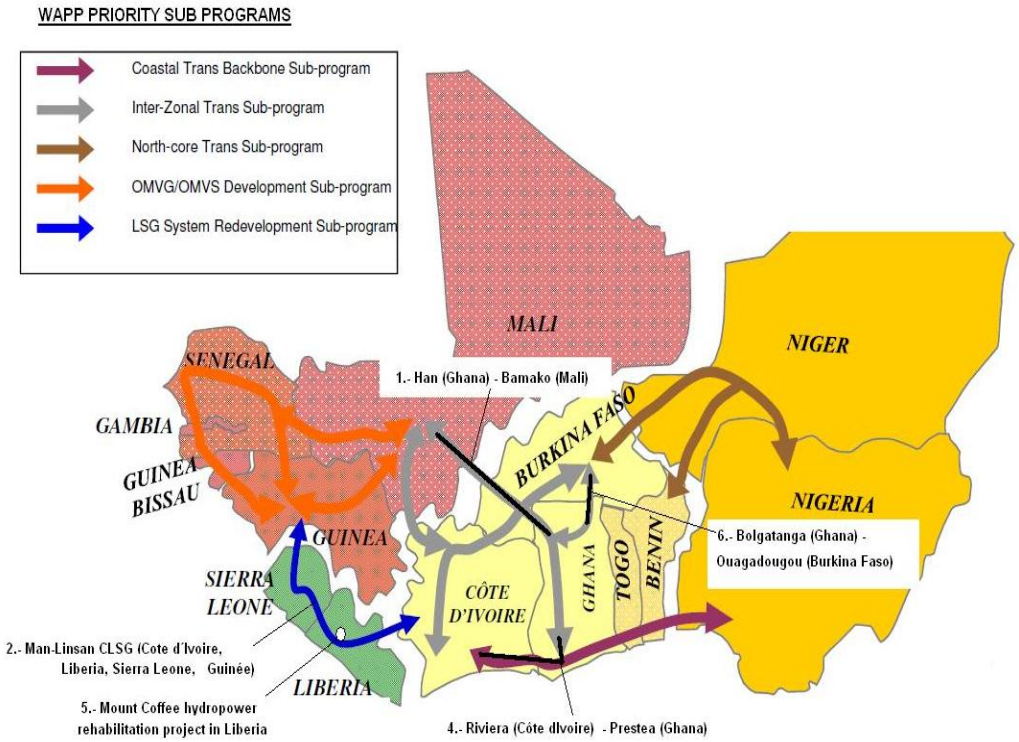


(2) UPDEA, *Etude Comparative des Tarifs d'Electricité pratiqués en Afrique*, December 2009.

2. WAPP INVESTMENT PROGRAM AND OVERALL FINANCING REQUIREMENTS

The priority projects adopted by ECOWAS and being implemented by WAPP are articulated around the following main subprograms namely:

A. Coastal Transmission Backbone Subprogram (Côte d'Ivoire, Ghana, Benin/Togo, Nigeria).
B. Inter-zonal Transmission Hub Subprogram (Burkina Faso, OMVS via Mali, Mali via Côte d'Ivoire, LSG via Côte d'Ivoire).
C. North-core Transmission Subprogram (Nigeria, Niger, Burkina Faso, Benin).
D. OMVG/OMVS Power System Development Subprogram (The Gambia, Guinea, Guinea Bissau, Mali, Senegal)
E. Côte d'Ivoire-Liberia-Sierra Leone-Guinea Power System Re-development Subprogram (Côte d'Ivoire, Liberia, Sierra Leone, Guinea).
F. WAPP Strategic Generation Subprogram (Emergency Power Supply Security Plan).



As of 2011, parts of these subprograms are already implemented or being implemented by WAPP and a revised version of a Master Plan is being finalized for updating the priority projects.

The subprograms include investments in generation, transmission and in the development of information/control centers. They include also the required pre-investment studies and associated capacity building components.

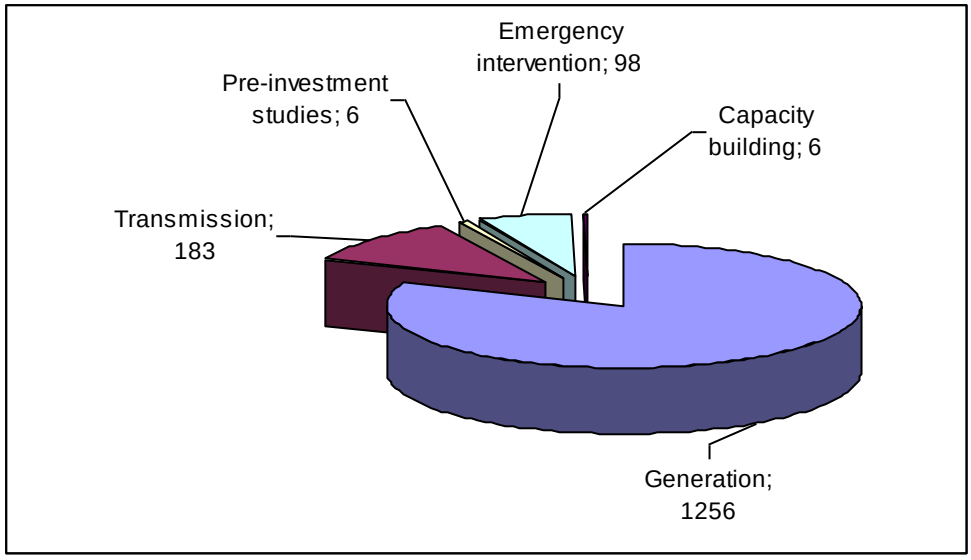
The overall financing requirements as identified in May 2011 (3) for implementing the subprograms mentioned above are as follows:

Table 6.3 WAPP-2011 Summary of Financing Requirements

	Financing requirements US$ m
Generation*	1255.55
Transmission	183.0
Pre-investment studies	6.34
Emergency intervention	98.0
Capacity building	6.2
Total	1549.09

(3) Source: WAPP Donors Meeting Aide Mémoire, May 2011.
*Including transmission lines of Kaleta and Sambangalou.

Graph 6.10 WAPP-2011 Summary of Financing Requirements (US$ million)



2.1 STATUS OF GENERATION PROJECTS

Over a total of 2600 MW identified as generation projects (c.f. annex V): (i) 35% are already either implemented or being implemented (financing secured), (ii) 26% require funding for conducting pre-investment studies, and (iii) 38% are to be developed by the private sector.

Projects being implemented

They are mainly hydropower projects. The implementation of these projects is scheduled between 2013 and 2017. For all these projects, funding was secured except for two projects: (i) OMVG projects still requiring an additional funding of approx. US$387 million (Kaleta and Sambangalou including 1677 km transmission lines); and (ii) For Adjarala hydropower project, the pre-investment study and bidding documents are completed and requests for financing the US361 million were submitted. Regarding Kaleta (240 MW), negotiations are being finalized between Government of Guinea and a Chinese company for implementing this project (see Annex V, Table 5.5).

Projects requiring pre-investment studies

Except for 50 MW solar power project to be developed in Mali, all the remaining are hydropower projects, namely Souapiti (515 MW) and Kassa "B" (118 MW). The total funding requirements for conducting the pre-investment studies is estimated at US$11 million.

Projects to be developed by the private sector

The three concerned projects are thermal. Two are combined cycles: Maria Gleta 450 MW and Aboadze 400 MW. The third consisted of OMVS 150 MW to be fuelled either by natural gas or by coal (depending on the availability of natural gas). OMVS Energy Ministers are still deliberating on the location of the power plant.

For Maria Gleta, the land was acquired in Benin, and the pre-Investment Studies were completed. For Aboadze, the land acquisition in Ghana is in progress. The pre-qualification for recruitment of Strategic Partner for Maria Gleta and Aboadze was completed on April 2011. Details on PPP structure are not yet defined.

Floating storage

It expected that by 2014, the present capacity of WAGP may not be able to meet the demand in particular for additional power plants on WAGP's route namely Nigeria-Benin-Togo-Ghana. The floating storage consisting in two vessels, respectively for LNG storage and for re-gasification was considered by WAPP as an alternative for securing gas supply for power generation. The project is being evaluated and scheduled to be implemented before 2014.

2.2 STATUS OF TRANSMISSION PROJECTS PER ZONE

As it can be seen in table 2.2 below, 7 of 14 projects representing 51% of the total estimated investment costs are already implemented or being implemented. This concerns mainly the Coastal transmission backbone (or subprogram "A") and the Inter-zonal transmission (or subprogram "B"). A more detailed status is provided in Annex V, Table 5.5.2: Transmission priority projects.

