SOUTHERN AFRICA GLOBAL COMPETITIVENESS HUB

Technical Report:

Southern African Development Community (SADC) POWER Sector Review and Consultation Mission to Angola

Gloria Magombo – Energy Advisor

Submitted by:
AECOM International Development

Submitted to:
USAID/Southern Africa

Gaborone, Botswana

December 2009

USAID Contract No. 690-M-00-04-00309-00 (GS 10F-0277P)

P.O. Box 602090 ▲Unit 4, Lot 40 ▲ Gaborone Commerce Park ▲ Gaborone, Botswana ▲ Phone (267) 390 0884 ▲ Fax (267) 390 1027
E-mail: info@satradehub.org

USAID FROM THE AMERICAN PEOPLE | SOUTHERN AFRICA

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3

1. INTRODUCTION 4

2. FINDINGS OF THE MISSION 5
   - Generation Capacity and Generation Expansion 5
   - Transmission Expansion 6
   - Renewable Energy Initiatives 7
   - Power Demand Situation 7
   - Public Private Partnerships and Government Commitment 7
   - Electricity Access 8
   - Energy Resources: Potential and Harnessing. 8
   - Regional Collaboration and Experience Exchange 9
   - Energy Sector Regulation, Tariffs and Revenue Collection 9
   - Utility Mandate, Staffing and Capacity Building 12

3. PRELIMINARY RECOMMENDATIONS 12
   - Short term generation and transmission projects 12
   - Power Sector Reform 13
   - Regulatory Framework 13
   - Medium and long term 13

4. CONCLUSION AND WAY FORWARD 13

ANNEX 1: GENERATION PROJECTS IN ANGOLA 14

ANNEX 2: PROGRAMME FOR THE SADC POWER SECTOR REVIEW MISSION TO ANGOLA OCTOBER 18 – 22, 2009 17

ANNEX 3: MISSION DELEGATION AND OFFICIALS CONTACTED 18

ACKNOWLEDGEMENTS

The mission expresses its sincere appreciation to the officials of the Ministry of Foreign Affairs, the Ministry of Energy, and the Angolan Power Utility - ENE for the assistance rendered during the Mission.

FOR SADC

Mr. Freddie Motlhatlhedi
Senior Programme Manager
Energy

FOR USAID Southern Africa Global Competitiveness Hub

Ms. Gloria Magombo
Energy Advisor

FOR SAPP

Mr. Alison Chikova
Chief Engineer,
SAPP Coordination Centre

FOR RERA

Mr. Robert Kahimise
Manager: Regulatory Support Services

Gaborone, November 2009

1. INTRODUCTION

The mission comprised of Mr. Freddie O. Motlhatlhedi (Southern African Development Community - SADC Senior Programme Manager – Energy, Mission Leader), Mr. Odala Matupa (Programme Officer – Energy), Mr Robert Kahimise (Manager – Regulatory Support Services – ECB of Namibia representing RERA), Mr. Alison M. Chikova (Chief Engineer – Southern African Power Pool) and Ms. Gloria S. Magombo (Energy Advisor – Southern African Global Competitiveness Hub). The team undertook the mission from October 18 to 22, 2009.

The objective of the mission was to asses the extent of and future plans for the power sector infrastructure development in Angola, particularly the generation and transmission infrastructure, looking at the extent to which the installed capacity meets the demand, the existing internal national grid and the possibilities to extend the grid into neighbouring SADC Member States. On the basis of the findings, to then come up with proposals for immediate, short term, medium term and probably long term measures to accelerate the connection of national electricity grid of Angola to the rest of the Southern African Power Pool (SAPP) Grid.

Connection to the SAPP Grid would promote security of supply to Angola and other SAPP Member States as well as facilitate application of competitive costs and optimized utilization of available energy in the region. The mission had sent a questionnaire in advance to Angola officials to gather data on the status of the electricity sector in Angola.

The mission arrived in Luanda, Angola on October 18, 2009. The detailed program of the mission is on Annex 1. The mission started with a visit to the Cambambe Hydro Power Station on Monday October 19, 2009. The Cambambe Hydro Power Station is located in the northern part of Angola approximately 200 km from Luanda. The mission delegates were accompanied by Mr. Kiala from the Ministry of Energy and Mr. Tony Ramos for the power utility, ENE. On arrival the mission was met by the Power Station Manager. The power station has a total installed capacity of 180 MW and is undergoing rehabilitation.

