REPÚBLICA DE ANGOLA
MINISTÉRIO DA ENERGIA E ÁGUAS

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SUSTAINABLE ENERGY FOR ALL

Rapid Assessment and Gap Analysis:

ANGOLA

September 2015

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Executive Summary

1. BACKGROUND

In recognition of the critical need to improve global access to sustainable, affordable and environmentally sound energy services and resources, the United Nations General Assembly declared 2012 the International Year of Sustainable Energy for All and urged Member States and the UN system to increase the awareness of the importance of addressing energy issues and to promote action at the local, national, regional and international levels. In response, the UN Secretary General launched a global Initiative to achieve Sustainable Energy for All by the year 2030. The key objectives under this goal are: (1) ensuring universal access to modern energy services; (2) doubling the rate of improvements in energy efficiency; and (3) doubling the share of renewable energy in the global energy mix. The outcome of the initiative and Member States growing interest in energy issues lead to the declaration by the United Nations General Assembly of the decade 2014-2024 as the Decade of Sustainable Energy for All, underscoring the importance of energy issues for sustainable development and for the elaboration of the post-2015 development agenda.

The Economic Community of Central African States (ECCAS), of which Angola is a member, has recently adopted the White Paper of CEEAC and CEMAC on a Regional policy for universal access to modern energy services and economic and social development (2014-2030), adopting specific targets regarding energy access, energy efficiency and renewable energies – in line with the Sustainable Energy for All initiative.

Additionally to the ECCAS initiative, the Republic of Angola has decided to officially opt-in the Sustainable Energy for All initiative. In fact, the goals of universal energy access, efficient use of resources and utilization of Angola's endogenous potential are also goals of the 2025 Angola Long Term Strategy.

This document presents the rapid assessment and gap analysis of the energy and related sectors of Angola, with particular reference to the three objectives of "Sustainable Energy for All." The rapid assessment and gap analysis, after the declaration of partnership, constitutes the second step in the participation of a country in the Sustainable Energy for All process, to be followed by the Action Agenda and Investment Prospectus.

The Rapid Assessment and Gap Analysis was conducted through a comprehensive desk review and stakeholder consultation covering government ministries and departments, utilities, private sector and development partners in Angola. The activity included a situation analysis, with baseline data on sustainable energy production, distribution and utilization, and covered an assessment of national initiatives on (1) universal access to electricity; clean fuels and devices for cooking/heating; and mechanical power; (2) improvements in energy efficiency; and (3) increasing the share of renewable energy in the national energy mix; and an analysis of sector strengths and weaknesses in specific areas relevant to the sector such as policy, planning, institutions, finance, monitoring (data and accountability), capacity and partnerships.

2. SUMMARY OF KEY FINDINGS AND CONCLUSIONS

2.1. Gap Analysis on Universal Access to Electricity

The Power Sector current situation shows relevant gaps across key dimensions of access:

Availability: Given the large size of the country and the lack of adequate infra-structures for generation, transmission and distribution only around 30% of the population currently have access to electricity. Most of the people with access to electricity are located in the 18 Provincial capitals of the country with 70% being in the city of Luanda. Health and education infra-structures outside of Provincial Capitals still have limited access to energy services.

Reliability: Generation and Distribution infra-structure have not adequately accompanied the strong growth in electricity consumption - mostly concentrated in the city of Luanda where the infra-structure is better developed and where major services, public sector and wealthier consumers are located. This results in frequent blackouts and many customers - domestic, service or industrial - having diesel based backup generators on their backyards.

Affordability: Although Angola has one of the lowest prices for electricity in the entire Sub-Saharan region and in the world (which have not been changed since 2006) the price for available and reliable power coming from diesel generators has increased significantly in the last months due to political decision to increase diesel price from 40 to 75 kwanzas per litre.

Sustainability: The electricity tariffs currently cover less than 20% of the electricity costs. The high dependence on diesel for power generation implies very high generation costs which result in a deficit situation for the recently unbundled power sector utilities. Additionally, energy losses are above 40% with many clients without working electricity meters. This unsustainable situation makes Access growth highly dependent on State Budget coming mostly from oil revenue and undermines the already scarce private sector involvement.

Despite the present relevant gaps across the various dimensions, 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 – which is a more ambitious goal than the 2030 54% goal adopted in the ECCAS White Paper. The Action Plan is expected to bring around 6 GW of additional generation in the next years to the Angolan power system with 5 GW of hydro power (Cambambe 2,Laúca and Caculo Cabaça) and 0,7 GW (Soyo CCGT) of natural gas based generation – which more than doubles currently installed capacity and significantly reduces average generation cost. The three large main systems are being interconnected. A total of 2 million customers are expected to get access to electricity by 2017, mostly through usage of pre-paid meters, representing more than 40% electrification rate.

Although the Government intentions and actions are well aligned with the Universal Access Goal of the Sustainable Energy 4 All initiative, several initiatives and improvements to face the most relevant challenges and barriers are proposed:

Challenge #1: Effectively mobilizing such high levels of investment and increase power sector efficiency

- Increase power sector financial sustainability through tariff restructuring and increase together with the implementation of loss combat programs (to be addressed more in detail in the Energy Efficiency goal).
- Approve and implement Private Sector Participation Program, promoting the involvement of private companies on Distribution areas to increase efficiency and guarantee investment.
- Review legal framework in order to clarify licensing regime – including interaction with environmental legislation - and reduce uncertainties to investors and financial institutions.
- Until power sector utilities are not financially stable provide sovereign guarantees to Power Purchase Agreement payments by RNT and its convertibility – in case of foreign investment – potentially making use of Partial Risk Guarantee and other risk mitigation mechanisms supported by multilateral institutions.
- Develop financing mechanism or institution to incentive/support local financing institutions in the extension of loan tenors.

Challenge # 2: Develop and reinforce the internal and institutional competence and capacity of the sector

- Create a Public Private Partnership "cell" inside Ministry of Energy in order to manage procurement of private investments in a competitive and transparent way that can attract DFI and multilateral sources of financing.
- Improve and expand the existing training and capacity building programs to create internal capacity in MINEA on project management and contractual negotiation and supervision.
- Improve and expand the existing training and capacity building programs so that the sector technicians are able to adequately operate and maintain the power sector infra-structures.
- Develop recruiting programs to reinforce the Ministry and the Sector Utilities Human Resources capacity and competence.

Challenge #3: Find effective ways to bring basic energy services to the rural areas of Angola based on solar power

- Given that grid extension will be focused until 2025 on powering the capitals of all Municipalities in Angola, create recently approved Rural Electrification Agency
- Provide adequate resources to the Rural Electrification agency in order to guarantee the implementation of the 500 solar villages and the 500.000 solar lamp program;
- Prioritize education and helth infra-structures in the 500 solar villages program in order to maximize benefit for local populations.

Adequately responding to the challenges of Access to Electricity and being able to achieve the 60% electrification rate could impact more than 7 million people in Angola until 2025.

2.2. Gap Analysis on Access to LPG and improved cookstoves

Access to modern energy for thermal applications show also relevant gaps across key dimensions of access, in particular, considering the target set in the ECCAS White Paper for Angola to have universal access to LPG by 2025:

Availability/Reliability: Access to LPG supply is mostly limited to urban areas in the country with the more in-land municipalities having occasional reliability issues in supply. In peri-urban and rural areas LPG presence is limited and efficient cookstoves are normally not available. People tend to use charcoal in the peri-urban areas and fire-wood in the rural areas. Limited initiatives on the promotion of efficient cookstoves have been taken in Angola. According to the IEA, program were launched in the 1980's and beginning of the 1990's to manufacture efficient cookstoves in the Luanda region but were terminated due to the ongoing conflict. Another program took place in 2003 between UN FAO and Angola's Institute of Forestry development which aimed at improving charcoal production and charcoal stoves, including the distribution of new type of cookstoves.

Also, a comprehensive and detailed database on fuelwood and charcoal use that would allow a clear view on the geographic distribution of this resource and its impacts does not exist to this date.

Affordability: LPG price is regulated by the Government with a significant level of subsidy making LPG an economically attractive alternative. However, regulated prices limit the economic incentives of private distributors to take LPG outside of main urban areas. Firewood, although affordable, requires extensive traveling due to deforestation. This activity is normally undertaken by women, limiting available time and gender equality.

Sustainability: Current energy use for cooking in Angola is highly dependent on traditional biomass sources resulting in significant levels of deforestation around major urban areas in the country. The high dependence of LPG on subsidies and the price regulation undermine also long term supply sustainability. The lack of training and adequate support services in rural areas as well as the low involvement of women in determining household cooking habits and technical needs in what relates to cooking stoves have proven to be crucial factors contributing to the failure in shifting into more sustainable and modern thermal energy applications.

However, LPG consumption has grown significantly in the last years supported by Sonangol. The Angola LNG infra-structure will increase significantly the Angolan production of LPG and further reinforcement of LPG infra-structure is underway – in particular considering the recently

approved target under the ECCAS White Paper for Angola to have universal access to LPG by 2025.

The recently approved Renewable Energy Strategy has a strategic target of distribution of 100.000 improved cookstoves in the more remote areas of Angola through the dedicated teams or the distribution of "renewable cheques" to be implemented by the recently approved Rural Electrification Agency, thus contributing to the goals approved under the ECCAS White Paper of by 2030 having efficient cookstoves in all urban and 90% of all rural dwellings which use biomass for cooking.

Recommendations on Access to modern cooking energy are focused on the challenge of *taking LPG and efficient cookstoves to the peri-urban and rural areas of Angola*:

- Liberalize or increase flexibility of LPG price outside of the main urban areas in order to foster private investment in distribution activities into rural areas;
- Leverage the Angola LNG terminal and the future refinery of Lobito infra-structures, potentially through a regional agreement as set out in the ECCAS White Paper, to increase LPG related infra-structure and availability.
- Launch campaign to promote awareness of the benefits of LPG and efficient cookstoves;
- Offer Fiscal incentives to the import or manufacturing of efficient cookstoves and of LPG user equipment and financing lines for companies interested in the production or distribution of efficient cookstoves or LPG;
- Provide adequate resources to the Rural Electrification agency in order to guarantee the implementation of the 100.000 efficient cookstoves program, targeting regions where fuelwood is scarcer or prices for charcoal higher;
- Promote procurement of international funding for national cookstove program and facilitate partnerships with private sector companies and NGOs in applications for international tenders regarding efficient cookstove programs and alternative primary energy sources for thermal use (biogas, animal waste, etc.);
- Create appropriate quality certification for improved cookstoves and promote technical research to adapting cookstoves and programs to country context;
- Form and properly train women's groups or associations, as being the main users and demanders for this type of energy, for the dissemination of improved cookstoves in rural areas;
- Develop and implement monitoring and evaluation mechanisms, namely sector statistics and energy balance accounting;
- Develop a complete and comprehensive database on energy use for thermal applications (fuelwood, charcoal, LPG, animal waste) throughout the territory;

Adequately responding to the challenges of Access to LPG and improved cookstoves, namely the targets of universal access to LPG by 2025 and the widespread use of efficient cookstoves both in urban and rural settings, have the potential to impact most of the population living outside Luanda – around 18 million people.

2.3. Gap Analysis on Access to energy for productive uses

Access to modern energy for productive use shows the following main gaps:

Availability: Additionally to the Power Sector, diesel is the main source of energy for productive uses in the country. It is widely available with rural areas having more limited access. LPG distribution in Angola is only based on Butane – Propane not being available. There are currently no distribution infra-structures for natural gas or liquefied natural gas. Heavy fuel oil which is the key export product from Angola refinery is also not available for internal use.

Reliability: Diesel distribution is quite reliable across the country although diesel quality is undermined by the old distribution infra-structure.

Affordability: Diesel has been very affordable in the past due to regulated price with significant level of subsidy. Since end of last year the Government has increased 3 times the price of diesel (from 40 to 75 kwanzas per litre) which has had a significant impact on economic activities highly dependent on diesel.

Sustainability: The current policy focused on diesel as the solution for majority of productive uses turns consumers highly dependent on subsidies – which has proven recently not to be sustainable, in particular considering lack of refining capacity in the country and need to import diesel. Also, on the environmental side, natural gas and LPG (Propane) constitute cheaper sources of energy for productive uses with more benign impacts on the environment.

Although the policy to maximize fuel availability through concentration on one source, diesel, has been very effective on guaranteeing availability, it had relevant implications on the sustainability of the measure. The recent significant change in the price of diesel has had a significant impact on economic activity in Angola and on the affordability of modern energy for such businesses. The absence of more competitive energy sources (on a non-subsidized level) such as Propane, Natural Gas and HFO undermine the capacity of private companies to find alternative solutions.

With the Angola LNG facility working, Angola will start producing butane, propane and liquefied natural gas. The existence of recent relevant natural gas discoveries make natural gas a strategic source of energy for Angola. The recent advances in small scale liquefied transport technology offer significant possibilities for Angola to promote access to this competitive, efficient and endogenous source of energy. Recommendations mainly focus on the challenge *to create a natural gas downstream market in Angola:*

- Create LNG truck filling station in Angola LNG infra-structure in Soyo and in other locations in the country;
- Subsidize, help finance or offer tax exemptions to “one-off” investment in satellite receiving LNG facilities for main provincial capitals and start developing regional gas infra-structure plans;
- Regulate natural gas market in order to facilitate access for private actors;

- While natural gas is not available, promote the distribution of Propane for productive uses from Angola LNG facility and infra-structures for HFO distribution for very large clients such as cement factories and others.

Adequately responding to the challenges of Access to energy for productive uses, could significantly impact thousands of companies and the Government's effort to promote the economic diversification of the country.

2.4. Gap Analysis on Energy Efficiency

Energy efficiency is normally associated with reduction in energy intensity through the decoupling between energy use and GDP. Sub-Saharan Africa is normally characterized by a high level of energy intensity (energy per unit of GDP output) mostly because of the weight of mining and other energy intensive industries (eg. Aluminium smelting in Mozambique) in total energy consumption, in particular in South Africa. The recent growth of the services sector has resulted in a reduction of energy intensity in sub-Saharan Africa as a whole.

Angola's energy situation is quite different than the rest of Sub-saharan Africa with historical consumption growth mostly led by the residential and services sectors and with Angola looking to reindustrialize the nation and develop energy intensive industries. Also, being Angola the second largest oil producer in the region, with a strong budget allocation to power sector infrastructure, the dynamics of consumption growth tend to be different from other developing nations. For example, power sector final consumption GDP intensity (kWh per unit of GDP) has increased in the past years. It is expected to continue growing until 2025 mostly because of the strong effort to increase electrification rate from 30% to 60%, the improvement in living conditions and the industrialization effort taking place.

Although historical performance may reveal a significant gap towards the goal of improving energy efficiency and even doubling its results, we argue that energy efficiency effort in the case of Angola has to be measured bottom up and not top down. Even if Angola had a significantly stronger commitment to energy efficiency, energy intensity would still grow. However, it would not grow as much. The ECCAS White Paper approved several bottom up objectives for energy efficiency in the region such as the reduction of energy losses to one third of current situation, the reduction of consumption in public sector buildings by 25% and 50% in new constructions, the phasing out of incandescent lamps, the widespread use of improved cookstoves and increasing the efficiency on charcoal production to 35%.

The potential for improving energy efficiency in Angola is enormous and although Angola has some scattered policies in place with impact on energy efficiency, there isn't a structured strategy or policy to improve energy efficiency nor a sense of urgency for it. For example, loss reduction through pre-paid meters is an important topic already on Government agenda but a lot more could be done even on meters, but also on tariffs, appliances, lighting, vehicles, buildings, wood/charcoal, awareness and education.

We outline some major challenges and recommendations on energy efficiency:

Challenge # 1: Lack of sense of urgency and call for action on energy efficiency

- Development of a comprehensive study on the impact of energy efficiency and development of a National Strategy for Energy Efficiency;
- Setup a bottom up measurement and monitoring system for energy efficiency measures to measure the results of the National Strategy;
- Awareness campaigns on the benefits of energy efficiency;
- Education and sensitization programs on efficient use of electricity.

Challenge #2: Increase electricity tariff sustainability and reduce energy losses

- Increase investment allocation to metering and monitoring systems in order to combat losses:
    - Accelerate deployment of pre-paid system and increase effectiveness of pre-paid meter system through increased availability of paying methods, differentiated rates according to level of monthly consumption, local support services to new customers, and the implementation of loss combat monitoring system and teams that address energy theft in a prioritized way.
    - Install telemetering systems in all large industrial and services clients guaranteeing Zero Losses in Medium and High Voltage.
    - Install a loss monitoring system per area to better locate and quantify energy losses and based on such information review consumption estimates for "avença" clients in each area.
- Introduce alternative methods of payment for electricity consumption - net/online, ATM, shops, etc.
- Increase electricity tariff sustainability through a restructuring of the energy tariff and billing system: increasing tariffs for the Services, Industrial and Wealthier Residential consumer segments until they are fully cost reflective while maintaining a lower and broad social tariff with limited service level. The lower tariffs should be exclusively available to pre-paid meters – once they are widely spread.

Challenge #3: Maximize the efficiency of new consuming technologies, buildings and industries still to be deployed

- Implement an energy efficiency labelling system with associated import tax penalties for non-efficient imports of appliances, lighting and vehicles;
- Prohibit the production, import and commercialization of incandescent lamps before 2020 – as per the ECCAS White Paper decision;
- Launch a program on public sector buildings to increase efficiency by 25% and approve regulation on energy efficiency in buildings applying to new construction;
- Approve regulation for Industrial and Services sector on energy audits. Establish tax incentives for implementation of energy audit recommendations;
- Introduction of mitigation measures such as energy-saving bulbs, efficient electronic equipment and house appliances, solar thermal panels for public and private water heating.

Challenge #4: Eliminate inefficient energy generation/transformation systems, including charcoal production

- Improve efficiency of charcoal production, estimated by IEA to be 3 times less efficient in Angola than production kilns in South America, targeting at least 35% efficiency as established in the ECCAS White Paper.
- Promote improved and more efficient cookstoves (already detailed in Access challenges and measures).
- Replace or significantly reduce usage of old generation facilities with efficiencies below 30% and increase usage of combined cycle technologies

Adequately responding to the challenges of Energy Efficiency, has the potential to impact all electrified customers – already more than 7 million people and expected to be more than 15 million people by 2025 – and even the more rural population through improved cookstoves.

2.5. Gap Analysis on Renewable energy usage

Angola is already a net contributor for the Sustainable Energy 4 All goal of doubling renewable generation in the global energy mix. Hydro power represented in 2014 53% of total power generation – much more than the world average.

Additionally, 2013-2017 Action Plan includes the short to medium term deployment of around 3 GW of hydro power – already under construction, including some mini-hydro power plants. Proposed Angola Energy 2025 vision aims at achieving a total renewable penetration in the power sector of 74% of the installed power capacity with hydro representing 66% and other renewables representing 8%. If such target would be met today, Angola would be one of the top 10 nations among all OPEC, SADC and OCDE members in terms of renewable energy penetration.

The target of having 95% of all additional power generation capacity from renewable energies until 2030 set out in the ECCAS White Paper may be difficult to apply to Angola as there is a firm intention to introduce also natural gas into the power generation mix. However, effort on hydro remains the Government top priority with recent approval of a new large 2 GW hydro power plant: Caculo Cabaça, and Government's intentions on hydro may only be commended as Angola is already a net contributor to the Sustainable Energy 4 All initiative. Additionally, an ambitious National Strategy for Renewable Energy supported on a Renewable Energy Atlas has been recently approved.

We outline key challenges and recommendations for Angola on renewable energy:

Challenge #1: Successfully implement the National Renewable Energy Strategy

- Approve regulation for renewable energies clarifying licensing regime, award system, power purchase agreement, remuneration and off-taking guarantees.

- Establish mechanisms to guarantee that biomass for energy is produced in a sustainable way without impacting deforestation.
- Promote the National Strategy for Renewable Energies at all levels (Ministry, National Directions, Provincial Directions, Institutes and Agencies) by creating the necessary Monitoring Committee and making sure the Strategy is an integrate part of future Action Plans and Annual Budgets.
- Approve Feed-in-Tariffs for renewables up to 10 MW and review applicable taxes.
- Allocate 1.000 million Kz to Rural Electrification Agency every year until 2025 to support rural electrification programs based on renewable energy and for the creation of subsidized credit lines for the acquisition of individual systems of for productive uses.
- Map country's remaining hydro power potential with a focus on mini and micro hydro potential for off-grid electrification.

Challenge #2: Promote Research & Development and internal capacity building and awareness on renewable energy

- Creation of a Research and Development lab dedicated to renewable energies building on the experience implemented in the past on the Training Center Hoji-Ya-Henda and in articulation with the Ministry of Science and the leading universities of the country;
- Promote the articulation and joint programs between the future Renewable Research and Development lab and other international R&D institutions
- Creation of at least one Training Centre on Renewable Energies
- Launch of a nationwide communication campaign on renewable energies

Challenge #3: Maintain large hydro development as a key priority and engage also the private sector

- Develop more detailed feasibility and environmental impact studies for already selected projects in the Keve and Catumbela basins, as well as medium hydro projects with potential to electrify off-grid areas in the Eastern Provinces;
- Launch international tenders for private sector to develop already selected medium/large scale hydro projects;
- Implement adequate payment guarantee schemes that enable access to financing for hydro related investments.

Adequately responding to the challenges of Renewable Energy will allow Angola to be one of the best performing renewable energy countries in the world – with renewables representing 74% of installed capacity.

Section 1: Introduction

1.1. Country Overview

1.1.1. Geography and Demography overview

Angola is located in the Western region of southern Africa, occupying an area of approximately 1,246,700 km^2 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 (Figure 2), 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.

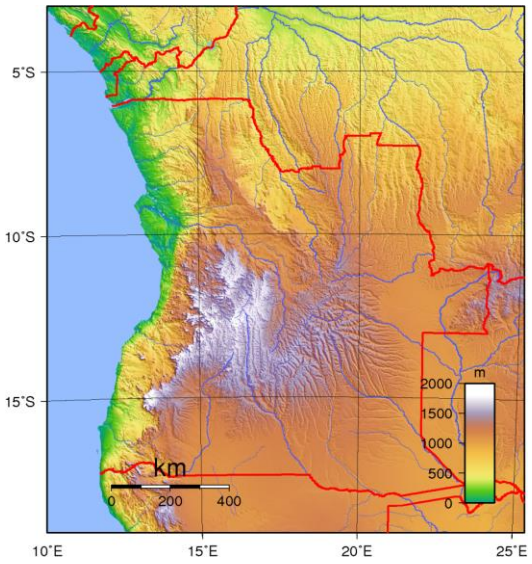


Figure 2 - Map of Angola's Topography

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 (the last general census prior to that one dated back to the 1970's), and is currently performing the final analysis of the data collected. Preliminary results indicate that Angola has a resident population of 24.383.301 inhabitants (in contrast with forecasts for 2015 prior to the results of the general census, which predicted a total population of 20.465.787 inhabitants), of which 11.803.488 are male (48%) and 12.579.813 are female (52%). Urban population represents over 62% of the total population.