Table 6.4 WAPP- Status of transmission projects per subprogram

Project Status	Number	Investment Cost US$ m	Subprogram (c.f. 2.1)	Interconnections
Implemented	3	226.3	A,A,B	1.Nigeria-Benin 2. Within Burkina 3. Within Ghana
Being implemented	4	954.3	A,B,B,D	1. Ghana-Togo-Benin 2. Ghana-Burkina 3. OMVG 4. Côte d'Ivoire-Mali
Feasibility study completed	2	702.3	E, C	1.Côte d'Ivoire-Liberia-S. Leone-Guinea 2.Nigeria-Benin-Niger-Burkina
Ongoing pre-investment study*	4	442.4	D,B,B,B	1.Côte d'Ivoire-Ghana 2.Within Ghana 3.Ghana-Mali 4.Guinea-Mali
Pre-investment study to be conducted	1		D	OMVS
TOTAL	**14**	**2325.3**		

*2004 Master Plan estimation.

In parallel to interconnection projects, WAPP is strengthening its Information and Control Center (ICC) as well as promoting 6 national control centers and 5 area control centers. The total investment cost is estimated at US$214.3 m. Part of the funding was secured and the financing gap is estimated at US168.56 m (c.f. annex 2.3 WAPP ICC & National/Area Control Centers).

2.3 STATUS OF MV CROSS-BORDER PROJECTS

The following MV Cross-border projects were initiated and funded within the framework of the First Energy Facility of the EU-ACP Program. They are either already implemented or being implemented:

Table 6.5 WAPP- Status of MV Cross-Border Projects

Name	Investment cost US$ m	Status
1. Ghana-Togo 2.Ghana-Burkina	19.810	Implemented
3.Côte d'Ivoire-Liberia		Being implemented
4.Togo from Benin 5.Togo from Ghana	4.6	Implementation to start in Sep. 2011
TOTAL	**24.4**	

2.4 EMERGENCY POWER SUPPLY PROGRAM

Regarding Guinea Bissau, the program is being implemented as WAPP has already secured a total financing of US$10 million from the ECOWAS and the UEMOA Commissions. Regarding Guinea, the cost of the emergency power supply program for the city of Conakry is estimated at US$108m with a financing gap of US$70m still to be filled (c.f. annex V, Table 5.5.5).

2.5 STUDIES AND CAPACITY BUILDING PROJECTS

The total cost of these projects is estimated at US$69m. The WAPP Capacity building for the ICC shares 61% of the total program cost. The implementation of this component still requires additional funding of US$40.6m. The other projects consist of the update of the WAPP Master Plan and the technical assistance (both funded), the WAPP Capacity building for Planning, Investment Programming and Environment Safeguards (PIPES) which still requires an additional funding of US$0.9m and WAPP Cote d'Ivoire, Liberia, Sierra Leone, Guinea (CLSG) re-development program with a funding gap of US$6m (c.f. annex V, Table 5.5.6).

3. INSTITUTIONAL SET UP AND POLICY FRAMEWORK

ECOWAS mandate is to improve upon the regulatory and contractual legislations related to the exchange of energy within the 15 countries in the region.

3.1 LEGAL AND REGULATORY FRAMEWORK

The West African Power Pool (WAPP)

Created in 1999, the West African Power Pool (WAPP) is a Specialised Institution of ECOWAS with objective to improve upon energy supply within the ECOWAS by integrating national power system operations into a unified electricity market.

The ECOWAS Energy Protocol

The Energy Protocol was adopted in January 2003. After its ratification by member states, the ECOWAS Energy Protocol became a regional law and was ratified in 2007 by the required number of national parliaments. The protocol aims at promoting long-term cooperation in the energy field, with a view to achieving increased investment in energy and increased energy trade in the West Africa Region. Key provisions of this legislation include (i) Protection of foreign investments, (ii) non-discriminatory conditions for trade in energy, and (iii) Dispute resolution procedures.

The ECOWAS Regional Electricity Regulatory Authority (ERERA)

ERERA was established in 2008 by Supplementary Act A/sa.2/1/08. Its responsibilities consist mainly of the regulation of cross-border electricity connections and trading among ECOWAS member States. This includes (i) the establishment of transparent tariff setting methodology for regional power pooling; (ii) adopting technical regulation; (iii) monitoring of regional market operations; (iv) resolving disputes among regional market participants; (v) contributing to the development of regional energy policy and (vi) assisting in building capacity of National Regulatory Bodies.

The first forum on the regional regulation of the electricity sector in West Africa was held in Accra on 9th and 10th November 2010.

3.2 SYSTEM PLANNING

The first ECOWAS Energy Plan was prepared in 1999. It was updated in 2004. It serves as overall framework for the development of power priority projects in the region. Its implementation is coordinated by WAPP through its three years business plan and its annual work plan. A supplementary Act on "the emergency power supply security plan (EPSSP)" was also adopted in 2008. The master plan is being updated and a reviewed set of priority projects will be finalized before end of 2011.

3.3 MOBILIZATION OF FUNDING

WAPP uses a two-pronged approach is adopted for mobilizing funding:

- Organizing donors' meetings every 4 months, attended by national and regional stakeholders involved in the implementation of priority projects (utilities, funding agencies, specialized institutions, Ministries). WAPP has succeeded in establishing an institutionalized forum where regional power projects are regularly reviewed;
- In addition, a donors' meeting is also convened specifically for examining a particular regional project

3.4 OPERATION

The Operational Manual for WAPP interconnected Power system was adopted in July 2007.

The implementation of the operational guidelines is coordinated at WAPP level by its Information and Coordination Center (ICC). In that regard, WAPP is coordinating a program consisting in modernizing and up grading National Control centers (6) and Control Area Centers (5) at country level and is establishing a web based SCADA system as a back up for the main WAPP ICC.

3.5 COMMERCIAL FRAMEWORK

Already in 2008, a methodology for establishing templates to power purchasing and transport contracts has been developed by WAPP under AFD funding. So far, two bilateral contracts are being finalized (August 2011), one on energy (VRA-SONABEL) and one on transport (Gridco-SONABEL).

For the design of the electricity market, WAPP has signed a contract in July 2011 with an international consulting firm to conduct a 6-month study aimed at (i) designing a market model, (ii) assisting in the establishment of comprehensive trading rules, and (iii) preparing a training plan and a training manual. The proposed model has to be approved by ERERA.

3.6 CAPACITY BUILDING

A strategy report on WAPP capacity building program initiative was prepared in 2008, under USAID funding. A systematic approach was adopted to set priorities for capacity building needed to develop the institutional framework for WAPP Operationalization.

Within that framework, WAPP has organized various training sessions under the funding respectively of AfDB, European Union, US AID and own WAPP resources. During 2010-2011, the trainings are in particular covering the following modules: technical aspects of interconnected grid operation, management (finance, accounting, biding), PPP approach, regulation at regional level and institutional reform. Training sessions were organized by leveraging existing training resources (training professionals and facilities) with objective to create the regional capabilities.

4. MAJOR FINDINGS AND CONCLUSIONS

Definitely, WAPP has succeeded in implementing its various activities through constant and active coordination. Steady progress has been achieved in parallel along four main components: (i) institutional set up, (ii) planning and investment preparation of priority projects, (iii) development of the information system, and (iv) implementation of capacity building strategy.

At this stage of development, the major challenge for ECOWAS/WAPP is to keep this momentum by strengthening and consolidating what has been already achieved.

However, to be effective, development of regional power trade requires also complementary measures to be taken at national level by the stakeholders collaborating with WAPP.

4.1 MEASURES FOR SUSTAINING REGIONAL TRADE DEVELOPMENT

- **Facilitating mobilization of funding for infrastructure projects**

As far as generation projects are concerned, mobilizing of funding is required for at least 3 hydro projects (Sambangalou, Kaleta, Adjarala) totalling 515 MW and for 3 thermal projects (Maria Gleta, Aboaze, OMVS) totalling 1000 MW. There is some information indicating that Kaleta may be covered by a Chinese funding source. Efforts are being initiated by WAPP for achieving PPPs. However, given the impact of implementing this size of projects on socio-economic development of the region, innovative tools for guaranteeing these investments are to be set up in collaboration with multilateral/bilateral funding institutions and national governments.

- **Bridging the missing interconnection links**

Over 14 priority transmission projects, 7 are still to be implemented and thus requiring funding mobilization.

- **Sustaining the development of PIPES team** in its effort for (i) updating investment priority projects, (ii) following up on project preparation and implementation, and (iii) promoting the mobilization of the required funding.

- **Securing the implementation of an efficient information and operation system**

WAPP is strengthening its Information and Control Centre (ICC) as well as establishing six national control centres and five area control centres. At this stage of development of interconnection projects implementation, it is key to prepare for a safe and efficient operation of the system through (i) securing the funding of the investment financing gap (US168.56 m), and (ii) conducting in depth capacity building program for system operators.

- **Development of market tools**

A study is being launched by WAPP for the design of the electricity market. Both ERERA and WAPP will (i) coordinate the implementation of the market model after its adoption, (ii) implement and to follow up on the establishment of comprehensive trading rules, and (iii) follow up on the implementation of the related training plan.

