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Promoting renewable electricity generation in africa: strategies and perspectives

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ABSTRACT/RESUME

Abstract: *The African continent includes 54 countries which are different by their size, economic power, demography, and resources. These disparities naturally reflect in regional and national energy and electricity situations before drawing those of the continent. Under the probable end of the production of electrical energy with fossil fuels. The energy sector, and particularly electricity one, induces economic, political, social, technical, environmental and climatic issues, inseparable. This article examines the political options and the economic cooperation of African countries for renewable electricity generation that are still emerging, and their costs are evolving relatively rapidly, notably as a result of technological advances and economies of scale. It is therefore important to invest in renewable energy and improve energy efficiency to reduce these negative effects in Africa. The extent to which these are used will determine the future combination of renewable energies in Africa and especially in Algérie.*

I. Introduction

The access of electric energy is a strategic priority in all regions of the world. Africa is a young and hopeful continent; its 54 countries constitute a zone of potential development. Today, several of its economies are among the most dynamic ones in the world.

The potentials are wide - abundant natural resources, young demography and a youth more and more qualified, which constitute an emerging middle class. Despite enormous potential in fossil and renewable energies, Africa has significant energy deficits: the resources of the continent are sometimes under-exploited, sometimes exported in raw form, or even often wasted.

In a global energy context where the demand growth is drawn by the developing countries, the energy offer remains mainly fossil. The fossil energy is not inexhaustible; the environmental and social problems caused by their exploitation don't stop to increase.

Given that renewable energy technologies have to compete with relatively low electricity tariffs, funding will be needed. Possible sources, both locally and internationally, are identified.

This global context is also characterized by high price volatility and procurement instability (Catherine Tissot-Colle Jean Jouzel, 2013). Africa concentrates 17% of the world population, the continent suffering from poverty and weak communication between North/South end West/East (Gilles Pison, 2019). Our continent consumes only 3% of the world energy whose half of fossil energy.

The electricity sectors are characterized by a highly developed transmission and distribution network that plays a key role in ensuring energy supply. Electricity network has long been operated and developed as vertically integrated monopolies, which cooperated with each other to develop the interconnections between the different networks; in order to allow a better satisfaction of needs. African economic growth is expected to accelerate in the coming year to reach 4,1% in 2020 (Akinwumi A. Adesina 2019).

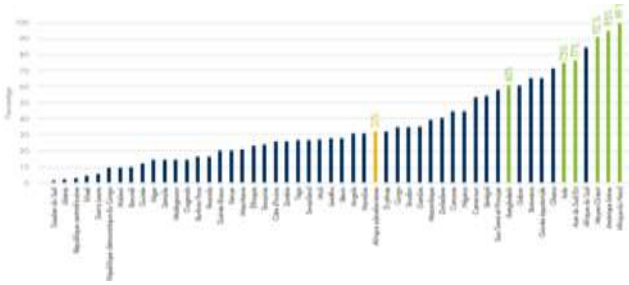
It is important to note that the production and distribution of electrical energy have today a strategic importance due to the strong growth in demand induced by the growing use of new technologies both in industry and households, such as information and communication technologies or the generalization of air conditioners, as well as electric trams; trains and hybrid cars in the transport sector.

What are the energy prospects for electricity production in Africa?

Among these countries, Algerie presents a significant potential energy resource: oil, gas and renewable energies. The Algerian economy is qualified as a rent economy based mainly on the revenues generated by the export of hydrocarbons, to reduce the dependence on hydrocarbons all forms of renewable energy must be developed. In particular, solar energy will diversify the energy mix supply and so consolidate the sustainable development of the country.
What are likely barriers to the development of renewable energy technology in the region?
What is the future of the Algerian electricity market in the African market?

