The energy transition in Algeria :An investigation of renewable energy exploitation' potential and challenges

التحول الطاقوي في الجزائر: دراسة لإمكانيات وتحديات استغلال الطاقات المتجددة

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Abstract:

The energy sector in Algeria has undergone several reforms in recent years, and this has helped to advance its electricity and natural gas markets and adjust prices. This article aims to investigate the challenges and the potentials of the energy transition process in Algeria, the study found that the country still lags behind other emerging economies in terms of efficient uses of its energy, due to an outdated transmission and distribution network for heating and electricity, as well as industry inventory and obsolete power plants while the sector's focus is increasingly on improving the energy efficiency of the economy,

Keywords: energy transition; renewable energy; Algeria's economy. Transformation, emerging economies

JEL Classification Codes: Q3, Q4

ملخص:

خضع قطاع الطاقة في الجزائر لعدة إصلاحات في السنوات الأخيرة ، وقد ساعد ذلك على النهوض بأسواق الكهرباء والغاز الطبيعي وتعديل الأسعار . تهدف هذه المقالة إلى التحقيق في تحديات وإمكانيات عملية تحول الطاقة في الجزائر ، ووجدت الدراسة أن البلاد لا تزال متخلفة عن الاقتصاديات الناشئة الأخرى من حيث الاستخدامات الفعالة للطاقات المتجددة ، بسبب شبكة النقل والتوزيع القديمة، بالإضافة إلى مخزون الصناعة ومحطات الطاقة التقليدية بينما ينصب تركيز القطاع بشكل متزايد على تحسين كفاءة وفعالية قطاع الطاقة ودوره في النهوض بالاقتصاد الوطني،

كلمات مفتاحية: التحول الطاقوي ؛ الطاقات المتجددة؛ الاقتصاد الجزائري ، الاقتصاديات الناشئة.

تصنيفات JEL :Q2، Q4،

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INTRODUCTION:

The energy sector undoubtedly occupies the most important part in economic and social activity as energy plays a very important and indispensable role in the production and development process, its importance rises with the increase in demand the recent decades as a result of the growing pace of technological development and population growth, During the last two decades, renewable energies have witnessed increasing exploitation at the level of many countries of the world. The contribution of renewable energies to the global energy mix at the end of 2012 reached 19%. After that, the world witnessed a great media momentum in the field of climate action to preserve the environment, which culminated in a historic agreement concluded in December 2015 to reduce carbon emissions and contain global warming. It was the beginning of the actual transformation in the field of energy from mere reports to reality. For the first time in history, one of the Sustainable Development Goals was adopted that relates only to energy, and aims to enone universal access to affordable, reliable and sustainable modern energy services. Many countries of the world have stepped up their efforts to make greater use of renewable energy resources in all fields. Many economies, even developing ones, already have rich environments for investment in sustainable energy sources.

In this regard, one of the most important global challenges related to the field of energy is the promotion of energy programs in order to spread it in a fair and acceptable manner socially and environmentally.

Undoubtedly, the exploited traditional energy resources are limited and vulnerable to extinction. In addition, it is the main cause of atmospheric pollution and led to environmental imbalance and the emergence of the problem of global warming.

Thus, it is necessary to search for diverse and renewable sources of energy, taking into account the preservation of the environment and society. Known as renewable energy (RE) characterized by its inexhaustibility, availability in all regions of the world in different forms and capacities, in addition to being environmentally and human -friendly energies.

All countries of The world are in a race towards the energy transition and the exploitation of these sources, Algeria, despite the huge volume of its reserves of traditional energies; trying to adopt the same global trend of clean energy, To preserve a percentage of its stock for future generations and in the same context, preserve the environment and society. This is done through the National Program for the Development of Renewable Energy and Energy Efficiency, which is planned for the period 2011-2030.

Algeria is characterized by a huge variety of renewable energy sources. From this point of view, we tried to formulate the main problematic of this study as follows:

What is the actual fact of the energy transition in Algeria? And which Challenges is this program facing?