- **Development of capacity building program**

To ensure its long-term sustainability, WAPP is already engaged in further implementing its Capacity Building Program Initiative (CBPI). Given the requirements for establishing a regional power trading market, it is of high priority to prepare the concerned staff and decision makers by providing further in depth knowledge and experience for in area included in CBPI such as:

- Increased competency to develop appropriate policies, regulations, and financing mechanisms to stimulate investment in energy infrastructure projects,
- Advanced knowledge of Power Pool Systems
- Increased knowledge of regional legal, commercial and financial frameworks with respect to utility operations and power pools,
- Expertise in developing Public Private Partnership approach
- Experience in developing Tariff Policy with respect to Power Pools,
- Expertise in developing Power Purchase Agreements for power pools,
- Additional knowledge of Power Pool Operation including additional understanding of the WAPP Systems Operation Manual with the adoption of Systems Operator Certification.

4.2 COMPLEMENTARY MEASURES AT NATIONAL LEVEL FOR SUSTAINING REGIONAL TRADE

Development of regional power trade requires complementary measures to be taken at national level by the concerned stakeholders (governments, utilities, regulators) and at regional level by ECOWAS for policy, ERERA for regional regulation and by WAPP for policy implementation.

The ultimate beneficiaries of regional trade are final consumers and their distribution companies. The development of regional trade will depend respectively on their ability to pay and on their quality of service. Upgrading electricity distribution management cannot be solved by taking isolated measures (such as increasing tariffs) but requires adopting a comprehensive approach integrating at least the following parameters: (i) ability to pay, (ii) technical distribution management, (iii) commercial management, (iv) tariff setting, and (v) human resources management.

- **Ability to pay**

Although data is not available for comparing electricity tariffs to their delivery cost, the common perception by distribution utilities is that tariffs are often not reflecting the real cost of generation, transmission and distribution. The final consumer is in some cases also paying the cost of self-generation and the cost of service disruption. It is only by evaluating the cost of these three factors that one can estimate the consumer ability to pay. Therefore ability to pay cannot be disconnected from the quality of service.

- **Technical distribution management**

It is measured by the quality and the continuity of the delivered power (voltage variation, number of shutdowns; outages). It is also measured by the technical and not technical losses. These factors can be easily measured and compared to benchmarks and best practices.

- **Commercial management**

It covers the whole chain of the consumers contact with the distribution company: (i) application to connect to the grid, (ii) metering, (iii) billing, (iv) methods of payment, (v) public relation approach for receiving the customers and addressing their enquiries. These factors can be also evaluated and compared to benchmarks and best practices.

- **Tariff setting**

Electricity tariffs are a set of various tariffs related to the consumer profile/category: social tariff, domestic tariff, commercial tariff, and industrial tariff (low, medium, high voltage tariff).

Except for the social tariff, revising electricity tariffs is a compromise between reflecting economic costs and achieving the financial viability of the utility. Methods exist for building coherent tariffs. Disseminating these methods could contribute at mitigating the political fears regarding tariff setting by limiting it to the level of social tariffs.

- **Quality and Human resources management**

Geared by the technical objective of securing the electricity supply, management of distribution utilities is often entrusted to operation engineers some times without having the required background for dealing with commercial management issues. Thus technical issues are often considered as first priority issues. In many cases, utility staff is aware of management issues but is not well motivated or enabled for implementing the required measures given the very centralized decision making process.

- **The Way forward**

Developing regional trade requires up grading distribution utilities management and progressively adopting viable tariffs. Initiating such approach will also give the right signal to the investors and to funding agencies.

Even if a political decision is taken at regional and national level for going toward that direction, implementing such an approach needs to be well designed and scheduled over a period of time (3 to 5 years). Best practices of such approach exist already within the Continent and abroad.

The following approach could be adopted:

Technical and commercial management

- Conducting an assessment of technical and commercial management parameters by utility and proceed to a benchmarking exercise and to comparison with best practices;
- Identifying and analysing best practices already achieved within the region/continent;
- Organising workshops and training sessions at regional/national levels for disseminating quality management tools and ways of implementing them;
- Thinking of promoting twinning with performing utilities on a voluntary basis including exchange of visits and also coaching process for specific actions.

Tariff setting

- Organising regional workshops/training sessions on electricity tariff setting, including methods for calculating the economic cost of delivering electricity to the various type of consumers,
- On a voluntary basis, assisting the utilities in setting the methodology for revising their tariffs,
- Conducting a study on the cost of self-generation and the cost of the non-served energy.

Political ownership

This far-reaching action requires the political ownership at regional level by ECOWAS. The Distribution and Commercialization Committee created in 2007 by WAPP could also be used as a forum and framework for coordinating such action.

REFERENCES

1. West African Power Pool: WAPP Generation & Transmission Assets (WGTA), First Issue, September 2010.
2. WAPP: 2010 Activity Report of the Secretariat General.
3. WAPP: *Système d'Echanges d'Energie Electrique Ouest Africain, Aperçu des Projets/ WAPP*, Projects at a Glance, May 2011.
4. WAPP Donors Meeting *Aide Mémoire*, May 2011.
5. WAPP: Status of Delivery of WAPP Projects; By Momodou a.k. Njie; May 2011.
6. WAPP: First Seminar For Judges on Regulation in the Electric Power Sector – Issues in Cross-border Power Delivery and Infrastructure, July 2011.
7. *Révision du Plan Directeur des Moyens de Production et de Transport de l'Energie Electrique de la CEDEAO*, Cotonou 15 & 16 juillet 2011- Tractebel Engineering-GDF/Suez.

REGIONAL POWER STATUS IN AFRICAN POWER POOLS

ANNEXES

ANNEX I CAPP

Table 1.1 Monitoring of CAPP Power Systems Operations

	Angola	Burundi	Cameroon	Congo	Gabon	Equatorial Guinea	CAR	RDC	SAO Tomé	CHAD	TOTAL
Installed capacity (MW) (2)	1768	51	980	237	374	86	37	2 437	31	72	6073
Thermal Installed capacity (MW) (1)	347		206	58	176	40	3			46	875
Hydro Installed capacity (MW) (1)		110	721		137			1 880			
Hydro Available Capacity (MW)	694	21	683	74	170	3	19	1 705			3369
Thermal Available Capacity (MW) (1)	158		204	52	172	36	2			41	664
Available Capacity (MW)	1717	51	980	181	374	72	37	2 437	16	42	5907
Energy imported (GWh)								38			38
Energy exported (GWh)								915.3			915.3
Hydro Energy generated (GWh)	3646										
Thermal Energy generated (GWh)											
Total Energy generated (GWh) (2)	4153	207	4 256	898	1 638	524	126	7 383	27	182	19 394
Gross Consumption (GWh) (2)	3719	207	4 085	433	1 436	220	71	4 890	22	155	15 238
Peak load (MW)											
Unsupplied Energy (GWh)											

(1) Source: CAPP database for Burundi, Cameroon, DRC and Gabon.
(2) Source: PEAC *Présentation générale du secteur électrique en Afrique Centrale,* Europ Aid/126679/C/SER/CG du 01/06/2011.

Table 1.2 Transmission Grid Length in CAPP Countries

		HV Grid Length (in km)								
Country	**Overall Total**	**500 kV**	**225 kV**	**220 kV**	**110 kV**	**90 kV**	**70 kV**	**66 kV**	**36 kV**	**50 kV**	**Others**
Angola											
Burundi					210		112				
Cameroon			480		337	1210					
Congo				460	267						192
Gabon			137			126			250		
Equatorial Guinea								8			
Centrafric					81				80		
DR Congo		1174		1483	1199		575			189	
SAO Tomé											
CHAD											
Total PEAC (km)	8570	1174	617	1943	2094	1336	687	8	330	189	192

Source: PEAC *Présentation générale du secteur électrique en Afrique Centrale, Europ Aid/126679/C/SER/CG du 01/06/2011*.

Table 1.3 Sub-Stations in CAPP Countries

Country	**Number of VHV Sub-stations**	**Number of Source sub-station**
Angola		
Burundi		
Cameroon	25	78
Congo	8	
Gabon	14	696
Equatorial Guinea		2
Central African Republic (CAR)	4	22
DR Congo	72	3740
SAO Tomé		
CHAD		
Total CAPP	123	4358

Source: PEAC *Présentation générale du secteur électrique en Afrique Centrale, Europ Aid/126679/C/SER/CG du 01/06/2011*.

