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Investment in Renewable Energies as a Tool to Achieve the Energy Security: a Comparative Study Between Algeria and Morocco

الاستثمار في الطاقات المتجددة كأداة لتحقيق الأمن الطاقوي: دراسة مقارنة بين الجزائر و المغرب

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Abstract

Since the advent of the industrial revolution, the consumption of energy resources has increased significantly, especially non renewable (coal, oil and gas), And these resources are no longer sufficient to meet the various energy needs, and this has become a threat to the energy security of many countries now and in the future, This has made the world look for other sources to satisfy these needs.

Where the results of research and development had emergence of new uses of old energy sources and called renewable energies, And many consider it the future of energy despite the obstacles that still prevent the general use of this energy.

Our study focused on two states, Algeria and Morocco, despite the difference in their strategies and their resources of energy, but the goals is one in the field of investment in renewable energies, as written down both countries for future ambitious goals focus on the production of electrical energy from renewable sources, where we highlight in this study on the reality and the prospects of renewable energies in both countries and as well as their contribution to the energy security in the region

Keywords : *Renewable energies, investment, the energy security, Algeria, Morocco.*

ملخص

منذ ظهور الثورة الصناعية زاد استهلاك الموارد الطاقوية بصفة كبيرة خصوصا الناضبة منها(الفحم، البترول و الغاز)، و لم تعد هذه المصادر كافية لتلبية الحاجيات الطاقوية المختلفة، و هذا ما أصبح يشكل تهديدا على الأمن الطاقوي للعديد من الدول حاليا و مستقبليا، ما جعل العالم يبحث عن مصادر أخرى لإشباع هذه الحاجيات.

حيث أسفرت نتائج البحث و التطوير عن ظهور استعمالات طاقوية جديدة لمصادر قديمة و أطلق عليها تسمية الطاقات المتجددة، حيث يعتبرها الكثيرون مستقبل الطاقة رغم المعوقات التي لا تزال تحول دون تعميم استخدام هذه الطاقة.

تركز دراستنا على دولتين هما الجزائر و المغرب، فرغم اختلاف استراتيجياتهما و مواردهما الطاقوية إلا أن أهدافهما واحدة في مجال الاستثمار في الطاقات المتجددة، حيث سطرت كلتا الدولتين أهداف مستقبلية طموحة تركز على إنتاج الطاقة الكهربائية من مصادر متجددة، حيث سنسلط الضوء في هذه الدراسة على واقع و آفاق الطاقات المتجددة في الدولتين و كذا مساهمتها في تحقيق الأمن الطاقوي بالمنطقة.

الكلمات الدالة: الطاقات المتجددة، الاستثمار، الأمن الطاقوي، الجزائر، المغرب.

Introduction

The energy subject is one of the most important subject that occupied humanity since old times, Where he relied on his muscular energy and animals power, and with his evolution relied on wind and water to navigate and grinding grain, but with the accelerating developments human beings needed a source more efficient so they discovered fossil energies which has become the most important source of energy, but the negative aspects of this energy on the side, and the excessive use on the other side made them think of other energy sources Characterized by sustainability and the preservation of the environment.

And with the continued rapid pace of consumption of the fossil energy will be implemented, and will be insufficient now and for future generations, so Human attempt to achieve the energy security obliged him to find new sources of energy characterized by abundance and preservation of the environment.

And of the leading sources reached by the human non-polluting energy as well as a permanent called renewable energies, which became the hope of the world to achieve the energy security now and in the future, thus; many nations invest and encourage investment in this area among these countries, we find Algeria and Morocco

*** The problem of study and Questions Subcommittee:** Through the above highlights we have the following problem:

- How can renewable energies contribute to achieve the energy security in Algeria and Morocco?

And through this problem highlights the following sub-questions:

- What is the concept of renewable energies and investment in renewable energies?

- What is the concept and requirements for achieving the energy security?

- What is the reality and the prospects of renewable energies in Algeria and Morocco?

*** Objectives of the study:** This study aims to:

- identify concepts related to renewable energies and energy security.