- **Objectives of the study:**

The main objective of this study is to shed light on the promising potentials of renewable energies in Algeria, and the feasibility of developing and exploiting these resources within the framework of Algeria's energy transformation; and for drawing a theoretical framework for renewable energies and the reality of the energy transition.

- **The importance of studying**:

- Most countries of the world are racing to adopt the concept of renewable energies and energy transformation;

- The modernity and vitality of the subject, especially in light of the economic and environmental crises;

- The components of renewable energies in Algeria and the diversity of its sources.

- **Study contents:** In order to understand the aspects of the subject and to answer its problems, we tried to divide the study into the following axes: The first axis: a conceptual introduction to renewable energies and energies; the second axis: the components and reality of renewable energies in Algeria.

1- The Concept of Renewable Energy:

It is defined as that energy that is generated from an inexhaustible natural resource and its presence is repeated in nature automatically and periodically, and it can also be converted into energy easily and without environmental damage, as it is considered eternal and environmentally friendly energies. (Frouhat, 2012, p. 146)

The International Energy Agency (IEA) defines it, "Renewable energy is formed from energy sources resulting from nature's spontaneous pathways, sunlight and wind, and is replenished in nature at a rate higher than the frequency of its consumption. (Kaoni, 2017, p. 22)

1.1 - Renewable energy resources: The renewable energy sources are as follow

1.1.1 Solar energy:

The use of the sun as a source of energy is among the alternative sources of oil on which future hopes are placed because it is clean and inexhaustible energy. Therefore, we find many countries interested in developing this source and setting it as a goal they seek to achieve. Solar energy is currently used in water heating and cooling, as is happening in other countries. developed, while it is used in developing countries in lighting and running water pumps in dry desert areas. Serious attempts are being made to use this energy in the future in desalinating water and producing electricity on a large scale. (Talbi, 2008, p. 203) There are two main types of solar energy technologies: (solar schools, 2022) Solar heat is when sunlight turns into heat energy or heat. Most solar thermal systems use solar energy to heat space or water. An example is a solar water heating system. Solar Photovoltaic (PV) is when sunlight is converted directly into electricity, using photovoltaic cells.

1.1.2 Wind energy:

It is a product of the work of air generators and electrical machines that move the wind to produce electricity, and the fan that rotates by the force of the wind allows the production of mechanical or electrical energy in any place where the wind blows sufficiently, and therefore this energy is considered the energy derived from the movement of air and wind and is used Wind units in converting wind into mechanical energy are used directly or converted into electrical energy through generators, and due to its relative importance, countries have given attention to this depletion of renewable energy sources. (Madahi, 2015, p. 114)

1.1.3 Hydroelectricity:

The moving water contains a stock of natural energy, whether the water is part of a flowing river or waves in the ocean. One of the renewable energy sources where man used water-powered wheels to raise water for irrigation and to drive the wheels and mills that he built on the banks of the rivers. However, the importance of these mills and wheels was limited to the period of water flow in the rivers, so the locations of the industry were determined, so the importance of water power was reduced when inventing The steam machine, especially in Western Europe and America, where coal and population density, then regained its importance after scientific and technological development and the discovery of electric generators and metal wires that resist electricity, which led to their development and expansion of their use. (Zawiya, 2013, p. 79)

1.1.4 Geothermal energy:

This energy is by extracting the energy in the soil for use in the form of heating or electricity, as the heat rises mainly from the on the earth towards its interior. temperature unless the geological components of the earth's interior contain pores and permeability and also contain water-reserving layers, i.e. subterranean layers containing water or water vapors. (Borja, 2017, p. 609)

1.1.5 Biomass energy:

a renewable source of energy using biofuels of various types such as methane (biogas) generated from wastewater and organic waste from farms, factories and homes. Other types of biofuels include trees that grow in so-called energy forests, or other plants that are grown for their energy potential. Biomass energy depends on combustion and thus generates carbon dioxide, so its use does not mitigate the global warming effect (GEMET, Biomass Energy, 2022)

