



**REPUBLIC OF ANGOLA**  
**MINISTRY OF ENERGY AND WATER**

**COUNTRY REPORT**

**Knowledge Co-Creation Program – Energy Policy**  
**Japan, May 29 to June 25 2016**

By Mr. Jacinto Caculo – Director of Energy and Water – Malanje Province

**1. GENERAL INFORMATION - COUNTRY OVERVIEW**

**1.1. Geography and Demography overview**

Angola is located in the Western region of southern Africa, occupying an area of approximately 1,246,700 km<sup>2</sup> area that makes Angola the sixth largest country of Africa. The extent of its coastline is of more than 1,600 kilometers, bordering the Atlantic Ocean. Angola has land borders to the North with the Republic of Congo and the Democratic Republic of the Congo, to the East with the Democratic Republic of Congo and Republic of Zambia, and to the South with the Republic of Namibia, with an extension of more than 1,400 km.

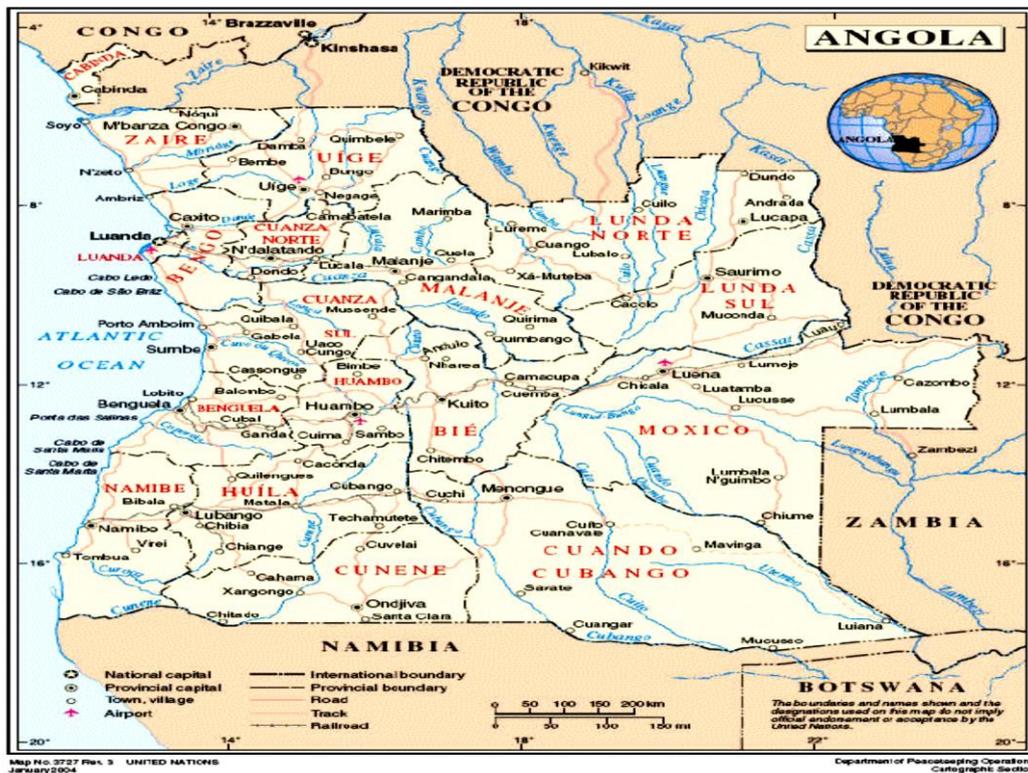


Figure 1 – Map of Angola

Although Angola is located in a tropical zone in the southern hemisphere, it has however a climate that is not characteristic of this region, notably due to the confluence of three factors: the orography in the countryside, the influence of the cold Benguela current along the South coast and the influence of the Namib desert to the southeast of the territory.

The territory of Angola is essentially characterized by contrasts between the dry and hot climate, known as Cacimbo, from May to August, characterized by low precipitation along the coast, and the humid climate in the months from October to April, milder and with more abundant rainfall in the interior.

Angola is divided in 18 provinces (Bengo, Benguela, Bié, Cabinda, Cuando Cubango, Cuanza Sul, Cuanza Norte, Cunene, Huambo, Huila, Luanda, Lunda Norte, Lunda Sul, Malange, Moxico, Namibe, Uige and Zaire), which are in turn divided into Municipalities with a total of 163. The Municipalities are in turn divided into a total of 618 communes. The Provinces are governed by a Provincial Government and the Municipalities and Communes have local administrations.

With regards to demographics, Angola conducted a general census in May 2014 which results indicate that Angola has a resident population of **25.789.024** inhabitants of which 12.499.041 are male (48%) and 13.289.983 are female (52%). Urban population represents over 62% of the total population.