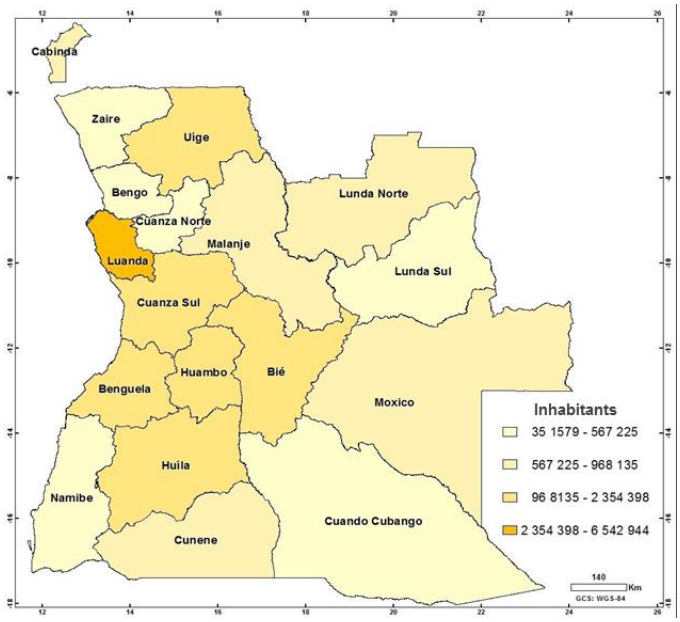


Figure 3 - Angola's population distribution, 2014 (Source: 2014 Census Preliminary Results)

Luanda Province is the most populated one, concentrating 27% of the population, followed by Huila (10%), Benguela and Huambo (8%), Cuanza Sul (7%), Bié and Uige (6%). These provinces concentrate 72% of the total population of the country.

The province of Bengo registers the lowest number of inhabitants with only 1% of the population. Cuanza Norte, Namibe, Zaire, Cuando Cubango and Lunda Sul have all less than 3% of the total population each, representing amongst them 11% on the national population.

Angola has a population density of 19 inhabitants per square km. Luanda, the most populated province of Luanda, is also the one that has the highest population density with 347 inhabitants per square km, despite its relative small surface (18.834 km2).

On the eastern part of the country, Cuando Cubango and Moxico have the lowest population density, with 3 and 4 inhabitants per square km respectively.

1.1.2. 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 thant 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.

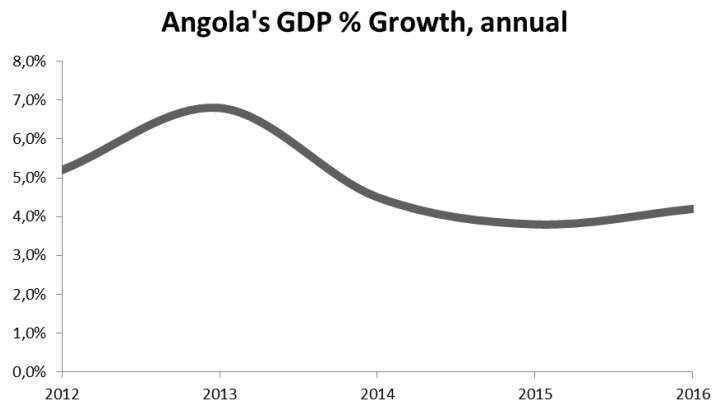


Figure 4 – Angola's GDP % Growth, annual (Source: African Economic Outlook 2015)

The non-oil sector, however, should suffer from lower oil prices and GDP is expected to slow to 3.8% in 2015, possibly increasing to 4.2% in 2016.

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.

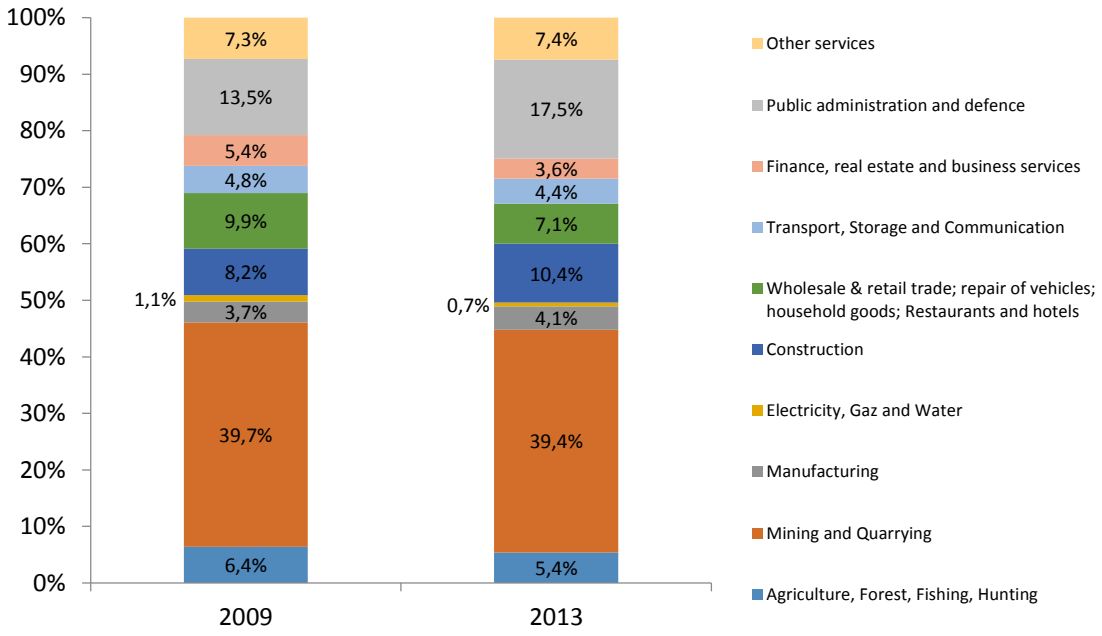


Figure 5 - GDP per Sector (Source: Outlook, 2015)

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.

1.2. Energy Situation

1.2.1. Energy Resources

1.2.1.1. Oil and Natural Gas

Angola is the second largest producer of oil in Africa after Nigeria. By the end of 2014, its proven reserves amounted up to 9 billion barrels, which represents around 15 years of production.

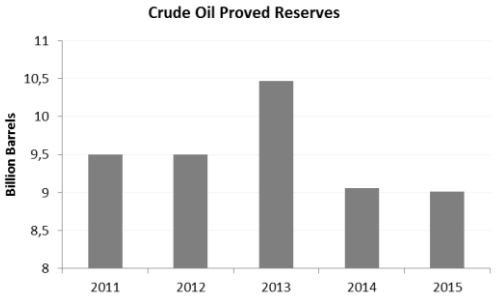


Figure 6 – Crude oil proved reserves (Source: EIA)

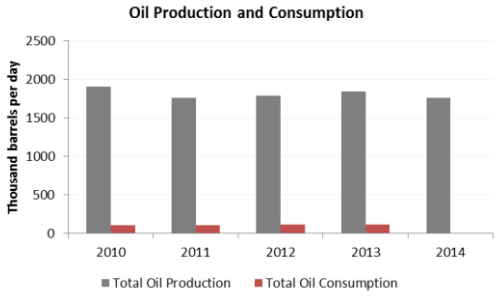


Figure 7 – Oil production and consumption (Source: EIA)

Oil production has allowed for a spectacular economic growth. However, long electrical infra-structure development periods and the war's consequences on existing infrastructures have not allowed to keep-up with the demand growth. Repressed demand has been compensated by generation based on diesel (mostly private), with subsidized prices and consequent impact on the nation's economy.

As for Angola's Downstream Sector for Oil & Gas, its refining capacity is to this day inefficient and under dimensioned to the country's needs, with high refining costs, resulting in imports of oil derived products such as diesel and gasoline, increasing dramatically the cost of the associated subsidies. There is an ongoing project to develop a new modern refinery in Lobito area which could also service other regional countries – if there could be a regional agreement as set out in the ECCAS White Paper.

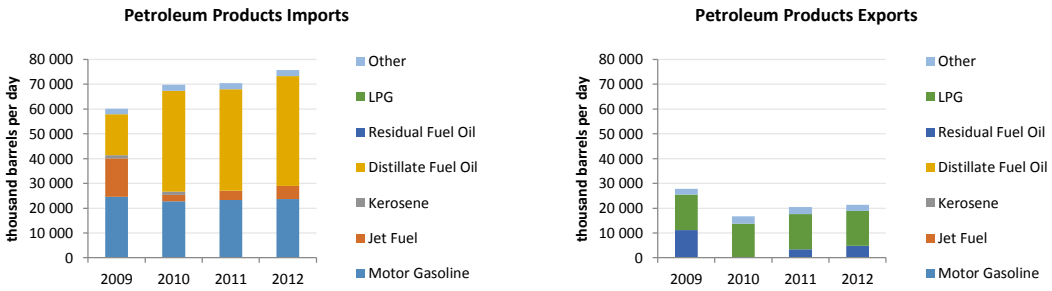


Figure 8 – Angola's Petroleum Products Imports and Exports by category (Source: EIA)

Diesel and Motor Gasoline are the two main oil product imports and increasing during the past years, with LPG and Residual Fuel Oils (such as Heavy Fuel Oil – HFO) being the main products exported and resulting from local refining.

Only recently, through a series of increases, has Angola decreased the level of subsidies for these types of fuels, eliminating them completely for gasoline and reducing to around 21% for diesel.

Apart from oil Angola disposes of considerable Natural Gas reserves, which are currently being exploited through the Angola LNG project. The total proven reserves represent over 270.000 million m^3.

An infrastructure of hundreds of kilometers of submarine pipelines collects gas from various petroleum production units and transports it to Soyo's terminal where it is treated and liquefied for export. The configuration of the terminal Angola LNG accounts for about 3,5 Mm3 per day (about 1,3 annual BCM) in a gaseous state for local use. This gas for local consumption is delivered at a constant flow rate, however the available storage in the pipeline between the terminal and the power plant - the so-called "line pack" - and any other gas storage that may be built, will allow its consumption to be concentrated in some hours of the day.

The terminal Angola LNG is designed for the liquefaction and export of about 6 Bcm of natural gas - about 5 times the volume of gas available in gaseous state. The liquefaction process is carried out by reducing the gas temperature to -162º C, which reduces occupied volume by about six hundred times. Current technology allows: i) either the transport in large LNG carriers to large-scale regasification terminals in distant countries; ii) or the transport in small LNG carriers to small / medium maritime terminals; iii) or even the shipping into small iso-containers or tanks transported by land, sea or rail to small storage and regasification units near the consumer.

Regarding the Angolan power sector, LNG can be used either to power a medium-sized LNG terminal, associated with new large power plants, or to fuel small storage and regasification units, associated with smaller turbines. The recent discoveries of natural gas "on-shore" in Cabinda make feasible the conversion of turbines in local power plants to natural gas. Recently, significant new discoveries of natural gas in blocks located south of Luanda have been announced. This gas, depending on the size and cost of extraction, may be able to use the existing infrastructure of subsea pipelines and enhance or extend the life of the terminal in Soyo, or may enable a new liquefaction plant south of Luanda, or even just be used for domestic consumption associated with large industry, petrochemical or generation projects.

Angola LNG project also produces LPG (Liquefied Petroleum Gas) issued from oil exploitation, which could replace charcoal and fuelwood in urban and semi-urban areas. According to UN Data, LPG production in Angola knew a spectacular increase in 2004-2006, most likely associated with IOC's efforts to reduce flaring and thus exploiting LPG, amounting up to 600.000 metric tons in 2012

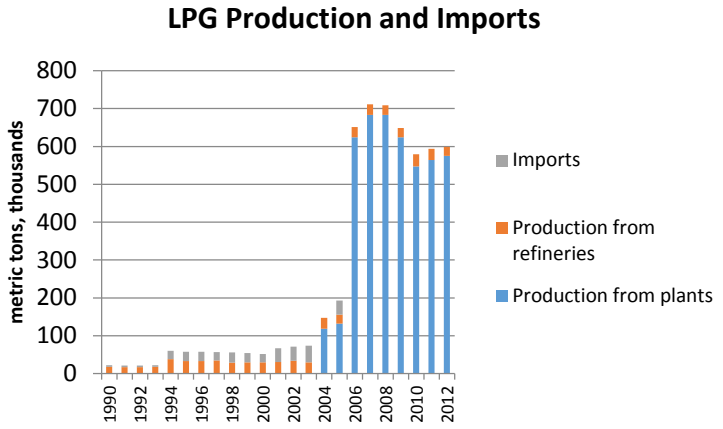


Figure 9 - Angola's LPG Production and Imports (Source: UN Data)

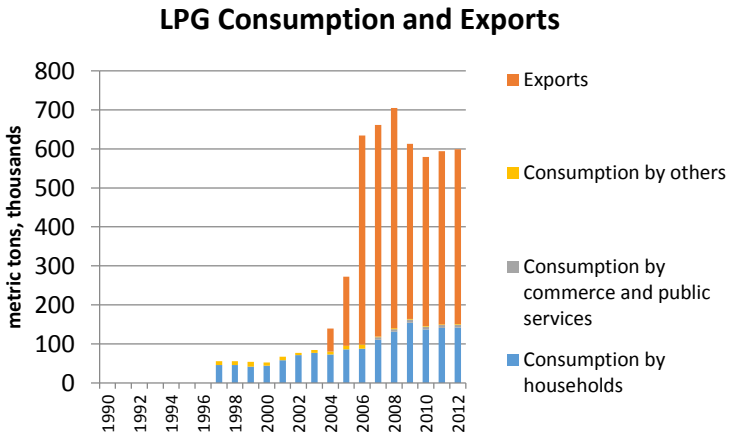


Figure 10 - Angola's LPG Consumption and Export (Source: UN Data)

As for the usage of LPG, a large majority of the LPG produced in Angola is exported (75%) with the main internal consumption being households (24%), mainly for thermal applications (cooking). The consumption of LPG by households has increased for the past 20 years, reaching a plateau of around 140.000 metric tons per year during the last 3 years. These 140.000 metric tons represent an average consumption of 5,8 kg of LPG per capita per year in Angola, a modest level when compared to the estimated amount by IEA in their Poverty Methodology (2011) based in World Health Organization data of 22 kg of LPG per capita per year.

1.2.1.2. 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.

Despite low generation costs associated with large hydropower plants and the benefits they represent to the future generations of the country, the best projects are concentrated in rivers with higher water flows and areas with more accentuated drops, which means a high territorial concentration of electric power generation, in particular in the Kwanza Basin and North System.

This concentration, along with the hydrological unpredictability and variability, implies building long transmission corridors with the associated losses, less energy quality in at the extremes of the lines and the need to maintain some thermal generation along the network in order to maintain its stability and ensure production in dryer years.

Also, Angola is faced with long construction deadlines for this type of dams and the need to find short and medium term solutions to meet the strong demand growth.

1.2.1.3. 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. Some statistics available from the UN Statistics Division Energy Statistics Database 2014, give some revealing trend with respect to fuelwood and charcoal.

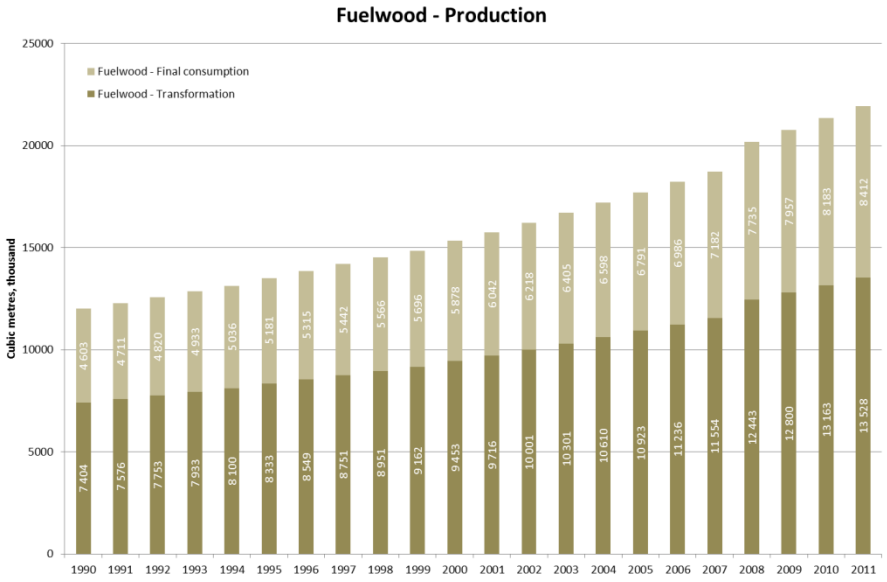


Figure 11 – Fuelwood production in Angola (Source: UN Statistics Division Energy Statistics Database, 2014)

As it can be seen from the figure above fuelwood production and hence consumption has been steadily increasing in the past few years, with final consumption of fuelwood for energy

purposes representing around 39% of the total. The great majority of fuelwood production (61%) is dedicated to transformation in charcoal plants.

According to the UN Statistics Division Energy Statistics Database (2014), charcoal production and consumption has been also steadily increasing with an average increase of almost 3% per year (in accordance with fuelwood trend dedicated to transformation), being exclusively dedicated to household consumption.

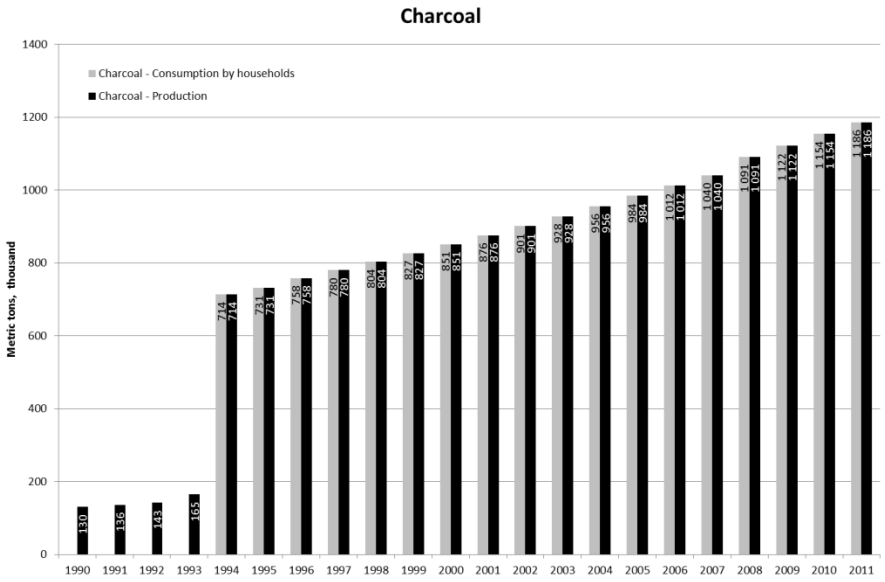


Figure 12 – Charcoal production and consumption in Angola (Source: UN Stat. Division Energy Database, 2014)

On a report issued from the Ministry of Agriculture on the National Strategy of Foresting and Reforesting in Angola in 2011, it is stated that vast forest areas of the country are subject to deforestation and desertification, either due to natural phenomena such as droughts or due to its exploitation (charcoal production, mining, etc.), uncontrolled burning due to traditional customs of agricultural and hunting. According to estimations in the Global Evaluation of World Forest Resources, Angola loses in average every year around 106 thousand hectares of natural forests and 370 hectares of plantations, on an annual rate of 0,2% and 0,5% respectively.

According to a study performed in 2007 by IDF/Angola, the provinces with the highest level of deforestation or degradation are Luanda, Huambo, Huila, Bié Benguela, Cunene and Cuanza Sul. Although the estimated deforestation rate of the country of 0,2% is rather low when compared to other countries in the region, the risks of degradations and loss of natural forests are considered real and in need of immediate action.

1.2.1.4. 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 BIOCOM project (based on sugar cane biomass) it does not have for the moment large renewable energy projects.

The following sections present an overview of the potential of each of the four identified renewable resources in Angola and their potential.

1.2.1.4.1. Solar Power

Angola has a high solar resource potential, with an annual average global horizontal radiation between 1.350 and 2.070 kWh/m2/year. Solar energy constitutes the largest and more uniformly distributed renewable resource of the country.

The most appropriate technology to harness the solar resource in Angola is the production of electricity through photovoltaic systems. This technology currently presents the fastest installation time (less than 1 year) and lowest maintenance costs. The use of batteries along with photovoltaic systems allows to totally replacing thermal generation, however this being a very costly solution its application only justifies from the economical point of view for decentralized small scale applications where the diesel transportation cost remains high. For other situations, the photovoltaic systems without batteries will reduce the use of diesel representing a complementary cost-effective solution to generators.

Medium and large scale projects in the Eastern System and in isolated systems - without batteries - present in Angola a levelized cost of electricity inferior to $0,2/kWh, representing therefore an economic alternative to diesel. In Central and Southern systems it is possible to reach costs under $0,15/kWh, and if in the beginning the projects are remunerated at the same cost as that of diesel avoided, the levelized cost drops down to less than $0,1/kWh after the 3rd year. Also, it is expected that the cost of this technology will continue to decrease.