- Know the reality of the Maghreb countries in the field of renewable energies and energy security.

- Identify the strengths and weaknesses possessed by each country in this area.

- Identify the prospects for the use of renewable energies and the requirements for achieving the energy security in the region.

*** The importance of the study:** highlighting the importance of the study through the importance of the topics addressed by:

- The importance of the subject of renewable energies as the energy of the future.

- The importance of the subject of energy security as one of the topics of the moment.

-The importance of the subject of energy transformation as the basis for the development of States.

*** The methodology of the study:** the preparation of this study was to rely on the descriptive and analytical approach, where we find the descriptive approach in the definition of variables of the study, the analytical method applied in the case study and analysis of the information obtained.

*** Study Tools:** the completion of the study was to rely on scientific books and periodicals foreign court, as four the applied side was relying on specialized reports, in addition to the Internet sites of public administrations and ministries sites and poetry national statistics.

*** study axis:**

The first axis: the concept of renewable energies.

The second axis: the concept and characteristics of investment in renewable energies

The third axis: concept and requirements for achieving the energy security.

The forth axis: Comparison study between Algeria and Morocco.

2- the concept of renewable energies

2-1- the concept and the types of renewable energies: The concept is relatively new but it is one of the most important terms that occupy researchers today.

2-1-1- The concept of renewable energies: and also known as permanent energies and clean energies and energy of the future, as defined by the International Energy Agency as "energy produced from natural sources, which are constantly renewed directly or

indirectly, like the sun, wind, biomass, geothermal, hydro energy, befouls and hydrogen energy derived from renewable sources [1].

The International Agency for Renewable Energy has been defined as "all types of energy produced from renewable sources and sustainable manner, including biomass, geothermal, hydropower, energy seas, solar energy and wind power. [2]"

Through the previous definitions, we find that the basis of the nomination of renewable energies return to the source which produced it, where the sources of renewable energies are not finished such as solar energy, where the sources of renewable energies are Permanent such as solar energy, or the fact that the Renewal in nature faster than consumption, such as geothermal energy and biomass.

2-1-2- Renewable energies characteristics: a lot of researchers consider the renewable energies as the energy of the future because the unique properties in this type of energy:

• Renewable energies are considered a constant source of energy and can be exploited for the current generations without the fear of inadequate for future generations.

• Renewable energies are considered clean energy, where it can be for the current generation to satisfy their needs from renewable energies without fear of negative effects on future generations.

• Renewable energies are considered available in most parts of the world , Solar energy on the planet equivalent to fold the human need for energy, and water account for 70% of the World area [3].

• Renewable energies considered as Guarantor of the world peace, because most of the current global conflicts revolve around the availability of fossil fuels rare sites, and the availability of renewable energies in most parts of the world there is no need for such conflicts.

• Considered most types of renewable energies free after the construction cost where maintenance expenses only on the contrary of the fossil energies that require large expenses recoverable.

• We can enter most renewable energies easily to our current energy system which reduces the investment costs.

• Renewable energy prices are not affected by changes in the prices of fossil fuels because it produces separately.

• The cost of most types of renewable energies is considered high compared with fossil fuels, but with the current developments, the costs are decreasing annually.

• some types of renewable energies is characterized by being dependent on complex technology not available in many developing countries and underdeveloped, What hinders the use of these energies.

• The weakness of energy conversion efficiency, Where Does Not Exceed the efficiency of the conversion of the solar panels to electric energy 28% maximum [4].

2-2-Types of renewable energies: Most experts agreed on the division of renewable energies to:

2-2-1- Solar energy: solar energy is one of the most important sources of energy, as the sun rays hyphen to Planet Earth more than 500 times the energy needs of human beings [5].

In view of the relationship of man with solar energy find it exploited since ancient times in drying the grain and heater and even in war

The relationship has evolved in the beginning of the twentieth century, when increased human need for energy and the search for other sources, where he discovered the silicon cells that convert thermal energy of the sun into electricity, and since that time he focused his efforts to develop this technology and reduce its cost.

And could benefit from solar energy in two ways, which can be utilized as thermal energy to used for heating and cooking and heating water, and can be used as electrical power by photovoltaic collectors.