II.Energy resources in Africa

Africa has fossil and renewable energy resources that are unequally distributed among its countries, but, nowadays, too often plunged into darkness. A large, rich continent with a population of 1.3 billion inhabitants, 30% of whom live in North Africa and South Africa. These two regions account for 80% of the energy consumed by the entire continent (large regional disparities) (Jean-Pierre Favennec, September 2015). Africa consumes 3% of the electricity produced in the world. Yet, more than half of its inhabitants do not have access to electricity (ADEA, 25/09/2015). Their average electrification rate is 42%, the lowest among developing regions. Five African countries rank at the top of the list of African countries with the best electrification rates (ESMAP, 2017). These countries located in North Africa (Algerie, Egypt, Libya, Morocco, and Tunisia) are among the 69 countries out of 127 studied where the electrification rate has reached 100% (Fabrice Juquois, 2016). South Africa (99th in the world) comes just behind these five countries, with an electrification rate of 85.40%. Next come Ghana with an electrification rate of 64.06%, Senegal (56.50%), Côte d'Ivoire (55.80%) and Nigeria (55.60%). Ethiopia, Kenya, Zambia, Mozambique, and Tanzania are at the bottom, both in Africa and globally, with electrification rates below 27%. This continent is catching up with the launch of several electrification programs. The low connection rate in Africa is shown in Figure 1.



Source: International Energy Agency, 2016, World Energy Outlook

Figure 1. *The low connection rate in Africa (access to electricity by country)*

Africa is a strategic producer of oil and gas with low consumption (42% oil, 28% gas); which leaves important quantities available for export. This low energy consumption is both cause and consequence of the low level of development of this region. Proven reserves of oil and gas amount to 16.9 billion tons of oil, and 503.3 trillion cubic feet of gas (Tcf), respectively: 7.5% and 7.6% of world reserves (According to BP statistic review of wold energy june 2017) and are roughly evenly distributed between North Africa and West Africa (Algerie, Angola, and Nigeria). Sub-Saharian Africa made one-third of oil and gas reserves discoveries between 2011 and 2016.
Coal reserves are highly concentrated in South Africa, which holds 97% of the continent's reserves (large reserves in Zimbabwe). Africa is also well endowed with uranium: 15% of the world's reserves. In Central and Eastern Africa, water resources are also important but underutilized. This continent has a regional asymmetry matching: North Africa supplies gas to Europe and West Africa exports gas to North America (main gas hubs), although only one-third of South African production is exported, mostly to the European Union and East Asia. South Africa is the third largest net exporter of coal in the world (Michel Battiau, 2008).

Electricity generation in Africa has increased with the use of non-fossil fuels; hence, there is a need for a rebalancing of primary energy in favor of renewable energies that have opportunities for sustainable development. The continent as a whole had a global capacity of 38,192 MW at 31/12/2016. Ethiopia tops the list of African countries with the largest installed capacity of renewable energy in 2017 (According to a report published by the International Renewable Energy Agency (Irena)), with a maximum net capacity of 4.188 megawatts (MW). South Africa, the most industrialized country on the continent, is in second place with a capacity of 4,064 MW (According to the report entitled "2017 Renewable Capacity Statistics").

Algerie ranks eighteenth with a capacity of 536 MW.

However, Africa reckons a lack of access to electricity that is a drag on the realization and reduction of poverty, not to mention the tariffs that are among the highest on the planet, to which Africans are subject (14 cents per KWh) while power cuts are common (eg Nigeria with up to 260 hours cut in a single month (Jerome Douat, Vergnet; 2019)) due to the price of fuel oil, inadequate networks, lack of investment, energy efficiency (There is a ten-fold increase in energy demand with economic growth in the case of Tunisia and Libya, and Algerie is capitalizing a high energy intensity of 0.520 toe / 1000 $; the lowest being in Sudan: 0.223tep / 1000 $ (Rafik Missaoui and Sami Marrouki,2014)).

One of the effective ways of reducing tariffs is to bring together available forces by building electricity interconnections such as the case of Chad and Burkina which benefit from a low tariff of $ 4 cents through an interconnection with the Nigerian grid, especially Maghreb countries. It is recommended to gradually reduce producing countries' oil and gas subsidies where the price is lower than the local cost of production; a situation that leads to over-consumption and which very often fills deficits and restructures the energy sector by improving decision-making and giving a greater role to the private sector. The state subsidies in the electrical field is given in table 1.