The Cambambe Power Station is undergoing rehabilitation where the four units are being upgraded from 45 MW to 65 MW giving a total output of 260 MW. The dam wall at the power station is also going to be increased from 108m to 128m (additional 20 metres) to increase water storage and energy generation capacity.

On October 2009, the second day of the visit, the delegation visited the Office of the Minister of Energy but were however unable to meet the Minister as she was committed with other engagements. The delegation then met a team from the Ministry of Energy (See Annex 2). Mr. Motlhatlhedi outlined the objectives of the visit and the expectation of the mission. He indicated that SADC was willing to assist Angola in improving electricity access through regional integration. He further emphasized the benefits of regional transmission interconnectors. A representative from the Ministry of energy made two presentations; one outlining the power sector programmes for Angola; and highlighting the transmission expansions and transmission reinforcement programme for Angola.

On October 21, meetings were held with the power utility of Angola ENE. The power utility representatives were headed by the Chief Executive Officer Mr. Nelumba. The mission objectives were presented by Mr. Motlhatlhedi. ENE presented the status of the power supply situation in terms of new generation projects. Among the projects presented were the Gove Hydro Power Station, the Benguela Gas Turbine Project, the Cambambe Hydro Power Station expansion and new Cambambe II expansion project. Among the transmission projects presented were the Gabela – Quileva 220 kV line, the Gove – Matala 220 kV interconnector, the Inga – Cabanda 220 kV interconnector and the Xangongo – Cahama 132 kV interconnector which will be supplied from Namibia.

Discussions were held on the status of the tariffs in Angola. The tariff categories are highlighted in table 2 below.

2. FINDINGS OF THE MISSION

The mission met the representatives highlighted in Annex 2 below and the mission's observations are highlighted below:

The challenges facing the Angolan system are indicated in the following sections.

- **Generation Capacity and Generation Expansion**

The mission confirmed that the installed generation capacity in Angola is 1,003 MW comprising of 760 MW (76 %), hydro, 83 MW (8%) thermal and 160 MW (16%) gas. This capacity is not sufficient to meet the current demand in Angola even though it might appear as if there is excess capacity due to lack of interconnectivity and insufficient transmission capacity. The installed capacity figures are indicated in the table below:

Table 1: Installed generation Capacity in Angola

Types of plant	Installed Capacity (MW)	% share
Hydro	Capanda – 520 MW Cambambe – 180 MW Gove - 60 MW	76%
Thermal	Benguela – 83 MW	8%
Gas	160 MW	16%
Total	1,003 MW	100%

The Angolan network is operated as three separate systems which are located in the northern, central and southern parts of Angola. Work is still to be done on the Eastern network. Each system maintains its own generation to meet its electricity demand requirements. The immediate focus of ENE is to interconnect the three networks so that they can benefit from the excess capacity available from Capanda Hydro Power Station.

The ENE expansion plan indicates that they will add up to 820 MW of new generation capacity by the year 2013. The projects and their status are indicated in the table below:

Table 2: New Generation Capacity in Angola

NEW GENERATION PROJECTS IN ANGOLA				
Plant	**Units**	**Total Capacity MW**	**Commissioning Date**	**Project Status and description**
Gove hydro	4x15	60	Jan 2011	▪ Rehabilitation of the dam ▪ Installation of the units ▪ Construction of 92km Gove-Huambo, 152 km Huambo – Cuito 220 kV lines ▪ Contract is in force
Benguela Gas Turbine	4x15	60	Dec 2009	Construction of new thermal power plant underway Extension of existing Quileva substation
Cambambe hydro power station upgrade	4x65	260	Dec 2011	▪ Upgrade from 4x45 to 4x 65 MW ▪ Contract is in force
Cambambe II hydro power station	4x130	520	2013	▪ Installation of second power plant at Cambambe site ▪ Construction of 200 km Cambambe – Luanda 400kV line ▪ Feasibility studies done
Lomaum hydro plant	2x10, 3x15	65	2013	Rehabilitation of existing plant to start next year

The Baynes hydro project in Namibia has been identified as a priority project for Angola. A transmission link would be needed from Baynes to supply the southern network in Angola.