## 1.2. Political, economic and socio-economic conditions

Angola is one of the fastest growing economies in sub-saharan Africa. Its economy is largely dependent on the oil sector, of which Angola is the second largest producer of the continent after Nigeria. In recent years, however, Angola's economy has experienced a significant diversification, with the growth of the non-oil sector being superior than that of the oil sector, driven mainly by agriculture, energy, manufacturing, construction and service sectors. Nevertheless, Angola's economy still remains largely dependent on oil, which accounts for an estimated 95% of exports, 70% of government revenue and 46% of GDP.

Apart from the oil sector, which remains the main contributor to GDP as it can be seen in the following picture (represented within the Mining and Quarrying category) the Mining sector (other than oil) accounts for 2.5% of GDP (included in the Mining and Quarrying category in the graphic below), mostly dominated by diamond production, of which Angola is the sixth world supplier. Agriculture, Construction and Manufacturing are slowly increasing its importance and the services sector is slowly developing.

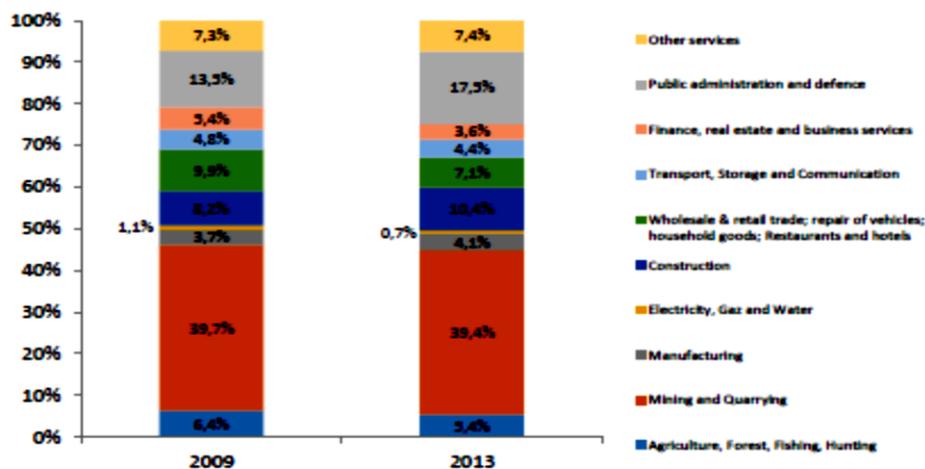


Figure 2 - GDP per Sector (Source: Outlook, 2015)

Angola is governed by a multi-party democracy since 1992, the year it held the first general elections. In 2008, new elections took place. The MPLA has been the governing party since the country's independence, and both Presidents that Angola has had to date are issued from this party. Currently, the President of the Republic is **Mr. José Eduardo dos Santos**, who became, at the time of his inauguration, in 1979, the youngest President of the continent. In the international panorama, Angola supports initiatives that foster peace and resolution of regional disputes, sponsoring the diplomatic means in the prevention of conflict.

### 1.3. Energy Situation

#### 1.3.1. Energy Resources

##### 1.3.1.1. Large Hydroelectric Plants

Angola is currently one of the countries in the world with the largest penetration of renewable energy in the electric sector, mainly due to the weight of its hydroelectric plants. In 2013, around 50% of the electrical energy produced in the country originated from hydroelectric plants.

The Ministry of Energy and Water Action Plan for the 2013-2017 period reinforces the focus on large hydroelectric plants through the construction of Laúca with 2060 MW and Cambambe II with 960 MW which are currently under construction. Other important hydroelectric projects are also planned, such as Caculo Cabaça, Jamba-Ya-Mina, Jamba-Ya-Oma and Baynes, which is a joint project with Namibia, located at the border.

##### 1.3.1.2. Fuelwood and Charcoal

Most of the rural areas have no access to electricity and other forms of modern energy. Fuelwood still constitutes one of the energy sources most commonly used in the rural areas of Angola for heating and cooking. The uncontrolled use of this resource has caused some deforestation problems, although circumscribed to the outskirts of small towns and villages. Charcoal, mostly used in urban areas, is mostly produced in a non-sustainable way, given that the trees cut for its production are not replaced or do not obey to any sustainable exploitation and reforestation program.

Statistics on fuelwood or charcoal use or production are not sufficiently known in Angola and it is therefore difficult to estimate the impact of this practice.

### 1.3.1.3. Renewable Energies

Angola has, besides its enormous hydric potential, a considerable potential of renewable energy sources with potential for power generation – hydro until 10 MW, Solar, Wind and Biomass.

Angola has only recently completed a first survey and mapping of its renewable resources, and besides some mini-hydropower centrals, the “**Aldeia Solar**” project and the recently launched BIOCUM project (based on sugar cane biomass) it does not have for the moment large renewable energy projects.

### Energy Matrix

The energy matrix of the Republic of Angola is predominantly represented by biomass, at about 64%, petroleum products 33% and electricity only 3%. This puts the country in the dilemma of energy dependence on fossil fuels biomass products. The installed capacity in 2013 was 1,848 MW which corresponded to an available capacity of 1,476 MW, of which 52% was hydro and 48% thermal, and total losses of 26% in 2012. Generation was 6,203GWh in 2012. Electricity generation grew 88% over the past 5 years (CAGR of 13,5%).