2-2-2-Wind power: Wind is considered as secondary result of the sun, in unequal temperatures and uneven ground makes the hot air rising to the highest layers, which generates a vacuum being filled with cold air, This phenomenon is called the wind.

And wind is one of the oldest types of energy adopted by the Human Rights, where it was adopted in the grain milling through the windmills and moving the ships sailing, and with the discovery of the wind

turbines increased interest in this type of energy and is used as a basis for generating electric energy in many States like the Netherlands and the United States.

2-2-3-Hydropower: The hydropower is generated by the movement of water, which spin the water turbines to generate electric power, Which means the conversion of dynamic energy into electricity.

And can produce hydropower from natural or artificial waterfalls highlands and as well as dams and waterways, and can be produced from wave action and the phenomenon of tides and as well as change the temperature of the ocean, the hydropower is considered the most common types of renewable energy used in the present day.

2-2-4-Biomass energy: is the oldest type of energies used by human where he shall burn wood and plants for heating and cooking and with various developments he converting agricultural, industrial and commercial residues chemical or biochemical way to generate heat or electricity.

Where the smoke rising through the burning process moving the turbines that generate electricity, Biomass is also used as a fuel for cars.

2-2-5-Geothermal energy: its origin from underground that contains a huge amount of thermal energy generated by nuclear reactions about 4.5 billion years ago, as this enormous energy stored beneath the earth's crust part of it comes out in the form of lava, steam and hot water springs.

This energy is converted into electricity through specialized stations, where different wells are drilled, and connect this wells with tubes and Steam rises as a result of high temperature to the top and rotates the electricity turbines, When the steam turns into water is returned to the ground.

We can used the geothermal energy directly for heating and cooling, or indirectly to generate electricity

2-2-6-Hydrogen energy: The hydrogen is the third most factors available in nature after the oxygen and Silicon, It can also be obtained from other elements such as water, it not considered as renewable energy in comprehensive concept, but is closer to the holder and energy storage, where electricity is produced by renewable and non-renewable sources, and is stored and transported in hydrogen [(6)].

3- the concept and characteristics of investment in renewable energies

Investment in renewable energies become one of the energetic strategic pursued by many countries in **order to achieve social or economic goals.**

3-1- Investment in renewable energies Definition: The definition of investment in renewable energies is not different from the definition of investment, it can be defined as "all assets owned by the investor directly or indirectly related to renewable energies, and the general investment conditions is available as Share capital and commitment and search for profit and the presence of risk.

as can be defined as" the recruitment money one of the areas of renewable energies in order to make a profit [(7)]"

3-2-Investment in renewable energies characteristics: are:

- The significant risk in investment: in terms of investment in renewable energies follows many investment risks such as production risks, technological risks, construction risks in addition to the legal and financial risks.

- The High profits: most of the renewable energy projects tend to achieve high yields and substantial operating efficiencies up to 80%.

- Big investments: most of the renewable energy projects require large capital especially in the construction period and less in the period of exploitation.

- Length of the payback period: most of the renewable energy projects characterized by a period of recovery of capital length, which means that these projects attract investors who do not want to convert their assets into money quickly.

- There is no relationship between the flow of raw materials and the economic or political conditions, that the rays of the sun or wind speed is not linked to economic crises, and this allows for investors to continue their production in the normal manner.

- Many States supporting projects of renewable energies in light of international policies aimed at reducing pollution and toxic gases [(8)].

3-3-Types of investment in renewable energies: Where distinguish the following types:

3-3-1- According to geographical classification:

- Local Investments: is the recruitment of tangible assets and intangibles in one of the areas of renewable energies in the same country as the investor, whether private or public.

- Foreign investments: the transfer of tangible and intangible assets from one country to another for use in the host country in renewable energy projects and the generation of wealth, and we find foreign direct investment and foreign indirect investment [9].

3-3-2-According to the capital: and we find:

- Public investment: means the exploitation of material or moral state assets in one of the areas of renewable energies for more than a year, in order to achieve social ,environmental and economic goals [10].