- **Transmission Expansion**

The priority transmission projects in Angola are to interconnect the three separate systems. The Gabela- Quileva 242km 220 kV line will interconnect the north and central systems and construction is in progress. Construction is expected to be completed by December 2010.

Feasibility studies were completed for the Gove – Matala 220 kV interconnector which will interconnect the central and southern systems. The line has a transfer capacity of 150 MW.

The Inga – Capanda 220 kV interconnector feasibility studies have been completed. This project aims to supply the Cabinda system. Three x 35MW Gas Turbine are also being considered as generator supply options for Cabinda. This power will be used to augment the planned supply from Inga.

The WESTCOR project is vital for Angola's power requirements. The project is still at pre-feasibility stage. Angola expressed interest in having supplies from Inga.

There are plans to construct 400 kV line from Cambambe and Capanda to Luanda. ENE does not currently have the expertise for the operation of 400 kV network.

Plans are underway to work on the transmission network of the eastern system.

- **Renewable Energy Initiatives**

The Ministry of Energy has setup a new directorate responsible for renewable energy to compliment the national electrification department. The technologies being considered are solar, wind, biomass and mini/micro hydro plants. Government is promoting these with the intention to supply power to schools and clinics, households will be considered at a later stage once an appropriate delivery modality is established.

- **Power Demand Situation**

There exists a high level of suppressed demand in all the three regions in Angola. The northern system has a demand of approximately 520 MW mainly representing the load in Luanda city.

The central system has available generation of 90 MW for Quileva and 10.8 MW from Lobito giving a maximum demand of approximately 100 MW for the central system.

In the southern system available generation is from Matala Hydro Power Station (27 MW) Namibe diesel (12 MW) and Lubango diesel (30 MW). The demand in the southern system is approximately 69 MW.

The electricity consumption in Angola is approximately 162 kWh per capita per person. For Africa the average electricity consumption is 563 kWh per capita per person.

- **Public Private Partnerships and Government Commitment**

Government indicated that some generation projects are to be developed by the private sector. However, the generation expansion plan is developed by ENE and is supposed to be endorsed by the Government.

- **Electricity Access**

Access to electricity still remains very low at between 22 - 25%. The challenge that the government and the utility are facing is to increase electricity access to the majority of the population.

- **Energy Resources: Potential and Harnessing.**

The Kwanza River possesses a lot of hydro potential. The government has identified nine feasible sites where hydro power stations can be built. The river has a potential to generate more than 6,000 MW. Currently, only two sites have been developed which are Capanda (520 MW) and Cambambe (180 MW).

The table below shows the projected total generation capacity from thermal and hydro technologies broken down by area. 4,500 MW of new generation will be needed by the year 2016. Funding for these projects will need to be identified and secured.

Table 3: Generation Potential on the Kwanza River Basin

No	Site	Potential Capacity, MW	Potential Energy, GWh
1	Capanda	520	1,200
2	N Hangue	450	1,300
3	Lauca	2,120	4,700
4	Cacula Cabasa	1,560	7,500
5	Zenzo I	450	2,700
6	Zenzo II	120	700
7	Tumuludo Casador	450	2,700
8	Luime	330	330
9	Cambambe	580	1,500
Total		6,580	26,400

There is also a lot of hydro potential in other parts of Angola in different river basins.

Table 4: Hydro Electric Potential in Angola

River/Basin	Capacity , MW	Energy, GWh
KWANZA	8 199	34 746
LONGA	1 190	4 796
QUEVE	3 020	11 796
N'GUNZA,BALOMBO	1 086	3 488
CATUMBELA	1 930	10660
CUBANGO	350	592
CUNENE	2 492	6 225
Total	**18 267**	**72 303**

Table 5: New Generation Capacity by Area

	New Generation Capacity (Thermal and Hydro Plants) , MW							
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
North	797	999	999	1626	2547	2614	4114	4614
Central	101	140	200	200	200	265	289	289
South	69	69	127	127	127	127	416	416
West	32	62	88	101	191	191	191	191
Total	**999**	**1270**	**1414**	**2054**	**3065**	**3197**	**5010**	**5510**

- **Regional Collaboration and Experience Exchange**

There is need to share experience by promoting exchange visits among energy officials including regulatory staff. Experiences from Botswana and Zimbabwe can be shared on photovoltaic and solar lighting projects.