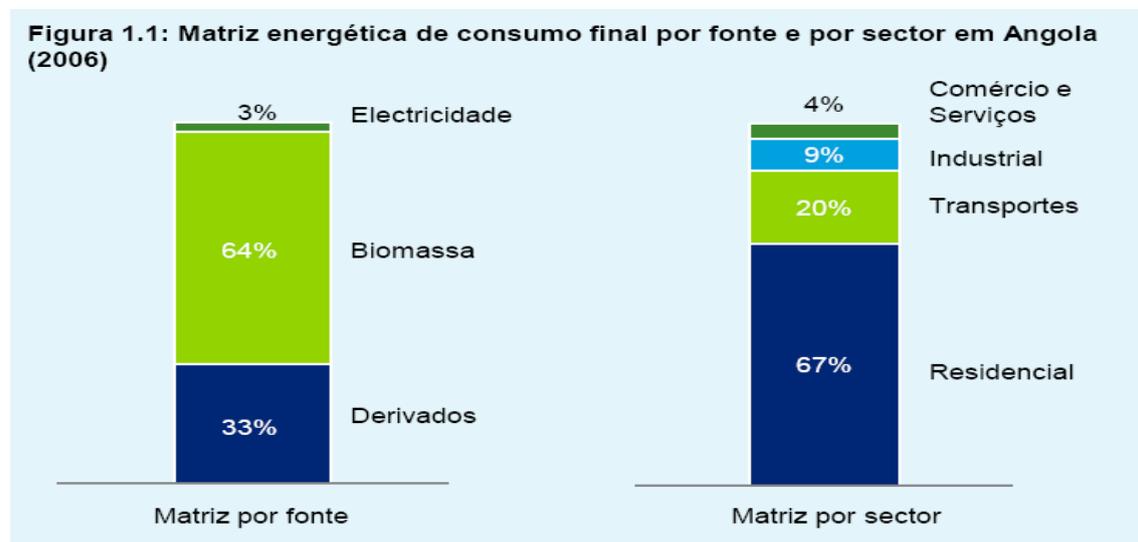


Figure 7 – Angola's Energy Matrix 2014 (Source: MINEA)

## 2. CURRENT ENERGY POLICY AND MEASURES

### POLICIES AND LAWS

Angola has developed a series of policies and laws in the past years to define the main objectives and orientations of the energy and electric sector. The mains policies and laws developed are presented in the following sections:

***i. Long Term Strategy Angola 2025***

The long term strategy Angola 2025 was approved in 2008, with the major strategic objective of “transforming Angola into a prosperous, modern country, without poverty [...] and with a growing insertion in the world and regional economy”. The long term strategy considers the implementation of a development strategy for the energy sector which promotes investment optimization, both across time and across different energy sources, in order to meet internal consumption and exports.

The strategy establishes global strategic objectives and pillars that represent important challenges which should guide the development of the power sector, namely:

1. To promote human development and the well-being of Angolans
2. To ensure a high rate of economic development
3. To develop national territory harmoniously
4. To promote an equitable and sustainable development
5. To promote Angola’s competitive insertion in the World Economy

***ii. Policy and Strategy for National Energy Security***

Presidential Decree Nr. 256/11 of September 29th approved the Policy and Strategy for National Energy Security, which defines the main strategic guidelines for the energy sector, including the redefinition of the existing institutional framework. In the long term, the policy embraces the need to transform the sector in order to respond to the major challenges associated with demand growth, along 6 axes:

1. Generation park growth
2. Use of renewable energies
3. Electrification and grid expansion
4. Tariff review and economic-financial sustainability
5. Restructuring and strengthening of power sector operators
6. Promotion of private capital and know-how

***iii. General Electricity Act, 2014 (Nr. 27/15, Changes Act Nr 14-A/96, of May 31st)***

The General Electricity Act, dated from the 31st of May 1996, was revised in 2014 and approved in 2015.

The General Electricity Act Revision aimed at reviewing the responsibilities of all public actors directly involved in generation, transmission, distribution and commercialization of electric energy, establishing the principles for tariffs and harmonizing the General Electricity Act with other current legislation.

**iv. Public Private Partnership Law**

The Angola's PPP law 02/2011 was published on the 14th of March with the goal of attracting private sector investment in Angola. The law's objective is to define the general rules of the overall operation of the public private partnerships, from its initial stages to the adjudication and subsequent follow-up of the implemented projects.

**v. Oil & Gas – Law Nr. 10/04 Petroleum Activities Law**

The main legislation governing the Oil & Gas Sector in Angola is the Petroleum Activities Law (PAL) from 2004 and the Law on Taxation of Petroleum Activities (PTL) also from 2004. Under these legislations, the Ministry of Petroleum (MINPET), representing the government, is responsible for the granting of concessions and prospecting license.

The Ministry of Petroleum (MINPET) is the Ministry that supervises the whole of the Oil & Gas Sector, being responsible for the execution of the National Policy and Coordination, supervision and Control of the entire Oil & Gas Activity.