- Private investment: that the private investor (not the state) employing the material and non-material assets in renewable energy projects for more than a year in order to make a profit, And can be locally or foreign investor.

4- concept and requirements for achieving the energy security.

4-1-The definition of energy security: the energy security can be defined as "the ability to cover the demand for energy at affordable prices. [11]"

It can also be defined as "the ability of households and institutions in the state, to cover the current and future needs of energy in the case of the interruption of the external supply of energy. [12]"

Through the previous definitions could be the definition of energy security as"the use of various energy sources to cover the energy demand at present and in the future, at affordable prices."

And we find the international agency of energy Identified tow tapes of energy security:

- The energy security Short term: we mean" the ability of the energetic system of state to adapt to sudden changes in supply and demand for energy and get it at an affordable price".

- The energy security long-term: investment in the appropriate time to provide energy needs for the future consistent with economic, environmental and social needs [13].

4-2- History the energy security: The energy security is a new concept, the idea of getting new sources of energy began during the Industrial Revolution, where demand has increased as a large supply of wood which led to the search for alternative sources of it, But the true concept of the energy security emerged during the Cold War and the threat of Soviet Union sources of American power in the Middle East, for enhanced international thinking in the energy security through the Arab war against Israel in 1973 to continue the consequences of the crisis to the year 1974, Where importers of fossil energy felt threatened and dependency which made them look for other sources of energy, and as well as the issuance of international laws to limit the dominance of the organization "OPEC" on the global energy market, and which increased the importance of the issue of energy security is the crisis of the rise of world energy prices between 1978 and 1979.

Currently in the light of the political situation experienced by many of the Petroleum Exporting Countries like Libya, Iraq and Egypt, and the change of energy policies in the world made the subject of energy security emerged again, where it should achieve the energy security in accordance with the environmental conditions, and this has led to focus on the issue of investment in renewable energies [14].

4-3-The energy security problem: the energy security is one of the most prominent topics that occupy the world arena, where the problem of energy security emerge through the increasing demand on energy, we find that the energy demand rose by more than 30% of 2003 to the present day And it will double in 2050, And on the other hand limited supply, especially non-renewable energies, it is expected the entry into force of oil and gas after 100 or 200years, either nuclear energy and coal between 50 to 100 years, and renewable energies alone could not meet the global demand, especially in the present time, and The growing concern for the environment and the world sought to produce clean power and the emergence of the term sustainable development which is intended to "meet the energy needs of the present without compromising the right of future generations." All of these reasons have made the energy security of the most important international issues [15].

4-4- The requirements of achieving energy security: Achieving the energy security both in the short or long term imperative for all countries of the world, in terms of energy represent the backbone of human development and to achieve the energy security must provide the following requirements:

- Technology: should be the development of the current technology to produce and extract the largest amount of energy in the lowest cost, especially in the field of new energies such as solar and nuclear and shale gas.

- The political will: to achieve energy security programs must be put in accurate and continuous follow-up of these programs, and cannot be achieved only by the availability of political will.

- Investment: there must be huge sums in the field of energy in different kinds of investments, especially in research and development in order to reach a positive medium and long-term results.

4-5- The role of renewable energies in achieving energy security: Through the characteristics of renewable energies, we find that it does not implement and this is what ensures the security of energy now and for the future generations, especially with the technological developments and the lower costs of construction and maintenance, Since many countries use renewable energies to support domestic production and reduce the energy import bill.

Also the renewable energies are available in all parts of the world, allowing its exploitation and contributing to the energy security in all parts of the world, which reduces the wars and political conflicts.

Also its environmentally friendly and this is what the current global trends agrees to reduce pollution and the use of environmentally friendly products, which means that renewable energies can contribute to the energy security on the one hand and to contribute to the protection of the environment on the other.

5- Comparison study between Algeria and Morocco

5-1- Economic and social statistics for Algeria, Morocco: It can be summed up social and economic statistics in the following table:

Table (1): General statistics on Algeria and Morocco end of 2014

	Algeria	Morocco
Area (km2)	2381741	446550
Population (million)	39.5	33.2
GDP (million dollars)	220.9	105
GDP per capita (US $)	5406	3316

Source: Report of the International Monetary Fund and the Arab Monetary Fund for the year 2015.