The following map shows the Atlas of the solar resource in Angola as well as the various locations identified with a significant potential for installing multiple GW of solar photovoltaic projects. It also includes sites preliminarily selected for the installation of 78 MW connected to the main grid, both medium and large scale projects, to reach the established 100 MW target under the recently approved National Renewable Strategy. These sites were selected for their low levelized cost of energy and are mainly located in the center and south part of the country

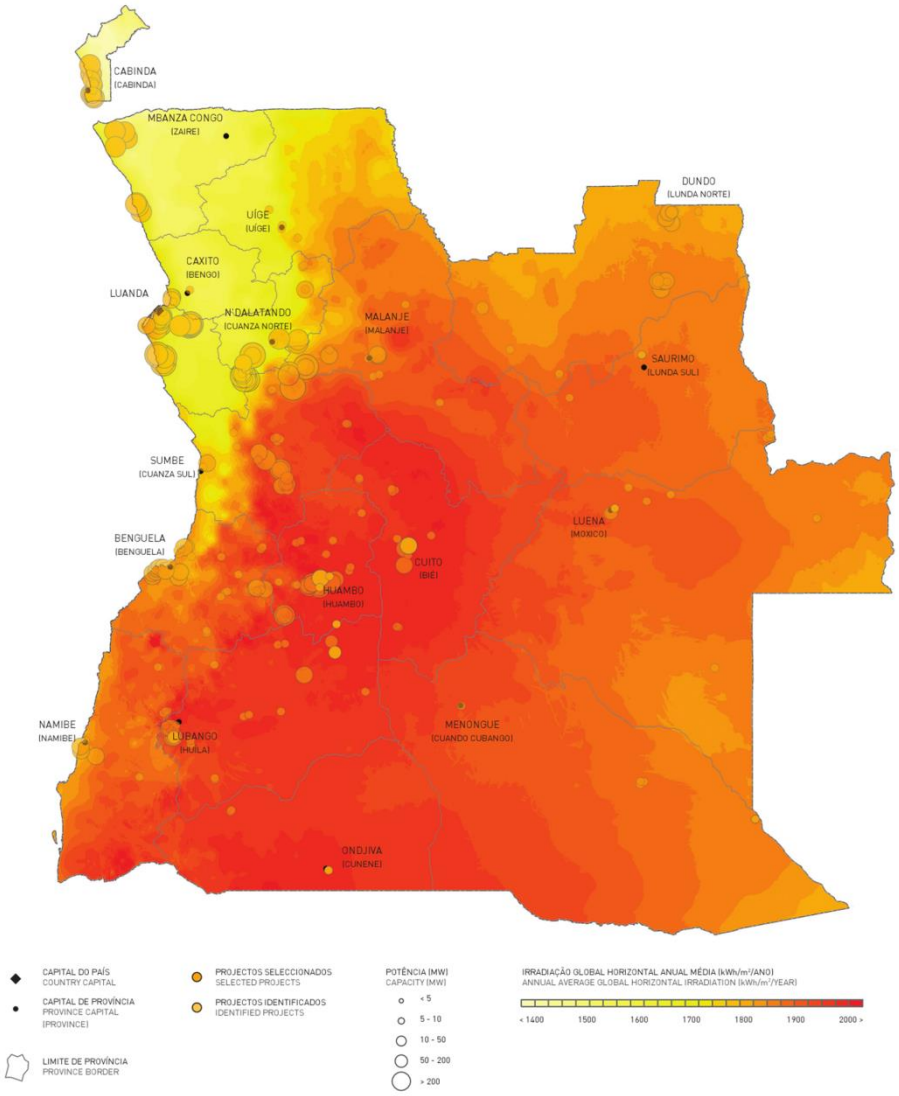


Figure 13 –Potential of identified PV projects (Source: Gesto)

The potential for rural electrification based on photovoltaic energy is important but much more expensive due to the need of including batteries. When considering local distribution networks, in some cases the re-sizing of the necessary storage (batteries) capacity by introducing diesel-based generation solutions – to face prolonged periods of poor solar irradiation – or other equivalent technological alternatives may be considered, depending on a cost-benefit analysis for each particular case.

In what concerns maintenance, Solar Systems present low maintenance costs when compared with other renewable energy solutions. It is important however that in isolated systems, its operators are properly trained to perform the necessary maintenance.

Other potential applications exist for the use of Solar Power in Angola, such as solar collectors for water heating for domestic , commercial and industrial use; Solar dryers to dry grain, fish and fruit, amongst other types of food; systems associated to water pumps for irrigation; building of residential, commercial or industrial buildings taking into account passive solar

energy in order to minimize consumption of thermal energy; Solar cookers as an alternative to fuelwood and charcoal in rural areas; Solar distillers to obtain drinkable water, etc.

1.2.1.4.2. Hydropower (up to 10 MW)

The Atlas of the Hydropower Resource demonstrates that, in addition to the high potential of the Kwanza, Queve, Catumbela and Cunene basins (representing 86% of the total estimated potential), other numerous rivers throughout the territory have adequate characteristics to hold projects of smaller dimension. Small hydro plants are the most economical alternative amongst the various renewable technologies studied; however, there is a significant variation between projects due to the specific characteristics of each site in terms of flow and fall.

A database of about 100 appropriate locations for small hydropower plants (SHPP), with a potential of 861 MW, is currently being constructed by MINEA. These SHPP can in some cases reach over 10 MW of power output. Other locations proposed by different investors to construct medium-sized hydro power plants supplement the SHPP locations database. The hydro power renewable atlas (figure below) suggests that there is potential for many more hydro projects in the country still to be identified and studied.

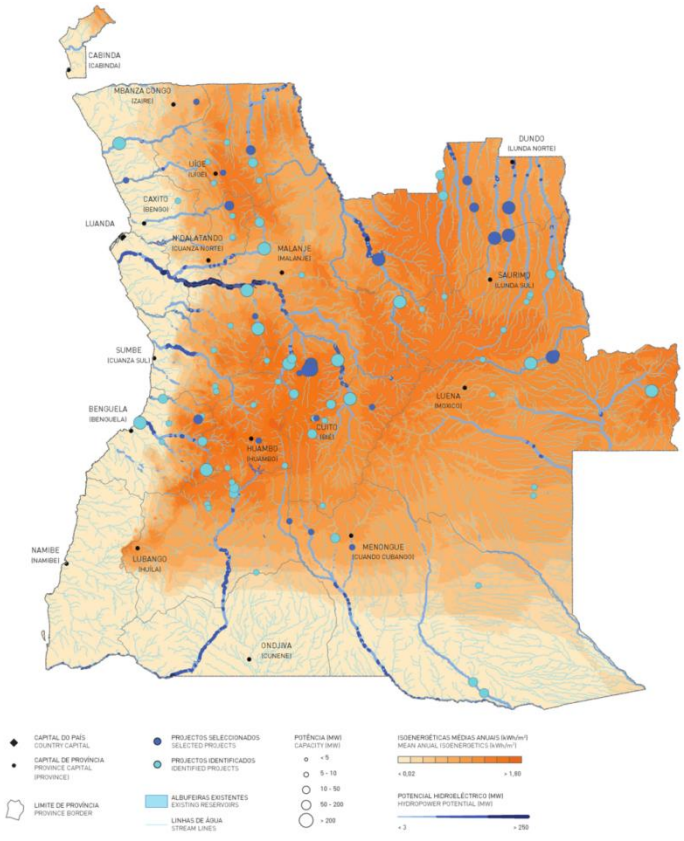


Figure 14 – Locations and Sizes of Mini-Hydropower Centrals (Source: Gesto)

Like the wind, hydropower is a highly localized resource, depending essentially on the water flow and existing or viable drop in each location.

1.2.1.4.3. Biomass

Biomass is defined as any biodegradable portion of products or residues issued from agriculture (including vegetable or animal substances), forestry and related industries as well as the biodegradable component of industrial and urban residues.

All of the vegetable biomass is formed during the photosynthesis process – absorption of CO2 from the atmosphere and H2O from the ground – producing carbon hydrates, which translates into solar energy being stored in the chemical connections of the biomass's structural components. The process of using biomass for energy production does not imply the release of additional CO2 molecules, since the carbon cycle is considered as being neutral and thus the resource considered as being renewable. Biomass is issued from a various numbers of by-products that can be used to produce energy. There are essentially four different types of residues from biomass, of which the two first harness the greatest potential:

- Forest residues and energy cultures;
- Residues from the agro-food industry (in particular sugar cane);
- Agricultural and Livestock residues;
- Urban and Industrial biodegradable residues;

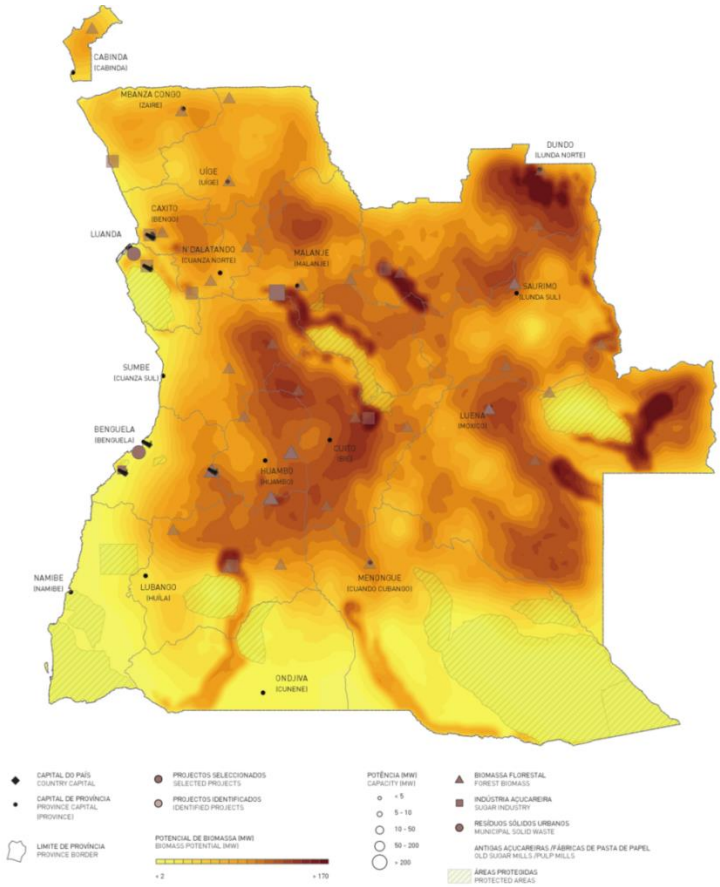


Figure 15 – Biomass projects potential (Source: Gesto)

Angola has an important electrical potential as the previous map illustrates, representing the combination of the electrical potential of forest residues issued from the exploitation of wood from natural forests and the potential associated to the sugar cane industry.

The central region (Huambo, Bié and Benguela) and the eastern region (Moxico, Lunda Sul and Lunda Norte) are areas more favorable in terms of resources (forest and agro-food industry), all provinces showing some potential with the exception of Namibe.

The potential of agricultural and livestock residues for the production of electricity is significantly inferior to that of forests and sugar cane. Concerning agriculture, the largest national resource is manioc, however this resource is highly dispersed in innumerous small scale family exploitations exclusively dedicated to feeding.

As for livestock, Cunene, Namibe and Huila hold the largest number of cattle, however rarely confined, which limits the potential and its exploitation. There could be nonetheless projects associated to the on-going investment in the agricultural sector.

Urban solid waste holds a relevant potential, in Angola concentrated in the largest urban areas such as Luanda and the Alto Catumbela axis – Benguela-Lobito. Two different kinds of possible valorization of urban solid waste exist: landfill with biogas production or waste incineration/combustion with or without physicochemical pre-treatment. The Strategic Plan for Urban Waste Management (PESGRU in its Portuguese acronym) for Angola anticipates an important increase in waste production and recommends its treatment.

1.2.1.4.4. Wind Power

The wind Atlas of Angola has allowed the identification of enough potential for electricity generation near the Atlantic scarp, along a north-south axis associated with higher altitudes, and in the southwestern region of the country, where the wind at a height of 80 meters above the ground reaches average speeds of more than 6 meters per second.

A total of 12 new locations with favorable conditions for the installation of up to 3,9 GW of power were identified.

Several of these sites are close to the main network and sub-stations, which have enough capacity to absorb this energy without technical restrictions or significant investments. The MINEA has an ongoing detailed mapping of the highest potential sites through measuring stations which have, in some cases, confirmed the identified potential. The levelized costs of wind generation may vary between $0,1 and $0,27/kWh, depending significantly on the confirmation of the potential of the resource and on the necessary network infrastructure to transport this energy.

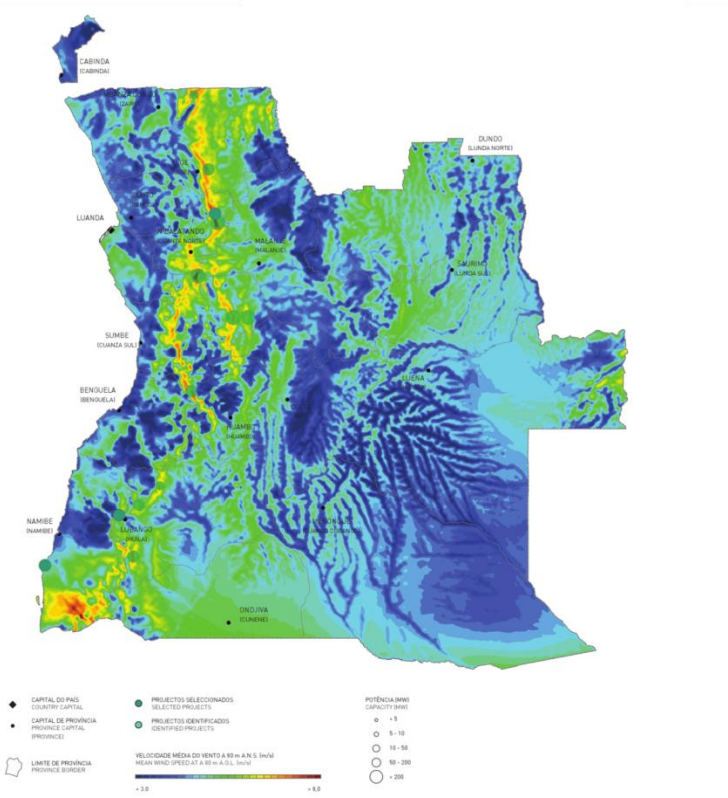


Figure 16- Possible Location and Potential of Wind Power Projects (Source: Gesto)

The latest data and studies indicate a greater benefit and viability in constructing several intermediate-size wind farms, in line with the transport capacity of existing or planned infrastructures.

The wind power resource is highly localized and depends not only on atmospheric phenomena but also on orography phenomena, surrounding rugged terrain or vegetation, amongst others.

1.2.2. Power Sector Overview

1.2.2.1. 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 30% 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.

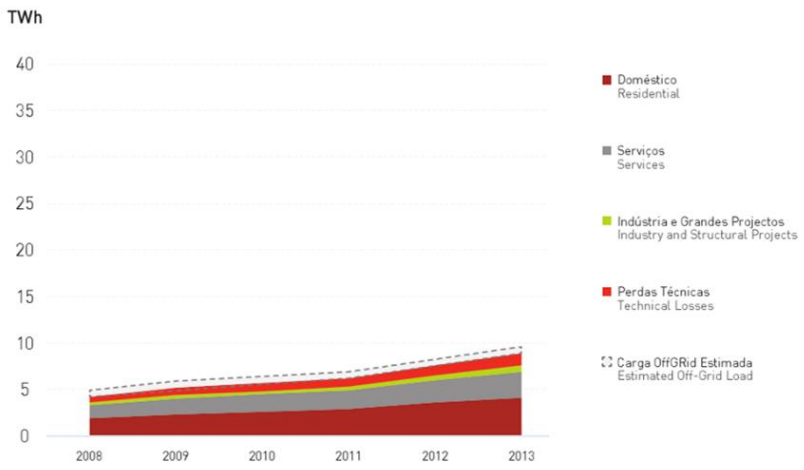


Figure 17 – Consumption per type of customer 2008-2013 (Source: Gesto)

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 auto-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.

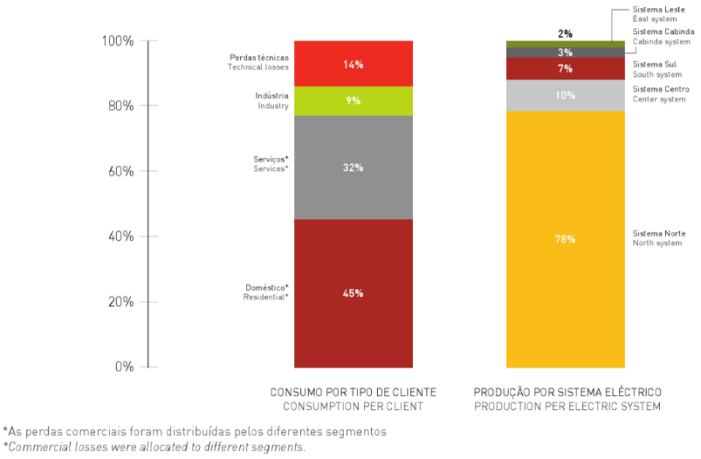


Figure 18 – Consumption per type of customer and electric system – 2014 (Source: Gesto)

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.

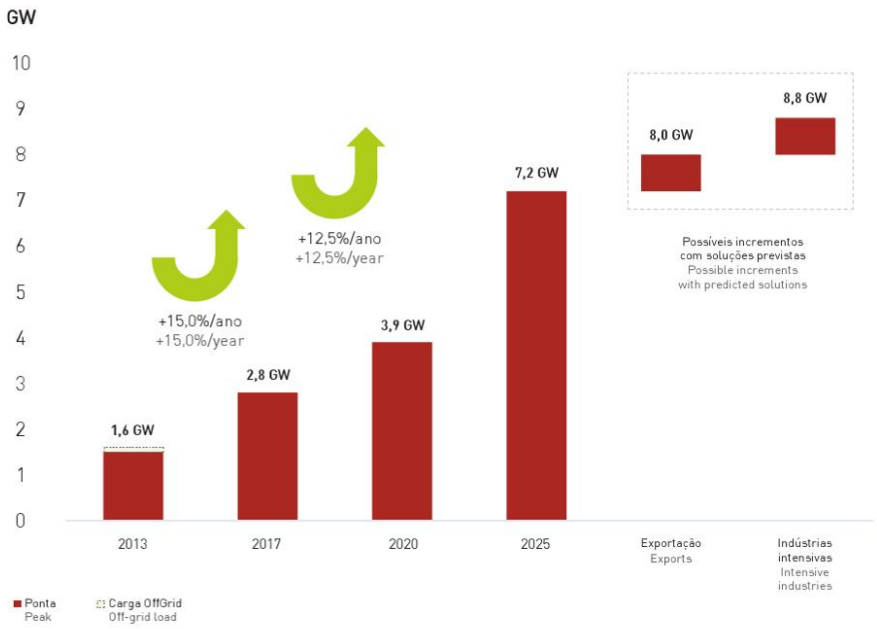


Figure 19 – Trend of the maximum energy load of the system until 2025 (Source: Gesto)

On power sector load, the possibility of additional energy-intensive industries is a real possibility, with a capacity up to 800 MW and the possibility of exports totaling a capacity of 800 MW towards the SADC market. The pace of electrification and industrialization of the country will require adjustments to the power sector investment calendar in order to adequately meet demand growth.

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%).

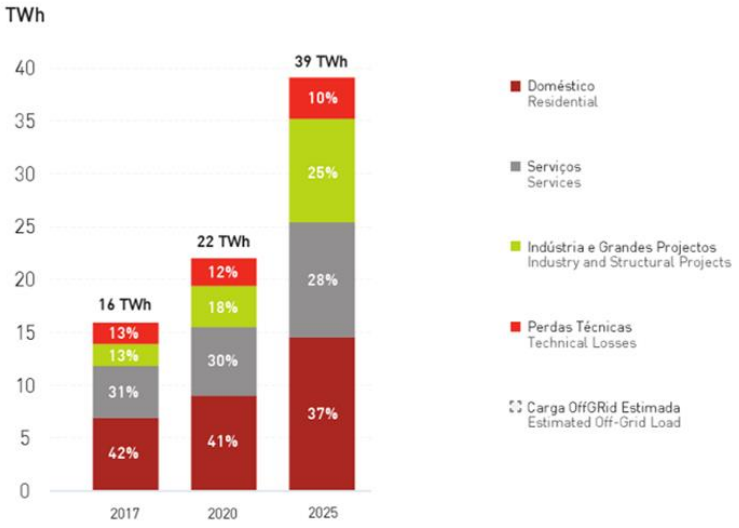


Figure 20 - Consumption per type of customer until 2025 (Source: Gesto)

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.

Table 1 – Infrastructures electrified with PV Systems (Source: DNER)

Infrastructure	1st Phase	2nd Phase	Total
Schools	10	23	33
Medical Posts	16	23	39
Administrative Buildings	10	29	39
Police Stations	3	7	10
Community Centres	-	7	7
Total	**39**	**89**	**128**
Public Solar Lighting	70	84	154

1.2.2.2. Electricity Transmission

Angola's electric network is constituted by 3 main independent systems: North, Central and South Systems. The province's capitals not covered by these systems are supplied by Isolated Systems.

The North System which supplies the city of Luanda and parts of the Bengo, Malange, Cuanza Norte, Cuanza Sul and Uige, represents around 80% of the whole of the electric power production of the country. A significant part of this energy supplies the city of Luanda itself, where most of the clients of the system are located. The following picture shows the main existing infrastructures in the beginning of 2014:

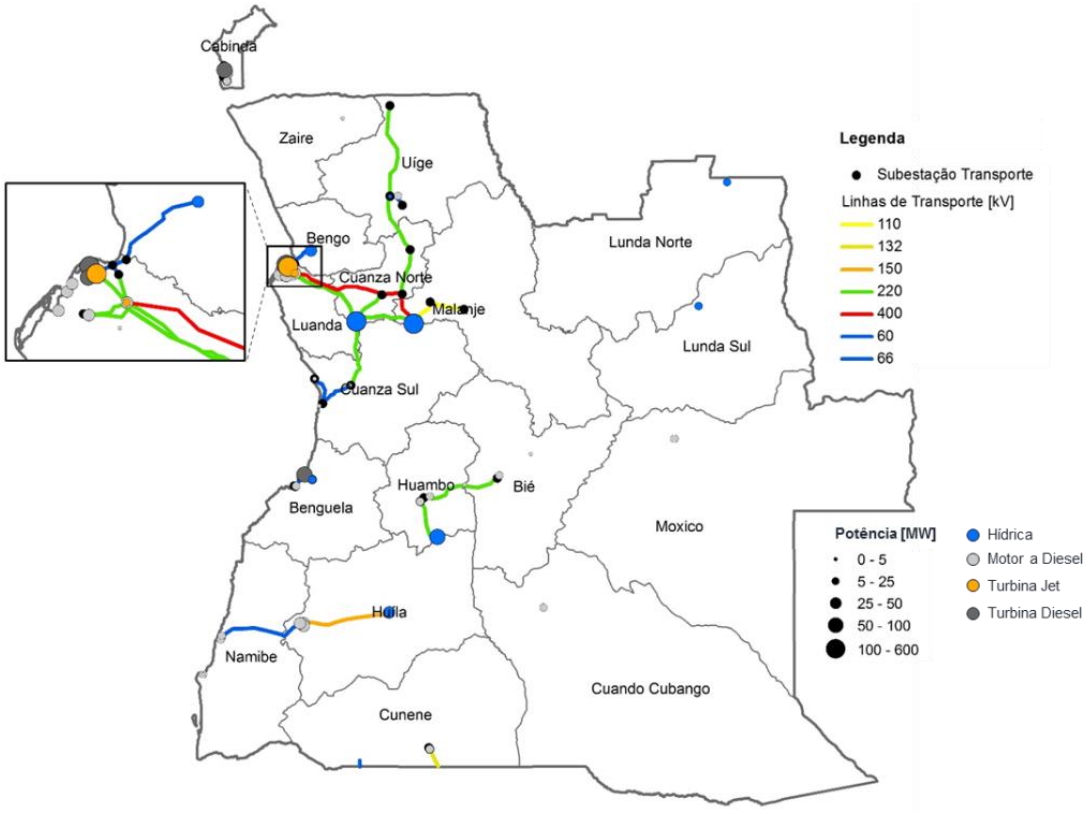


Figure 21 – Main infrastructures in the beginning of 2014 (Source: Gesto)

The 2013-2017 Action Plan foresees the interconnection and expansion of the 3 main systems and the creation of a fourth system in the eastern part of the country that will connect the provinces of Lunda Norte, Lunda Sul and Moxico.