Sonangol, a public company created in 1976 by the Angolan government from the nationalization of ANGOL and supervised by MINPET, exists to control hydrocarbon resource exploration on Angola. Sonangol is according to current legislation the exclusive concessionaire for exploration of oil and gas in Angola, as well as being responsible for all the chain of value associated to Oil & Gas in Angola.

In order for Oil & Gas operations to be carried out in Angola, the MINPET must issue either a prospecting license, under which the holder may perform activities of prospection, exploration and production in a defined area, or a petroleum concession to Sonangol, the sole concessionaire for petroleum operations according to current legislation, who may carry out operations alone or jointly with third party operators, once authorized by the MINPET. Sonangol is therefore involved in nearly all Oil & Gas activities in Angola.

**vi. Electric Sector Structure**

The Electric Sector, under custody of the Ministry of Energy and Water, has recently suffered a large restructuring, with the extinction the former companies which operated all the segments of the sector, and the creation of three new companies, PRODEL, ENDE and RNT.

The following illustration presents a summary of the Electric Sector's restructuring:

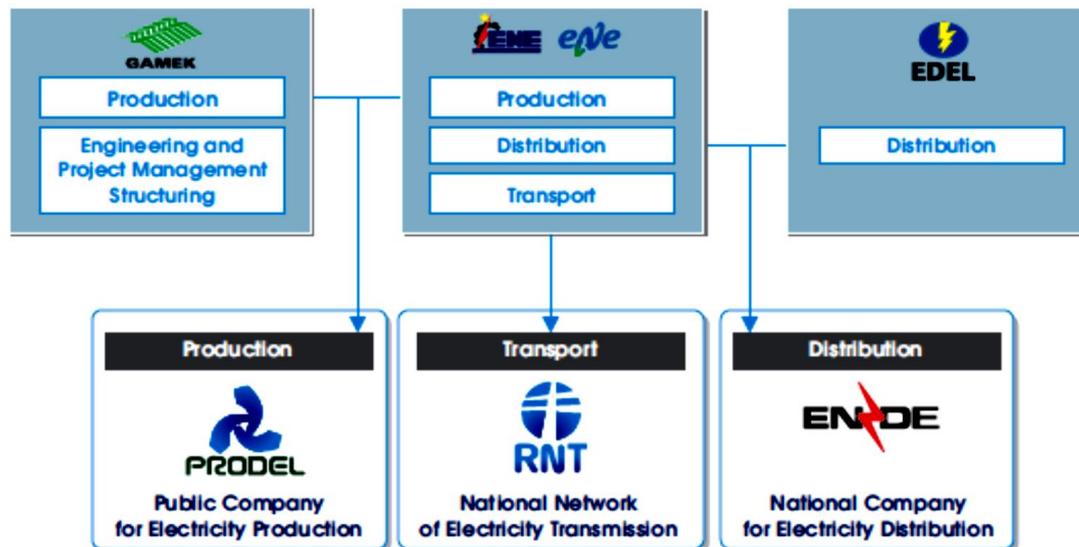


Figure 8 – Restructuring of the Electric Sector (Source: Programa de Transformação do Sector Eléctrico - PTSE)

The Ministry of Energy and Water of Angola, MINEA, has as an objective to propose, formulate, manage, execute and control the Government’s policy in the areas of energy, water and sanitation. Amongst its responsibilities, the Ministry must propose and promote the execution of the Energy and Water policies, to establish clear strategies to exploit in a reasonable way all energy resources, ensuring their sustainable development; to plan and promote the national policy on electrification; to foster research in its domains; to create the necessary legislation to rule the sector’s activities, etc.

#### Other relevant Laws:

1. Biofuels Law Nr 6/10, from 23 April
2. Atomic Energy Law Nr. 4/07

## MEASURES AND PROGRAMS

### 1. Action Plan 2013-2017

The Angolan Government has a very ambitious Action Plan for the period up to 2017 with around \$18b investments underway and is currently finalizing a long term vision for the power sector with a clear roadmap to take modern **electricity services to 60% of the population** by 2025.

The 2013-2017 Action Plan for the Electric Power Sector is mainly focused in the increase of generation capacity, with 3 mains structuring projects currently under construction:

- **Cambambe Hydropower Plant:** This power plant, located in the river Kwanza, currently with 180 MW of capacity, is currently being expanded and risen, with an extra 80 MW added to the existing plant, and a new central is being built which will allow expanding the available power to 960 MW. The centrals should be operational between the end of 2016;

- **Soyo's Natural Gas Combined Cycle Power Plant:** Soyo's Central, with around 750 MW, will profit from natural gas available in gaseous state at Angola LNG's terminal in Soyo. This central will be connected to Luanda through two Very High Voltage lines also under construction. The central should be operational during 2016;
- **Laúca Hydropower Plant:** This power plant, also located in the Kwanza River, will have approximately 2 GW of installed power and will be one of the largest in Africa and the world.