By table note that Algeria has the largest area and population and as well as achieve greater GDP per capita, compared with Morocco.

5-2- Statistics on energy in Algeria and Morocco: To clarify the vision in this element will count on the following sub-items:

5-2-1- Reserves of fossil fuels: can be represented in the following table:

Table (2): Algeria, Morocco reserves of fossil fuels end of 2014

	Algeria	Morocco
Proven oil reserves (billion barrels)	12.2	0.001
Reserves of natural gas (billion cubic meters)	4504	1
Reserves of shale gas (trillion cubic meters)	20.2	-
Oil discoveries	15	01
Gas discoveries	17	01

Source:OAPEC2015Report &Vello Kuuskraa , World shale gas & shale oil Resource Assessement , EIA Energy conference , june 17,2013 , usa, p2

We note that Algeria has large reserves of fossil fuels compared to Morocco, where he relied heavily upon to cover its needs of energyand economic, and Morocco depend on imports to cover the needs of energy and on other activities such as tourism and agriculture to meet their economic needs.

5-2-2- Energy production and consumption: can be summarized in the following table:

Table (03): production and consumption of energy in Algeria and Morocco end of 2014

	Algeria		Morocco	
	Produce	consumption	Produce	consumption
Total energy(Tboe/D) Thousands of Barrels of OilEquivalent	3187	1073	16.4	422
Oil(Tbo/D)	1704	425.8	0.5	317.4
Gaz(Bcm3) Billion Cubic meters	131	-	0.1	-
Coal(Tboe/D)	-	6	-	81
Hydropower(Tboe/D)	0.3	0.3	14.5	14.5

Source:OAPEC2015Report &Sonatrach Report 2014

From the table we notice that Algeria investigates surplus in production in comparison with Morocco, where produce much more than consume and export the rest to various countries, but for Morocco depends on imports to cover the deficit and as well as the exploitation of other sources, But in the field of hydro-power, the production of Algeria weak compared to Morocco, While Morocco is trying to reduce the import bill depending on renewable sources.

As for Energetic exchanges between the two countries, we find that Algeria exported 2.75 billion cubic meters of natural gas to Tunisia and 0.6 billion cubic meters of natural gas to Morocco [(16)].

As for the pricing of electricity in Algeria ranges between 1.77 -4.17 Dz ($ 0.016-0.38) per kilowatt/h depending on consumption, and This pricing rose 11% beginning in 2016, while Morocco pricing ranges between 0.9-1.49darham Moroccan (0.091-0.15 $) per kilowatt/h according to consumption rate [(17)].

5-3- Renewable energies in Algeria and Morocco

5-3-1- Natural capabilities in the field of renewable energies

A- Solar Power: Algeria has insolation rate estimated 2,000 MW average of 6.57 kWh / m2 / day with an area of 86% of the desert and is considered one of the best areas to create a global solar power plants.

As for Morocco it owns Sun rate is estimated at 2000 MW with an average 5 kilowatt hours / m2 / day [(18)].

Despite to the converging sun rate but Preference for Algeria Because of its large area.

B- Wind power: estimated wind power in Algeria to 2650 kilowatt hours per year, with speeds of 2 to 6 meters / second and an 5-8 m / s in the coast, where are ideal for the extraction of water but not suitable for large commercial projects, and there are many sites can the establishment of the wind farms such as Adrar, Biskra, Tiaret and Oran [(19)].

As for Morocco is estimated at 2,500 megawatts of energy, the average wind speed of 6 m / s and up at the coast areas to 11 meters / second [(20)].

Where the preference in this area to Morocco.

C- Hydropower: in Algeria studies indicate that there are 103 dams, 50 are under exploitation but are usually used for irrigation and drinking, and not only generate 228MW.

The Morocco owns 26 stations generate 1265 MW in 2007, with the development of other plants in the future [(21)].