Table 1.4 CAPP: Electrification Rates: Access rate to electricity in Centre Africa – 2009

Country	% Overall	% Urban	% Rural
Angola	26	48	10
Burundi	3	25	1
Cameroon	29	45	9
Central African Republic	5	15	1
Congo	30	40	15
Gabon	37	40	18
Equatorial Guinea	27	71	8
DR Congo	11	25	4
SAO Tomé	49	62	34
CHAD	4	16	2

Source : P.E.A.C. *Indicateurs de Performance des Sociétés Electriques du P.E.A.C. Tendances de 2000 à 2009*, Europe Aid/126679/C/SER/CG ; WYG International, 01 juin 2011

Table 1.5 CAPP: Electricity Consumption per Capita (kWh/capita)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Angola	91	91	79	135	120	126	137	151	186	187
Burundi										
Cameroon	233	238	233	257	245	239	240	239	245	245
Central African Republic	22	23	19	22	20	18	19	19	17	19
Congo	115	117	128	126	126	137	148	155	155	167
Gabon	1194	1212	1239	1253	1233	1216	1265	1305	1352	1326
Equatorial Guinea	135	157	190	220	256	283	454	477	507	532
DR Congo	89	86	83	76	77	73	75	70	68	63
SAO Tomé										
CHAD	8	8	6	6	6	8.5	8	10	12	9

Source : P.E.A.C. *Indicateurs de Performance des Sociétés Electriques du P.E.A.C. Tendances de 2000 à 2009*, Europe Aid/126679/C/SER/CG ; WYG International, 1 June 2011.

ANNEX 1

Table 1.6 CAPP: Comparative Tariffs (cents US/kWh)

UTILITY		**SNEL**	**SEEG**	**SNE**	**STEE**	**ENERCA**	**AES-SONEL**
COUNTRY		(RD CONGO)	(GABON)	(CONGO)	(CHAD)	(CAR)	(CAMEROON)
Social tariff (E = 100 kWh/month)	1 kW	2.65	7.13	9.94	11.07	16.90	11.55
Monophase domestic usage	2 kW	3.90	11.52	6.72	25.60	16.94	11.55
(E = 200 kWh/month)	4 kW	3.90	15.10	6.72	25.60	16.30	11.55
Three phases domestic usage	6 kW	8.70	15.90	6.72	25.60	16.94	12.73
(E = 600 kWh/month)	10 kW	8.70	16.64	6.72	25.60	16.51	12.73
Three phases commercial usage	12 kW	11.00	17.23	6.40	26.75	16.80	14.94
(E = 1800 kWh/month)	15 kW	11.00	17.58	6.40	26.75	16.66	15.70
Mid-industry & motive power	20 kW	15.00	14.76	5.64	23.26	14.27	14.09
(E = 2500 kWh/month)	25 kW	15.00	15.80	5.64	23.26	14.13	15.00
Medium voltage (E = 35000 Wh/month)	250 kW	9.80	16.17	7.60	19.33	11.91	13.17

(3) Source : UPDEA: *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.

Table 1.7 Synthesis of the interconnections

Interconnection	Sub-station	Voltage kV CA	Capacity MW	Length km	Estimated total cost US$ m
Angola - DRC	Maquela do Zombo – inga 3	400	900	192.00	187.29
Republic of Congo - Gabon	Monogo Kamba – Bongolo – Chutes de l'impératrice	400	600	482.1	435.13
Gabon - Equatorial Guinea	Ntoum – Bata	400	600	271.4	296.65
Equatorial Guinea - Cameroon	Bata – Menve'ele	400	600	95.4	146.22
Cameroon - Chad	Maroua N'Djamema	220	125	205.8	115.71
Total				**1246.7**	**1181.0**

Exchange rate (8 April 2010):

1 EUR = 659.957 FCFA (XFA)
1 USD = 0.75 Euro
1 USD = 491.97 FCFA (XFA)
1 USD = 1$ CAD

Source : EIRE CEEAC- *Etude sur l'Interconnexion des Réseaux Electriques des Pays Membres de le Communauté Economique des Etats de l'Afrique Centrale-RSWI/SOGREAH* - December 2009.

Table 1.8 Status of generation and transmission priority projects and funding gap

N°	Project/location	Status	Required actions	Est. Cost US$ m	Source of funding	Funding gap
Investment in generation						
1	**Cameroon-Congo borders** Development of: -Chollet hydro-power site **600 MW** -associated transmission lines	-Site identification conducted, -Inter-states Memorandum signed in October 2010 between Cameroon and Congo, - funding of the project secured by a Chineese partner -Studies: 10 mo -Construction: 2 years	- selection of contractors for construction - implementation of institutional framework		-Chineese partners - Concerned countries	m.c. m.c.
2	**Cameroon** - Development of Mem'vele , hydropower plant; **220 MW** - Construction of associated transmission lines -Cameroon-Gabon -Cameroon-Equ.G	- Inter-government MoU being signed? -Project implementation started in November 2010 - construction: 3 years	- facilitation of tri-partite agreement between Cameroon-Gabon-Equatorial Guinea	Studies: N/D Investment: N/D	China funding Cameroon China funding Cameroon	m.c. m.c.
3	**Gabon** Development of: -Grand Poubara hydropower site **320 MW** -associated transmission lines	- Project being implemented under China funding - construction: 3 years	- Follow up on studies and projects implementation	Studies: N/D Investment: N/D	China funding Gabon China funding Gabon	m.c. m.c.
4	**Equatorial Guinea** Development of Djiploho hydropower sites: **90 MW**?	- Project being implemented: the Power plant and 80% of associated transmission lines in cooperation with China	Follow up on projects implementation	Studies: N/D Investment: N/D	China funding Equatorial Guinea China funding Equatorial Guinea	m.c.

Investment in transmission lines						
1	Study on the interconnection of ECCAS member countries	Study conducted and draft final report presented (piloted by ECCAS)	- Follow up on studies and projects implementation	Studies: 2.5 MUC	ADB/ADF ECCAS	m.c.
2	Inga - Cabinda - Pointe Noire Interconnection **DR Congo, Angola, Congo**	-Studies being conducted; -Inter-states and inter-utilities MoU Signed, - Co-funding by AfDB, DBSA, AFD and promoting countries	-Mobilization of funding for construction - selection of contractors for construction - implementation of institutional framework	-Mobilization of funding for construction - selection of contractors for construction - implementation of institutional framework	Co-funding secured by AfDB (0.5), DBSA, AFD (0.3) and promoting countries & CAPP/ECCAS (0.5)	EUR175 m
3	Cameroon – Chad Interconnection **Cameroon, Chad**	- Inter-government MoU signed - Prefeasibility study conducted under EU funding, - Feasibility studies being conducted under AfDB funding	-Mobilization of funding for construction - selection of contractors for construction - implementation of institutional framework	Studies: - c.f. project n°10 - Implementation: EUR89.5m		Studies: US$ 0.05m Implementation EUR89.5m
4	- Rehabilitation and structural reinforcement of Bendera power plant	- Inter-government MoU signed	- Follow up on studies and projects implementation	Studies: N/D	EU, DRC, Burundi CAPP/ECCAS	US$0,05m

	CAR - Construction of associated transmission lines -**Bendera-Uvira-kiliba-Bujumbura ;** **-Bendera-Kalemie**	- Ongoing project studies under EU funding, - construction: 3 years		Investment: to be determined		

Studies of generation and transmission projects						
1	Development of the Inga Site and of the related interconnections **DR Congo**	Studies: 18 mo - contract with consultant signed in - study being conducted since January 2011?	-follow up of the study - Decision on priority investments for developing the site - Mobilizing the funding for the selected priority investment projects	- Studies: US$15 m - Investments: to be determined	ADB; DRC	
2	Inga – Calabar Interconnection **Cameroon, Congo, DR Congo, Equat. Guinea, Gabon, Nigeria**	Studies; 10 months - Draft TOR of studies ready; - Inter-government MoU signed by 8 concerned states - Construction: 5 years	- Recruitment of consultant, - follow up of FS - Mobilization of funding for construction - implementation of institutional framework	Studies: - FS - Bidding: US$3.0 m Implementation: US$926 m	- ADB, Concerned member countries	- US$0,1 m - US$3,0 m
3	**Inga III hydropower plant and associated transmission lines DR Congo**	-Pre-faisability study conducted in 2008 (4320 MW); -option being	C.f. Results of the study on "Development of the Inga Site and of the related	-Construction: -Power plant: US$7629m -Transmission lines: t.b.d.		

		evaluated under development of Inga site study,	interconnections"			
4	Development of Ruzizi 3 and Ruzizi 4 hydropower sites **Rwanda**	-Feasibility of Ruzizi 3 -Request for Qualification : Feb. 2011 - Pre-feasibility of Ruziz 4 being conducted under EIB funding		Studies: N/D Investment: N/D	EIB EGL	
5	Interconnection Inga-Burundi and Inga-Est DRC	-TORs being prepared - funding of studies requested -Studies: 12 mo -Construction: 4 years	- close funding gap for studies; -facilitation and coordination of the studies; -close funding of works	Studies: t.b.d. Investment: t.b.d.	Being requested	Studies: US$ 0.05m

Source : P.E.A.C. *Projets du PEAC : Etat d'Avancement et Besoins de Financement*. Bruno Kapandji kalala, Secrétaire Permanent du PEAC, May 2011.