Table 1. *State subsidies in the electrical field (2014)*

	Senegal	Algerie	Chad	Nigeria	Ivory Coast
Domestic rates (in dollars / KWh)	0,20	0,06	0,35	0,06	0,14
Small Business Rates (in dollars / KWh)	0,14	/	0,25	0,09	0,17
Company results (millions of dollars)	-130	-800	/	/	+13,8
Cut-off (hours / month)	6	6,3	142	256	3,3
Access to electricity as% of production (2014)	56,5%	99%	3,5%	45%	78%
Share of lost production (in value)	25%	9%	30%	25%	17,6%

Source: *World Bank, 2014*

II.Electricity in Africa by region
II.1. Electricity in North Africa

According to the World Bank, 35% of the African population has access to electricity. The regional generation capacity is 100 GW, where 54 GW are disposed by the **Maghreb Electricity Committee** (COMELEC). The **percentage** of access to electricity is approaching 100% in all countries except Sudan. The region includes 5 net hydrocarbon exporting countries (Algérie, Libya, Egypt, Sudan, and recently Mauritania).
Electricity exchanges within the region are marginal compared to the potential. While there are electrical interconnections in almost all countries in the region, trade remains relatively limited with a goal of balancing imports and exports (Hay Riad, September 2012). Maghreb countries have strengthened electricity interconnections between them, by building 400 kV electrical backbone that increases the exchange capacity.

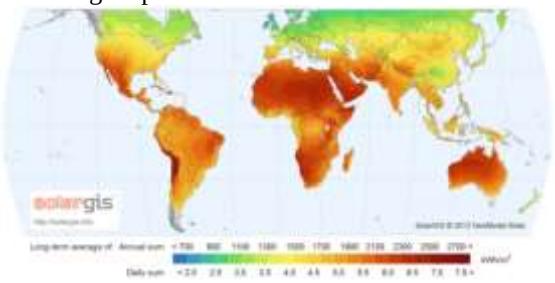
Algérie is playing an increasing role in the development of major electricity transmission networks in the African and Mediterranean area. There is currently only one interconnected network between North Africa and Europe via two (750 MW) transmission cables between Morocco and Spain. This capacity must be reinforced by 2020 by the installation of a third cable which should bring the total capacity of exchange to 1000 MW. Morocco has become an energy hub between the two Mediterranean shores and provides basic infrastructure to the emergence of a real electricity market. The future plans predict a harmonization of the Maghreb electricity market with those of the European Union which will allow electricity exports (for example natural gas, solar path), the Mediterranean Solar Plan (MSP) and **Medgrid industrial consortium**, seek to promote the development of an interconnection network between Europe and the **southern** and **eastern Mediterranean**.

II.1.1. Algérie

The average growth of national gas **consumption** is 5% per year. It is a major strategic problem for our country. It must absolutely be solved under duress. First and fore most by redeploying the energy mix towards renewables. In fact; we live a real aberration as fossil fuels represent 100% of this mix, and on the other hand, renewable energies represents 0.02% of the national energy balance, while our country is a real open-air electric pile, and ranks third in world reserves of shale gas **with seven** (7) **basins** containing **shale gas** with a potential of 700 Tsf, especially in the major basins of Ghadames / Berkine, Timimoun, and Reggane (Guillaume Charon, 2014).
According to the German Space Agency, the potential of renewable energies in Algeria is the largest in the Mediterranean basin. The Great South of Algeria, the arid and semi-arid zones occupy more than 90% of the total surface of the country (2 381 745 Km²). The **insolation** time **over** the quasi-totality of the **national territory exceeds 2000** h

per year and can reach 3900 hours (highlands and Sahara) (Abdel - Nasser Cherigui, 2015). The energy received daily on a horizontal surface of 1 m^2 is around 6.57 kWh / m^2 / day over most of the national territory, ie about 1700 KWh / m^2 / year in the north and 2263 KWh / m^2 / year in the south of the country. The Algerian solar potential is 37 billion cubic meters, the equivalent of 10 large natural gas fields that have been discovered in Hassi R'mel.