1.1.6 Other new energy resources:

It means those non-traditional sources, which were discovered a long time ago and are still in the stages of research, experiments and development, and have not yet reached commercial production, and perhaps the main reason for that is that they require a high level of technology, and among the most important of those sources we mention:

- Hydrogen Energy: Developed countries are seeking to provide the latest research on clean, environmentally friendly and available energy sources, especially with the aggravation of the global warming problem, as hydrogen energy is considered one of the future energies as it is environmentally friendly. Perhaps the most important characteristic of hydrogen energy that is produced from the union of hydrogen and oxygen in fuel cells is its presence everywhere, and in the same context it has been scientifically proven that hydrogen is not an energy source but an energy carrier. of the same quantity, (DW D. , 2022), but its production is still high cost. Although it is clean and environmentally friendly energy, in addition to it being multiple types, such as those intended for home consumption and others for transportation. (DW D., 2022) and for this, car companies have intended to produce electricity that can run an electric motor that drives the vehicle, but the use of hydrogen at the present time will to the consumption of a large amount of energy needed to prepare an infrastructure that includes its supply stations and other necessary equipment for these stations, and leads to a large consumption of natural gas. (Ratul and Madahi, 2012, p. 140)

1.2 Characteristics of Renewable Energy:

Renewable energies are characterized by several characteristics, including the following: (Darwasi and Haqa, 2018, p. 5)

- It is one of the free resources in nature and available all over the world, renewable and there is no danger of its depletion; - It plays an important role in human life, and contributes to meeting a high percentage of its energy requirements, which are long-term sources because they are mainly related to the sun and the energy emitted by it;
- Renewable energy is not a ready stock from which we can use whatever we want whenever we want. Renewable energy sources are not available or disappear in a way that is outside the human ability to control them or determine the available amounts of them, such as the sun and the intensity of radiation;
- The use of renewable energy sources requires the use of many devices with large areas and sizes, and in fact this is one of the reasons for the high initial cost of renewable energy devices (the costs of their establishment), which at the same time constitutes one of the obstacles to their rapid spread, while we find their operating costs are relatively low;
- Various forms of energy are available in renewable energy resources, which require the use of appropriate technology for each form of energy.

1.3 Importance of Renewable Energy Sources:

Renewable energy resources are of great importance for several reasons, the most important of which are as follow: (Al-Labadie, 2015, pp. 149-250)

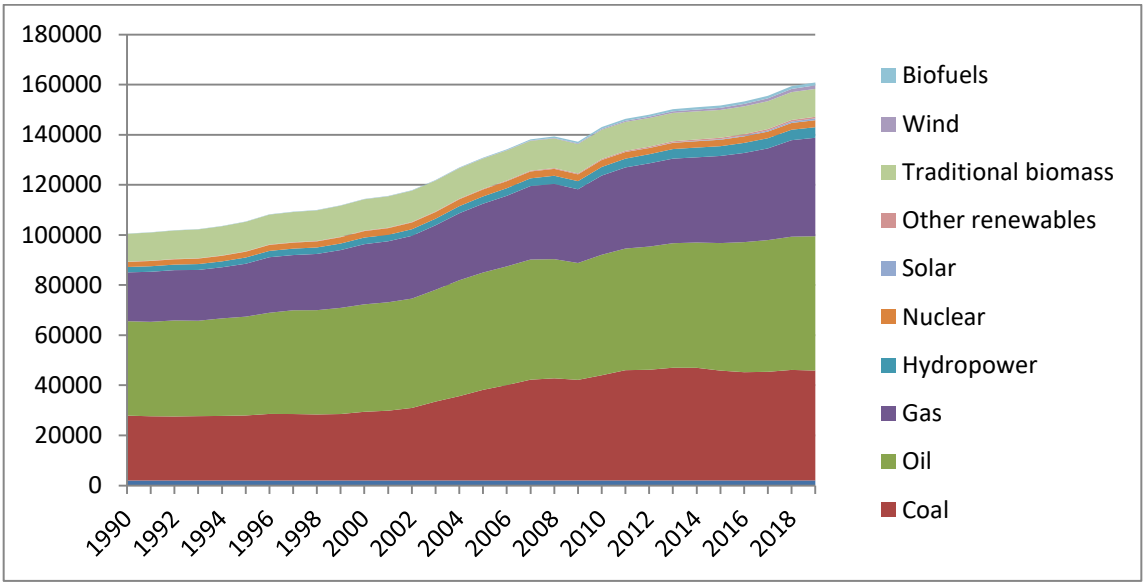
- Availability in most countries of the world.
- - A local source that does not move and is compatible with the reality of the development of remote and rural areas and their needs;
- Clean, does not pollute the environment and maintains public health;
- Economical in many uses and with a great economic return;
- Enjoining their continued availability, reasonable price and regularity;
- Do not make any noise or leave any harmful residues that pollute the environment;
- Uses uncomplicated technologies that can be manufactured locally in developing countries;
- Cannot be accused of high global fuel prices that increase the price of the monthly bill, and could be completely independent of bringing energy through traditional means such as fossil fuels with high efficiency.