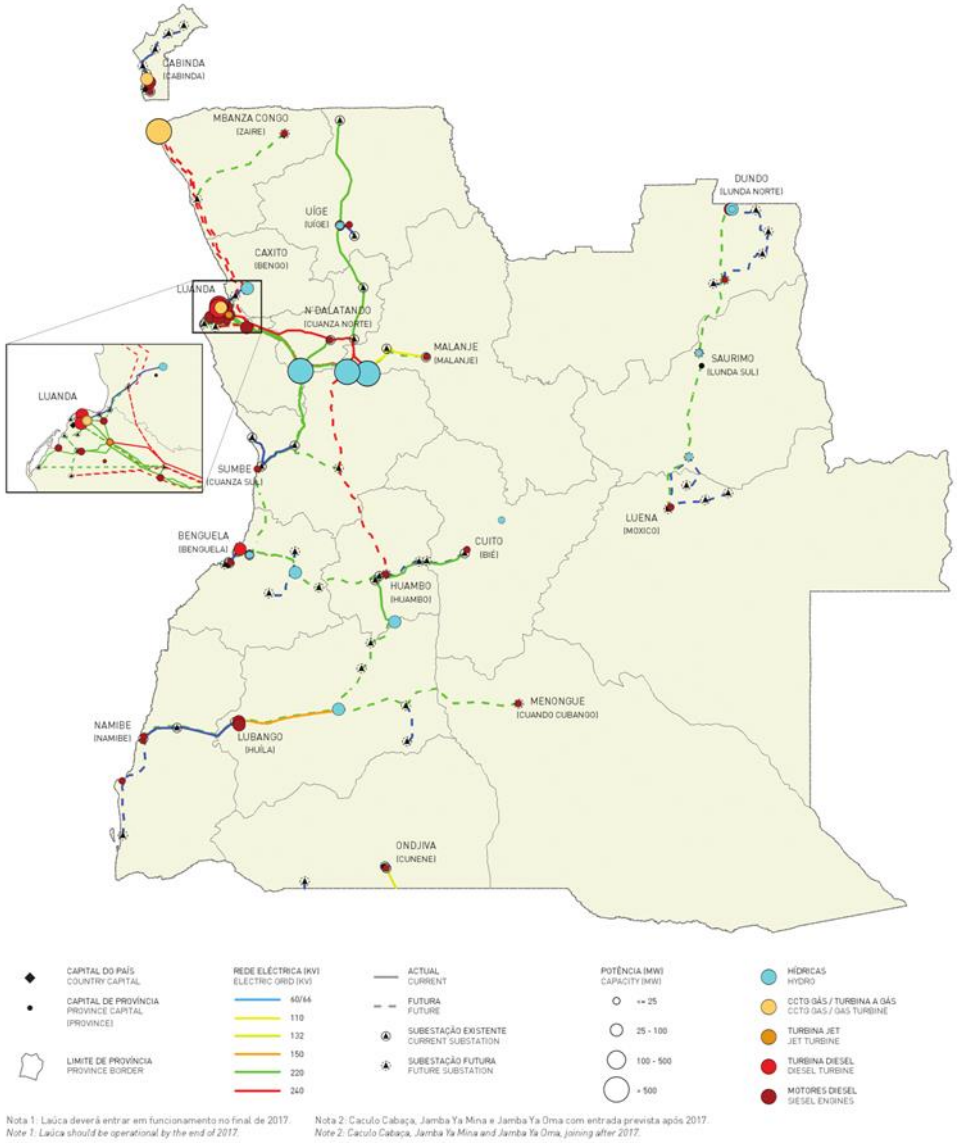


Figure 22 - Main infrastructures for power generation and transmission in 2017 (Source: Action Plan 2013-2017)

The main priority projects in the transmission and distribution side are the connection Lomaum-Biópio Sul, which will interconnect the Lomaum Hydropower Plant with Benguela; the transmission system associated to Gove; the expansion of the distribution network in Luanda, mainly to new residential areas, with the expansion of the Cazenga, Camama and Viana substations, the construction of the Filda, Boavista and Morro Bento substations and high-voltage lines; the construction of the substations dedicated to the 60/15 kV distribution system and the construction of distribution networks in medium and low voltage, including 600.000 domestic connections in the above mentioned areas. In the remaining provinces, the rehabilitation and expansion of the Cabinda, Huambo, Benguela, Cuito, Malange, M'Banza Congo, Lubango and Namibe are planned.

Also, the High Voltage system associated to the CCC Soyo 1 will be constituted by 2 lines connecting to Luanda from Soyo, a connection Nzeto-M'Banza Congo and the expansion of the high voltage system between Cacuaco and Catete. The High Voltage system associated to

Cambambe will allow the power flow from Cambambe to Luanda and Cuanza Sul. Also planned are the transmission systems associated to Laúca and Caculo Cabaça.

The interconnection Centre-South will be done through a transmission line between Gove and Matala that will extend into Namibe-Tombwa. The eastern system will be constituted by a series of lines and substations that will interconnect the Lundas Provinces with Moxico.

1.2.2.3. 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.

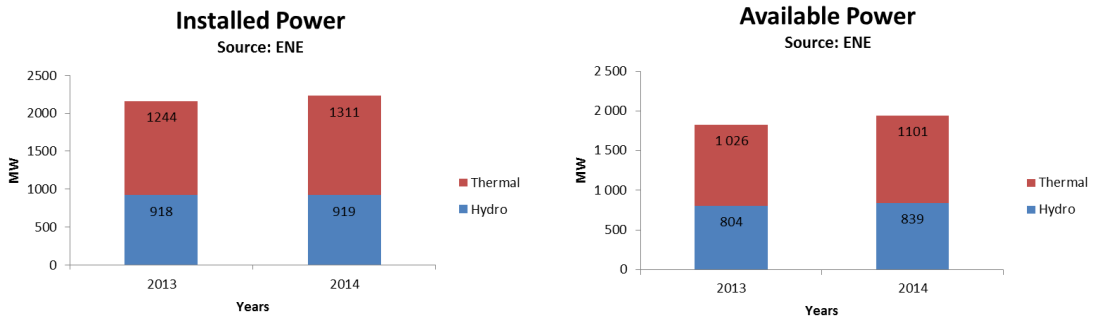


Figure 23 – Installed and Available Power in Angola per type – 2013 and 2014[1] (Source: ENE)

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

As it can be seen from the following figures, the great majority of the installed and available power is concentrated in the North System which supplies the city of Luanda, the major electricity consumption hub in the country. Also, in this system, due to the presence of the Kwanza Basin, the majority of the installed and available power originates from hydro source, unlike the other systems that are mainly based in diesel thermal generation.

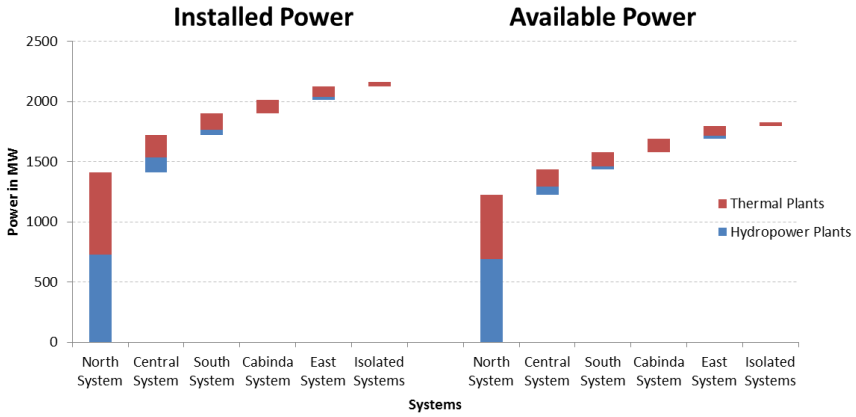


Figure 24 - Installed and Available Power per System, 2013 data (Source: ENE)

[1] 2014 data based on real and forecast data

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.

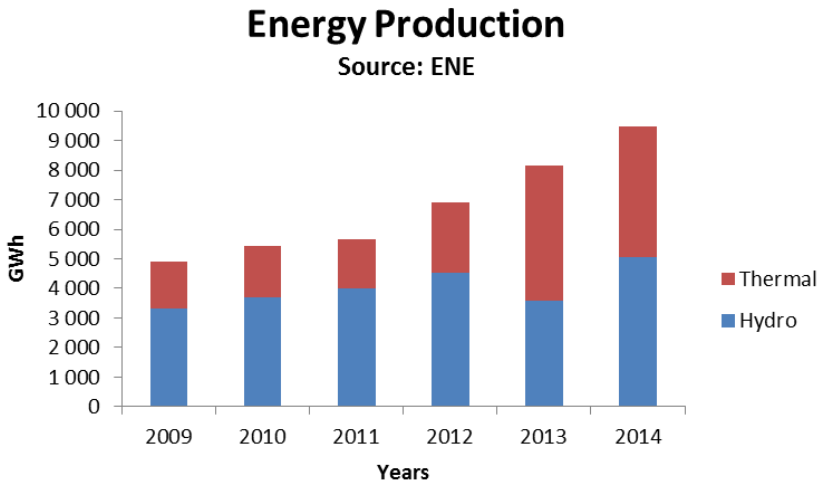


Figure 25 – Energy Production in Angola 2009 – 2014 (Source: ENE)

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

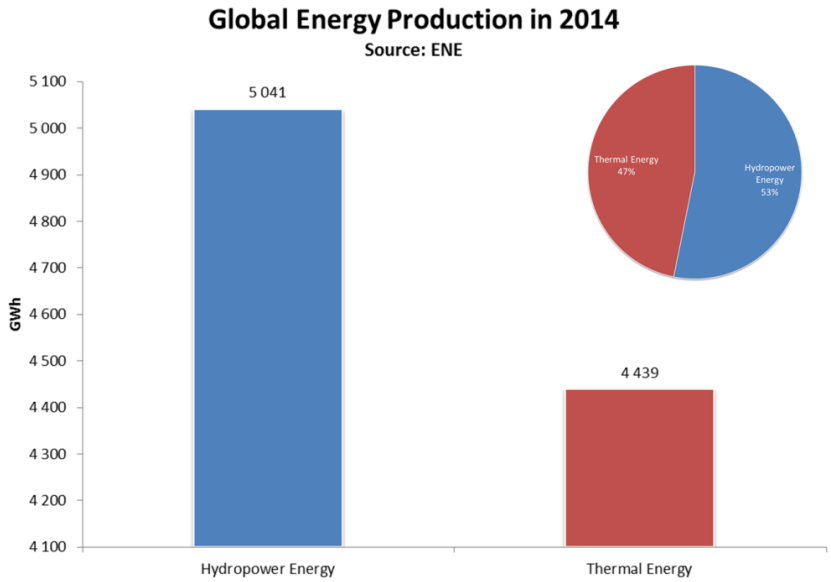


Figure 26 – Energy Production in Angola for 2014[Error! Bookmark not defined.] **(Source: ENE)**

1.2.3. Energy and economic development

1.2.3.1. Oil Rent & Subsidies

Oil rents are, according to the World Bank, the difference between the value of crude oil production at world prices and total costs of production. Oil rent has always represented a significant share of Angola's GDP, decreasing slightly in the past few years as the economy slowly diversifies. In 2013, Oil Rent represented around 46 billion USD.

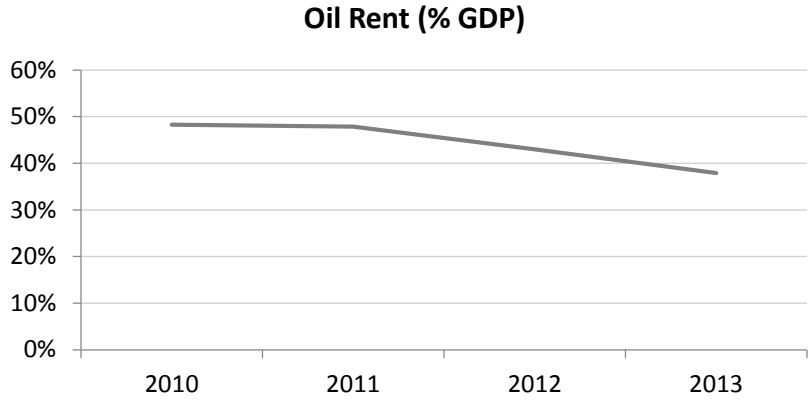


Figure 27 – Angola's Oil rent as % of GDP (Source: World Bank)

At the end of 2014 the IMF performed a study about the fuel price subsidy reform in Angola. According to the IMF, fuel subsidies in 2014, before the recent fuel price increase, represented 3,7% of GDP, including fuel subsidies for electricity generation (which accounts for 1,3% of GDP alone). These subsidies are considered to be inefficient and inequitable having at the same time an important impact in Angola's budget.

Again, before the recent fuel price increase, the average gap between domestic and international fuel prices in Angola was estimated at a staggering 146%, with major variations according to the type of fuel.

The recent fuel price increase determined by Presidential Decree 235/15 of the 30th of April increased prices significantly, with diesel increasing 25%, kerosene 29% and LPG 22%. Gasoline, for which subsidies were completely eliminated, had its price liberalized, with a maximum price increase allowed of 27%.

The following figure illustrates real price decomposition for each type of fuel and applied subsidy and current retail price. LPG has the strongest subvention proportion (67%) with a final retail price of 55 AKZ/kg, followed by Kerosene (44% of subvention) with a final retail price of 45 AKZ/liter and Diesel (21% of subvention) with a final retail price set at 75 AKZ/liter. Gasoline retail price was established at 115 AKZ/liter (the maximum increase allowed according to the Presidential Decree), compared to the previous retail price of 90 AKZ/liter.

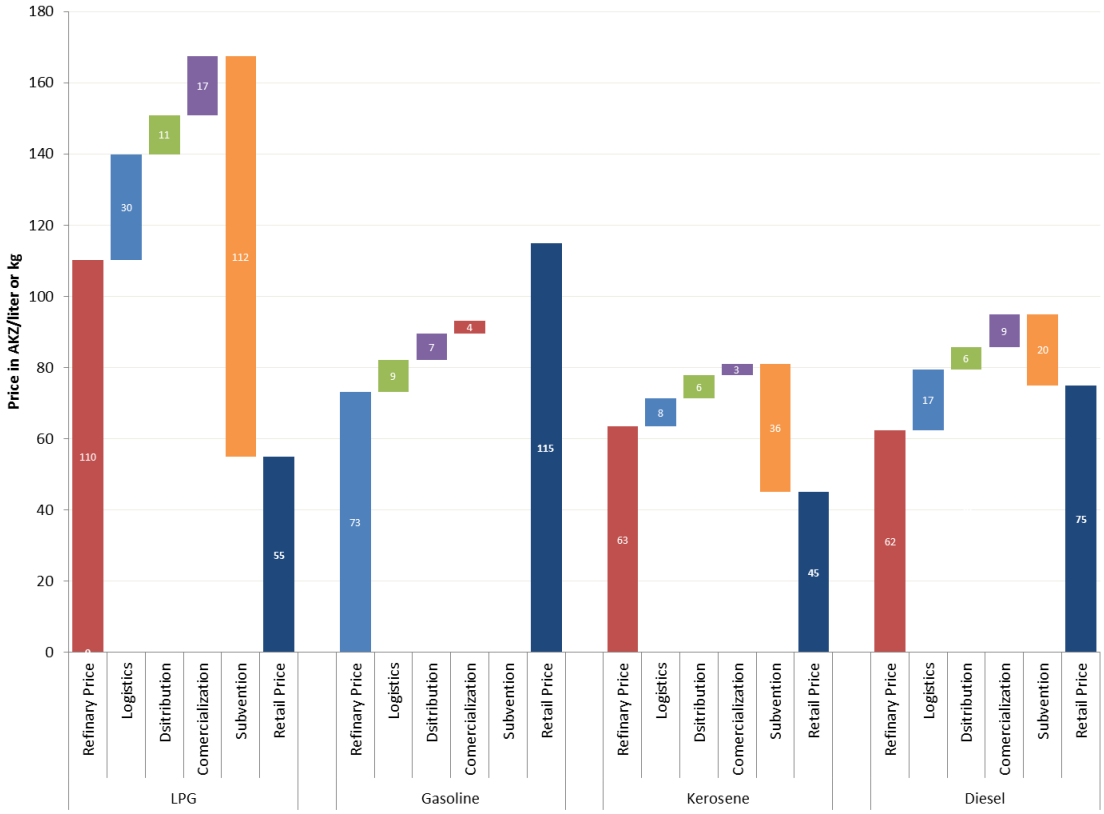


Figure 28 – Angola Fuel Price Decomposition after price increase in 2015 (Source: MINFIN, Angola)

LPG in Kwanzas per kg, others in Kwanzas per liter (1 USD = 125 Kwanzas)

According to the IMF report, Industry represents the largest share in fuel consumption with 47%, followed by Household consumption (32%) and Government (21%).

Also according to this study, 80% of the fuel consumption is done by the richest 40% of households whereas 7% of fuel consumption is only done by the poorest 40% households. Due to this higher proportion of fuel consumption by well-off households, fuel subsidies tend to be unequal and benefit to those who need the least, thus being an" inefficient and costly way of protecting the poor". Despite this inequality, it is expected that subsidy decrease of fuel products will still impact the poor severely.

1.2.3.2. Energy and Industrialization

Concerning industrial development, the strong commitment of the long-term Angola 2025 strategy in the country's industrialization is achieved not only by the 2013-2017 National Development Plan, which establishes a set of priority "structural" projects, but also by the recent sectorial planning instruments, in particular the New Plan for the country's Industrialization and the Tourism Master Plan. This commitment is further enhanced by the Diversification Acceleration Program, which aims to diversify the country's sources of wealth.

The historical weight that industry plays in the total electricity generation - around 8% - is the lowest among the major countries of the SADC.

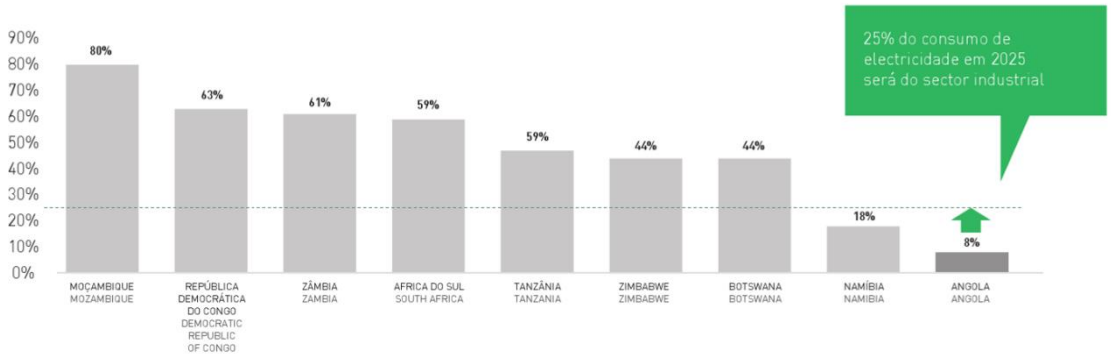


Figure 29 – Weight of the industry's energy consumption on the total energy production of SADC's countries (Source: IEA, 2009)

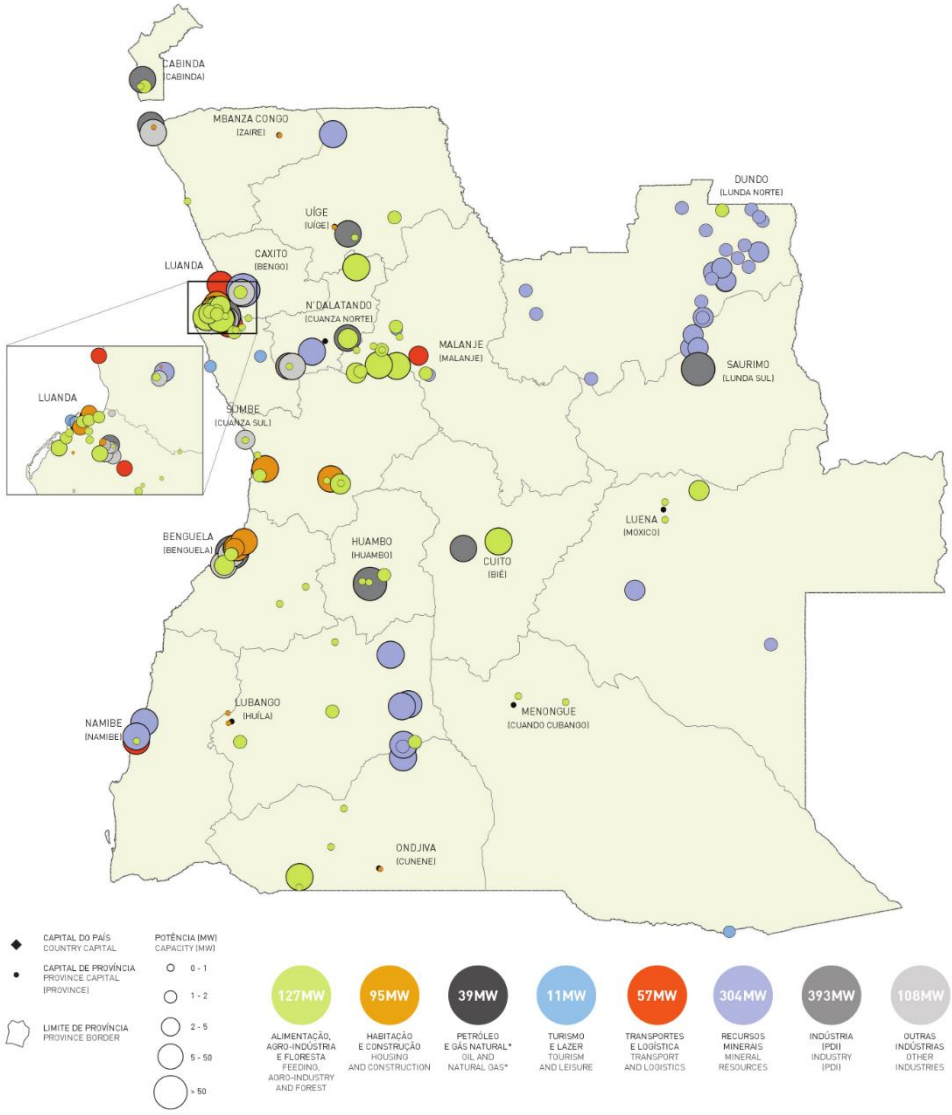


Figure 30 – Location and estimative of the priority clusters' consumption by 2025 (Source: Gesto)

The strong outlook for the industrial sector's growth is supported by the existence of a wide range of more than 160 specific "structural" and priority projects, in different stages of development. These projects are grouped in different clusters whose energy needs and estimated future growth supports the estimated 25% target for energy consumption from the

industrial sector. The Industrial Development Hubs (PDI) and the mining activities - especially iron exploration – are the main growth drivers, immediately followed by the agro-industry cluster, the construction sector (with a strong weight of the cement industry) and other industries.