The sun is a spherical star that is a source of life as it provides us with most of the energy we use (Christin ngo preface by Bernard Bigot, 2008). But each of the energy sources has advantages and disadvantages, in terms of cost, security of supply, impact on the environment (Christin ngo preface by Bernard Bigot, 2008). All countries in the region have considerable solar potential, as shown in the following map:



Source: *Solar GIS, 2013 GeoModel Solar*

Figure 2. *Importance of solar potential in North Africa and in the world*

In this context, Algerie initiates a green energy dynamic by launching an ambitious program for the development of renewable energies, and energy efficiency program.

Algérie can position itself as a major player in the production of electricity, from the photovoltaic and wind sectors by integrating biomass, cogeneration, geothermal energy and beyond 2021, solar thermal. These energy sectors will be the engines of sustainable economic development capable of stimulating a new model of economic growth. 37% of the installed capacity by 2030 and 27% of the electricity **generated** to national consumption will be with renewable energy sources. The consistency of the renewable energy program to be achieved for the national market over the 2015-2030 periods is 22,000 MW, distributed by sector as follows:

Table 2. *The Renewable Energy Program for the National Market*

Unit: MW	1st phase 2015-2020	2nd phase 2021-2030	Total
Photovoltaic	3 000	10 575	13 575
Wind	1 010	4 000	5 010
CSP	-	2 000	2 000
Cogeneration	150	250	400
Biomass	360	640	1 000
Geothermal	05	10	15
Total	4 525	17 475	22 000

Source: *Ministry of Energy and Mines of Algerie, 2016*.

The projects will complement the solar energy program which started with the installation of the first hybrid power station, natural gas-solar installed in Hassi R'mel in July 2011. This central, realized by NEAL, in partnership with the Spanish firm ABENER, combined cycle technology, and parabolic solar concentrators.

The following table presents the other important CSP projects in Algerie:

Table 3. *Four solar hybrid plants project in Algérie*

Solar Hybrid power plant	Location	Installed capacity CSP / MW	Year
SPP I Solar Power Plant One	Hassi R'Mel	25 (total capacity is 150 MW)	2011 (June)
SPP II Solar Power Plant Two	Meghaïr	470 including 70 solar	2014
SPP III Solar Power Plant Three	Nadma	70 Solar	2016
SPP IV Solar Power Plant Four	Hassi R'Mel	70 Solar	2018

Source: *New Energy Alégrie 2016*

Investments in AlgérieAchievements

- The first solar-gas hybrid power plant in Algérie (130 combined cycle gas and 25 MW solar field of 5% minimum produced from solar) was inaugurated on 14/07/2011. Located in HassiR'mel, this plant was named SPP I, from the name of the company that made it, Solar Power-One;
- In 2014, implementation of Adrar's 10.2 MW wind power plant;
- In 2014, implementation of Ghardaïa's 1.1 MW photovoltaic power plant;
- In 2016, 18 photovoltaic power plants with an installed capacity of 268 MW were commissioned in the highland region and southern Algeria;
- In 2017, the turbine production plant in the wilaya of Batna, which is part of the Algerian-American partnership (Sonelgaz and Géneral Electric), is "a national achievement and a success" for producing gas and steam turbines for national projects and export to Africa in the future;
- In 2017, the commissioning of photovoltaic solar power plant in the municipality of Ain El Melh, located 120 km southwest of the chief town of wilaya, with a capacity of 20 megawatts (the ministry of energy and mines Algérie, 2017), this photovoltaic solar power plant (production of electric energy) is the first of its kind in the capital of Hodna and whose realization required the mobilization of an investment of nearly 3.9 billion dinars.

Call for tender

Starting next summer, 11 new stations reported the President and CEO of the Electricity and Renewable Energy Corporation (SKTM, a subsidiary of Sonelgaz), that the company plans to produce approximately 295 MW of electricity with alternative energies in the highlands of several wilayas next summer, as part of a program to build 23 generating plants with a capacity of 350 MW of electricity across the country with operators Chinese Group YINGLI SOLAR / SINO HYDRO / CNTIC. Algérie is considering the production of 4,000 MW of electricity from renewable energies and has called on domestic and foreign investors to focus more on the renewables market (with an adequate regulatory framework (According to the official journal 2016)).