In total, these 3 projects represent an increase in power of 3,5 GW, more than the total power currently installed and a significant reduction in average generation cost. Additionally, Angola has recently approved the Caculo Cabaça project with an additional 2 GW in the Kwanza river.

The Action Plan also envisages a strong investment in transmission, with the interconnection of the North, Central and South Systems until 2017 and the creation of a new System in the East, interconnecting the capitals of Lunda Norte, Lunda Sul and Moxico. More than 6.000 km of Very High Voltage transmission lines and over 40 substations are planned.

Finally, on the distribution level more 600.000 new connections are planned in Luanda as well as a high level of investment in the electrification of the remaining province's and municipalities' capitals, with a total of 2 million customers expected to get access to electricity by 2017, mostly through usage of pre-paid meters, representing more than 40% electrification rate.

## **2. Transformation Program for the Electricity Sector – PTSE**

The Transformation Program for the Electricity Sector (PTSE, Portuguese acronym) is already underway.

The main objectives of this program are to ensure the economic and financial sustainability of the sector; to promote the entry of private capital and private know-how through an attractive compensation regime based in PPAs with differentiated feed-in tariffs for specific cases and the creation of the Unique Buyer, who will acquire all the energy produced in the public system; to restructure the current organization through the creation of unique public entities for each of the sector's domains (Production, Transmission and Distribution); to reinforce the role of the Sector's Regulator, IRSE, in the new Market Model.

## **3. National Strategy for Renewable Energy**

The Government of Angola recently approved the **National Strategy for Renewable Energy** establishing concrete targets for the various renewable energy sources until 2025 with a total of 800 MW of renewable power – other than large hydro - installed, around 8 % of the total mix, which represents an ambitious objective in terms of renewable energy penetration.

This strategy aims at contributing to the Policy and Strategy for National Energy Security, by promoting the diversification of the national energy mix and to the Integrated Rural Development and Poverty Fighting Program, as well as fostering growth and job creation. On

the international side, this strategy contributes to fighting climate change and is in line with Angola's participation in SADC and IRENA (International Renewable Energy Association).

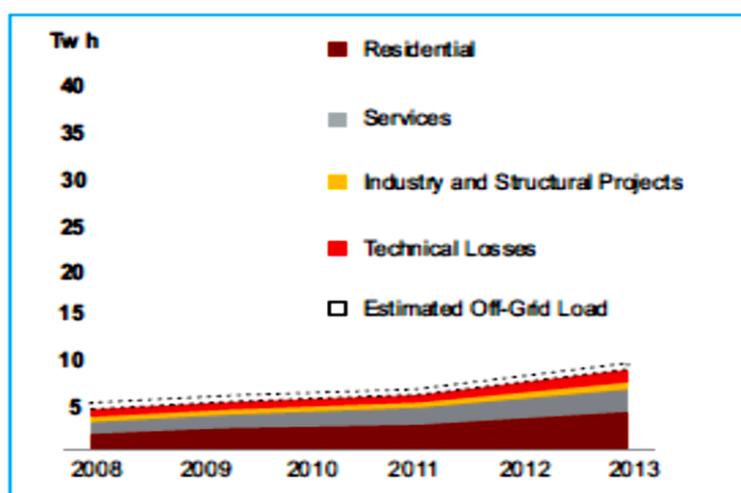
### 3. PAST ENERGY DEMAND AND SUPPLY

Electricity consumption in Angola is limited. It is estimated that only 40% of people has access to electricity of whom 70% are located in Luanda, applying constant pressure on supply.

#### *Energy Demand, Electrification and Distribution*

The Power Sector in Angola is characterized by a low consumption per capita (around 375 kWh per inhabitant), resulting from a low **electrification rate of around 40% of the population**.

The economic growth of the past years associated with a high electrification effort and important investments in what concerns reinforcing power generation and existing power plant's operation has translated in a strong increase of offer and demand. Between 2008 and 2014 the energy consumption recorded an annual average growth rate of 15.5%. As a result the Angolan energy consumption referred to production reached 9.48 TWh in 2014, without considering suppressed demand and self-generation.



*Figure 8 – Consumption per type of customer 2008-2013 (Source: Gesto)*

The strong growth of the energy consumption along the past years is associated with: i) a great effort from the Government of Angola in order to extend electricity coverage; ii) an improvement of the population's living conditions, which results in higher electricity consumption and iii) an increase of the available generation capacity.

Although available generation capacity has grown significantly over the past years, power demand is still suppressed. Suppressed demand results in frequent power supply cuts along with a widespread use of generators for self-consumption, with a greater incidence in the humid months due to the use of air conditioning. Geographically, in 2014 the energy consumption was still highly **concentrated in the northern system**, representing roughly 78% of the country's energy consumption. The weight of the northern system is mainly due to the

consumption associated with the province and city of Luanda where, according to the 2014 census, there are over 6 million inhabitants and where the highest density of industries and services is observed within the country.