1.4 The reality of the energy transition and What is meant by the transition to clean (renewable) energy?: (IAEA, 2022)

The energy transition means the transition from a mode of production and consumption of energy based on non-renewable fossil energy to an energy mixture with lower carbon intensity and increasing proportions of renewable energies. With the political will, the economic and environmental reality, the quality of governance and management, the culture of society and the transformations of fossil and alternative energy markets, according to the World Energy Council, the energy transition must combine three basic dimensions: energy security to achieve the efficiency of providing energy for current and future generations;

Justice in providing energy to all peoples of the world, especially emerging countries, at reasonable prices; - Preserving the environment on a permanent basis through energy efficiency and the development of renewable energies. (Rochu, 2018, pg. 131) The transition to clean energy is also meant moving away from energy production from sources that emit a lot of greenhouse gases from fossil fuels, and towards energy sources that emit little or no greenhouse gases. The path of this global transition was agreed upon in the Paris Agreement, an international deal between more than 180 countries within the United Nations Convention on Climate Change. In essence, the agreement aims to limit the increase in global average temperatures to less than two degrees Celsius (-2°) compared to pre-industrial levels, by encouraging the use of low-carbon energy sources to reduce greenhouse gas emissions. Of the two-thirds of the world's electricity from burning fossil fuels, meeting these climate goals by 2050 will require at least 80% of electricity to be converted to low-carbon sources, according to the International Energy Agency.

Fig 01: Generated Powers by Source, (world, unit: terawatts/hour)



Source: BP Statistical Review of World Energy & Ember 2020 Available at https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/renewable-energy.html

As shown in the above figure, the amount of energy generated has doubled over the years, being the cornerstone of the modern industrial economy. Energy sources provide an essential component of almost all human activities: they provide services for cooking, heating, lighting, health, food production and storage, education, mineral extraction, industrial production, and transportation. Modern energy services are a powerful driver of economic and social development, and no country has succeeded in developing beyond a subsistence economy without enoning at least minimal access to energy services for a broad segment of its population. Throughout the world, the energy resources available to them and their ability to pay largely determine the way people live their lives. However, it is crucial to realize that what people want are the services that energy provides, not fuel or electricity per se.

1.4.1 Energy Transition Strategies:

These strategies can be summarized in the following: (Abbas and Bin Owaida, 2019, pg 374)

- Optimum consumption of energy: This is done by working to reduce the energy consumption of the building heating process, by insulating buildings and developing and innovating heating methods in line with renewable energies. And the development of means of transportation and the adoption of new ways to operate vehicles with alternative energies that comply with the requirements of sustainability, in addition to providing electricity used in industrial processes and electrical equipment.
- Considering the energy transition as the main driver of the development process: by creating economic competition among the major energy resource-producing institutions to move towards the optimal and efficient exploitation of energy resources, which enables them to exploit renewable energies as an alternative to traditional energies, in addition to improving their image and providing new job positions.
- Planning for the transformation process: This process is carried out by integrating all energy dealers, according to pre-prepared program plans aimed at providing all energy needs without compromising the environment and the rights of current and future generations.