- **Energy Sector Regulation, Tariffs and Revenue Collection**

The Ministry informed the delegation that IRSE has been created as a separate legal body with clearly stated mandate in the Act; although they are still in transformation and lacks the necessary skills to fulfill their full mandate. The 1996 general Law of Electricity and the Law on delimited Areas of Economic Activities (Law 5/02) are the fundamental laws which form the Angolan power sector's legal framework. The same Law 5/02 states that the generation, transmission and distribution of electrical power for public consumption are **"relatively reserved areas"**, meaning that those activities require the State concession in order to be operated by private entities irrespective of their dimension. Hence the Angolan legal framework, although enabling to attract private sector investment the regulatory framework wouldn't sustain private investment due to low tariffs caused by government subsidized tariffs or concessions.

The mission confirmed that IRSE coordinated the latest tariff review proposal from ENE and EDEL, through the tariff council or commission. The participants on the tariff council consisted of Ministries of Energy, Economic, Finance; ENE and EDEL. The Government is expected to take the final decision on the proposal and inform IRSE and the tariff council accordingly.

The tariff council through IRSE intends to implement inclining-block tariffs whereby the first 50 units would be priced at approximately 4USc/kWh, units above 50 and ≤ 200 would be priced at an average tariff of 4.4 USc/kWh, and consumptions above 200 units could be increased to average tariffs of 10-11USc/kWh. No affordability levels or cost-of-service studies have been done in Angola, hence benchmarking has been used to set the proposed tariff levels.

Overall, it was clear from the discussions with the Angolan power sector stakeholders that the Regulator continues to have limited oversight on granting of licenses, tariff approvals and approval & monitoring of investments in the electricity industry. However, the Act still mandates IRSE to implement General Electricity Law

(Law 14-A96), development of Public Electricity System (SEP), and with the protection of consumers' interest in pricing of electricity.

The current average tariff for Angola is approximately 4 USc/kWh (See table 2 below).

A separate company EDEL is responsible for the distribution of electricity in Luanda. This is a separate independent company with its own board of directors from ENE which is a vertically integrated company in generation, transmission and distribution.

It is noted that there was no tariff increase from August 2006 to date. This negatively affects the operations of the utility although government continues to subsidize 60% of the operating cost of ENE.

There is a general trend for an increase in tariffs for all sectors from the period 2000 to 2006. There was a decrease of 18% between 2004 and 2006 for the BT Tariff Social category.

In relative terms the tariffs increased six to twelve fold between 2000 and 2006 depending on the customer category.

Table 6: 2009 Monthly Electricity Consumption Statistics- Angola

Category	**No. of Consumers**	**Average Monthly Consumption (MWh)**	**Average Price of Energy (USc/kWh)**
Residential	407,770	122,364	3.70
Business	20,011	50,759	3.84
Industry	1,870	69,583	3.76
Government			
Municipalities			
Street Lighting	316	2,851	3.72
Water Pumping	4	2,119	4.16
Mining	N/A	N/A	
Other			
Total	429,971	247,675	

Table 7: Average Tariffs in Angola

Category / Tariff	Average Tariffs - 2000 to 2006							
	Mar-00	May-00	Apr-01	Nov-01	Sep-02	May-04	Aug-06	Aug-09
	Kz /kWh	Kz /kWh	Kz /kWh	Kz /kWh	Kz /kWh	Kz /kWh	Kz /kWh	Kz /kWh
AT - Distribution - (EDEL)	0.222	0.544	0.919	0.994	1.960	2.640	2.650	2.650
Venda AT	0.274	0.544	0.707	0.994	1.390	2.640	3.090	3.090
P. medio AT	0.248	0.544	0.813	0.994	1.675	2.640	2.870	2.870
MT- Distributor (EDEL)	0.340	0.569	0.783	1.020	1.420	2.830	2.950	2.950
Venda MT Industrial	0.415	0.569	0.783	1.096	1.590	2.190	2.630	2.630
Venda MT Commercial	0.471	0.639	0.880	1.230	1.790	2.460	2.719	2.719
P. Medio MT	0.409	0.592	0.815	1.115	1.600	2.493	2.766	2.766
BT Industrial	0.493	0.677	1.022	1.440	2.160	3.070	4.400	4.400
BTCommercial	0.554	0.752	1.113	1.600	2.400	3.410	4.400	4.400
BT Domestic	0.527	0.737	1.091	1.570	2.360	3.350	3.350	3.350
BT Tariff Social	0.201	0.312	0.462	0.660	1.000	1.420	1.160	1.160
BT Special							4.400	4.400
BT IP	0.366	0.542	0.802	1.120	1.730	2.460	2.460	2.460
P. Medio BT	0.357	0.503	0.745	1.065	1.608	2.285	3.362	3.362