Table 1.9 Status of Cross-border electrification projects

Cross-border electrification Projects							
N°	**Project/location**	**Objective**	**Status**	**Required actions**	**Est. Cost US$ m**	**Source of funding**	**Funding gap**
1	Cross-border electrification of Zongo **(DRC)** from Bangui **(CAR)**	1) hydropower plant Boali 3 (10 MW) + transmission lines	1)Feasibility up dated by Hydrochina Juadong Engineering corporation and contract for conducting the works signed in July 2011 with CAR - Legal MoU signed between DRC and CAR	-Mobilization of funding for construction - selection of contractors for construction	- Studies : 0.13 -Implementation: 96.45 MUC	1)Financing scheme : **- UC60 m ADF grant** (35.8 to CAR and 24.4 for DRC); **UC2. 36.24 m as follows:** -China: 18.4 grant &loan -BDEAC: 10 loan -WB:6.98 grant (approved) -AFD:4.26 grant (approved) -CAR & DRC contribution (1.46)	
		2) Electrification of Zongo and other 6 localities in DRC from CAR	2) Zongo electrification technical feasibility study updated under the Bank funding. To be submitted to the Board in December 2011 3) commissioning date: December 2016	-Mobilization of funding for construction - selection of contractors for construction	Studies: 0.617 MUS$ Works: to be defined	- BAD/IPPF (US$0.554 m) - CAPP/ECCAS (FCFA 37 m)	m.c.
2	Cross-border		TOR of studies		Studies: EUR0.515 m		

	electrification of 7 villages **(CAR)** from Mobaye **(DRC)**		and project information sheets ready		Implementation: EUR19.6 m	Promise of financing of works by BADEA	
3	Electrification of Léré, Para, Ribao, Momboré, Mamboroua and Binder **(Chad)** from Guider (**Cameroon)**		-Prefeasibility conducted; -TOR of studies and project information sheets ready		Studies: EUR0.368 m Implementation: EUR13.8 m	Promise of financing. of works by BADEA	
4	Electrification of Bongor **(Chad)** from Yagoua **(Cameroon)**		-Inter-States MoU signed, -study being conducted under EU funding		Studies: EUR0.184 m Implementation: EUR3.79 m		
5	Electrification of Kye-Ossi (**Cameroon**), Ebebiyin (**Equatorial Guinea**) and Meyo-Kye **(Gabon**)		Prefeasibility conducted; TOR of studies and project information sheets ready	Studies: 0.26 Implementation: 7.5	Studies: 0.276 MEUR Implementation: EUR10.576 m		

Source : P.E.A.C. *Projets du PEAC : Etat d'Avancement et Besoins de Financement. Bruno Kapandji kalala, Secrétaire Permanent du PEAC*, May 2011.

Table 1.10 Evaluation of CAPP Trans-Boundary Projects

N°	Project Title	Costs (in '000 Euros)		
		Studies	Investments	Total
1	Transboundary Electrification of Zongo (RDC) from Bangui (RCA)[2]	184	39521	39705
2	Transboundary Electrification of 7 villages (RCA) from MOBAYE (RDC)[2]	515	19590	20106
3	Electrification of Léré, Para, Ribao, Momboré, Mambouroua & Binder from Guider (Cameroon)[2]	368	13813	14181
4	Electrification of Bongor (Chad) from Yagoua (Cameroon)	184	3790	3974
5	Electrification of Datcheka, Fianga & Gounougaya (Chad) from Doukoula (Cameroon)	184	7 045	7 229
6	Electrification of Kye-Ossi (Cameroon), Ebebiyin (Equatorial Guinea) & Meyo – Kye (Gabon)	276	10 576	10 852
7	Electrification of Mbinda & Mayoko (Congo) from Lekoko (Gabon)	184	5 023	5 207
8	Electrification of Divenie (Congo) from Malinga (Gabon)	184	6 043	6 227
9	Electrification of Bambama (Congo) from Boumango (Gabon)	184	6 322	6 506
10	Electrification of Leketi & Okoyo (Congo) from Leconi (Gabon)	304	11 402	11 706
11	Electrification of Medjeng (Gabon) from Mongomo (Equatorial Guinea)	18	368	386
12	Reinforcement of power supply to Noqui (Angola) from MATADI (DRC)	184	5325	5 509
13	Electrification of Maquela do Zombo (Angola), Kimbetele, Luvaka, Kimpangu & Nguiinga (DRC) from Kwilu sub-station (DRC)	453	17 138	17 590
	Total	**3 222**	**145 958**	**149 180**

Source: P.E.A.C. Projets du PEAC : *Etat d'Avancement et Besoins de Financement*. Bruno Kapandji kalala, Secrétaire Permanent du PEAC, May 2011.

ANNEX II: COMELEC

Annex II

Table 1 COMELEC 2009: MONITORING OF COMELEC POWER SYSTEMS OPERATIONS

	ALGERIA	LIBYA	MAURITANIA	MOROCCO	TUNISIA	TOTAL
Installed capacity (MW)	11325	6273	134	6 135	3 480	27347
Thermal Installed capacity (MW)	11099	6273	104	4 166	3 359	25001
Hydro Installed capacity (MW)	288		30	1 748	66	2132
Renewable Energy: Wind		0		222	55	277
Available Capacity (MW)						
Energy imported (GWh)	369	129		4 847	146	5491
Energy exported (GWh)	405	113		224	198	940
Hydro Energy generated (GWh)	342		112	2 952	79	3485
Renewable Energy: Wind				391	98	489
Thermal Energy generated (GWh)*	42663	30426	364	16 924	14 785	105162
Total Energy generated (GWh)	43005	30426	476	20 267	14 962	109136
Electricity Consumption	33817	20336	347	22 384	12 214	89098
Peak load (MW)	7280	5282	71	4 375	2 660	

*Mauritania: sales from third 138 GWh parties included in total production.

Source: Statistiques de l'Electricité du COMELEC, 2009.

Annex 2 Table 2: Interconnections within COMELEC countries and with Europe

WITH COUNTRY	LENGTH KM	VOLTAGE KV	CAPACITY MW	STATUS
<MOROCCO> NEIGHBORHOOD INTERCONNECTIONS 2009				
SPAIN	61	400KV	700MVA	In operation
	61	400KV	700MVA	In operation
ALGERIA	49	225KV	235MVA	In operation
	67	225KV	235 MVA	In operation
	230	400KV	2400MVA	In operation

<Tunisia> Neighborhood Interconnections 2009				
With Country	Length km	Voltage kV	Capacity MW	Status
Algeria	35,5	90	74	In operation
	60	90	63	
	65	150	145	
	60	225	217	
	160	400	961	Under construction
Libya	2 x 110	225	2 x 217	2nd test planned for april 2010
	160	225	217	
	330	400	961	Planned year 2015
Italy	200	400	1000	Planned year 2016

Source: *Statistiques de l'Electricité du COMELEC*, 2009.

ANNEX III : EAPP

EAPP Annex III- Table 3.1 Source: EAPP-Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011

	Burundi*	Djibouti	East DRC**	Egypt	Ethiopia	Kenya	Rwanda**	Sudan	Tanzania	Uganda*
Installed capacity (MW)	36.5	123	103	22 118	836	1 354	79	1 083	1 150	342
Thermal Installed capacity (MW)	5.5	123	18	18 636	153	439	42	740	589	
Hydro Installed capacity (MW)	31.0		85	2 800	675	728	37	343	561	328
Other Renewable Capacity (MW)				425	7	187				14
Isolated capacity (MW)				257				152		
Energy imported (GWh)***	83	-	-	251	-	26	84.7	-	68	-
Energy exported (GWh)	-	-	44.3	814	-	-	-			73
Hydro Energy generated (GWh)	111.8									
Thermal Energy generated (GWh)	36									
Total Energy generated (GWh)	93.6	325.6	239.8	128 798	3 819	6 436	212.9	5 506	4 143	2069
Gross Consumption (GWh)	61	242.6	194.7	106 558	3 238	5 377	176.7	4 285	3 292	1206
Peak load (MW)	29	56.9	56.9	21 000	747	1 072	45.6	985	694	310
Electrification rate (%)	2.3	44	6	99	41	20	4	30	14	10
Average electricity consumption (kWh/capita)	14	93	375	1375	39	148	23	87	81	68

Source: EAPP-Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

*Estimated based on 2007 data.
**Estimated based on 2005 data.
***Mercados, Energy Markets International; EAPP Technical Assessment of the Current Regional Power Market Ver 1.2 (Draft) 25 November 2009.