2- Elements of the transition to renewable energies in Algeria

2-1 Solar energy: It is considered one of the important sources of renewable energies in Algeria, due to its geographical nature and its large area (2,381,745 km2), which makes it a solar field with distinction, attracting an average of 3000 solar hours annually (Ministry of Energy and Mines, Renewable Energy Directory 2007, 2007, p. 39) and this is what the following table shows:

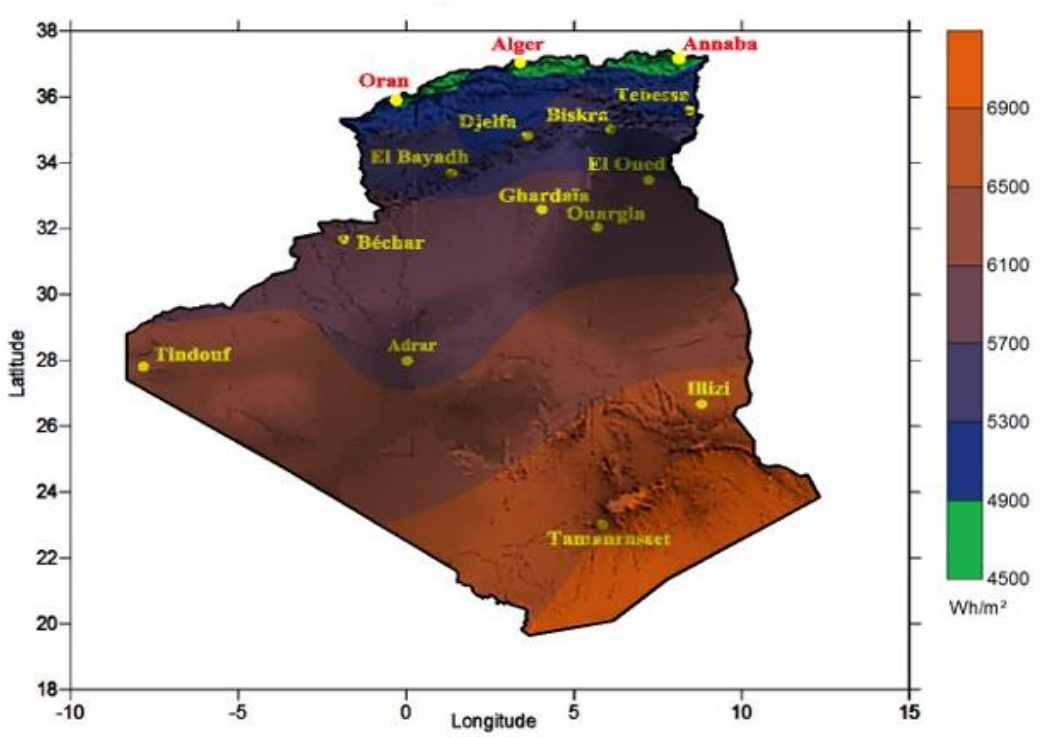
Table (1): potential of solar energy in Algeria

areas	coastal area	plateaus	desert area
Onface (%)	4	10	86
Average duration of sunrise (hour/year)	2650	3000	3500
The rate of energy obtained (kWh/m2 per year)	1700	1900	2650

Source: Ministry of Energy and Mines, Renewable Energies Guide 2007, Algeria, 2007, p. 39

Through the data of the previous table, it appears that most of Algeria's potential in solar energy is concentrated in the desert areas, which are characterized by low population density. When that yields decreases, the rate of sunrise decreases the further north we go. Accordingly, Algeria's potential of solar thermal energy is 170,000 TWh annually, while the potential of photovoltaic energy is 13.9 TWh annually. Where the Renewable Energy Development Center published a map of the Algerian Solar Atlas (1992-2002), which are very important cards in the field of designing solar energy systems, as the use of these maps by the designers of those systems would improve the efficiency of energy production in accordance with the local climate. (Center for Renewable Energy Development (Algeria), 2022)