The implementation of this program should allow:

To intensify the national production, reduce the dependence of the Algerian economy on hydrocarbons, save nearly 600 billion m3 of gas over 20 years (Algérie has exported to date, without interruption, more than 1500 billion m^2 of gas to Europe, the USA, and Asia), reduce nearly 193 million tonnes of CO2 emissions and still allow to develop the local industry of outsourcing of traditional energies, new and renewable, in order to reduce the import of spare parts. Finally, it is a niche that interests many companies, especially since the market is theoretically open. Beyond this ambitious plan and the realistic projections just outlined, it is notably the question of financing that poses a problem.

- High level of subsidies to the energy sector and low electricity prices.
- Water availability can be a serious constraint to the development of CSPs.
- The exchange of electrical energy between African countries remains a serious challenge.

In order to boost renewable energies and set up a genuine national industry, it is recommended to encourage the creation of small and medium-sized SME-SMI enterprises to support the consistent investments launched in this field. There is a need to educate the public about the effect of rationalizing energy use considering that it is the most important factor in the entire electricity production-consumption chain.

II.1.2. Morocco

Morocco has very few fossil fuel deposits and therefore still relies heavily on energy imports (in 2014: import of 89.4% of the energy used) (Ahmed LAHLIMI ALAMI, 2014). In 2015, Morocco's electricity generation capacity was 8154 MW, divided between coal (31%), fuel and diesel (10%), hydroelectricity (22%), gas (25.8%) and wind energy (9.4%)

This country estimates its solar potential at 5kWh / m2 and launched at the end of 2009 a project that aimed to set up a production capacity of 2000 MW in 2020, ie 38% of the installed capacity at the end of 2008, and 14% of the electric power in 2020. In particular, the NOOR1 solar power plant develops 160 MW in 2016 (Hay Riad, September 2012) and it targets 42% of its electricity production due to renewables in 2020. But the latter which allows energy diversification while continuing to use fossil fuels (62% oil, 20% coal and 5% gas). The country has also set up a ten of hydroelectric installations and a tens wind farms (competitive investment costs for wind power [16]). The delays of the projects of these countries due to:

- Lack of investment due to insufficient market size and weak economies in most countries;
- The lack of financial viability of these projects;

The Maghreb countries have set up ambitious programs for the development of renewable energies at different dates. For this purpose, it is necessary to undertake regulatory and institutional reforms for the deployment of this energy at national and regional level.

To improve the situation of this African region, it is necessary to:

- Establishing regulatory, legislative and institutional frameworks to provide long-term visibility and transparency on investment conditions;
- Regional integrations are essential to pool investments, increase the size of potential markets, rationalize the deployment of infrastructures, and to optimize their maintenance and secure their management;
- The use of a technically efficient and economically competitive centralized electrical system, capable of generating new wealth, new investment capacity;
- Training staff and transfer skills for all related jobs;
- An important point about renewable energy is information and consumer awareness that needs to be developed.

II.2. Electricity in West Africa

The West Africa Power Pool (WAPP) represents an installed capacity of 13GW. The main sources of energy are natural gas (Nigeria also has the largest reserves of natural gas in Africa, 2.8% of proven reserves in the world at the end of 2016 in front of Algerie. Nigeria has produced nearly 44,8 billion cubic meters in 2016 or nearly 1.3% of global gas production), hydroelectricity, fuel oil whose price is prohibitive for electricity production. There are several interconnections between Senegal, and Mali (330 kV), Burkina Faso and I**vory Coast** (225 kV), as well as between I**vory Coast**, Ghana, Togo, Benin, and Mali. Nigeria. Thus, the development of renewable energies is an important potential that exists on the Senegalese coasts and in Cape Verde, furthermore, it has an important sunshine, evaluated between 5 and 7 kWh / m2 / day (is almost 2 times more than in France).To improve the situation it is necessary:

- Use of Nigeria's gas resources to develop thermal generation in the eastern part of the region;
- The development of interconnections between the networks of the different countries and the PEAC (Central African Power Pool).
- Optimum exploitation of dams to provide electricity can increase the profitability and predictability of production (Production can increase by 15% in years with high water resources and decrease by 30% in years of severe drought).