The energy consumption in Angola is mostly urban and residential. It is estimated that the residential sector demand accounts for 45% of total generation, followed by services (roughly 32%) and industry (approximately 9%). Technical losses of energy are believed to reach 14% due to the conservation conditions of the electric grid.

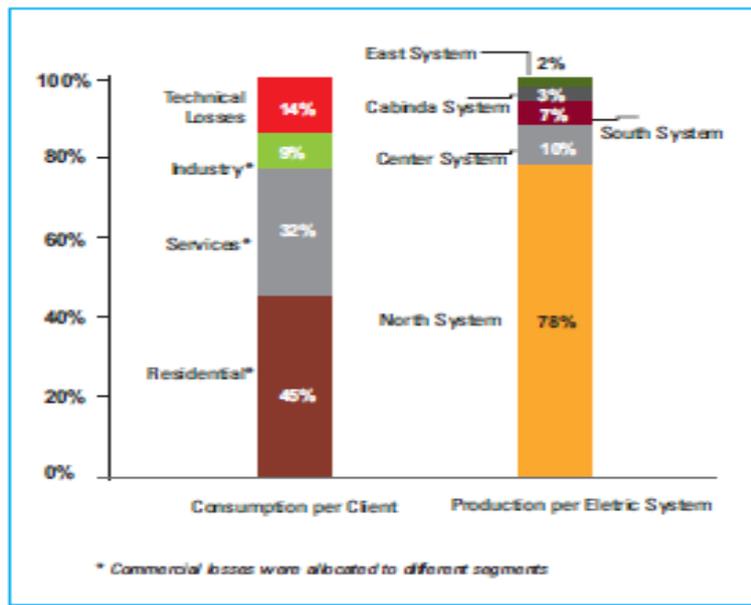


Figure 9 – Consumption per type of customer and electric system – 2014 (Source: Gesto)

### Electricity Generation

In 2014, the total installed power capacity of Angola amounted up to 2.230 MW, which represented an increase in 3,15% when compared to the previous year. Of this total installed capacity 87% (1.940 MW) was available, an increase in 2% of availability with respect to 2013.

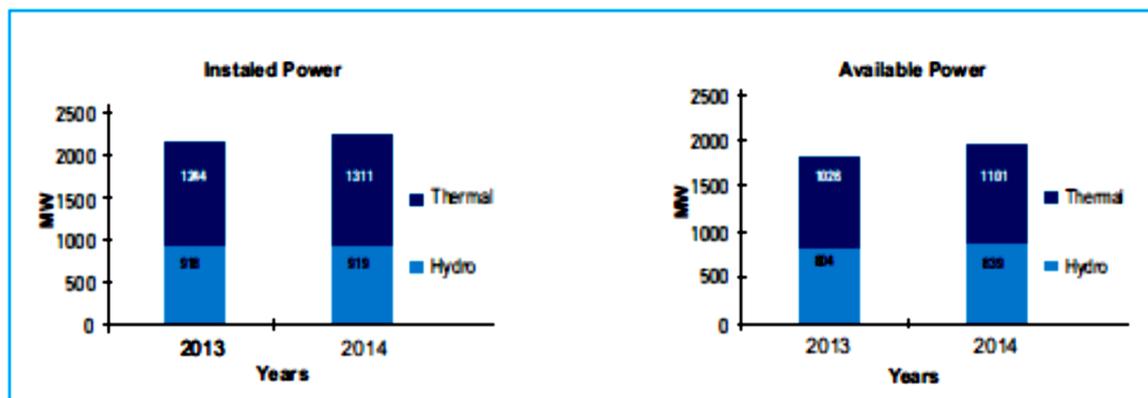


Figure 10 – Installed and Available Power in Angola by type – 2013 and 2014 (Source: ENE)

Around 40% of the installed and available power is from hydro source, the remaining 60% corresponding to diesel based thermal generation.

Overall, the North system accounts for 65% of the total installed and available power, followed by the Central System (15%) and the South System (8%).

Energy consumption (and production) has been steadily increasing for the past years at a rate of more than 15%, having reached 9,5 TWh in 2014.

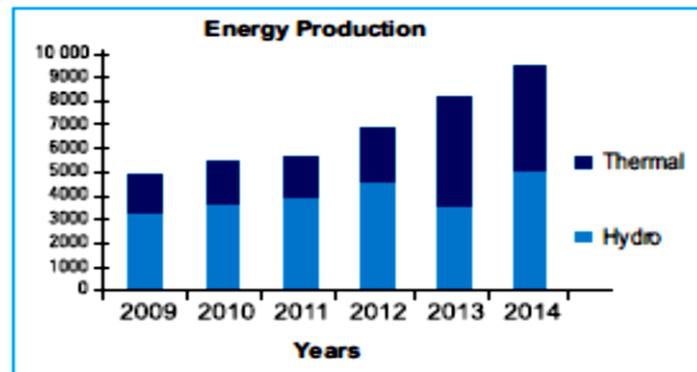


Figure 11 – Energy Production in Angola 2009 – 2014 (Source: ENE)

In 2014 energy production from hydropower source reached 5 TWh (53%) and diesel thermal generation 4.4 TWh (47%).