ANNEX III: EAPP PRIORITY PROJECTS BY IMPLEMENTATION STAGE

Table 3.2.1 Generation priority projects

Country	Plant Name	Type	Installed Capacity (MW)	Earliest Year in Operation	Cost US$m	Status	Comments
Ethiopia	Gibe III	Hydro	1870	2013	2205 (2006 est.)	Being implemented	
	Gibe IV	Hydro	1468	2016	2100 (2009 est.)	FS still required	- MOU signed with a Chineese company in 2010 - Funding required for FS and/or investment
	Mandaya	Hydro	2000	2031	2471	Prefeasibility study exists	- Funding required for FS
	Karadobi	Hydro	1600	2036	2231.8	Prefeasibility study exists	- Funding required for FS
Eastern DRC	Rusisi III	Hydro	145	2017	485.41	**Ruzizi 3** -FS exists -Request for Qualification : Feb. 2011 **Ruziz 4** - Pre-feasibility being conducted under EIB funding	- Ruzizi 3: Funding required for investment
	Rusisi IV	Hydro	287	2027	594		
Rwanda	Kivu I	Methane	100	2013	325 (*)	N.A.	The cost includes gas gathering system, supply pipeline, Diesel generation plant, road access and development of port facility at Kibuye
	Kivu II	Methane	200	2033	650	N.A.	Cost assumed to be equivalent to Kivu I
Tanzania	Stigliers Gorge (I,II,III)	Hydro	1200	2020 2023 2026	1084 386 317	Prefeasibility study in 1980. Cost escalated up to 2009	- Funding required for FS
Uganda	Karuma	Hydro	700	2016	2793	Included as alternative in Uganda Generation Plan (2009)	- Including 5% environment cost - Funding required for FS or investment
	Ayago	Hydro	550	2023	2152	Cost up dated in 2010	-Including environment cost -- Funding required for FS
	Murchison Falls	Hydro	750	2032	1658	Cost up dated in 2010	-Including environment cost -- Funding required for FS

*East Africa Business Week, November 2009.

Source: EAPP-Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

Annex III, Table 3.2.2 Transmission priority projects

Existing, under-construction and fund secured interconnections

Interconnection	Voltage kV	Capacity MW	Earliest Year in Operation	Cost US$m	Status	Comments
Uganda-Kenya	132	118		N.A.	Existing	
Tanzania-Uganda	132	59		N.A.	Existing	
Ethiopia-Sudan*	220	200		N.A.	Under construction	
Ethiopia-Djibouti	220	180		N.A.	Under construction	
Uganda-Kenya	220	300		N.A.		Fund secured
Uganda-Rwanda	220	250		N.A.		Fund secured

Ongoing interconnection projects

Interconnection	Voltage	Capacity	Earliest Year in Operation	Cost US$m	Status	Comments

Ongoing interconnection priority projects

Tanzania-Kenya	400kV	1520	2015	117	Ongoing FS, detailed design and tender documents preparation	- Funding secured -Bidding for line construction may start at the end of 2011
Ethiopia-Sudan (*)	500 kV	3200	2016	511	FS completed	Funding required
Ethiopia-Kenya	500 kV	2000	2016	845	Design and tender document preparation study to start early 2011	Funding required
Egypt-Sudan (*)	600	2000	2016	1034	FS completed	Funding required

*These interconnection projects are scheduled in different phases and priorities.

Other Ongoing projects

Rusumo-Rwanda	220 kV	320	2015		FS completed	Funding required
Rusumo-Burundi	220 kV	280	2015			Funding required
Rusumo-Tanzania	220 kV	350	2015			Funding required
Uganda-Kenya	220 kV	300	2014		Under construction	
Uganda-Rwanda	220 kV	250	2014		Detailed and Tender Documents preparation study starts in 2011	Funding required
Rwanda-DRC	220 kV	370	2014		Under Construction	
DRC-Burundi	220 kV	330	Expected in 2014		FS, detailed engineering and tender documents preparation study to start early 2011	Funding required
Burundi-Rwanda	220 kV	330	2016		FS update to start early 2011	Funding required

Additional identified interconnection projects

Interconnection	Voltage	Capacity	Earliest Year in Operation	Cost US$m	Status	Comments
Tanzania-Uganda	220 kV	700	2023	30		- Funding required for FS
Uganda-Kenya	220 kV	440	2023	71		- Funding required for FS
Kenya-Ethiopia	500 kV	2000	2020	845	FS exists	- Funding required for investment
Ethiopia-Sudan (*)	500 kV	1600	2020	255		- Funding required for FS
Sudan-Egypt (*)	600 kV	1600	2020	1034		- Funding required for FS
Ethiopia-Sudan (*)	500 kV	1600	2025	255		- Funding required for FS
Sudan-Egypt (*)	600 kV	2000	2025	1034		- Funding required for FS
Uganda-Tanzania & Kenya	2x220 kV	1140	2023	101		- Funding required for FS

*These interconnection projects are scheduled in different phases and priorities.

Source: EAPP-Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011.

Annex III: Table 3.3. 2009 East Africa Compared Electricity Tariffs by Type of Tariff (Cents US$/kWh)

		REGIDESO	EWSA	NEC	KPLC	EEPCO	UEGCL	EEHC
		(Burundi)	(Rwanda)	(Sudan)	(Kenya)	(Ethiopia)	(Uganda)	(Egypt)
Social tariff (E=100 kWh/month)	1 kW	3.7	14	3.04	6.06	4.3	23.7	1.34
Single phase domestic usage	2 kW	3.82	14	9.88	7.19	5.1	24.8	1.56
(E = 200 kWh/month)	4 kW	3.82	14	9.88	7.19	5.1	24.8	1.56
Three phases domestic usage	6 kW	5.84	14	9.88	8.15	6.3	25.5	2.5
(E = 600 kWh/month	10 kW	5.84	14	9.88	8.15	6.3	25.5	2.5
Three phases commercial usage	12 kW	11.8	14	12.3	8.48	7.7	24.3	8.02
(E = 1800 kWh/month)	15 kW	11.8	14	12.3	8.48	7.7	24.3	8.02
Mid-industry & motive power	20 kW	11.8	14	12.3	8.45	6.4	25.5	8.33
(E = 2500 kWh/month)	25 kW	11.8	14	12.3	8.45	6.4	26.3	8.33
Medium voltage	250 kW	17,4	14	4.97	7.25	4.5	12.8	3.2
(E = 35000 kWh/month)								

Source : *UPDEA- Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.

ANNEX IV SAPP

Annex IV: Table 4.1: SAPP DEMAND AND SUPPLY SITUATION IN 2010

Country	Utility	Installed Capacity [MW]	Available Capacity [MW]	Peak Demand [MW]	Generation (GWh)	Sales (GWh)	Net Imports (GWh)	Net Exports (GWh)	Electrifi-cation Rate (%)
Angola	ENE	1 187	990	795	4 900	3 498	27	0	17
Botswana	BPC	202	190	553	445	2 936	2945	0	25
DRC	SNEL	2 442	1 170	1 081	7 641	6 323	38	871	8
Lesotho	LEC	72	72	121	486	488	49	7,4	9
Malawi	ESCOM	287	287	274	1 543	1 439	-	0	10
Mozambique	EDM	233	174	546	341	1 748	2326	309	15
	HCB	2 075	2 075				-	-	
Namibia	NamPower	393	360	564	1 305	3 648	2462	294	35
South Africa	Eskom	44 170	41 074	36 970	232 812	218 591	10047	13754	75
Swaziland	SEC	70	70	200	288	1 019	909	0	28
Tanzania	TANESCO	1008	880	833	4 371	3 393	52	0	10,5
Zambia	ZESCO	1 812	1 215	1 600	10 156	9 631	-	65,6	30
Zimbabwe	ZESA	2 045	1 320	2 029	6 951	7 367	710	0	40
TOTAL SAPP		55 996	49 877	45 566	271 239	260 081			
Total Interconnected SAPP		53 514	47 720	43 664					

Source: SAPP Power Sector Requirements, By Alison Chikova, SAPP Coordination Centre, September 2011.

Annex IV **Table 4.2** SAPP PRIORITY PROJECTS

No	Country	Generation Project Name	Capacity [MW]	Project Description and associated Transmission	Expected Date	Estimated Project Cost USD m	Project Status	Project Owners	Project Sponsors & Funders	Perceived Risks
1	Mozambique	Benga	600	Coal fired. Phase 1 is 600 MW.	2015	1300	Project structuring and development phase 1	Mozambique	Public private Partnership	
2	Mozambique	Moatize	600	Greenfield baseload plant mainly for regional exports. Phase I: 600 MW and has potential for phase II for another 600 MW. Transmission includes the Mozambique Backbone.	2015	1300	Project structuring and development. Project Implementation.	EdM/ Strategic Partner	Public private Partnership	
3	Botswana	MDDP (Former Mmamabula) Coal fired Power Station	600	Coal mine and Coal-fired Power Station Development at Mmamabula in Botswana Initial stage Phase 1 is set at 300 MW. New coal fired plant and associated transmission. Due to prolonged negotiations on the tariff offering the commercial Operations Date for the first unit is envisaged to be March 2015. Transmission Components includes 3x 400 kV transmission lines to the border with RSA	2015	660	Inter-Governmental MOU between Botswana & South Africa signed on 18 August 2006. Inter-Utility MOU between BPC and Eskom was signed on 13 November 2006 PPA and tariff negotiations not finalised. EIA Report for the mine and power plant approved by Department of Environmental Affairs following a series of public meetings and sponsors addressing concerns and comments from stakeholders. EIA Report for 40km 3 x 400kV transmission lines from Mmamabula to the RSA border has been submitted to Department of Environment Affairs for final approval.	Gvt of Botswana / Private Sector	Private Sector	Tariff level. Delayed tariff negotiations EIAs related to transmission lines in RSA for evacuation of power