II.3. Electricity in Central Africa

The Central African Power Pool (PEAC) has the largest hydropower potential in Africa, 650 GWh / year, or more than 57%. The DRC (Democratic Republic of Congo) has the largest potential for hydropower with 100 GW, which could currently cover all the needs in sub-Saharan Africa. The potential of Grand Inga is estimated at more than 40 GW, it is the largest dam in the world.

The exploitation of hydropower uses the variation of potential energy of water depending on the height, and the power that can be extracted from a waterfall is proportional to its flow and its height (Jean-Pierre Favennec, December, 2009). We can have a high fall with low flow, low falls with a high flow as well as intermediate situations. Large amounts of water and an important height difference are essential to produce a lot of electricity. Indeed, 1Kwh represents the energy of 3.6 tons of water; falling from a height of 100 m. Hydropower is expensive in investment but economical in operation (Christin ngo, 2008). This complex is the heart of the DRC's electricity generation fleet (this form of energy thus ensures the country a long-term supply guarantee, while remaining limited by possible periods of drought) (Bernard Wiesenfeld, 2005). So, and for that, there must be:

- Rehabilitation and maintenance of plants can increase operational capacity;
- Increasing hydropower generation while respecting the environment, population, and ethical rules;
- The development of gas production;
- The creation of a free market for the exchange of energy in space through interconnected energy paths;
- Coordination and implementation of regional power infrastructure projects;
- The common definition of technical and commercial rules for the exchange of electrical energy;
- Harmonization of regulatory frameworks in the regional power sector.

II.4. Electricity in East Africa

The installed capacity of Eastern Africa Power Pool (EAPP) is 42 GW. Ethiopia's abundant hydropower resources play a key role in this region. The Ethiopian potential is estimated at about 40,000 MW for a power installed in 2009 of 810 MW and the capacity of electricity production could be raised to 10000 MW in 2018 due to the main projects that have been realized. In this case, it is necessary:

- Highlight the geothermal potential;
- The harmonization of all aspects, regulations, policies, and cooperation between the different countries that are taken into account.

II.5. Electricity in Southern Africa

The Southern African Power Pool (SAPP) represents an installed capacity of 56 GW of which 45 GW is located in South Africa, and still faces under-production problems. 25% of the population does not have access to electricity. Most of the production is of coal sources, but there are nevertheless two nuclear units built near Cape (Koeberg) which has two reactors with a capacity of (2 X 900 MW). In terms of uranium reserves and extraction (Bernard Wiesenfeld, 2005), Africa occupies an important place: in Niger, South Africa, Malawi, and Namibia. It is necessary:

- Re-examine the electricity needs in the region;
- Promote research on $C0_2$ capture and storage, without which it is difficult to envisage the development of production from coal;

- Develop renewable energies that are on the agenda.

In general, electricity in Africa comes from coal, natural gas, the primary source of energy being biomass. Yet, its land is also particularly conducive to renewable energy. The increase in installed electricity capacity and the increasing use of renewable resources could, however, transform the economy and lifestyles of Africans; especially since renewable energies constitute a major pillar of the "Business Plan for Climate in Africa". Moreover, Africa is witnessing an explosion in the production of renewable energies in the coming years, especially those from solar technologies: "Hydroelectric and photovoltaic predominate."

In Africa, 1 m^2 gives 300 and 600 Wh per day depending on the countr (Anne Labouret, Michel Villoz, 2006). This phenomenon is known as the experience effect: the prices of PV and parabolic modules around the world have dropped since the 1970s and 1980s because of the scale economies and accumulated experience (learning curve); the learning rate is about 20%, which means that the price of modules decreases by 20% each time the quantity produced is multiplied by two.
The costs and performance levels of renewable energy facilities are generally similar in the world, although the exact cost and performance of each technology cannot be precisely quantified (Jean-Pierre Favennec, December, 2009).