Fig (2): Map of the Algerian Solar Atlas

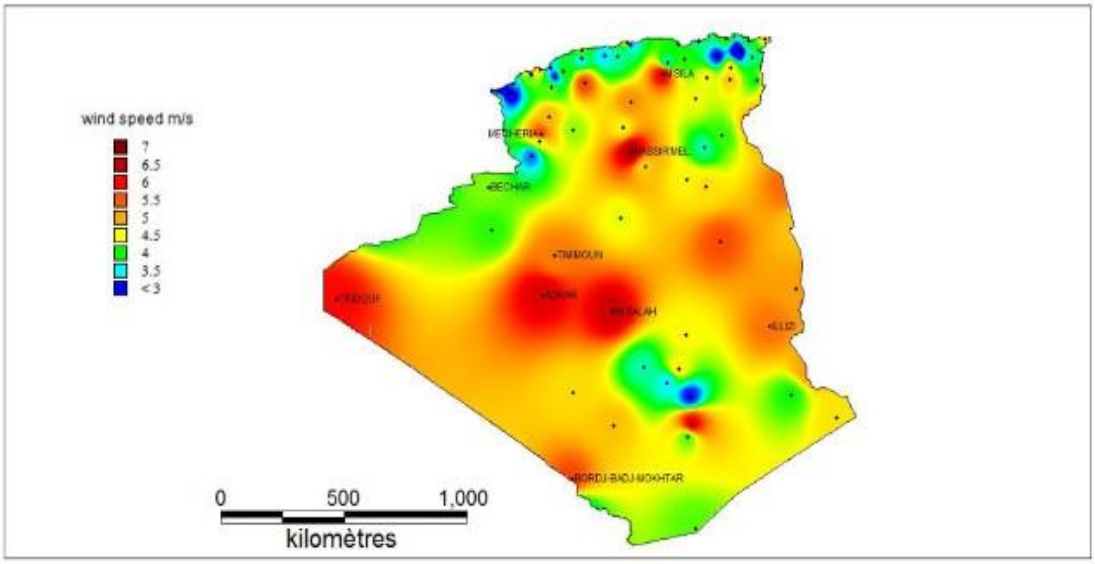


Source: Renewable Energy Development Center, 07/17/2022, https://www.cder.dz/spip.php?article2222

The largest solar energy project is located in Hassi ERamel. The plant has a capacity of 25 MW of concentrated solar energy and 125 MW of gas, which has been operational since 2011. In 2014, the photovoltaic power plant began operating in Ghardaia with a capacity of 1.1 MW, and in 2018, another photovoltaic power plant was commissioned with a capacity of 10 megawatts in Bir El Rabaa in El Birma (about 400 km east of Hassi Messaoud). Meanwhile, the Electricity and Renewable Energy Company (SKTM) of the SONALGAZ complex built 22 photovoltaic power plants during 2018, with a production capacity of 343 MW. (Raquel Ersoy & Terrabon Pfaff, 2021, p. 21)

2.2 Wind energy: Algeria has a significant potential of wind, as these potentials change from one region to another as a result of the topography and climate diversity. Algeria is divided into two main geographical regions; The northern region and the southern region. The northern region is characterized by moderate wind speed, while the southern region (especially the southwest) is characterized by a higher wind speed than the northern region.

Fig (3): Atlas of wind speed in Algeria at a height of 10 meters on earth (m/sec)



Source: Renewable Energy Development Center, 07/17/2022, https://www.cder.dz/spip.php?article3584

The map above shows that the wind speed reaches 6.5 m/s in the Hassi El Raml region, ranges between 6.4 and 6.3 m/s in the Ain Saleh and Adrar regions, then drops to 5.6 m/s in the Mashreya regions and passes to Tiaret, then 5.3 and 5.1 m/s in the states of Msila and Djelfa, respectively. (Centre for the Development of Renewable Energy (Algeria), 2022) In general, the development of a map of the wind speed and the capacities of the energy generated from the wind speed available in Algeria allowed the identification of eight highly windable and capable regions to host wind power generation equipment (two areas on the coastal strip, three areas in the high plateaus and three areas in the desert). The Kaberten field (70 km north of Adrar) was established to produce electricity through wind energy in 2014 with a capacity of 10 megawatts. (Moakni, 2002, pg. 31), while studies indicate that Algeria's potential for wind energy is estimated at 35 TWh per year. (Raquel Ersoy and Terrabon Pfaff, 2021, p. 21)