Exchange Rate 1 USD =	90	Kz

Category / Tariff	Average Tariffs - 2000 to 2006							
	Mar-00	May-00	Apr-01	Nov-01	Sep-02	May-04	Aug-06	Aug-09
	USc /kWh	USc /kWh	USc /kWh	USc /kWh	USc /kWh	USc /kWh	USc /kWh	USc /kWh
AT - Distribution - (EDEL)	0.25	0.60	1.02	1.10	2.18	2.93	2.94	2.94
Venda AT	0.30	0.60	0.79	1.10	1.54	2.93	3.43	3.43
P. Medio AT	0.28	0.60	0.90	1.10	1.86	2.93	3.19	3.19
MT- Distributor (EDEL)	0.38	0.63	0.87	1.13	1.58	3.14	3.28	3.28
Venda MT Industrial	0.46	0.63	0.87	1.22	1.77	2.43	2.92	2.92
Venda MT Commercial	0.52	0.71	0.98	1.37	1.99	2.73	3.02	3.02
P. Medio MT	0.45	0.66	0.91	1.24	1.78	2.77	3.07	3.07
BT Industrial	0.55	0.75	1.14	1.60	2.40	3.41	4.89	4.89
BTCommercial	0.62	0.84	1.24	1.78	2.67	3.79	4.89	4.89
BT Domestic	0.59	0.82	1.21	1.74	2.62	3.72	3.72	3.72
BT Tariff Social	0.22	0.35	0.51	0.73	1.11	1.58	1.29	1.29
BT Special							4.89	4.89
BT IP	0.41	0.60	0.89	1.24	1.92	2.73	2.73	2.73
P. Medio BT	0.40	0.56	0.83	1.18	1.79	2.54	3.74	3.74

Table 8: Annual tariff Increase in Angola, %

Category / Tariff	Tariff Increase - 2000 to 2006 (Annual Increase from prevoious Year)								Number of time increase from 2000
	Mar-00	May-00	Apr-01	Nov-01	Sep-02	May-04	Aug-06	Aug-09	
	%	%	%	%	%	%	%	%	
AT - Distribution - (EDEL)		145%	69%	8%	97%	35%	0%	0%	**11.9**
Venda AT		99%	30%	41%	40%	90%	17%	0%	**11.3**
P. Medio AT		119%	49%	22%	69%	58%	9%	0%	**11.6**
MT- Distributor (EDEL)		67%	38%	30%	39%	99%	4%	0%	**8.7**
Venda MT Industrial		37%	38%	40%	45%	38%	20%	0%	**6.3**
Venda MT Commercial		36%	38%	40%	46%	37%	11%	0%	**5.8**
P. Medio MT		45%	38%	37%	43%	56%	11%	0%	**6.8**
BT Industrial		37%	51%	41%	50%	42%	43%	0%	**8.9**
BTCommercial		36%	48%	44%	50%	42%	29%	0%	**7.9**
BT Domestic		40%	48%	44%	50%	42%	0%	0%	**6.4**
BT Tariff Social		55%	48%	43%	52%	42%	-18%	0%	**5.8**
BT Special								0%	
BT IP		48%	48%	40%	54%	42%	0%	0%	**6.7**
P. Medio BT		41%	48%	43%	51%	42%	47%	0%	**9.4**

- **Utility Mandate, Staffing and Capacity Building**

The power utility has an establishment of 4,100 employees. The number of customers amounts to 430,000, of which close to 95 % are in the residential sector. This is mainly due to the fact that the industries are not yet operating at full capacity. This is intended to change in the future as more load and industries open up.

The power utility (ENE) is constrained on staffing levels. As part of the restructuring the utility has assigned personnel to specific projects. The eventual restructuring would create separate generation, transmission, distribution & supply business units within the utility.