Program analysis

The analysis carried made it possible to highlight the part which will play renewable energies in the current and the future park of production of electricity and the requirement that renewable energies imposing during its insertion in the production of electricity. The solar thermal sector totals up to 6 projects with a total capacity of a little more than 1350 MW. Most important of these power stations will produce 400 MW as regards power. The smallest power station of 150 MW and will be built in the wilaya of Béchar.

Lastly, the wind power sector totals 7 projects with a total capacity of 260 MW with 04 projects of a capacity of 50 MW and 3 projects of a capacity of 20 MW. The sites having to shelter these projects were not defined yet, but should be localised in the area of Adrar known for its important potential on the matter.

Source: *New Energy Alégrie 2016*

Figure 3. *Locations of some projects*

The expected results of renewable energy program are:

- Savings in 600 billion dinars of m3 of GN;
- Half of this volume will be preserved for the next decades;
- The other exported half will generate additional receipts for the country;
- Creation of more than 200.000 employment direct and indirect; including 100.000 employment in export;
- Reductions of the gas emissions for purpose of greenhouse;
- Improvement of the radiant intensity;
- Prohibitions of the loans in currencies;
- Improvement of energy safety.

Among the obstacles with which will be confronted the Algerian state at the time of the realization of program of renewable energies, we can quote:

- The prohibition of the loans in currencies (Algerie authorizes only the loans in local currency: offer reduced possibilities of financing of EnR);
- The durability of the support (EnR appear expensive within sight of the important subsidies in the energy sector, Question about the availability of the funds in the Funds of EnR to cover the costs of EnR);
- The exchange rate risk and risk of inflation;
- Potential land problems (the access to grounds is a challenge);
- Possible problems of connection and integration to the network;
- The lawful process and procedures not very clear.

III.Conclusion

African continent owns abundant reserves of fossil fuels and more of renewable energy. Urbanization, demographic growth, and economic increase lead to more important demand for electric energy. The

continent will have to increase its electricity production by 4% per year by 2040 to face this need. The national strategies of African countries must take this commitment into consideration and so to ensure universal access to energy by 2040. The stakes are high because it is about providing electricity to 645 million additional people, either by connecting them to the network, either through mini decentralized networks or off-grid energy supply. The security of supply in the electricity market is determined by the different characteristics of each country (Leon Freris, David Infied, 2009): the internal disponibility of primary energetic resources, economic and social conditions, and environmental context.

Algerian electrical system is located in a strategic position. It's about a great opportunity and a leverage of economic development for the neighboring countries. The demand for electrical energy is expected to explode under the impulse of economic growth, demographic changes, and urbanization. At this point, Algerie is seeking solutions with political power to increase investment in energy infrastructures. The impact of infrastructures on growth and productivity is all the more important when it comes in the large area.

To improve the country's electricity situation, we can resume two main options: satisfy the local market before exporting electricity to other countries or produce in neighboring countries to supply the local market.

In this sense, we propose some solutions:

- ✓ The creation of a legal framework for common electrical systems, that could produce competitive situations for electricity exchanges;
- ✓ The reduction of energy intensity in order to fight against the waste of energy;
- ✓ The modernization of the investment framework: liberalize the economic system, facilitate the entry of private actors and associate independents into the production of renewable energy;
- ✓ The procurement through 'take or pay' contracts;
- ✓ The mobilization of national resources by the rise of the part of renewable energies;
- ✓ The development of an industrial SME local network, specialized in the production of accessories and other components around renewable energies.

The opening of extraordinary spaces for renewable energies will be a way to export electricity to other continents. These are all solutions to explore and to quantify so that the control of energy demand corresponds to the country's population growth and in the first-place electrical needs. The exploitation of solar energy, especially, in a country like Algerie, can be very profitable. Today, we are aware of not being able to realize such a project alone. We have to reconcile our strengths to benefit from new opportunities in the electrical sector. Before that, it will be necessary to adapt the multinational company's strategy to the different regional area. We can't also forget that human, environmental, political, cooperation between different countries…criteria have to be considered.

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