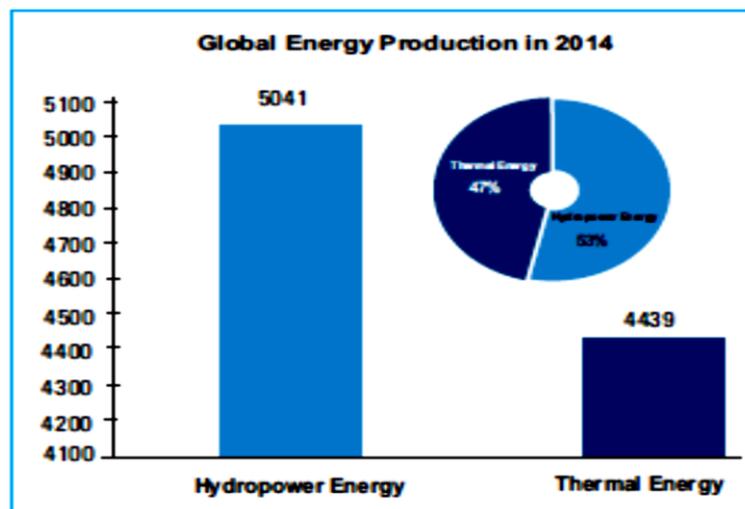


Figure 12 – Energy Production in Angola for 2014 (Source: ENE)

#### 4. OUTLOOK OF ENERGY DEMAND AND SUPPLY

Until 2025 demand is expected to grow at a strong pace, with the overall system load reaching 7.2 GW – more than four times the current level. An average annual growth of 15% is expected to take place until 2017, slightly decreasing to 12.5% between 2017 and 2025. The highest rate of growth until 2017 is associated with the implementation of the Action Plan 2013-2017 and with the significant level of investment considered in the Action Plan.

The country has an investment program ongoing to put in place 5,000 MW until 2017.

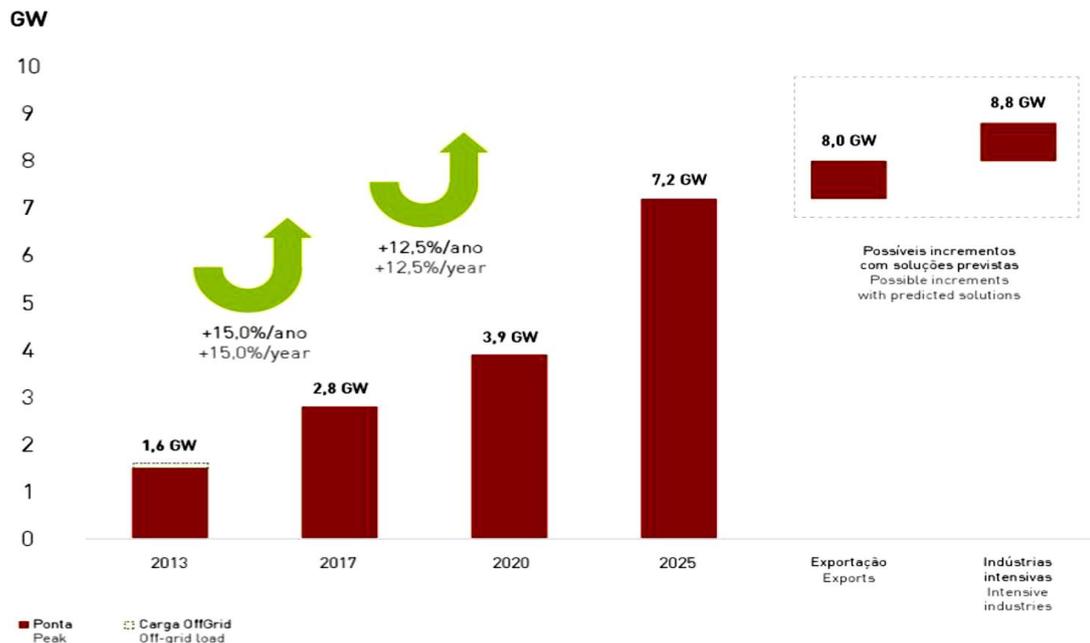


Figure 13 – Trend of the maximum energy load of the system until 2025 (Source: Gesto)

The energy demand referred to generation is expected to reach 39.1 TWh in 2025 with a considerable influence of the residential sector (37%) and a significant contribution from services (28%) and industry (25%).