Currently, there is no expertise to operate the 400 kV network as this is to be outsourced. Local engineers need to be equipped and trained so that they can independently operate the 400 kV network. The utility intends to send engineers to Eskom to be trained on the operations of 400 kV network and to be utilized as trainers in Angola.

3. PRELIMINARY RECOMMENDATIONS

Angola has a huge potential to be self sufficient in energy supply based on the available hydro and gas resources. The interconnection of thee separate internal transmission systems will assist in sharing and in optimizing the generation resources available.

- **Short term generation and transmission projects**

The government has clearly identified strategies of meeting its power requirements in the short to medium term.

For the generation side, these include:

a) Rehabilitation of existing infrastructure;
b) Installation of thermal type generating units; and
c) Use of renewable energy sources of energy.

The mission is recommending that the Baynes hydro power project be treated as a priority project for both Angola and Namibia. The Baynes project should therefore be packaged and promoted to financiers at regional level.

For transmission projects the mission recommends that the interconnection of the existing three systems in Angola should remain a priority. However, it is important to also include in the existing plans the regional interconnectors which should include the Angola- Namibia interconnector (in the south) and the WESTCOR Project.

There is a need to carry out a study to evaluate the amount of suppressed demand in the country to facilitate effective planning process.

- **Power Sector Reform**

There was evidence of restructuring which is ongoing in Angola within the government and at the power utility level. It is recommended that as part of the restructuring and there is need to ring fence various departments into generation, distribution and supply and this will assist in the allocation of costs to the various levels of the supply chain.

- **Regulatory Framework**

Although the mission failed to meet the electricity regulator due to other commitments, the discussions on the tariffs and other regulatory functions indicated that the regulator is currently unable to fulfill its mandate due to lack of capacity.

- **Medium and long term**

a) The SADC region should provide alternative power supply options to Angola; and
b) In the long term, the hydro potential along the Cunene River should be explored for the benefit of other SADC members. This is a project which has been in the SADC activity plan but has not been pursued by both countries.

4. CONCLUSION AND WAY FORWARD

The mission was successful and the officials met were very helpful in highlighting the areas that needed clarifications.

A number of actions were identified. These are:

a) **WESTCOR:** SADC will follow up and advise on the progress of the WESTCOR Project.
b) **Rural Electrification**: A rural electrification master plan needs to be put in place. The government and utility representatives should visit and learn from other SADC countries on how rural electrification programs have been done.
c) **Baynes Project:** Package the Baynes project for marketing at regional level so that the project can reach financial closure early.
d) **Capacity Building:** Encourage and facilitate capacity building programs for the utility, regulator and government officials. There is need to send the locals for training and attachments to other utilities so that they can gain experience on the operation of the 400 kV network. There is also need for Regional Electricity Regulators Association of Southern Africa (RERA) to engage IRSE and Ministry of Energy on regulatory shortcomings within the Angolan system that currently restrains the regulator from fulfilling its full mandate.
e) **Transmission Integration**: Angola should accelerate the connectivity of the three separate systems and also interconnect the eastern part of the country.

- **Follow up**

The report will be shared with officials from the Government of Angola and the Utility.

ANNEX 1: GENERATION PROJECTS IN ANGOLA

HYDRO PLANTS - NORTHERN					
	MW	Capacity factor	Mw-Aver.		YEAR
Capanda # 1& 2	260,0	0,90	233,0	OPERATING	
Capanda #3	130,0	0,72	93,0	OPERATING	
Capanda #4	130,0	0,32	42,0	OPERATING	
Cambambe	90,0	0,50	45,0	OPERATING	
Mabubas	17,8	0,50	8,9		2012
Cambambe alteamento	170,0	0,50	85,0		2012
Cambambe nova casa de força	520,0	0,50	260,0		2013
Laúca L2	67,0	1,00	67,0		2014
Laúca L1 #1	500,0	0,85	427,0		2015
Laúca L1 #2	500,0	0,68	341,0		2015
Laúca L1 #3	500,0	0,22	110,0		2015
Laúca L1 #4	500,0	0,16	82,0		2016