Industrialization will be one of the major drivers of energy consumption and power availability and reliability will be a key input to the growth and success of Angola's industrialization effort.

1.2.3.3. Energy/Power intensity

As outlined in 1.2.2.1 the residential and services sectors are the largest sectors in terms of power consumption (respectively 42% and 31% of total power generation). The services sectors represent around 50% of Angolan GDP and will continue to be a key driver of energy consumption growth. The residential sector power consumption is mainly urban happening mostly in the large populated cities of Angola, mainly Luanda.

Power sector final consumption GDP intensity (kWh per unit of GDP) has increased in the past years and it is expected to continue growing until 2025 mostly because of the strong effort to increase the electrification rate, improvement in living conditions and the industrialization effort.

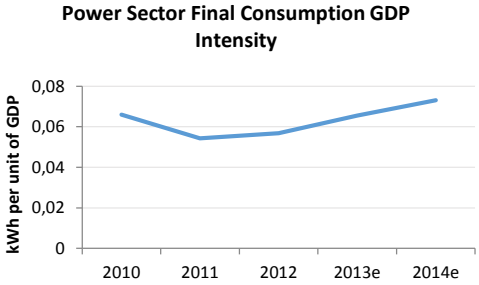


Figure 31 – Power Sector Final Consumption GDP Intensity (Source: Gesto)

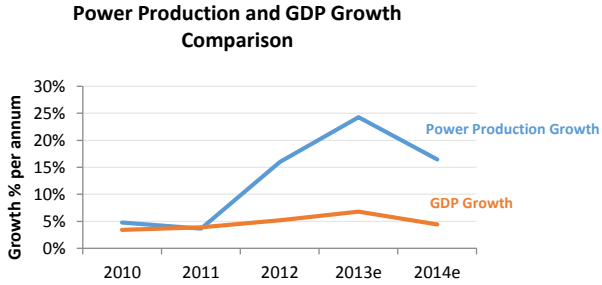


Figure 32 – Power Production and GDP Growth Comparison (Source: Gesto)

Also, the figure above illustrates this clearly, as electricity production rate has significantly increased faster (15,5% average per annum) when compared to GDP growth rate.

Access to electricity and other sources of energy (e.g. LPG) is a significant driver of human and economic development. As outlined in 1.2.2.1 access to power is still very low and therefore significant growth potential still remains.

1.2.3.4. Power Sector Economy

Between 2010 and 2013, consolidated revenues (which correspond to the sum of sales and services of EDEL and ENE, excluding subsidies and internal sales between the companies)

increased from 14 billion kwanzas to 26 billion kwanzas in 2013, as displayed in the following figure. As a percentage of GDP, power sector revenues represent only 0,2% of total GDP, although it has been increasing in the past few years:

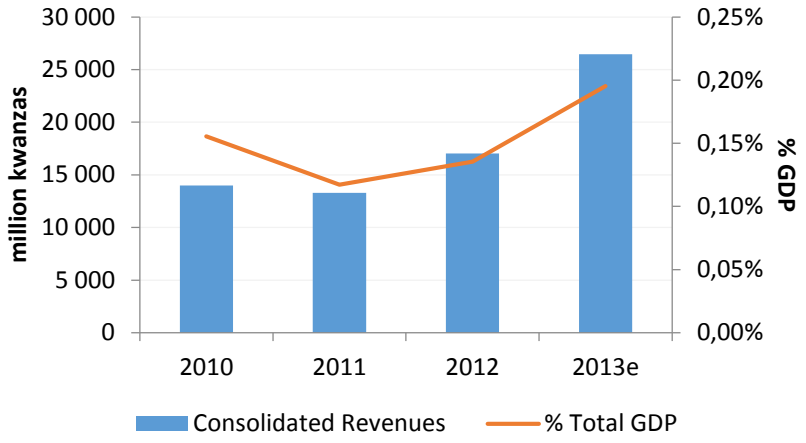


Figure 33 – Evolution of consolidated revenues in the power sector (Source: ENE, EDEL, GAMEK, BFA; 1 USD = 125 Kwanzas)

This increase in revenue can be explained by the increase in production but also due to improvements in AT&C losses. Still, power sector revenues remain low and below cost.

Electricity tariffs have not been updated since 2006 covering only 20% of the generation costs, which represents a substantial and real devaluation (given the cumulated inflation during the period of over 140%). The average rate per unit of energy is of around 3,4 AKZ/KWh today.

If we compare these rates with other countries and in particular from Africa, Angola still has the lowest rates in absolute terms, as demonstrated bellow:

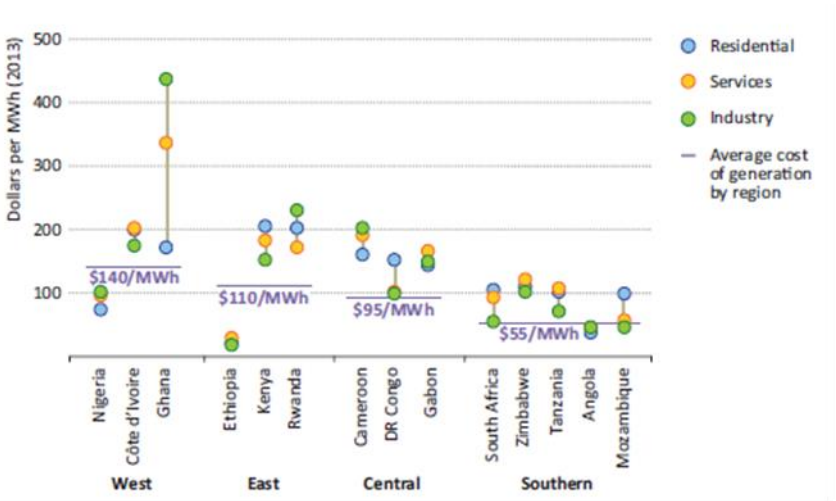


Figure 34 – Electricity tariffs per type of consumer – comparison of selected countries (Source: IEA 2013)

In addition, Angola still registers a high level of AT&C losses, reaching a level of around 43%, when compared to international benchmarks which put the average levels according to the region between 8% and 18% (source Africa Energy Outlook 2014).

Finally, the power sector investment plan of $18billion as set out in the 2013-2017 MINEA Action plan by itself constitutes a major economic development driver. Although the economic impact differs between generation, transmission and distribution, it remains highly relevant.

Power generation investments economic impact

Most of the investment of the Action Plan is in generation ($8,2b) – in particular hydro.

At generation level, the construction of plants, in particular hydropower, implies the mobilization of hundreds of jobs for several years with very positive impact in terms of the direct and indirect employment generated. The hydropower plants with regularization - like Laúca and Cafula - are the ones that bring greater contribution to the territory because in addition to the job creation, they act as strategic water reserves with potential for human consumption, agriculture, tourism and firefighting.

The construction involves, in many cases, the construction of site access infrastructures that will benefit the region and the plant is also a starting point for the electrification of the surrounding territory. Other renewables, by focusing on smaller projects, allow a greater dispersion of investment and benefits along the territory.

Private sector involvement in generation

Several generation projects have been developed through private sector participation in the past:

- Mabubas hydro power plant rehabilitation – 26 MW
- Hidrochicapa hydro power plant – 16 MW
- Lomaum hydro power plant rehabilitation – 50 MW
- Biocom – biomass power plant – 40 MW available power for the grid.
- Bom Jesus cement factory has an installed power capacity of 145 MW with some excess capacity to sell to the power grid
- Several diesel based rental generation units are currently operating in Luanda and Benguela.

Two years ago a public tender for 7 mini-hydro locations was launched and contract negotiations with IRSE have recently been concluded. Also, a large hydro-thermal project in the Benguela, Huambo and Bié provinces has been approved by the President in 2015.

Angola has a Public Private Partnership law in place and has recently changed its general electricity law to facilitate private sector involvement.

Transmission investment economic impact

Regarding transmission, where $5,9b investment is planned under the 2013-2017 Action plan, the impact on the territory is mainly caused by the construction of transmission lines and substations. The impact of the construction of these lines in the territory is limited to some benefits in access and roads since the construction has no stable presence in one place. Also close-by populations cannot benefit from the energy at very high voltage.

Distribution investments economic impact

Distribution can only be developed once the generation and transmission infra-structures are in place. Dispite the lower level of investment in the period 2013-2017 ($3,7b), the economic impact from Distribution is very significant. The existence of electrical grid is, by itself, a source of development. The inhabitants of an electrified village have access to basic services important for their well-being and human development: lighting, communication and access to information, food cooking and storage, among others. Additionally, the existence of electricity will increase the productivity of traditional tasks and foster the emergence of small industries and productive uses with benefits in trade between villages.

The operation and maintenance of a distribution network, a small network based on renewable energy or an isolated system, can also create jobs. However, more important than the employment generated is the ability to maintain these facilities in operation, essential for the development of the benefited regions.

1.2.3.5. Energy and Innovation

MINEA has a Training Center for power sector employees, the Hoji-ya-Henda training center. In 2006, MINEA launched the “CASOL – Casa Laboratório” (House-Lab) project where a 2,7 kW stand-alone PV system was installed and tested.

Figure 35 – CASOL project in Hoji-ya-Henda training center

More recently the Universidade Metodista de Angola inaugurated an experimental center for Renewable Technology and Energy (CETER) where biodiesel and small scale wind and solar are being tested. Also, the Universidade Agostinho Neto, through its Engineering Faculty, has been cooperating with MINEA and organizing conferences on renewable energy.

No significant additional Research & Development activities on energy are known.

Section 2: Current situation and Gaps with regard to SE4ALL goals

2.1. The ECCAS White Paper and the overall and regional SE4ALL goals

The Sustainable Energy 4 All has established the following goals for the 2030 horizon: (1) ensuring universal access to modern energy services; (2) doubling the rate of improvements in energy efficiency; and (3) doubling the share of renewable energy in the global energy mix.

The Ministers of Energy of the ECCAS (Economic Community of Central African States) have approved on the 18th of October 2014 the White Paper for a Regional policy for universal access to modern energy services and economic and social development (2014-2030). The White Paper was later formally adopted by Heads of State in the ECCAS N'Djamena conference under decision nº 52/CEEA/CCEG/15.

The White Paper sets out clear objectives until 2030 in line with the SE4ALL goals.

On universal access and quality of service the White Book sets the following targets:

- To multiply by 3 the penetration of non solid fuels (notably GPL) in urban areas and by 4 in rural areas, with the more advanced contries – Angola and Gabon – to target universal access to LPG by 2025;
- To increase electrification rate to 54% by 2030 and 63% by 2040, with more advanced countries such as Gabon and Cameroon to target universal access before 2030;
- To reduce kerosene to residual utilization in rural areas by 2030, through substitution with renewable energy technologies;
- To have blackouts only in residual situations before 2020.

On energy efficiency the White Book sets the following targets:

- Reduce to a third the level of energy losses;
- Increase efficiency in public buildings by 25% and in new buildings/houses by 50% until 2030;
- Progressive phase out of inefficient equipments, with incandescent lamps to be prohibited before 2020;
- To have all urban households and 90% of rural households using biomass for domestic uses with efficient cook-stoves (with at least 40% improvement regarding traditional ones);
- To increase efficiency in charcoal production to 35%.

On renewable energy the White Book sets the following targets:

- To have almost all biomass for energy coming from sustainable sources by 2030;
- To have more than 95% of the additional power capacity until 2030 coming from renewable energies (hydro, biomass and other renewables)

The following chapters address the gaps of current Angola situation vis-à-vis the different SE4ALL goals.

2.2. Electricity Access vis-à-vis goal of SE4ALL

The Power Sector current situation shows relevant gaps across key dimensions of access:

Availability: Given the large size of the country and the lack of adequate infra-structures for generation, transmission and distribution only around 30% of the population currently have access to electricity. Most of the people with access to electricity are located in the 18 Provincial capitals of the country with 70% being in the city of Luanda. Health and education infra-structures outside of Provincial Capitals still have limited access to energy services.

Reliability: Generation and Distribution infra-structure have not adequately accompanied the strong growth in electricity consumption - mostly concentrated in the city of Luanda where the infra-structure is better developed and where major services, public sector and wealthier consumers are located. This results in frequent blackouts and many customers - domestic, service or industrial - having diesel based backup generators on their backyards.

Affordability: Although Angola has one of the lowest prices for electricity in the entire Sub-Saharan region and in the world (which have not been changed since 2006) the price for available and reliable power coming from diesel generators has increased significantly in the last months due to political decision to increase diesel price from 40 to 75 kwanzas per litre.

Sustainability: The electricity tariffs currently cover less than 20% of the electricity costs. The high dependence on diesel for power generation implies very high generation costs which result in a deficit situation for the recently unbundled power sector utilities. Additionally, energy losses are above 40% with many clients without working electricity meters. This unsustainable situation makes Access growth highly dependent on State Budget coming mostly from oil revenue and undermines the already scarce private sector involvement.

2.3. Access to modern energy for thermal applications vis-à-vis goal of SE4ALL

Access to modern energy for thermal applications show also relevant gaps across key dimensions of access, in particular, considering the target set in the ECCAS White Paper for Angola to have universal access to LPG by 2025:

Availability/Reliability: Access to LPG supply is mostly limited to urban areas in the country with the more in-land municipalities having occasional reliability issues in supply. In peri-urban and rural areas LPG presence is limited and efficient cookstoves are normally not available. People tend to use charcoal in the peri-urban areas and fire-wood in the rural areas. Limited initiatives on the promotion of efficient cookstoves have been taken in Angola. According to the IEA, program were launched in the 1980's and beginning of the 1990's to manufacture efficient cookstoves in the Luanda region but were terminated due to the ongoing conflict. Another program took place in 2003 between UN FAO and Angola's Institute of Forestry development which aimed at improving charcoal production and charcoal stoves, including the distribution of new type of cookstoves.

Also, a comprehensive and detailed database on fuelwood and charcoal use that would allow a clear view on the geographic distribution of this resource and its impacts does not exist to this date.

Affordability: LPG price is regulated by the Government with a significant level of subsidy making LPG an economically attractive alternative. However, regulated prices limit the economic incentives of private distributors to take LPG outside of main urban areas. Firewood, although affordable, requires extensive traveling due to deforestation. This activity is normally undertaken by women, limiting available time and gender equality.

Sustainability: Current energy use for cooking in Angola is highly dependent on traditional biomass sources resulting in significant levels of deforestation around major urban areas in the country. The high dependence of LPG on subsidies and the price regulation undermine also long term supply sustainability. The lack of training and adequate support services in rural areas as well as the low involvement of women in determining household cooking habits and technical needs in what relates to cooking stoves have proven to be crucial factors contributing to the failure in shifting into more sustainable and modern thermal energy applications.

2.4. Access to energy for productive uses vis-à-vis goal of SE4ALL

Access to modern energy for productive use shows the following main gaps:

Availability: Additionally to the Power Sector, privately own diesel generators are the main source of energy for productive uses in the country. Diesel is widely available in urban areas but with limited access in rural areas. LPG distribution in Angola is only based on Butane – Propane not being available. There are currently no distribution infra-structures for natural gas or liquefied natural gas. Heavy fuel oil which is the key export product from Angola refinery is also not available for internal use.

Reliability: Diesel distribution is quite reliable across the country although diesel quality is undermined by the old distribution infra-structure.

Affordability: Diesel has been very affordable in the past due to regulated price with significant level of subsidy. Since end of last year the Government has increased 3 times the price of diesel (from 40 to 75 kwanzas per litre) which has had a significant impact on economic activities highly dependent on diesel.

Sustainability: The current policy focused on diesel as the solution for majority of productive uses turns consumers highly dependent on subsidies – which has proven recently not to be sustainable, in particular considering lack of refining capacity in the country and need to import diesel. Also, on the environmental side, natural gas and LPG (Propane) constitute cheaper sources of energy for productive uses with more benign impacts on the environment.

2.5. Energy Efficiency vis-à-vis goal of SE4ALL

Energy efficiency is normally associated with reduction in energy intensity through the decoupling between energy use and GDP. Sub-Saharan Africa is normally characterized by a high level of energy intensity (energy per unit of GDP output) mostly because of the weight of mining and other energy intensive industries (eg. Aluminium smelting in Mozambique) in total energy consumption, in particular in South Africa. The recent growth of the services sector has resulted in a reduction of energy intensity in sub-Saharan Africa as a whole.

Angola's energy situation is quite different than the rest of Sub-saharan Africa with historical consumption growth mostly led by the residential and services sectors and with Angola looking to reindustrialize the nation and develop energy intensive industries. Also, being Angola the second largest oil producer in the region, with a strong budget allocation to power sector infrastructure, the dynamics of consumption growth tend to be different from other developing nations. For example, power sector final consumption GDP intensity (kWh per unit of GDP) has increased in the past years. It is expected to continue growing until 2025 mostly because of the strong effort to increase electrification rate from 30% to 60%, the improvement in living conditions and the industrialization effort taking place.

Although historical performance may reveal a significant gap towards the goal of improving energy efficiency and even doubling its results, we argue that energy efficiency effort in the case of Angola has to be measured bottom up and not top down. Even if Angola had a significantly stronger commitment to energy efficiency, energy intensity would still grow. However, it would not grow as much. The ECCAS White Paper approved several bottom up objectives for energy efficiency in the region such as the reduction of energy losses to one third of current situation, the reduction of consumption in public sector buildings by 25% and 50% in new constructions, the phasing out of incandescent lamps, the widespread use of improved cookstoves and increasing the efficiency on charcoal production to 35%.

The increase in national wealth will result in families using their income to improve comfort, which will increase residential energy consumption. Also, the increase in families' income will in turn enhance the provision of services, namely those related with leisure and tourism. For example, the investment in the provision of touristic services for the national market will lead to an increase in international tourism coming to Angola.

Regarding the forecast of energy demand, a direct correlation between the increase of the national wealth (GDP) and the increase of energy consumption is observed. Given the expected continued growth of national income, a strong pressure for increasing available generation is expected in order to meet the energy demand.

Although a lot remains to be achieved in what concerns energy efficiency in Angola, some actions that have been launched in the past or are currently on-going will have a positive contribution in achieving the energy efficiency goal:

- The Energy Savings Plan, launched by EDEL in 2009, aimed at promoting the use of energy-efficiently light-bulbs through the organization of workshops and a campaign of

replacement of light-bulbs (providing energy-efficient light-bulbs for free), first aimed at public institutions and on a second phase at private clients

- The "Aldeia Solar" (Solar Village) program, which installed (and will continue installing) solar panels in rural areas not connected to the main grid, mainly in public buildings. Along with this program solar public lightning was installed in these locations
- The use of pre-paid meters, which aims at improving the revenue collection of the electric sector, by making the client pay for what it really consumes, and therefore optimize its consumption (no more lights left on during the day, air conditionings functioning 24/7, etc.)
- Improvement of the technical conditions of the distribution grid in Luanda and some provincial capital cities.
- The implementation of a recently launched programme by MINEA of an energy efficiency awareness campaign denominated "Vida ,Energia e Eu"
  The implementation of an educational program in the area of renewable energy and energy efficiency by MINEA denominated "Cientista Ndengue"

2.6. Renewable Energy vis-à-vis goal of SE4ALL

Angola is already a net contributor for the Sustainable Energy 4 All goal of doubling renewable generation in the global energy mix. Hydro power represented in 2014 53% of total power generation – much more than the world average.

Additionally, 2013-2017 Action Plan includes the short to medium term deployment of around 3 GW of hydro power – already under construction, including some mini-hydro power plants. Proposed Angola Energy 2025 vision aims at achieving a total renewable penetration in the power sector of 74% of the installed power capacity with hydro representing 66% and other renewables representing 8%. If such target would be met today, Angola would be one of the top 10 nations among all OPEC, SADC and OCDE members in terms of renewable energy penetration.

The target of having 95% of all additional power generation capacity from renewable energies until 2030 set out in the ECCAS White Paper may be difficult to apply to Angola as there is a firm intention to introduce also natural gas into the power generation mix. However, effort on hydro remains the Government top priority with recent approval of a new large 2 GW hydro power plant: Caculo Cabaça, and Government's intentions on hydro may only be commended as Angola is already a net contributor to the Sustainable Energy 4 All initiative.

Other than hydropower generation, Angola has recently signed a PPA with BIOCOM for the production of around 100 MW from biomass (sugarcane) near Malange. In the Central area the Hydro-Thermal project is under study, combining a series of biomass plants (based on forest residues) and mini-hydro generation. The "Aldeia Solar" program has allowed the installation of a series of PV solar panel solutions in remote areas, thus providing access to basic energy services in off-grid areas. Finally, concerning wind power, although no wind power project is yet to be considered, significant progress has been made in determining the wind resource available, with a nation-wide wind measuring campaign going on for over a year.