4	Zimbabwe	Kariba South Extension	300	2x150 MW hydro extension and associated transmission. The existing Kariba Power Station consists of a concrete dam with power generation stations on the north and south banks of the Zambezi River. Associated Transmission also needed at 330 kV level. Ensures conjunction operation of the plant with others on Zambezi River	2015	300	Feasibility studies completed. Project Implementation stage	ZESA	ZESA /Private Partner	
5	Zambia	Kalungwishi	210	New hydro power development	2013		Feasibility Studies done	IPP		
6	Namibia	Kudu	800	Construction of a 800 MW CCGT "F" class power station on the Namibian Coast just north of the Namibian-South African border and Orange river. Development of Kudu Gas field 170 km off shore of the Namibian coast. Construction of a gas pipeline to bring the gas on shore.	2016	640	Detailed pre - feasibility study done in 2000 updated in 2003. Feasibility Phase started 5 July 2005. Power station investment requirement is expected to be N$4.8 Billion, to be funded through a special purpose vehicle, "KuduPower. NamPower will only participate in the development of power station & transmission line. Updating feasibility studies	NamPower	NamPower /Public Private Partnership	Foreign exchange risk
7	Mozambique	Mphanda Nkuwa (Phase I)	1500	Includes development of and RCC curved gravity dam, power station and transmission lines. Plant to operate at 95% availability to target a regional market. Transmission includes the Mozambique Backbone	2017	2500	Project structuring and development. Project Implementation. The Mozambique Backbone should be commissioned at a cost of USD 2 billion.	EdM / Private Partner	Public private Partnership	
8	Mozambique	HCB North Bank	1245	Development of north bank at an existing dam site. Project to target mostly export market. Transmission includes the Mozambique Backbone	2015	2000	Update of Feasibility Studies in progress. Project preparation stage.	Government of Mozambique/Private Partner	HCB	

9	Zambia	Kafue Gorge Lower	750	Earth rock fill type dam proposed upstream of existing station. Project targeting local and export market	2015	750	Discussions underway with potential investors. Reservoir operation studies done to select dam site location. Project now overseen by the Ministry of Energy and Water Development of Zambia	ZESCO	ZESCO /Private Partner	
10	Swaziland	Lower Maguduza	140	Hydro cascade	2015	250	Pre Feasibility Study done	SEC	Private Partner	
11	Namibia	Baynes	360 - 500	Site on the Lower Kunene River for a mid-merit hydro power station development. Lower dam wall and larger machines recommended to avoid potential environmental impacts. Project targeting export market. Up to 500 MW may be developed. Transmission includes the Namibia – Angola Interconnector	2015	850	Project timing entails 6-12 months for the pre-feasibility phase, 2 years for the feasibility phase. Namibian and Angolan governments negotiating terms for the feasibility study. Project technical committee met. Feasibility studies to be done. Project Preparation stage	Nampower	Private Partner	Environmental issues
12	Zambia / Zimbabwe	Batoka	1600	Project entails the construction of a run off the river hydro power plant on the Zambezi River, 54km downstream of the Victoria Falls. Project lead-time is 6 years. 4 x 200 MW units on either side of the dam (Total 1600 MW) with capacity shared equally between Zimbabwe and Zambia. To target regional market. Transmission project component includes the second Zimbabwe-South Africa 400 kV transmission line which should be commissioned by 2015	2017	2500	Zambezi River Authority is coordinating the dam part of the project. Feasibility Studies completed. Agreement between Zimbabwe and Zambia needed to proceed with the project. Project lead time is 5 years from financial closure. Feasibility studies to be updated. Project Preparation stage	ZESCO/ ZRA/ ZESA	No firm investors yet	Environmental issues
13	Lesotho	Kobong	800	Pumped Storage hydro power plant	2017	1400	Pre feasibility studies done. Feasibility Studies to be done. Project Preparation stage	LEC	LEC /Private Partner	

14	DRC	Inga 3	3500	Inga hydro power development	2015	3500	Pre-feasibility Studies done. Project Preparation stage	SNEL	SNEL / Private Partner	

Source: SAPP Power Sector Requirements, By Alison Chikova, SAPP Coordination Centre, September 2011.

Annex IV

Table 4.3 SAPP Electricity Tariffs

		edel	zesco	eskom	escom	edm	jirama	zesa	nampower
		(Angola)	(Zambia)	(SAR)	(Malawi)	(Mozambique)	(Madagascar)	(Zimbabwe)	(Namibia)
Social tariff (E=100 kWh/month)	1 kW	2.08	1.13	4.62	4.17	4.04	9.06	2.07	12.15
Monophase domestic usage	2 kW	4.48	2.04	4.62	3.78	10.25	22.93	1.46	12.15
(E = 200 kWh/month)	4 kW	4.48	2.04	4.62	3.78	10.25	23.38	1.46	13.75
Three phases domestic usage	6 kW	4.48	2.18	4.12	3.53	11.34	22.28	1.01	12.15
(E = 600 kWh/month	10 kW	4.48	2.18	4.12	3.53	11.34	22.88	1.01	18.85
Three phases commercial usage	12 kW	5.88	4.13	3.64	6.57	14.75	22.12	1.11	8.79
(E = 1800 kWh/month)	15 kW	5.88	4.13	3.64	6.57	14.75	22.34	1.11	10.47
Mid-industry & motive power	20 kW	5.5	4.52	3.38	12.44	9.28	22.23	1.04	10.13
(E = 2500 kWh/month)	25 kW	5.5	4.92	3.55	14.53	10.13	22.5	1.04	12.15
Medium voltage	250 kW	2.93	4.72	2.81	9.87	8.08	22.55	1.45	9.19
(E = 35000 kWh/month)									

Source : UPDEA- *Etude Comparatives des Tarifs d'Electricité Pratiqués en Afrique*; December 2009.

ANNEX V WAPP

Annex V: WAPP

Table 5.1 MONITORING OF WAPP POWER SYSTEMS OPERATIONS 2010

	NIGERIA	BENIN / TOGO	GHANA	CÔTE D'IVOIRE	BURKINA FASO	NIGER	MALI	SENEGAL	GUINEE	GAMBIE	GUINEE BISSAU	SIERRA LEONE	LIBERIA
Installed capacity (MW)	8425	337	2 186	1 391	241	91	295	629	181	67	5.6	79.2	12.6
Thermal Installed capacity (MW)	6477	272	1 006	787	205	91	139	569	78	67	5.6	23.2	12.6
Hydro Installed capacity (MW)	1948	66	1 180	604	36	0	156	60	102	0	0	56	0
Available Capacity (MW)	4212	261	1 909	1 243	197	46	288	508	88	49	3.7	72	
Energy imported (GWh)	0	1636	107	143	385	552	581	253	0	0	0	0	0
Energy exported (GWh)	1323	0	1 036	482	0	2	0	0	0	0	0	0	0
Hydro Energy generated (GWh)	7416	185	6 995	1 618	118	0	284	0	474	0	0	NA	0
Thermal Energy generated (GWh)	17629	193	3 171	4 269	448	268	343	2 246	141	250	NA	NA	NA
Total Energy generated (GWh)	25045	379	10 166	5 888	565	268	627	2 246	615	250	NA	NA	NA
Gross Consumption (GWh)	23722	2015	8 811	5 548	950	818	1 207	2 500	615	250	NA	NA	NA
Peak load (MW)	3804	324	1 506	912	159	150	210	429	12	0	NA	2.5	0
Unsupplied Energy (GWh)	NA	54	380	224	17	NA	3	177	12	0	NA	2.5	0

Source: WAPP Generation and Transmission Assets (WGTA) First Issue, September 2010 (updated in August 2011).

NA: Not available.