THERMAL PLANTS - NORTHERN					
	MW	Capacity Factor	MW-Aver.		YEAR
GTG #1	24,0	0,80	19,2	OPERATING	
GTG #2	28,0	0,80	22,4	OPERATING	
GTG #5	18,0	0,80	14,4	OPERATING	
CD CFL	60,0	1,00	60,0	OPERATING	
CT Quartéis	15,0	1,00	15,0	OPERATING	
GTG #4	18,0	0,80	14,4	11	2009
CD Rocha Pinto	24,0	1,00	24,0	7	2009
CT Viana	50,0	1,00	50,0	6	2010
CT Cimangola	96,0	0,80	76,8	7	2010
CT Mabor ou Cazenga	56,0	0,80	44,8	7	2010
GTG #3	40,0	0,80	32,0	1	2012
CT Soyo #1	400,0	0,80	320,0	10	2012
CT Soyo #2	400,0	0,80	320,0	10	2013

HYRDO PLANTS - CENTRAL					
	capacity	Capacity factor	POWER	COMISSIONING	
	MW		Mw-Average	MONTH	YEAR
Biópio	10,8	0,50	5,4	OPERATING	
Biópio	3,6	0,50	1,8	1	2010
Gove	60,0	0,50	30,0	1	2011
Lomaum	65,0	0,50	32,5	1	2014
Cacombo	24,0	0,50	12,0	1	2015

THERMAL PLANTS – CENTRAL					
CENTRAL	CAPACITY	Capacity factor	POWER	COMMISSIONING	
	MW		Mw.Average	MONTH	YEAR
CD Lunda Norte (Dundo)	0,8	0,8	0,64	OPERATING	
CD Lunda Sul (Saurimo)	2,1	0,8	1,68	STANDBY	
CD Moxico (Luena)	1,7	0,8	1,36	OPERATING	
Nova CD Moxico (Luena)	3,2	0,8	2,56	12	2009
CD Lunda Norte (Dundo)	15,0	0,8	12,0	6	2010
CD Lunda Sul (Saurimo)	7,5	0,8	6,0	6	2010
CT Moxico (Luena)	7,5	0,8	6,0	6	2010

HYDRO POWER CAPACITY IN ANGOLA								
	2009	2010	2011	2012	2013	2014	2015	2016
North	610	610	610	798	1318	1385	2885	3385
Central	11	14	74	74	74	139	163	163
Southern	27	27	27	27	27	27	316	316
Western	24	24	50	63	153	153	153	153
Total	672	676	762	962	1472	1704	3517	4017

THERMAL POWER CAPACITY IN ANGOLA								
	2009	2010	2011	2012	2013	2014	2015	2016
North	187	389	389	829	1229	1229	1229	1229
Central	90	126	126	126	126	126	126	126
Southern	42	42	100	100	100	100	100	100
Western	8	38	38	38	38	38	38	38
Total	327	595	653	1093	1483	1483	1483	1483

ANNEX 2: PROGRAMME FOR THE SADC POWER SECTOR REVIEW MISSION TO ANGOLA OCTOBER 18 – 22, 2009

DATE	TIME	ACTIVITY	VENUE
18 OCT.	12h25	ARRIVAL	LUANDA AIRPORT
19 OCT.	6h00-17h00	SITE VISIT (ENE) CAMBAMBE	MINISTRY OF ENERGY-ANGOLA TO ARRANGE
20 OCT.	9h00-9h15 9h00-11h00 11h00-12h30 14h00-17h00	ENCONTRO DE CORTESIA COM SUA EXCELÊNCIA MINISTRA DA ENÉRGIA DE ANGOLA PRESENTATION ON THE ANGOLA ENERGY SECTOR(GEPE/DNEE/GII) PRESENTATION OF THE SADC TECHNICAL MISSION(THE SADC REPRESENTATIVE) MEETING WITH NATIONAL ENERGY UTILITY (ENE)	MINISTRY OF ENERGY-ANGOLA MINISTRY OF ENERGY OF ANGOLA MINISTRY OF ENERGY-ANGOLA (GEPE/DNEE/GII) OFFICES OF EMPRESA NACIONAL DE ENERGIA-ENE
21 OCT.	9h00-12h00 14h00-16h00 16h30-17h30	MEETING WITH: a) IRSE b) NATIONAL SECRETARY OF SADC SYNTHESIS OF MISSION REPORT DEBRIEFING MEETING WITH THE HON. MINISTER OF ENERGY	MINISTRY OF ENERGY-ANGOLA MINISTRY OF ENERGY-ANGOLA
22 OCT.	8h00	DEPARTURE	LUANDA AIRPORT