Finally, the National Strategy for Renewable Energies establishes an ambitious goal of RES in the energy mix and aims at creating the necessary conditions for this goal to be reached. It is now necessary to effectively promote and implement this Strategy.

Section 3: Challenges and opportunities for achieving SE4ALL goals

3.1. Policy and Institutional Framework

3.1.1. Policy Framework

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.

Also noteworthy is the recent adoption, at a regional level, of the ECCAS White Paper already addressed in chapter 2.1.

3.1.1.1. 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 equitative and sustainable development
5. To promote Angola's competitive insertion in the World Economy

To promote human development and the well-being of Angolans

The strategy assumes the specific objective of providing access to electricity to the majority of the population, as a means of promoting human development.

To ensure a high rate of economic development

To provide sufficient and reliable energy with lower operating costs to attract private participation in the national economy and in the re-industrialization of the country.

The reindustrialization process, focused on priority clusters and mega clusters, is the first pillar of the country's 2025 strategy.

To develop the national territory harmoniously

The power sector vision considers the efficient allocation of generation plants and transmission network in order to ensure reliability to the country's development axis established in the long term strategy, as per the following map

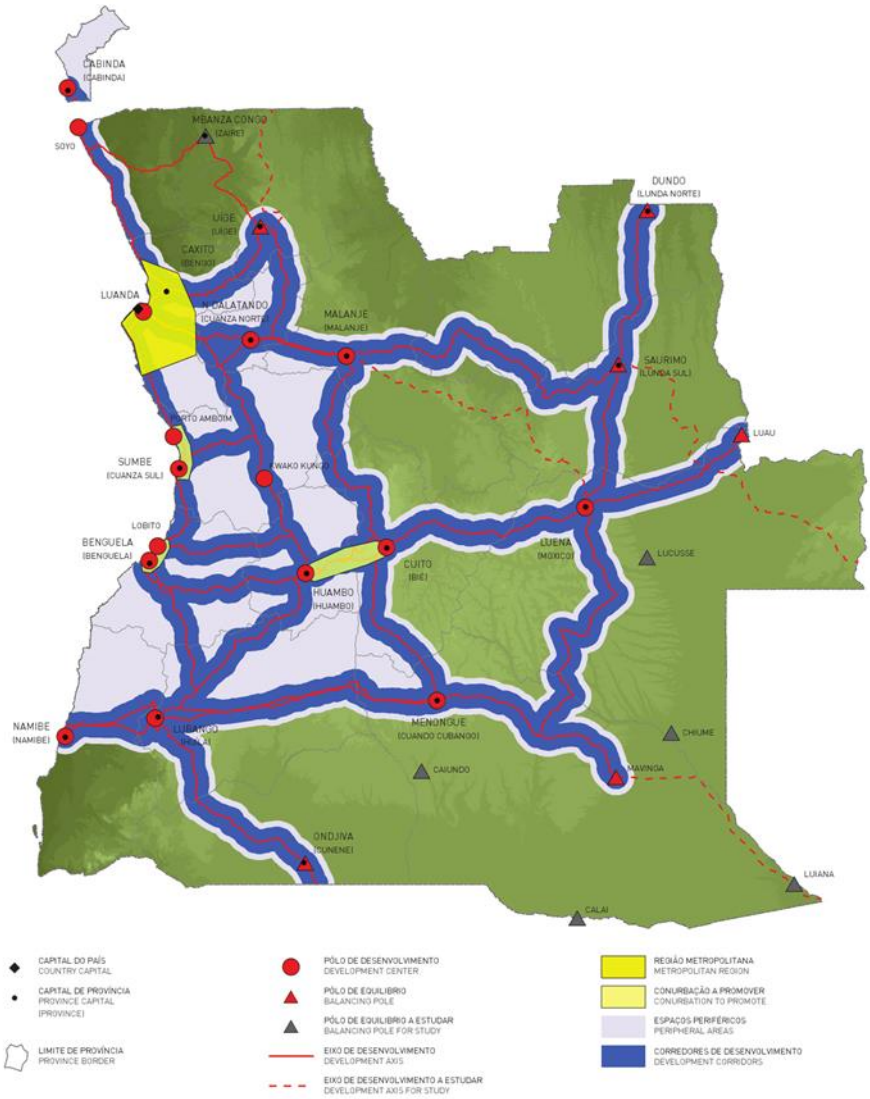


Figure 36 – Territorial development (prospective vision) Angola 2025

<u>To promote an equitative and sustainable development</u>

Long term strategy objectives include: an efficient and lasting use of natural resources while respecting environmental sustainability; a guaranteed use of natural resources for future generations; desertification control and regional development. The implementation of a renewable energy development policy is one of the actions to be implemented by 2015-2025, with particular emphasis on reducing the use of forest biomass for cooking in rural areas.

<u>To promote Angola's competitive insertion in the World Economy</u>

On the external perspective, the strategy aims to achieve a competitive integration with the SADC and CEEAC regional power markets, making the best use of Angola's privileged location and of the abundance of hydro resources.

3.1.1.2. 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

3.1.1.3. General Electricity Act, 2014

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.

3.1.1.4. 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.

This law should have been complemented by a set of regulations in order to make it functions properly. This, however, never came to be and the PPP law was never effectively applied to this date. With the new General Electricity Act and Private Participation in the Electric Sector Program coming into action, it is important that Angola has all the necessary mechanisms to successfully implement PPPs.

3.1.2. Institutional Framework

3.1.2.1. International cooperation and partnerships

Angola is part of SADC (Southern African Development Community) and ECCAS (Economic Community of Central African States) where it has been actively participating in regional policy

and energy related projects. Angola is also a member of IRENA. Angolan utilities are members of the Southern Africa Power Pool SAPP and the Central Africa Power Pool CAPP. IRSE, the Angolan power sector regulator is member of RERA.

Historically, Angola has developed strong bilateral relationships and on-going cooperation on the energy sector with various countries and regional as well as international organizations.

Angola cooperates with several multi-lateral organizations, namely the African Development Bank, which is currently collaborating with Angolan institutions on the Power Sector Reform Support Program (PSRSP), and World Bank - MIGA which has supported some of the ongoing large infra-structures.

Furthermore, Angola has recently opted-in the Sustainable Energy 4 All initiative, and has been cooperating with UNDP on such initiative.

3.1.2.2. 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:

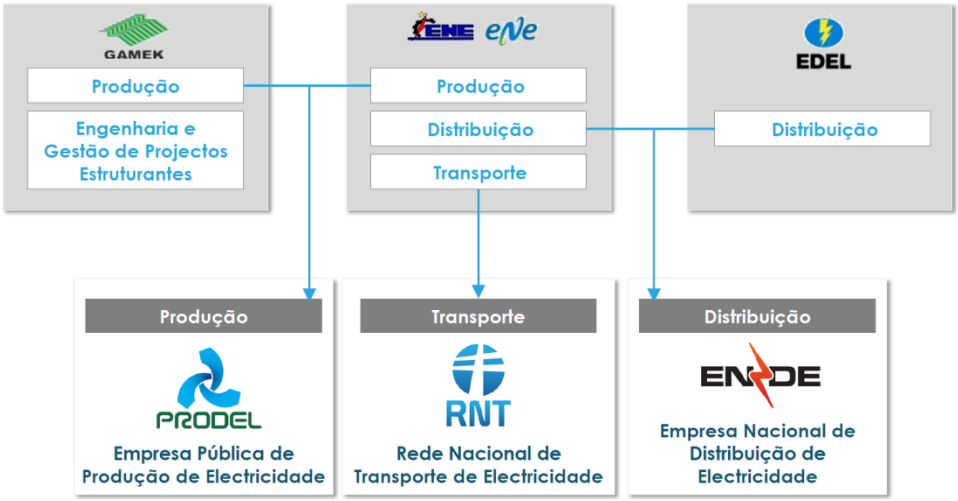


Figure 37 – Restructuring of the Electric Sector (Source: Programa de Transformação do Sector Eléctrico - PTSE)

3.1.2.2.1. The Ministry of Energy and Water

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.

Within the Ministry of Energy and Water three National Directions supervise and implement the Ministry's policy: the DNEE (National Direction of Electric Energy), DNER (National Direction of Renewable Energies) and DNERL (National Direction of Rural and Local Electrification).

3.1.2.2.2. PRODEL

PRODEL, the Public Company for Electricity Production – is the new public company with the responsibility of operating and maintaining the generation facilities belonging to the state. It integrates Capanda Hydropower plant, previously under the responsibility of GAMEK, and the generation assets of ENE – the former National Company of Electricity.

3.1.2.2.3. RNT

RNT – National Network of Electricity Transmission – is the new public company with the responsibility of the management and planning of all the transmission network of the country, integrating all the Very High Voltage Transmission assets of former ENE.

3.1.2.2.4. ENDE

ENDE – National Company for Electricity Distribution – is the new public company with the responsibility of distributing electricity, integrating all the activities and assets of former EDEL and the distribution assets of former ENE.

3.1.2.2.5. GAMEK

GAMEK (Gabinete de Aproveitamento to Médio Kwanza), previously in charge of Capanda Hydropower Plant, which now falls under the responsibility of PRODEL, will maintain its activities of Engineering and Management of Structuring Projects.

3.1.2.2.6. IRSE

The Regulatory Authority of the Electric Sector, IRSE in its Portuguese acronym, was created by Presidential decree nº 4/2002 on the 12th of March.

IRSE has amongst its responsibilities to establish the electric sector's functioning rules through several regulations such as Tariff Regulation, Access to Network and Interconnections Regulation, Quality of Service Regulation, Commercial Relationship Regulation and Dispatching Regulation. The main objectives of IRSE's mission is to guarantee energy supply, protect the consumers, favor the economic and financial balance of the Electric System's public companies, foster competition and ensure a non-discriminatory commercial environment. All the sector's public companies are subject to IRSE's regulation and it functions as an advisor to MINEA on all matters related to the energy industry.

3.1.2.2.7. Provincial Energy Directions

On a local level, Provincial Governments (18 in total) have their own Directions of Energy and Water which follow and foster local projects.

3.1.2.3. Oil & Gas Sector Structure/Institutional framework

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.

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 MINPET, representing the government, is responsible for the granting of concessions and prospecting licenses.

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.

3.1.2.4. Innovation and research institutional framework

Angola has several universities with engineering courses and faculties with presence across the country. The following institutions are public:

- Agostinho Neto University, a public university in Luanda
- Universidade José Eduardo dos Santos, a public university in Huambo
- Universidade Katyavala Bwila, a public university in Benguela
- Universidade Mandume ya Ntemufayo, a public university in Lubango
- Universidade 11 de Novembro, a public university in Cabinda
- Universidade Kimpa Vita, a public university in Uíge
- Universidade Lueij A'Nkonda, a public university in Malanje

Additionally many private universities are present, with Universidade Metodista de Angola being noteworthy for the recent inauguration of CETER (the Renewable Technology and Energy experimental center).

Also Hoji-ya-Henda, the electricity training center of MINEA has been involved in the past in research activities, namely the CASOL project.

3.2. Programs and Financing

3.2.1. 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 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 2015 and 2016;
- Soyo's Natural Gas Combined Cycle Power Plant: Soyo's Central, with around 720 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. Construction is currently on-going and it is expected to be operational by the end of 2017.

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.

3.2.2. Transformation Program for the Electricity Sector – PTSE

The Transformation Program for the Electricity Program(PTSE, Portuguese acronym) is already underway and has recently accomplished the create

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.

The program is divided into three phases:

- **Phase I - Diagnostic, Mobilization and Change Management**: This phase has been concluded and it included the confirmation of the planned new Market Model, the identification of open issues, communication with the Boards of the implied public companies and the effective launch of the restructuring phase
- **Phase II – Unbundling of the Electric Sector**: this phase includes the restructuring of the new public companies (ENE and EDEL into PRODEL, ENDE and RNT) as well as IRSE and GAMEK, the development of the Sector's capacities and the creation of the Operational Improvement Plan. The creation of the new public entities was completed end of 2014 with a progressive entry into service during 2015.
- **Phase III – Functional and Operational Improvement**: this phase, to be implemented until 2016, will focus on the detailed design of the new operation model, on implementing the Operational Improvement Plan

Despite the on-going transformation process, the sector's public companies still do not dispose of enough human and technical resources with the proper training in order to guarantee the implementation of the sector's investment plan within the proposed calendar or to ensure the efficient exploitation of the current and future infrastructures.

3.2.3. Angola's Power Sector Long Term Vision – 2025

The long term strategy Angola 2025, establishes strategic objectives for the country, which represent strategic challenges for the development of the energy sector, independent from the current situation of the oil markets.

The growth of generation capacity and the expansion of the grid, as well as the mobilization of private capital, are strategic long-term axes established in the Policy and Strategy for National Energy Security, with impact on the long term development of the country and on the diversification of the national economy.

The National Development Plan and the Action Plan for the Sector, establish clear investment goals and plans for the 2013-2017 horizon. Given the long implementation timeframes for investments in the sector, the Government of Angola has recognized as critical that priorities and key projects be defined now, for a 2018-2025 timeframe, in line with the goals and aspirations of Angola Strategy 2025 and the Electric Sector Transformation Process (PTSE).

Evolution of demand up to 2025

The 2025 vision for the power sector is based upon the goal of meeting the country's needs and, given the high level of those needs and the timeframe available, maximizing well-being through ambitious goals and an efficient allocation of resources. A strong growth of energy consumption is anticipated up until 2025, foreseeably reaching a load of 7.2 GW, more than four times the present. This growth will result mainly from bringing power to 60% of the population, from the

increase in residential consumption, growth of national wealth through the services sector and from the country's industrialization.

Expansion of the electricity network from a Demand point of view

Comparative studies have shown that investing in grid expansion with an economic rationale – keeping the existence of isolated systems where grid investments have long distances per energy unit or when there are competitive small hydro projects nearby - allows greater regional and territorial balance in overall energy supply.

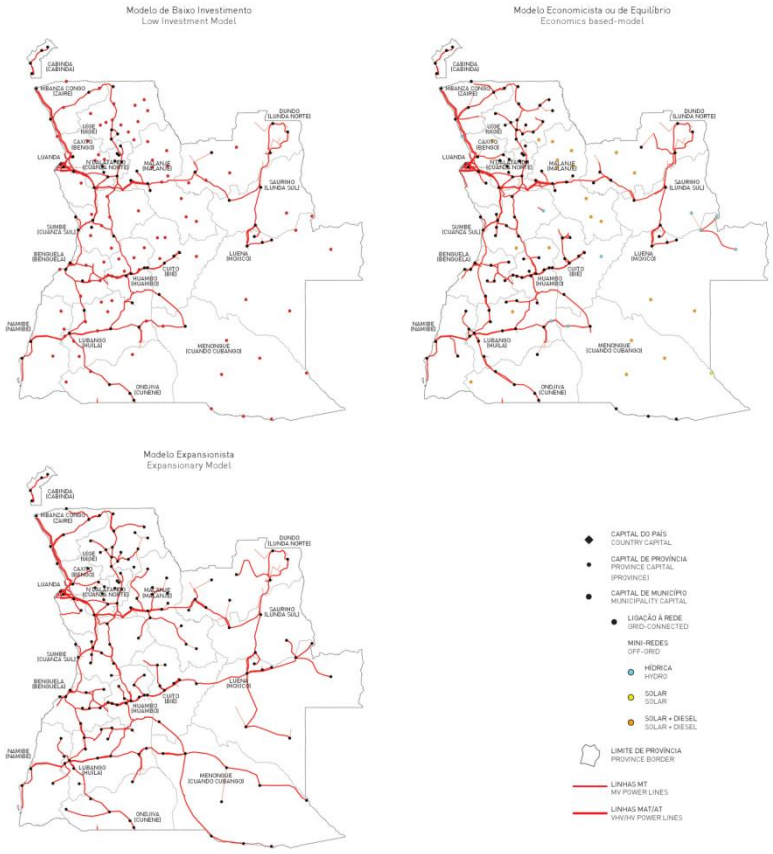


Figure 38 - Alternative Electrification Models to reach 60% electrification rate (Source: Angola Energy 2025)

Rural Electrification

Electrification outside large urban areas – which will be the responsibility of the future National Institute for Rural Electrification – will concentrate on the goal of bringing electricity to all municipality and commune townships in the country. Grid extension will be considered a priority and will enable the electrification of 5% of the population and of 173 locations. Isolated systems based upon small-hydro, diesel or solar, will serve 32 locations. It is also anticipated that, in accordance with the Strategy for Renewable Energies, 500 "solar villages" will be installed in off-grid main villages and in other settlements of larger dimension and, for the remaining population, individual systems based on solar energy will be supplied.

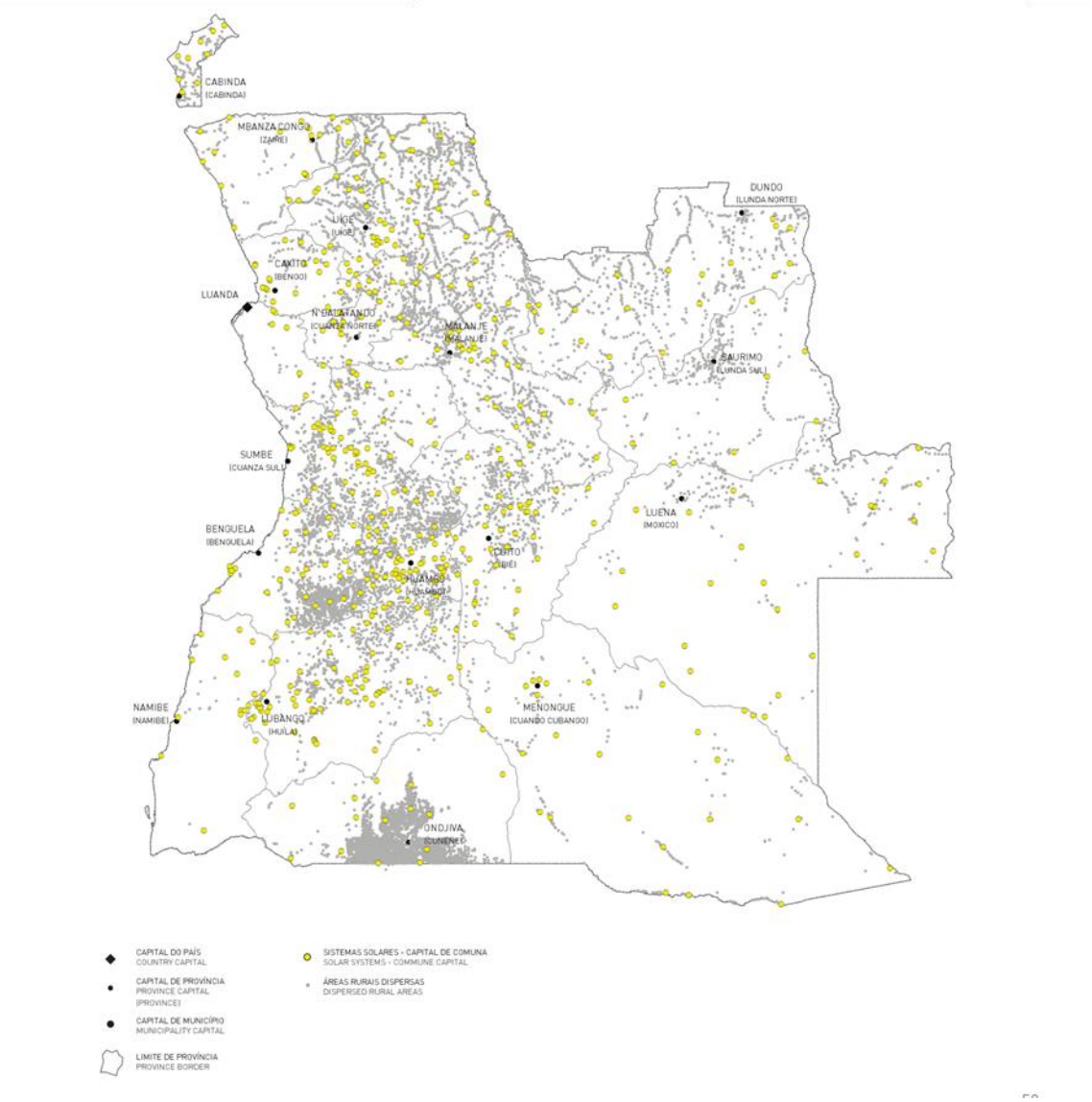


Figure 39 - Map of localities proposed for the installation of "solar villages" and disperse rural settlements (Source: Angola Energy 2025)

Angola has numerous options for the generation of power. The Long Term Vision considers the key options - hydro, thermal and other renewable– individually and combined in scenarios that meet the required levels of safety and redundancy. The generation mix selected for the 2025 horizon results from a weighting of criteria: economic, regional development, environmental and energy security.

<u>New Large Hydropower Plants</u>

Angola has exceptional hydro resources, with 159 sites identified in previous studies as having potential for large hydropower plants, in addition to those already under construction or decided upon. From these 159, the best sites were analyzed and compared in detail by means of a strategic environmental evaluation and 3 scenarios were developed, with different priorities: economical Optimization, Economy/Territorial balance and Regional Development. Additionally, some planned or already decided hydropower plants have been optimized, taking into account energy security and the system integrated needs.

Natural gas and other thermal sources

The beginning of operations of the natural gas terminal at Soyo makes it possible for the power system to operate with a lower cost fuel and lower levels of emissions than diesel (which implies high costs and subsidies). Several alternative sources of gas were evaluated, recommending the full use of the gas available for national consumption in Soyo, the use of liquefied natural gas (LNG) also for internal consumption in Luanda, Benguela and Namibe, and the use of on-shore natural gas available in Cabinda for local power generation. The materialization of recent natural gas discoveries, depending upon the strategic decisions that will be taken, may have a relevant impact in the national energy matrix. Therefore, possible locations of gas treatment infrastructures were considered and the installation of power plants in these locations, namely Namibe, Benguela and Kwanza Sul was analyzed.

As regards the remaining thermal sources, the Coke which will result from the new refinery may constitute a low cost source of energy, but with high emissions of CO2, to be used eventually for own consumption. LNG and heavy fuel oil (HFO) should replace diesel whenever economically justified, keeping diesel essentially for reserve or backup power plants.

Renewables

Government has recently approved the National Strategy for Renewable Energies, with an overall objective of 800 MW and concrete targets for each of the main sources, which are considered under the vision.

Generation scenarios and options

The various sources of energy have been combined in accordance with 4 main guidelines resulting in 20 scenarios. Each scenario was detailed so as to ensure a minimum required level of guaranteed power capacity, sufficient to safely satisfy the demand.