2.3 Geothermal Energy: The governorate of renewable energies and energy efficiency confirmed that Algeria has huge capabilities of geothermal energy resources, and cited data from the Algerian Atlas of Renewable Energy Resources that Algeria has more than 240 thermal sources, which has enormous potential in energy resources of geothermal origin . The cartographic representation of the geothermal energy resources available on the national territory allows to see and evaluate the exploitable potential of this resource. He also pointed out that the main geothermal resources are classified according to temperature, the most famous of which is the heat source of Hammam Dabbagh, which is classified among the hottest thermal sources in the world, with a temperature of 98 degrees Celsius at its point of flow. The same governorate also confirms that these geothermal energies can be exploited to produce electricity, space heating (hotels and places of recreation and rest) and geothermal power plants, as well as heating agricultural greenhouses. In this context, he pointed out that "a

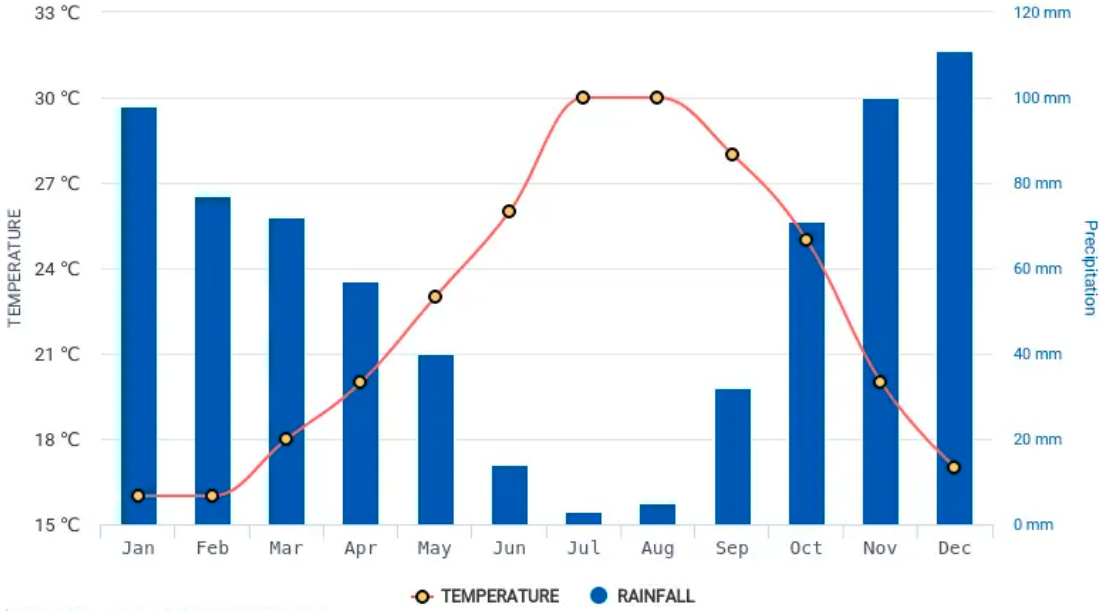
pilot project has been implemented by the National Office of Irrigation and Water Drainage (ONID) of the Ministry of Water Resources, which is to exploit geothermal energy from the "hot water energy (60 degrees Celsius) that is provided by water wells. (Algerian News Agency, Renewable Energies: Algeria has huge capabilities of geothermal energy resources, 2021)