Annex V

Table 5.2 WEST AFRICA COMPARED ELECTRICITY TARIFFS BY TYPE OF TARIFF (Cents US$/kWh) 2009

Power Utility		**CIE**	**CEET**	**SONABEL**	**EDM**	**NIGELEC**	**SENELEC**	**PHCN**	**SBEE**	**VRA**	**NAWEC**	**LEC**	**ECG**	**EDG**
Country		(Côte d'Ivoire)	(Togo)	(Burkina Faso)	(Mali)	(Niger)	(Senegal)	(Nigeria)	(Benin)	(Ghana)	(Gambia)	(Liberia)	(Ghana)	(Guinea)
Social tariff (E=100 kWh/month)	1 kW	6.51	13.5	20.1	15.96	11.23	17.58	1.05	14.4	8.07	12.57	34	6.27	8.7
Monophase domestic usage	2 kW	18.8	13.55	23.41	19.79	11.23	17.74	3.12	14.93	7.8	15.03	34	6.27	8.7
(E = 200 kWh/month)	4 kW	20.6	14	26.93	19.79	11.23	20.47	3.12	14.93	7.8	15.03	34	6.27	8.7
Three phases domestic usage	6 kW	16.51	15.55	25.48	29.57	11.23	17.74	3.04	16.34	10.32	16.68	34	8.61	8.7
(E = 600 kWh/month)	10 kW	17.74	15.85	27.23	29.57	11.23	19.56	3.04	16.34	10.32	16.68	34	8.61	8.7
Three phases commercial usage	12 kW	18.74	17.91	24.71	30.57	13.4	23.52	6.45	16	14.61	24.17	34	14.61	12.4
(E = 1800 kWh/month)	15 kW	19.1	18.36	25.3	30.57	13.54	24.91	6.45	16	14.61	24.17	34	14.61	12.4
Mid-industry & motive power	20 kW	18.89	18.4	24.95	23.19	13.52	24.63	6.44	16	13.22	24.17	34	13.22	12.4
(E = 2500 kWh/month)	25 kW	19.33	18.95	24.95	23.19	13.68	25.31	6.44	16	13.22	24.17	34	13.22	12.4
Medium voltage (E = 35000 kWh/month)	250 kW	16.37	14.92	24.62	19.37	8.27	20.09	7.95	15.15	14.06	27.33	34	14.06	12.4

Source : UPDEA, *Etude Comparative des Tarifs d'Electricité pratiqués en Afrique*, December 2009.

ANNEX VI

Table 5.3 Total WAPP's Transmission Lines by Utilities and Voltage Levels

Utilities	63 KV	66 KV	69 KV	90 KV	110 KV	132 KV	150 KV	161 KV	1125 KV	330 KV	TOTAL (KM)
CEB	196.83	76						2603.1		340	3 215.93
CIE				2 548.5					2 081.3		4 629.8
EDG	427.95				331.5						759.45
EDM							381.04				381.04
GRIDCO			132.8					4 253.2	219.9	215	4 820.90
PHCN						6.749				7 092.4	12 845.43
SONABEL				141.76		315			559.38		1 016.14
SENELEC				285.62					221.6		507.22
TOTAL UTILITIES' TRANSMISSION LINES											**27 834.95**

Source: WAPP Generation and Transmission Assets (WGTA) First Issue, September 2010

ANNEX V-Table 5.4: WAPP – Population Served and Electricity Access (%)

Country	POPULATION SERVED	ELECTRICITY ACCESS (%)
BENIN	7 862 944	23
BURKINA FASO	13 902 972	10
COTE D'IVOIRE	17 654 843	30
GAMBIA	1 641 564	25
GHANA	22 409 572	25
GUINEA	9 690 222	13
GUINEA BISSAU	1 442 029	3
LIBERIA	3 024 004	5
MALI	11 716 819	10
NIGER	12 525 094	3
NIGERIA	150 000 000	40
SENEGAL	11 987 121	30
SIERRA LEONE	6 005 250	8
TOGO	5 548 702	13

Source: WAPP Generation and Transmission Assets (WGTA) First Issue, September 2010.

ANNEX V- Table 5.5 Overview of WAPP Priority Projects By Implementation Stage

Table 5.5.1 Generation priority projects

Zone	Name - location	Installed capacity (MW)	Investment cost (US$ m)	Financing gap (US$ m)	Type of fuel	Commis-sioning date
Commissioned and being implemented						
E	Bambuna -	50	88		hydro	Dec. 2009
D	Fomi – Guinea	90	N.A.	N.A.	hydro	2016
	Mount Coffee - Liberia	64	218.7	-	hydro	2015
	Felou – Mali (OMVS)	60	236	-	hydro	2013
	Gouina- Mali (OMVS) (3x47)	141	N.A.	N.A.	hydro	
	Sambangalou –Senegal (OMVG)	128		approx. US$387 m including 1677 km transmission line		
	Kaleta – Guinea (OMVG)	240	889.67		hydro	2015
	Adjarala –Togo (CEB)	147	360.1	360.1	hydro	2017
	TOTAL	920	1792.5			
Projects at pre-investment studies stage						
	Pre-feasibility study of Kassa B hydro	118		0.725	hydro	2016/17
	Pre-investment study of Kassa B hydro			4.727	hydro	
	Pre-investment study of Souapiti	515		5.0	hydro	
	Pre-investment study of solar power plant in Mali	50		0.5	solar	
	Total	683		10.95		
Projects to be promoted by private sector						
	EPSS-Maria Gleta – Benin	450		Request for bids launched	thermal	
	EPSS-Aboadze - Ghana	400			thermal	
	EPSS-OMVS	150			thermal	
	Total	1000				
	Floating storage		TBD			

Source: WAPP Donors Meeting Aide Memoire, May 2011.

Table 5.5.2 Transmission priority projects

Zone	Name - location	Investment cost (US$ m)	Financing gap (US$ m)	Commissioning date	Status
Commissioned projects					
A	330 kV Sakété - Ikeja West Line (Nigeria-Benin Interconnection)	58.3	-	Commissioned in 2007	Synchronization issue to be solved- through WAPP-WB 25m technical assistance
B	225 kV Bobo - Ouagadougou Transmission Line (Burkina Faso)	130	-	Commissioned in 2009	
A	330 kV ABOADZE (Ghana) - VOLTA (Ghana)	38	-	Operational since September 2010	
	TOTAL	**226.3**			
Being implemented					
A	330 kV Volta - Lome 'C' - Sakété (Ghana-Togo-Benin Interconnection)	105	-	2013	
B	225 kV Bolgatanga-Ouagadougou (Ghana - Burkina Faso Interconnection)	183	-	2013	Funding mobilized by AfDB, EIB and WB (WB board in June 2011)
D	OMVG 225kV transmission line (1677 km)	561.3	-	2013/14	Cost included in approx. US$387 million of OMVG project (Sanbangalou & Kaleta hydro power)
B	Côte d'Ivoire - Mali	105	-		
	TOTAL	**954.3**			
Projects with FS Completed					
E	Cote d'Ivoire - Liberia - S.Leone - Guinea WAPP Interconnection	513.2	-	2014	- Project Preparation Advance of US$1.95 million provided by WB -€1.55 million for pre-contract activities of Owners Engineer mobilised from EU-Africa Infrastructure Trust Fund -financing of implementation being mobilized from WB, AfDB, EIB and KfW
C	*Birnin Kebbi (Nigeria) - Bemberke (Benin) – Niamey (Niger) – Ouagadougou (Burkina Faso)*	189.1	N.A.	*2014*	detailed engineering studies, and tender document in preparation
	TOTAL	**702.3**			

Projects with ongoing pre-investment studies (2004 Master Plan cost estimation)					
D	330 kV Riviera (Côte d'Ivoire)- Prestea (Ghana)	46.7	-	2015	- Pre-investment studies to be finalized in February 2012; - Funding secured EU-Africa Infrastructure Trust Fund through EIB
B	330 kV Aboadze – Prestea – Kumasi – Bolgatanga , Tumu – Han – Wa	30.5	N.A.	2015	
B	Han (Ghana) – Bobo Dioulasso (Burkina Faso) –Sikasso (Mali)– Bamako (Mali)	227.4	-	2015	Donor Consultation Meeting held in February 2011 during which €172 million was mobilized from AFD, EIB, EBID, and AfDB
B	Guinea - Mali Interconnection Project (Nzerekore - Fomi - Linsan - Bamako Interconnection Project)	137.8	2.5	2016	For pre-investment studies (to be finalized in 2012)
	TOTAL	**442.4**	**2.5**		
D	225 kV OMVS - Tamabacounda				FS to be conducted

Source: WAPP Donors Meeting Aide Memoire, May 2011.

Table 5.5.3 WAPP ICC & National Control Centers

Name	Investment cost US$ m	Financing gap US$ m	Commissioning date
WAPP-ICC	138.5	136	
WAPP-ICC Back up	1.56	1.56	
National Control Centres	74.27	31.0	

Table 5.5.4 Cross border MV projects (1st Energy Facility, EU-ACP Programme)

Name	Investment cost US$ m	Financing gap US$ m	Commissioning date
1.Ghana-Togo 2.Ghana-Burkina	19.810		Implemented
3.Côte d'Ivoire-Liberia			Being implemented
4.Togo from Benin 5. Togo from Ghana	4.6		Implementation to start in Sep. 2011
TOTAL	**24.4**		

Table 5.5.5 Emergency programs

Name - location	Investment cost US$ m	Financing gap US$ m	Commissioning date
Conakry power supply	108	78	
Guinea Bissau	10		Being implemented
Total	**118**	**78**	

Table 5.5.6 Studies, capacity building and facilitation projects

	Total cost Million US$	Financing gap	Status
WAPP Master Plan update	2.329		
WAPP CLSG re-development program	12.454	6.004	
WAPP Capacity building for ICC	42.1	40.6	
WAPP Capacity building for the PIPES	3.4	0.9	
Technical Assistance	8.9		
Total			

Source: WAPP Donors Meeting Aide Memoire, May 2011.