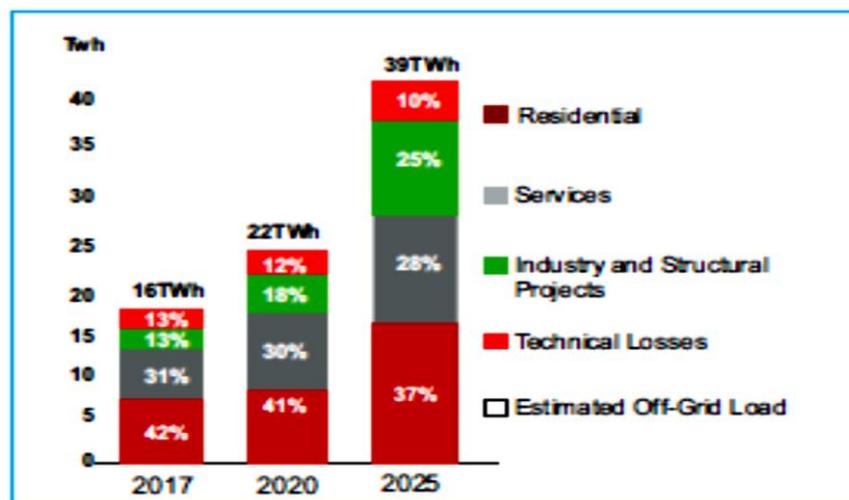


Figure 14 – Consumption per type of customer until 2025 (Source: Gesto)

Angola will thus see a sharp growth in energy consumption, meaning that the average energy consumption per inhabitant will increase from 375 kWh per capita in 2013 to 1230 kWh in 2025. This growth is mainly due to three factors:

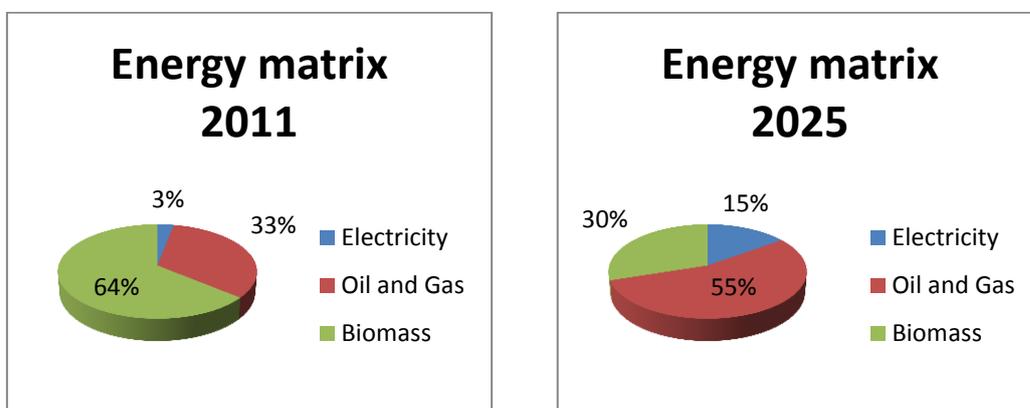
- ✓ The Angola 2025 strategy’s main goal is to provide access to basic energy services to the population. Regarding energy supply from interconnected systems, it is established a goal for **increasing the electricity coverage from 30% to 60% by 2025**. With this target it is expected a total of 3.7 million customers in 2025 (more than three times

the present number), meaning that more than 18 million people will benefit from energy supply.

- ✓ The population living in remote areas should be supplied by small hydro, solar panels or even diesel solutions, depending on the best technical and cost/benefit solution, considering that the target population has mainly low-income.
- ✓ Angola has currently undergoing a program called “Aldeia Solar” which objective is to implement photovoltaic solar systems in rural areas not covered by the main grid, with a particular focus on public buildings. Two phases of this program have already been completed, but despite the progress accomplished the number of localities benefiting from these solution is still low.

The total hydro electrical potential of the country which can be economically developed is assessed at about 72,000 GWh per annum, corresponding to an installed capacity of about 18,000 MW.

In 2025, as a result of the implementation of the Energy Security Strategy and Policy, the energy matrix should present profound changes and more balance and sustainability in sectoral terms (consumption matrix) and in terms of energy sources (energy mix). Electrical energy will see its weighting increase significantly from the current 3% to about 12% or 15%, and oil derivatives will also increase in weighting from 33% to about 55%, to the detriment of the high current weighting of the use of biomass. The intention is to make the transition to more efficient and cleaner energies, in particular to replace biomass by LPG (Liquefied Petroleum Gas) in the residential sector, and higher use of renewables sources of energy.



## 5. MAJOR DIFFICULTIES AND BOTTLENECKS CURRENTLY FACED IN FORMULATING ENERGY POLICIES

The Electricity Act provides for the possibility of private participation in Generation and Distribution but until now this participation is negligible due the amount of investment needed in the Electricity Sector.

*This situation is due, amongst other factors, to the lack of:*

- *Proper regulations (of the PPP Law)*

- *Incentive policies*
- *Attractive tariffs enabling returns on the invested capital; and*
- *An effective electricity market regulator.*

## 6. SUBJECTS I WOULD LIKE TO STUDY

- i. Japanese Electric Power Institutional and Regulatory Framework and role of the Regulator;
- ii. Legal framework of the Public Private Partnership in Japan
- iii. Incentive policies, specially for power generation plants under 10 MW;
- iv. Incentive policies for the creation of private companies assembling renewable energy equipment and components for rural electrification.