The three scenarios presenting lower overall cost – which balances generation cost, investment level, impact on transmission infra-structure as well as environmental cost or impact - were then compared and a scenario was selected. The 2025 vision opted to balance hydro and natural gas and to prioritize hydropower plants and locations that optimize the balance between economy and regional development.

2025 Power Sector Vision

According to this Long Term Vision, demand will see significant growth based on an electrification process focused in provincial capitals and municipal townships (which represent 97% of the 3.7 million household clients expected in 2025) and commune townships whenever economic and technical rational allow it. Priority will be given to grid extension so as to maximize the number of municipal and commune townships and the continued investment in structural projects in the interconnected grid. In order to ensure a safe power supply, even in years of lower hydro flow, Angola should have 9.9 GW of installed capacity – through increasing power capacity in all sub-systems and through a strong reliance on hydro and gas (which will correspond, respectively, to 66% and 19% of installed power capacity).

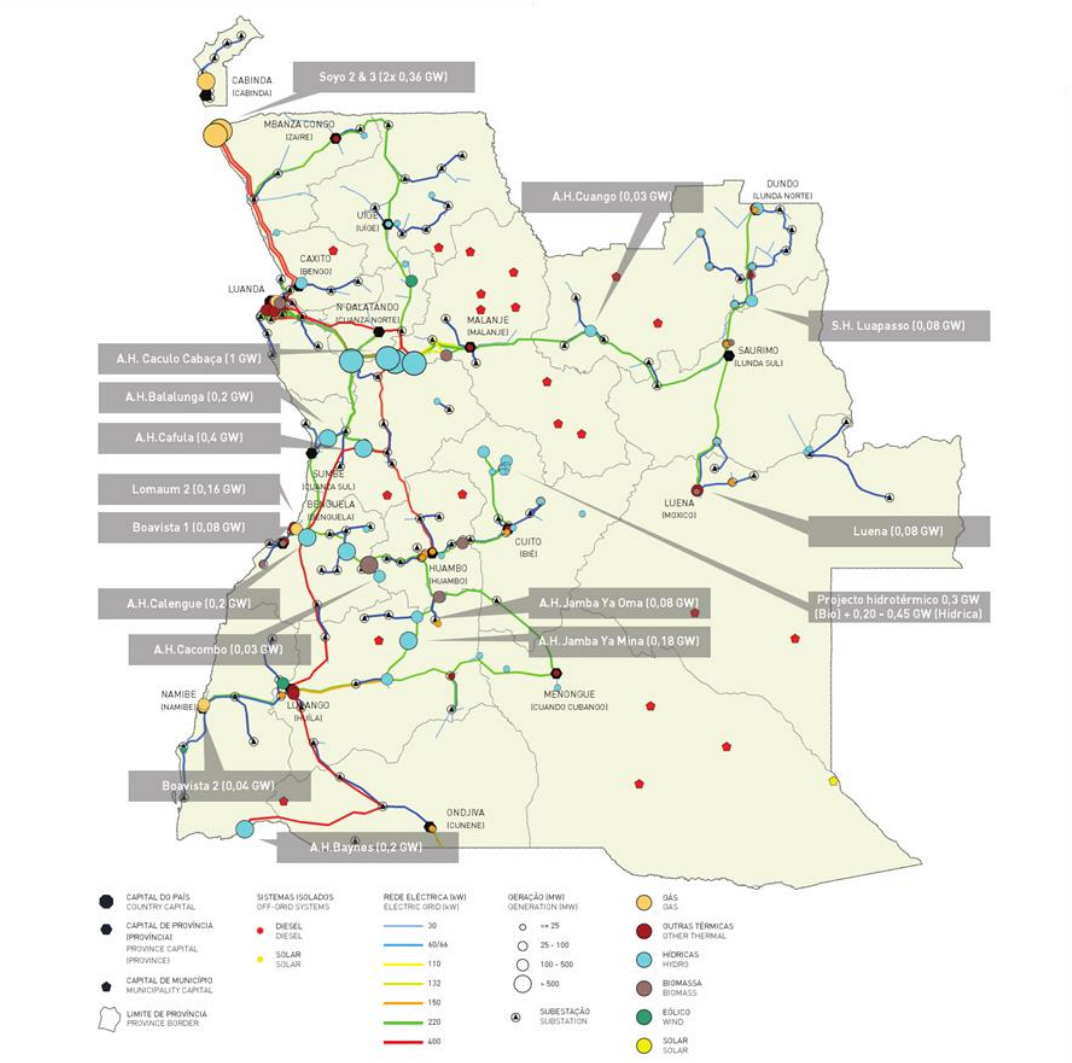


Figure 40 - Map of generation, networks and substations of RNT in 2025 (Source: Angola Energy 2025)

The Vision establishes that Angola will achieve more than 70% of installed renewable capacity – one of the highest percentages in the world – which includes 800 MW of additional renewables (biomass, solar, wind and mini-hydro), thus placing Angola on a level playing field with the best 10 countries in the world in SADC, OPEC and OECD, as to installed renewable power and CO2 power sector related emissions.

The National Transmission Network will continue to expand after 2017, with the goal of interlinking all provincial capitals, of taking the power grid to an ever increasing number of municipal and commune townships, of maximizing generation efficiency and of promoting Angola's interconnection to the regional system of SADC. The North-Central-South transmission corridor will provide provinces with competitive energy and enhanced supply security, connect the Angolan power system to DR Congo (in the North) and Namibia (in the South) and, after 2025, allow the transport of gas based generation from new gas discoveries.

All investments contemplated in the vision have an impact on the territory. The detailed Atlas of the power sector in 2025 was created offering a view of the territorial dimension of the vision and the possible impact for each Province, Municipality or Commune. Investments with higher

impact on the territory will be the hydropower plants, in particular those with regularization and multi-purpose possibilities, biomass plants and electricity energy distribution.

Achieving the vision: Public Investment and Private Sector Participation

To achieve the vision in the 2018-2025 horizon it will be required to mobilize public and private investments of USD23b. The mobilization of a new investment cycle, without undermining the support to other sectors also strategic for the country, requires the power sector to generate revenues to repay those investments in the medium and long term. The study shows that the lower costs of hydro and gas allow to ambition a financially self-sustaining sector with electricity tariffs in line with those charged in the region. However, that vision requires a strong commitment to losses reduction and a gradual update of electricity tariffs.

Public investment will progressively be replaced by long term private financing. Public financing is to be reserved for investments in the public sphere: large dams, the national transmission network, investments in the distribution areas allocated to the public utility and rural electrification. The remaining investments should be progressively undertaken by the private sector, enabling single buyer's creditworthiness in a way that allows for the mobilization of the required funding.

This long-term strategy is currently undergoing its approval process at the Presidency and Council of Ministers level.

3.2.4. Private Participation in the Electric Sector Program

Angola faces a major challenge in implementing the established goals until 2025. On the one hand, the high level of investments necessary, reaching up to 39 billion USD by 2025, in a difficult macroeconomic context (inflation, devaluation of currency, decrease in GDP, lack of revenues due to oil price decrease); on the other hand a sector suffering from economic and financial unsustainability with revenues covering less than 20% of the costs and lack of human, technical and financial resources to reach such objectives.

Private Sector has been increasingly present in the generation and distribution sectors, with the ability to mobilize resources and know-how to increase the sector's efficiency and capacity.

Following the Government's Long Term Vision for the Power Sector until 2025, the Private Participation on the Electric Sector Program has selected the projects to be implemented resorting to private investment and defined the guidelines to accomplish these contracts, proposing at the same time a comprehensive organization and methodology for the successful implementation of the Program.

The program is subdivided into three subprograms and is composed of 148 projects, half of which correspond to Rural Electrification projects. Total investment sums up to 12,4 billion USD, the great majority focused on generation.

The Power Generation Subprogram is composed by a series of generation projects based on hydropower, thermal, wind, solar and biomass. Hydro and Thermal account for the great majority of the expected production. In this subprogram, the private sector is expected to invest

over 7,2 billion USD in order to install more than 2,5 GW. These projects are expected to be long term concessions for the production of energy or Power Purchase Agreements with the Unique Buyer, RNT.

The Urban Distribution Subprogram aims the concessions of Angola's major city's peri-urban areas and urban and peri-urban areas of the Province's capitals. Total investment in this area should be more than 3 billion USD, with the state supporting part of the costs until the full entry of the private sector.

The Rural Electrification Subprogram is itself divided into three different types of actions: (i) the extension of the distribution network outside the main urban areas with a total of 174 locations, connected to the main network; (ii) creation of isolated systems in 31 locations, composed of a generation plant and a distribution network; (iii) extension of the Solar Village (Aldeias Solares) program to 500 locations corresponding to Commune capitals and settlements with more than 3.000 inhabitants.

In total this subprogram should involve a public investment of around 2 billion USD, reaching over 370.000 new clients.

This Program is currently undergoing its approval process at the Presidency and Council of Ministers level, along with Angola's Power Sector Long Term Vision – 2025.

3.2.5. 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).

Angola depends fundamentally on its hydro resources and oil derivatives for the production of electric energy. In rural areas biomass still remains one of the main fuels used. Renewable energies other than large hydro are still not significant.

Repressed demand and the abuse of subsidized diesel, the geographic concentration and long construction delays of large hydropower projects, lack of access to modern energy sources and the unsustainable use of biomass in rural areas constitute problems that renewable energies will help solving.

Rural Electrification with renewable energies

Renewable energies can in many cases play a major role in rural electrification and in providing basic services, essential for the socioeconomic development of isolated areas.

Once the areas that will benefit from the main grid extension have been identified, it is important to analyze the best solutions for the population not covered by that extension. Solar power is assumed to be the energy resource with the greatest coverage, more flexible and adequate to either supply small local networks – with batteries or coupled with small generators – or for isolated systems. Pico and Micro hydropower plants and bio digesters may constitute alternatives in locations where resources are readily available.

Challenges for the implementation of on-grid renewables

There are many barriers to the implementation of renewable energies and a greater involvement of the private sector. The strategy states that it is important to mitigate these barriers by creating favorable legal and regulatory conditions to the implementation of renewable energy projects, implementing adequate incentive and financing mechanisms and promoting communication on renewable energies.

Goals and Strategic Objectives

Given the situation, the Government of Angola established in its strategy as a goal for 2025 that at least 7,5% of electricity generated in the country originates from renewable energy sources other than large hydro, with a total power of 800 MW planned.

In order to achieve this goal three objectives are established with specific goals and measures:

- Objective 1 – Improve access to energy services in rural areas based in renewables:
    - Concerning public and community services, create the National Institute of Rural Electrification (INEL in its Portuguese acronym) and increase the "Solar Village" program;
    - Concerning domestic use, promote market solutions and act only on more disperse areas with low-income;
    - Concerning productive uses and private initiative, concentrate in agricultural communities and the creation of distribution networks and service providers throughout the country;

- Objective 2: Develop the use of new on-grid renewable energy technologies: concrete goals and guidelines for each type of renewable energy are set, promoting in the case of solar power the development of manufacturing units in the country. Know-how and supervision of these technologies in different areas should be fostered through the creation of a Research and Technology Centre for Renewable Energies in articulation with the Ministry supervising Science and Technology and the Superior education system. The specific objectives established until 2025 for each of the identified renewable resources in Angola are as follows:
    - **Solar power**, reach 100 MW of installed power, 10 MW of which off-grid, along with the creation of a PV panel manufacturing unit and associated cluster.
    - Generation with **small-size hydropower plants** (up to 10 MW), to reach 100 MW with at least 60 MW oriented towards the electrification of municipality capital based on isolated systems.

- **Biomass**, reach 500 MW of installed capacity, supporting the creation and development of new agricultural and livestock projects, in particular sugar-cane, of new forest exploitations in the central and eastern parts of the country and the creation of incineration units for Municipal Waste.
- **Wind Power**, reach 100 MW of installed capacity, with a greater regional diversification and a better usage of existing infra-structures.
- In what concerns **other types of renewable energy sources**, support the creation of a Research & Development center for renewable energies in Angola.

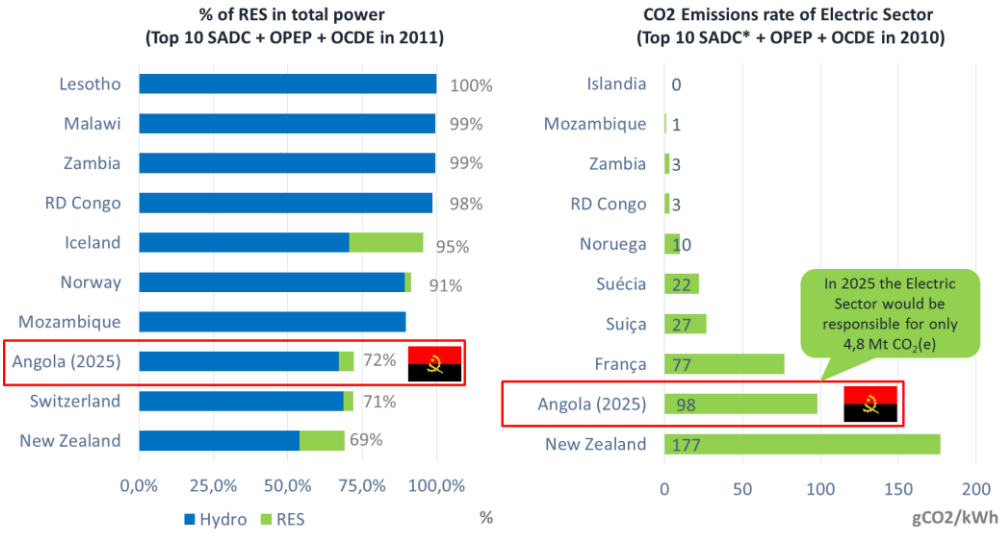
- Objective 3 – Promote and accelerate public and private investment: it is planned, amongst other measures, the creation of specific legislation for renewable energies, feed-in tariffs for projects up to 10 MW, creation of credit lines to stimulate private initiative in rural areas and the development of communication campaigns and technical training sessions.

Improvement of women's life conditions in rural areas, creating local jobs, fostering business, education and imprving security and safety are transversal aspects that the strategy will also promote.

From strategy to action

This strategy is also committed at obtaining results. Other than its promotion by MINEA, the integration of the strategy to planning and budgeting workgroups within the ministry, it is planned to create an Inter-ministerial Supervision Commission and the elaboration of status reports every 3 years.

With this Strategy, Angola has set a series of ambitious objectives in what concerns the electric sector and the introduction of renewable energies in particular. The picture bellow illustrates how Angola would position itself if it reaches its ambitions for the electrical sector and the introduction of renewable energies by 2025.



*Emissions data for Malawi and Lesotho not available

Figure 41 - Sustainability of Electric Sector in 2025 (Source: EIA, IEA, Analysis Gesto)

By 2025 and if it reached its goals, Angola would be the 8th country with the highest rate of renewables (installed power based on renewable sources hydro + other renewables) amongst all countries of SADC, OPEP and OCDE.

As for the the average emissions rate of the electric sector comparing with the same group of countries, Angola would position itself in the Top 10 (9th place).

3.3. Challenges and Opportunities

3.3.1. Universal Access to Electricity

Although the Government intentions and actions are well aligned with the Universal Access Goal of the Sustainable Energy 4 All initiative, several initiatives and improvements to face the most relevant challenges and barriers are proposed:

Challenge #1: Effectively mobilizing such high levels of investment and increase power sector efficiency

- Increase power sector financial sustainability through tariff restructuring and increase together with the implementation of loss combat programs (to be addressed more in detail in the Energy Efficiency goal).
- Approve and implement Private Sector Participation Program, promoting the involvement of private companies on Distribution areas to increase efficiency and guarantee investment.
- Review legal framework in order to clarify licensing regime – including interaction with environmental legislation - and reduce uncertainties to investors and financial institutions.
- Until power sector utilities are not financially stable provide sovereign guarantees to Power Purchase Agreement payments by RNT and its convertibility – in case of foreign investment – potentially making use of Partial Risk Guarantee and other risk mitigation mechanisms supported by multilateral institutions.
- Develop financing mechanism or institution to incentive/support local financing institutions in the extension of loan tenors.

Challenge # 2: Develop and reinforce the internal and institutional competence and capacity of the sector

- Create a Public Private Partnership “cell” inside Ministry of Energy in order to manage procurement of private investments in a competitive and transparent way that can attract DFI and multilateral sources of financing.
- Improve and expand the existing training and capacity building programs to create internal capacity in MINEA on project management and contractual negotiation and supervision.
- Improve and expand the existing training and capacity building programs so that the sector technicians are able to adequately operate and maintain the power sector infra-structures.

- Develop recruiting programs to reinforce the Ministry and the Sector Utilities Human Resources capacity and competence.

Challenge #3: Find effective ways to bring basic energy services to the rural areas of Angola based on solar power

- Given that grid extension will be focused until 2025 on powering the capitals of all Municipalities in Angola, create recently approved Rural Electrification Agency
- Provide adequate resources to the Rural Electrification agency in order to guarantee the implementation of the 500 solar villages and the 500.000 solar lamp program;
- Prioritize education and health infra-structures in the 500 solar villages program in order to maximize benefit for local populations.

Adequately responding to the challenges of Access to Electricity and being able to achieve the 60% electrification rate could impact more than 7 million people in Angola until 2025.

3.3.2. Access to Modern energy for thermal applications

Recommendations on Access to modern cooking energy are focused on the challenge of *taking LPG and efficient cookstoves to the peri-urban and rural areas of Angola*:

- Liberalize or increase flexibility of LPG price outside of the main urban areas in order to foster private investment in distribution activities into rural areas;
- Leverage the Angola LNG terminal and the future refinery of Lobito infra-structures, potentially through a regional agreement as set out in the ECCAS White Paper, to increase LPG related infra-structure and availability.
- Launch campaign to promote awareness of the benefits of LPG and efficient cookstoves;
- Offer Fiscal incentives to the import or manufacturing of efficient cookstoves and of LPG user equipment and financing lines for companies interested in the production or distribution of efficient cookstoves or LPG;
- Provide adequate resources to the Rural Electrification agency in order to guarantee the implementation of the 100.000 efficient cookstoves program, targeting regions where fuelwood is scarcer or prices for charcoal higher;
- Promote procurement of international funding for national cookstove program and facilitate partnerships with private sector companies and NGOs in applications for international tenders regarding efficient cookstove programs and alternative primary energy sources for thermal use (biogas, animal waste, etc.);
- Create appropriate quality certification for improved cookstoves and promote technical research to adapting cookstoves and programs to country context;
- Form and properly train women's groups or associations, as being the main users and demanders for this type of energy, for the dissemination of improved cookstoves in rural areas;

- Develop and implement monitoring and evaluation mechanisms, namely sector statistics and energy balance accounting;
- Develop a complete and comprehensive database on energy use for thermal applications (fuelwood, charcoal, LPG, animal waste) throughout the territory;

Adequately responding to the challenges of Access to LPG and improved cookstoves, namely the targets of universal access to LPG by 2025 and the widespread use of efficient cookstoves both in urban and rural settings, have the potential to impact most of the population living outside Luanda – around 18 million people.

3.3.3. Modern Energy for Productive Uses

Although the policy to maximize fuel availability through concentration on one source, diesel, has been very effective on guaranteeing availability, it had relevant implications on the sustainability of the measure. The recent significant change in the price of diesel has had a significant impact on economic activity in Angola and on the affordability of modern energy for such businesses. The absence of more competitive energy sources (on a non-subsidized level) such as Propane, Natural Gas and HFO undermine the capacity of private companies to find alternative solutions.

With the Angola LNG facility working, Angola will start producing butane, propane and liquefied natural gas. The existence of recent relevant natural gas discoveries make natural gas a strategic source of energy for Angola. The recent advances in small scale liquefied transport technology offer significant possibilities for Angola to promote access to this competitive, efficient and endogenous source of energy. Recommendations mainly focus on the challenge *to create a natural gas downstream market in Angola:*

- Create LNG truck filling station in Angola LNG infra-structure in Soyo and in other locations in the country;
- Subsidize, help finance or offer tax exemptions to “one-off” investment in satellite receiving LNG facilities for main provincial capitals and start developing regional gas infra-structure plans;
- Regulate natural gas market in order to facilitate access for private actors;
- While natural gas is not available, promote the distribution of Propane for productive uses from Angola LNG facility and infra-structures for HFO distribution for very large clients such as cement factories and others.

Adequately responding to the challenges of Access to energy for productive uses, could significantly impact thousands of companies and the Government’s effort to promote the economic diversification of the country.

3.3.4. Promotion of Energy Efficiency

The potential for improving energy efficiency in Angola is enormous and although Angola has some scattered policies in place with impact on energy efficiency, there isn't a structured strategy or policy to improve energy efficiency nor a sense of urgency for it. For example, loss reduction through pre-paid meters is an important topic already on Government agenda but a lot more could be done even on meters, but also on tariffs, appliances, lighting, vehicles, buildings, wood/charcoal, awareness and education.

We outline some major challenges and recommendations on energy efficiency:

Challenge # 1: Lack of sense of urgency and call for action on energy efficiency

- Development of a comprehensive study on the impact of energy efficiency and development of a National Strategy for Energy Efficiency;
- Setup a bottom up measurement and monitoring system for energy efficiency measures to measure the results of the National Strategy;
- Awareness campaigns on the benefits of energy efficiency;
- Education and sensitization programs on efficient use of electricity.

Challenge #2: Increase electricity tariff sustainability and reduce energy losses

- Increase investment allocation to metering and monitoring systems in order to combat losses:
    - Accelerate deployment of pre-paid system and increase effectiveness of pre-paid meter system through increased availability of paying methods, differentiated rates according to level of monthly consumption, local support services to new customers, and the implementation of loss combat monitoring system and teams that address energy theft in a prioritized way.
    - Install telemetering systems in all large industrial and services clients guaranteeing Zero Losses in Medium and High Voltage.
    - Install a loss monitoring system per area to better locate and quantify energy losses and based on such information review consumption estimates for "avença" clients in each area.
- Introduce alternative methods of payment for electricity consumption - net/online, ATM, shops, etc.
- Increase electricity tariff sustainability through a restructuring of the energy tariff and billing system: increasing tariffs for the Services, Industrial and Wealthier Residential consumer segments until they are fully cost reflective while maintaining a lower and broad social tariff with limited service level. The lower tariffs should be exclusively available to pre-paid meters – once they are widely spread.