D- Geothermal energy: in Algeria have counted more than 200 hot fountain more than 33% of the temperature exceeds 45 degrees, and there are sources reach temperatures of 118 degrees Celsius in Beskra [(22)].

Generally the Maghreb region does not possess great potential in geothermal energy that can be relied upon to generate electricity, but used for heating and Treatment only.

5-3-2- The production of renewable energies: can be summarized in the following table:

Table (04)production of renewable energies in Algeria and Morocco end2014

	Algeria	Morocco
Hydropower	228	1770
Wind power	10	291
Solar Power	32.1	35
Total renewable energies	270.1	2071
Total power generated	15957	4249
proportion of renewable energies %	1.69	25.8

Source: - OAPEC2015Report, p

Note that Algeria does not rely on renewable energies in order to provide important reserves of fossil fuels, while Morocco relies on renewable energies in order to reduce its energy imports, which are estimated at 90% of the total energy consumed, as renewable energies contribute in Morocco to 32% of total energy electricity consumed in 2012 (23).

5-4- The prospects for renewable energies in Algeria and Morocco

Algeria: aims Algeria to reach 40% renewable energy of Total Energetic power in 2030 through the establishment of stations capacity of 12,000 MW of which 10,000 MW solar power and 2000 MW wind power to cover the internal needs(24), also plans to export 10,000 other MW if there is an appropriate safeguard (25).

Morocco: Summarized objectives underlined by the State of Morocco at 42% renewable energy of Total Energetic power in 2020 through the establishment of plants capacity of 6000 MW evenly divided on hydropower, wind power and solar energy, where it is expected that wind energy produces 6,600 GWh annually and requires achieve this investment is estimated at $ 3.5 billion, while for solar power is expected to produce 4,500 gigawatts/h per year with an investment of $ 9 billion, based on five different locations (26).

Morocco was also selected among the 40 best country in the global investment climate in renewable energies and ranked 27th globally and first among Arab countries According to a report of ERNEST& YONG (27).

5-5- The contribution of renewable energies in the achievement of the energy security in Algeria and Morocco

Algeria: renewable energies contribute to achieve the energy security in Algeria by providing new sources of energy four local consumption and export, and as well as rationalizing the consumption of fossil fuels and maintaining it for future generations.

As well as it contributes to the achievement of economic security by contributing to export, and reduce the local electricity consumption bill.

Morocco: renewable energies contribute to achieve the energy security, where Morocco is suffering from a big deficit in energy production compared with consumption, and depending on renewable energies will decrease energy import bill currently and can even be exported in the future.

6- Conclusion

Through this paper was identify the various types of renewable energies and its pro and cons ,and the highlight of the concept and the energy security requirements and the importance of renewable energies to achieve it, Where we came to the following conclusions:

- Algeria and Morocco has a very large natural potential in the field of solar energy, which is considered one of the best areas globally in this field.

- Algeria is considered the richest in terms of the availability of fossil fuels which has important reserves of gas and oil, while Morocco is considered poor in this area.

- two countries rely on fossil fuels as the primary

source for electric power generation, while the exploitation of renewable energies remains weak does not exceed 2% in Algeria and 25% in Morocco.

- A variation in the use of renewable energies in both countries due to the different availability of resources and as well as national strategies.

- The two countries put ambitious programs for the exploitation of renewable energies, where Algeria set to reach 40% in 2030 and Morocco 42% in 2020.

- Algeria and Morocco can achieve the energy security now and in the future if based on renewable energies.

Recommendations: Through the above, we suggest the following recommendations:

- Should pay attention to to renewable energies as the energy of the future for the two countries.

- Must raise the investments in to the renewable energy sector and the unification of research and development efforts between the two countries.

- The concentration of investments in solar energy for Algeria, and solar energy and wind energy for Morocco because its have comparative advantage in these areas.

- Monitor the implementation of plans for renewable energy projects accurately.

- Human resource configured in the field of renewable energies, and as well as modern technology.

- Create search centers for renewable energies technology, and activating the role of the existing centers.

- Educate investors of the importance of investing in renewable energies and setting financial and legal incentives.

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