Challenge #3: Maximize the efficiency of new consuming technologies, buildings and industries still to be deployed

- Implement an energy efficiency labelling system with associated import tax penalties for non-efficient imports of appliances, lighting and vehicles;

- Prohibit the production, import and commercialization of incandescent lamps before 2020 – as per the ECCAS White Paper decision;
- Launch a program on public sector buildings to increase efficiency by 25% and approve regulation on energy efficiency in buildings applying to new construction;
- Approve regulation for Industrial and Services sector on energy audits. Establish tax incentives for implementation of energy audit recommendations;
- Introduction of mitigation measures such as energy-saving bulbs, efficient electronic equipment and house appliances, solar thermal panels for public and private water heating.

Challenge #4: Eliminate inefficient energy generation/transformation systems, including charcoal production

- Improve efficiency of charcoal production, estimated by IEA to be 3 times less efficient in Angola than production kilns in South America, targeting at least 35% efficiency as established in the ECCAS White Paper.
- Promote improved and more efficient cookstoves (already detailed in Access challenges and measures).
- Replace or significantly reduce usage of old generation facilities with efficiencies below 30% and increase usage of combined cycle technologies

Adequately responding to the challenges of Energy Efficiency, has the potential to impact all electrified customers – already more than 7 million people and expected to be more than 15 million people by 2025 – and even the more rural population through improved cookstoves.

3.3.5. Renewable Energy

Key challenges and recommendations for Angola on renewable energy:

Challenge #1: Successfully implement the National Renewable Energy Strategy

- Approve regulation for renewable energies clarifying licensing regime, award system, power purchase agreement, remuneration and off-taking guarantees.
- Establish mechanisms to guarantee that biomass for energy is produced in a sustainable way without impacting deforestation.
- Promote the National Strategy for Renewable Energies at all levels (Ministry, National Directions, Provincial Directions, Institutes and Agencies) by creating the necessary Monitoring Committee and making sure the Strategy is an integrate part of future Action Plans and Annual Budgets.
- Approve Feed-in-Tariffs for renewables up to 10 MW and review applicable taxes.
- Allocate 1.000 million Kz to Rural Electrification Agency every year until 2025 to support rural electrification programs based on renewable energy and for the creation of subsidized credit lines for the acquisition of individual systems of for productive uses.

- Map country's remaining hydro power potential with a focus on mini and micro hydro potential for off-grid electrification.

Challenge #2: Promote Research & Development and internal capacity building and awareness on renewable energy

- Creation of a Research and Development lab dedicated to renewable energies building on the experience implemented in the past on the Training Center Hoji-Ya-Henda and in articulation with the Ministry of Science and the leading universities of the country;
- Promote the articulation and joint programs between the future Renewable Research and Development lab and other international R&D institutions
- Creation of at least one Training Centre on Renewable Energies
- Launch of a nationwide communication campaign on renewable energies

Challenge #3: Maintain large hydro development as a key priority and engage also the private sector

- Develop more detailed feasibility and environmental impact studies for already selected projects in the Keve and Catumbela basins, as well as medium hydro projects with potential to electrify off-grid areas in the Eastern Provinces;
- Launch international tenders for private sector to develop already selected medium/large scale hydro projects;
- Implement adequate payment guarantee schemes that enable access to financing for hydro related investments.

Adequately responding to the challenges of Renewable Energy will allow Angola to be one of the best performing renewable energy countries in the world – with renewables representing 74% of installed capacity.

Annex 1 - Matrix of existing programs and required financing for achievement of SE4ALL goals

Table 2 represents the level of investment undertaken by the Angolan Government to fulfill the 2013-2017 Action Plan (with corrected figures with respect to some re-configured projects). The Action Plan represents a total investment of 17,8 bUSD during the period with a significant effort of 3,6 bUSD per year.

Table 2 – Action Plan 2013-2017 Investments (Source: MINEA Action Plan 2013-2017, Analysis Gesto)

Tipology	Total Investment (M$)
Generation (Hydropower and Thermal Plants)	8.200
Transmission (Lines and Substations)	5.900
Distribution (Electrification of new centralities, Municipal Commune capitals and agro-industrial projects)	3.700

The following tables detail the planned projects and investments for the 2018-2025 period in generation and distribution as foreseen in the Angola's Long Term Vision for the Electric Sector.

Generation alone represents the main investment planned for this period, of which Renewable Energies other than large hydro represent 17% of the total investment. If we take into account all Renewable Energies including classic Hydropower projects (Very Large, Large and Medium Hydropower plants above 10 MW), the total investment reaches a significant 93% of the total generation investment and therefore a significant contribution to the Renewable Energy SE4ALL Objective.

Urban and Rural Distribution projects represent a total investment of 5 bUSD and 1,6 bUSD respectively, with transmission projects (both lines and substations) reaching around 3,7 bUSD.

Overall, Angola plans a total investment of over 23 bUSD for the 2018-2025 period, with a strong accent in promoting universal access to energy and increasing Angola's already important Renewable Energy share in the total energy mix.

Table 3 – Generation Projects per type planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	Project	Installed Capacity (MW)	Total Investment (M$)
Very large hydro	PRODEL	HPP Caculo Cabaça (Kwanza)	1000,0	2500,0
		HPP Cafula (Queve)	402,6	1120,6
		HPP Baynes (50% Angola)	200,0	660,0
		HPP Túmulo do Caçador (Condicional)	453,0	1041,0
		HPP Zenzo 1 (Condicional)	460,0	1206,0
Large Hydro	Private	HPP Jamba Ya Mina	180,0	710,0
		HPP Jamba Ya Oma	75,0	500,0
		HPP Cacombo (Catumbela)	29,2	319,0
		HPP Calengue (Catumbela)	189,7	471,0
		HPP Quilengue (Queve)	217,2	475,3
		HPP Cutato 1 (Hydrothermal)	157,0	502,4
		HPP Cutato 2 (Hydrothermal)	86,0	422,4
		HPP Cutato 3 (Hydrothermal)	57,3	160,6
		HPP Lomaum 2	160,0	385,0
Medium hydro	Private	HPPLuapasso (H.S. Luapasso)	24,6	205,9
		HPP Camanengue (H.S.Luapasso)	29,0	172,9
		HPP Samuela (H.S.Luapasso)	15,0	92,8
		HPP Cuango	30,0	158,0
		HPP Cune 1 (Hydrothermal)	24,4	53,2
		HPP Cune 2 (Hydrothermal)	19,3	56,4
		HPP Cune 3 (Hydrothermal)	15,3	135,6
		HPP Cunhinga 1 (Hydrothermal)	28,5	94,4
		HPP Cunhinga 2 (Hydrothermal)	22,4	90,4
		HPP Cunhinga 3 (Hydrothermal)	22,4	72,4
		HPP Cunhinga 5 (Hydrothermal)	17,4	90,2
		HPP Chiumbe Dala (in progress)	12,0	24,0
Mini-hydro	Private	HPP Chiumbe Dala (in progress)	7,5	30,0
		HPP Luquixe 2 (in progress)	2,1	13,0
		HPP Andulo (M.H. tender)	0,5	3,1
		HPP Kuito 2 (M.H. tender)	0,6	3,7
		HPP Kuando (M.H. tender)	2,0	12,4
		HPP Liapeca CH Liapeca (M.H. tender)	4,0	24,8
		Several on-grid Mini-Hydro (AO2025)	46,6	240,7
		HPP M'Bridge (M.H. tender)	4,6	28,4
Off-grid mini-hydro	Private	HPP Cuemba (M.H. tender)	0,5	3,1
		Several off-grid Mini-Hydro (AO2025)	28,3	220,5
CCGT	Private	CCGT Soyo 2A	360,0	432,0
		CCGT Soyo 2B	360,0	432,0
Thermal	PRODEL	Thermal power plant in Luena	80,0	104,0
	Private	CCGT Fútila II	100,0	154,0
Wind	Private	Several Wind farms (Renewable Strategy)	100,0	350,4
Photovoltaic	Private	Several Photovoltaic plants (Renewable Strategy)	99,9	267,8
Biomass	Private	Biocom	100,0	174,0
		Other sugar mills	10,0	30,0
		Hydrothermal Project	300,0	776,3
		Biomass power plants in the East	40,0	134,3
		Municipal solid waste - Luanda	30,0	178,8
		Municpal solid waste - Benguela	20,0	110,9

Table 4 – Urban Distribution Projects planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	Project	# estimated clients 2025 (k)	Estimated investments ($M)
Urban Distribution	ENDE	Urban distribution area of Luanda	1 272,0	1 111,9
		Urban distribution area of Lubango	124,5	295,8
		Urban distribution area of Benguela	179,9	307,5
		Urban distribution area of Huambo	120,0	309,8
	Private	Peri-urban distribution area of East Cacuaco (Luanda)	139,4	206,4
		Peri-urban distribution area of South Viana (Luanda)	163,9	241,8
		Peri-urban distribution area of South Belas (Luanda)	143,1	193,0
		Peri-urban distribution area of Lubango (incl. Matala)	83,0	197,2
		Peri-urban distribution area of Benguela	119,9	205,0
		Peri-urban distribution area of Huambo	80,0	206,5
		Urban and peri-urban distribution area of Saurimo	89,9	227,3
		Urban and peri-urban distribution area of Uíge	87,1	175,4
		Urban and peri-urban distribution area of Cuito	80,5	218,8
		Urban and peri-urban distribution area of Malanje	87,2	167,7
		Urban and peri-urban distribution area of Cuanza Sul	89,9	137,2
		Urban and peri-urban distribution area of Menongue	53,2	135,1
		Urban and peri-urban distribution area of Namibe	61,7	122,9
		Urban and peri-urban distribution area of Luena	59,0	174,6
		Urban and peri-urban distribution area of Dundo/Lucapa	52,7	127,1
		Urban and peri-urban distribution area of Cabinda	93,5	75,1
		Urban and peri-urban distribution area of Zaire (Mbanza Congo and Soyo)	53,1	58,1
		Urban and peri-urban distribution area of Caxito	37,1	96,6
		Urban and peri-urban distribution area of Ndalatando	42,1	49,1
		Urban and peri-urban distribution area of Ondjiva	17,5	39,1

Table 5 – Rural Distribution and associated generation projects planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	Project	Installed Capacity (MW)	# estimated clients 2025 (k)	Estimated investments ($M)
Grid extension	Private	Rural Distribution concessions of the North System (various groups)	N.A	72,9	155,5
		Rural Distribution concessions of the Center System (various groups)	N.A	78,7	254,6
		Rural Distribution concessions of the South System (various groups)	N.A	75,4	240,0
		Rural Distribution concessions of the East System (various groups)	N.A	47,0	152,8
		Rural Distribution concessions of Cabinda System (various groups)	N.A	9,9	15,7
Offgrid Thermal System	Private	Offgrid system of Cuito Cuanavale (in progress)	6,0	3,7	21,6
		Offgrid system of Mavinga	4,8	2,4	15,2
		Offgrid system of Oncócua	1,2	0,5	3,4
		Offgrid system of Vila Nova Armada	0,6	0,2	1,6
		Offgrid system of Cangola	0,2	0,3	1,4
		Offgrid system of Gombe (Nambuangongo)	0,2	0,3	1,3
		Offgrid system of Massango	0,6	0,2	1,5
		Offgrid system of Caomba	1,2	0,4	3,3
		Offgrid system of Quiuaba Nzogi	0,2	0,0	0,5
		Offgrid system of Marimba	1,2	0,3	2,9
		Offgrid system of Cunda diá Baze	0,6	0,1	1,4
		Offgrid system of Caungula	1,2	0,4	3,2
		Offgrid system of Lubalo	1,2	0,5	3,3
		Offgrid system of Luquembo	1,2	0,5	3,4
		Offgrid system of Cambundi	2,4	0,8	6,4
		Offgrid system of Quirima	1,2	0,5	3,4
		Offgrid system of Cassongue	1,2	0,5	3,5
		Offgrid system of Mungo	2,4	0,8	6,4
		Offgrid system of Cangamba	3,6	1,3	9,7
		Offgrid system of Chicomba	0,2	0,1	0,7
		Offgrid system of Lumbala Nguimbo	2,4	1,0	7,1
Offgrid Renewable System	Private	Hydro System of Cuemba (M.H. Tender)	0,5	1,7	12,4
		Hydro System of Freitas Morna / Ambriz	3,2	4,1	39,0
		Hydro System of Quedas de Kaquima / Cuchi	2,2	2,8	36,6
		Hydro System of Cutato	3,6	1,9	36,6
		Hydro System of Cassai / Luau	14,5	22,2	260,2
		Hydro System of Muanga Tumbo	4,9	5,6	79,6
		Photovoltaic System of Rivungo	2,0	0,8	22,3
Solar Villages	Private	Solar Villages (500 Systems)	N.d.	N.d.	219,0

Table 6 – Transmission projects planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	Voltage Level / Power Line	Estimated Length (km)	Estimated investments ($M)
EHV line 220kV	RNT	Cacolo - Chicapa	151,0	58,1
		Belém do Dango - Caála	12,0	4,6
		Calengue - Nova Biópio	10,0	3,9
		Capanda - Malange II	112,0	35,3
		Catete - Zango	40,0	15,4
		Chitembo - Menongue	167,0	52,6
		Gove - Chitembo	104,0	32,8
		Jamba - Tchamutete	63,0	19,8
		Kapary - Caxito	25,0	9,6
		Kuito - CH Queiroz Galvão	132,0	41,6
		Lubango - Namibe II	163,3	51,4
		Lucala - Pambos de Sonhe II	90,0	28,4
		Malange - Ngana Calunga	219,0	84,3
		Maquela do Zombo - M'Banza Congo	106,0	33,4
		Ngana Calunga - Cacolo	185,0	71,2
		Nova Biópio – Benguela Sul	49,2	15,5
		Nova Biópio - Quileva II	19,2	6,0
		Pambos de Sonhe - Uíge II	121,0	38,1
		Ramiros - Kilamba	25,0	9,6
		Camama - Zango	20,0	6,3
		Biocom - Malange	43,0	13,5
		Fútila - São Pedro	30,0	11,6
		Morro Bento - Ramiros	25,0	9,6
		Chicala - Morro Bento	15,0	5,8
EHV line 400kV	RNT	C.Cabaça - Cambutas I	75,0	30,8
		Cafula - Wako Kungo	45,0	18,5
		CH Cafula - Nova Biópio	195,0	80,0
		Lubango - Quilengues	125,0	51,3
		Nova.Biópo - Quilengues	194,0	79,5
		Lubango - Xangongo	275,0	112,8
		Xangongo - Baynes	250,0	102,5
Overall Total			**3085,7**	**1133,7**

Table 7 – Interconnection projects planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	Voltage Level / Power Line	Estimated Length (km)	Estimated investments ($M)
220kV Interconection	RNT	Cabinda - RDC	20,0	6,3
220kV Interconection	RNT	Luachimo - RDC	10,0	3,2
400kV Interconection	RNT	Soyo - RDC	130,0	53,3
Overall Total			**160,0**	**62,8**

Table 8 – Substation projects planned for the period 2018-2025 (Source: Angola Energy 2025)

Typology	Utility	System / Projects	Estimated investments ($M)
Cabinda			**30,2**
EHV Subtation 220/60kV	RNT	SE Fútila	17,8
EHV Subtation	RNT	Reinforcements	12,4
Center			**195,3**
EHV Subtation 220/30kV	RNT	SE Chitembo	15,4
EHV Subtation 220/60kV	RNT	SE Caála	28,5
EHV Subtation 400/220kV	RNT	SE Nova Biópio	46,6
EHV Subtation	RNT	Power Plant Conection	19,7
		Reinforcements	85,0
East			**69,2**
EHV Subtation 220/60kV	RNT	SE Cacolo	21,2
		SE Ngana Calunga	32,0
EHV Subtation	RNT	Reinforcements	16,0
North			**727,0**
EHV Subtation 220/60kV	RNT	SE Caxito	27,9
		SE Chicala	49,9
		SE Ebo	15,4
		SE Zango	49,6
		SE 31 Janeiro	31,2
EHV Subtation 400kV	RNT	SE Cafula	18,4
EHV Subtation 400/220kV	RNT	SE Cacuaco	64,7
EHV Substation	RNT	Power Plant Conection	33,0
		Reinforcements	436,9
South			**318,1**
EHV Substation 60/30kV	RNT	SE Ondjiva	11,3
EHV Substation 220/60kV	RNT	SE Tchamutete	20,4
EHV Substation 400/60kV	RNT	SE Quilengues	30,6
		SE Xangongo	93,2
EHV Substation 400/220kV	RNT	SE Lubango	41,3
EHV Substation	RNT	Reinforcements	121,3
Total			**1 308,7**

Table 9 – Rural Electrification Support projects (transmission) planned for the period 2018-2025 (Source: Angola Energy 2025)

Tipology	Utility	System	Estimated Length (km)	# of Substations	Estimated investments ($M)
Rural Elect. support	RNT	60kV system to suport Rural Electrification in Center System	571,0	16,0	275,9
		60kV system to suport Rural Electrification in East System	669,2	6,0	199,8
		60kV system to suport Rural Electrification in North System	1436,0	21,0	486,4
		60kV system to suport Rural Electrification in South System	714,2	12,0	263,3
Overall Total			**3390,4**	**55,0**	**1225,4**

Annex 2 - Initiating a Sustainable Energy for All initiative in Countries: some suggested steps

During the past years, Angola has created and adopted the necessary tools to allow it to continue converging on its energy development objectives, with the creation of an immediate Action Plan to bring the sector to level, by transforming its power sector with the creation of more effective and performant public companies, by equipping itself with a Long Term Vision for energy development and a clear Strategy for implementing renewable energies and finally with the creation of a comprehensive program to foster private participation in the Sector.

Most of the objectives set in these policies and instruments are in-line with the creation of a sustainable energy development initiative as set in the SE4ALL objectives. It is now important that Angola maintains its dynamic and properly implements and promotes these stragtegies.

In order to fully converge with the SE4ALL goals, it is important that Angola creates a comprehensive action plan, mainly including:

- Prioritization of projects that will effectively contribute to the SE4ALL objectives
- Creation of adequate financing plans for the implementation of the projects
- Creation of the an Institutional framework for the implementation and coordination of SE4ALL activities directly with the Ministry of Energy and Water.

Annex 3 - Hydropower and Thermal Centrals Details

Table 10 - Hydropower and Thermal Centrals Details – 2013 data (Source: ENE)

Hydropower Centrals					
System[2]	**Centrals**	**Nº Groups**	**EIS**	**Installed Power (MW)**	**Available Power (MW)**
N	Capanda	4	2005	520	500
N	Cambambe I (sem alteamento)	4	1962/1973	180	180
N	Mabubas	4		25,6	12
C	Biópio	4	1956	14,4	7,2
S	Matala	3	1955	40,8	22
E	Chicapa	4	2008	16	16
N	Luquixe I	1	1968/1971	0,9	0,6
N	Luquixe II	2		2	0
E	Luachimo	4	1957	8,4	6,3
C	Gove	3	2012	60	60
C	Lomaum	2	1961/2014	30	0
C	Lomaum	2	1961/2014	20	0
N	Cambambe I (com alteamento)	4	-	0	0
N	Cambambe II	4	2015	0	0
N	Laúca L2	1	-	0	0
N	Laúca	6	-	0	0
Total Hydro				**918,1**	**804,1**

Thermal Centrals					
System[2]	**Centrals**	**Nº Groups**	**EIS**	**Installed Power (MW)**	**Available Power (MW)**
N	Cazenga 1	1	1979	24,4	22
N	Cazenga 2	1	1985	32	30
N	Cazenga 3	1	1991	40	0
N	Cazenga 4 e 5	2	2001	44	0
N	Cazenga 6 e 7	2	2010	44	40
N	Viana	1		22	20
N	Boavista 1	1	2011	45	40
N	Boavista 3	1	2012	45	40
N	Boavista 2	1	2012	42,1	40
N	Sumbe	2	jun/07	2,4	1,2
N	Porto Amboim	1	2004	1	1

[2] N: North System; S: South System; C: Central System; E: Eastern System: CAB: Cabinda

N	Porto Amboim (Aggreko)	3		3,75	3,75
N	Gabela	1	2011	0,88	0,8
N	CFL	3	2012-Oct	72	66
N	CFL	2	2013-Dec	48	44
N	Morro da Luz	29	2012-Nov	40	30
N	Morro Bento	40	14/11/2012	40	40
N	Benfica	10	2012-Dec	40	36
N	Quartéis	8	2012-Dec	30	24
N	Viana km 9	24	2013-Jan	40	30
N	Cassaque	18	jul/13	20	20
N	Soyo	4	2014	0	0
N	Soyo	2	2015	0	0
C	Biópio	1	1972	20	17,5
C	CT Lobito	4	1986	20	3,5
C	Quileva (Aggreko)	6		30	30
C	Kuito-Kaluapanda	4	2011-Sep	10	9,6
C	Camacupa	2		2	2
C	Chinguar	5		2,59	1
C	Benfica Huambo	4	2013-Feb	15	15
C	Cavaco-Benguela	5	2012-Dec	20	20
C	Quileva-Benguela	6	2013-Jan	66	44
S	Xitoto	2		11,2	0
S	Tômbwa	2		2,4	2,4
S	Tômbwa	6		7,6	6
S	Menongue	7	2102-Nov	10	10
S	Lubango-Anexa SE	11	2012-Dec	40	40
S	Lubango-Zona Industrial	28	2102-Nov	40	40
S	Namibe-Xitoto	6	2102-Nov	10	10
S	Namibe-Aeroporto	3	2012-Dec	10	10
S	Menongue (Antiga)	7		5,6	2,48
CAB	Malembo (Fútila)	2	apr/11	70	70
CAB	Cabinda-Chibodo	18	nov/13	30	30
CAB	Cabinda-Sta Catarina	6		10	10
E	Dundo	2		3,2	0
		1		1	1
E	Dundo (nova)	8		30	30
E	Luena	2		3,2	3,2
		2		3,6	3,6
E	Luena (Jembas)	4		7,5	7,5
E	Saurimo	3	dec/11	7,5	7,5
E	Dundo	8		30	30
CAB	Buco Zau (Cabinda)			2	1
CAB	Belize (Cabinda)			2	1
Isolated	Zaire (Mbanzakongo)			14,5	11,5
Isolated	Cunene	3		10	10
N	Malange I	9		7,2	6
N	Malange II	5		0	0
Isolated	Soyo (Zaire)	3		6	5,2
Isolated	Bailundo (Bié)	2		1,6	1,6
Isolated	Wako Kungo (Kuanza Sul)	2		1	1
Isolated	Uige	4		4,8	3,2

Total Thermal	**1244**	**1026**
TOTAL	**2162**	**1830**