2.4 Biomass Energy: Biomass was the primary form of energy in humankind. Where electricity and heat can be produced through the combustion of waste and the remains of organic, plant or animal matter. Converting them makes it possible to obtain versatile fuels. This conversion can be done thermally (combustion, gasification, pyrolysis), biochemical (digestion, fermentation) or mechanical (extraction). The choice depends on the type and amount of biomass available, the type of final energy required, economic and environmental conditions, and other factors. (MOUSSI, 2014, p. 4) In this regard, the Algerian Renewable Energies and Energy Efficiency Governorate confirmed that Algeria's potential in the field of bioenergy is estimated at more than 500,000 tons of oil equivalent, based on a study conducted by the Renewable Energy Research Center. A different nature, especially agricultural, urban and industrial. Where these wastes consist mainly of organic materials, in addition to this is the potential of organic slurry resulting from sewage treatment plants, which can be exploited, according to the same study - through the recovery of biogas and in the solid state as fuel .

The governorate, based on the data of the National Waste Agency, confirms that the change in food habits has led to an increase in household waste, noting the growth of the average amount of daily waste generated by an individual between 1980 and 2010, from an average of 0.63 kg / day / inhabitant in To an average of 1 kg / day / inhabitant. The major cities, including Algiers, Oran, and Setif concentrate large amounts of waste that can be converted into energy. Accordingly, the governorate confirmed that it is possible to achieve electricity production of more than 1900 GWh thanks to the energy valuation of household waste and the like. As the average annual consumption of electricity per capita in Algeria is about 1236 kilowatt-hours, and accordingly you see that the provided capabilities can cover the electricity needs of more than one and a half million people across the national territory. (Algerian News Agency, 2021)

2.5 Hydroelectric power: Algeria is considered a country with very limited hydroelectric potential, due to the scarcity of water as a result of low rates of rainfall and high evaporation limiting the potential for hydroelectric power generation. Algeria is characterized by a hot summer climate and moderate to cold winter. Rain falls about 100 days a year as a maximum, and a large part of the year's rain is concentrated within a few days with snowfall. etc., to decrease to less than 500 mm in the hills like Batna, Tiaret, Chlef, Oum El Bouaghi,...etc, while it decreases and is almost non-existent in the states of the South and the Great South, where it reaches 11 mm in Adrar as the lowest scale and 14 mm in Izi and 23 in Tamanrasset, these weak components made hydroelectric power in Algeria yield up to 500 gigawatt hours annually, but only 117 gigawatts were generated in 2018. (Raquel Ersoy and Terrabon Pfaff, 2021, p. 21). However, there are some Attempts by the Custodial Ministry during the past year to renew and rehabilitate several hydroelectric power stations and bring them into service.

Fig(4): Average levels of precipitation and the temperatures in Algeria



Source: HikersBay, Climate conditions in Algeria, 17/07/2022, http://hikersbay.com/climate-conditions/algeria/alzrwf-almnakhyh-fy-aljzaer.html?lang=ar#weather-rain-months

3- the development Structures and outcome of the exploitation of renewable energies in Algeria:

The idea of renewable energies and energy transformation since the eighties has received the attention of the government, and that is what we saw through its efforts in establishing structures and enacting laws that would adopt the idea of energy transformation. Despite the enormous ingredients and the fertile environment for that transformation, the achievements were meager compared to those ingredients. And this is what we have noticed through the results obtained from the underlined national program PNEREE.

• **The National Program for Renewable Energies and Energy Efficiency 2011-2030 (PNEREE):** The government launched a program to develop renewable energies based on the provision of about 22,000 megawatts from renewable sources between 2011 and 2030. Through which the government aims to produce electricity from renewable sources by 27 percent % of total production and 40% of domestic consumption of renewable energies within the year 2030. The program also includes a program to rationalize energy consumption, especially in the housing and transportation sectors (People's Democratic Republic of Algeria, 2022), where the program will be implemented through a study phase in addition to two phases of implementation:

- the first phase 2011-2013: as a study phase, this phase aims to control the knowledge and technologies related to renewable energies as it is a new field, and accordingly the government is working on experimenting with various technologies in order to collect data from various studies in order to choose the most appropriate technologies with the capabilities and conditions climatic;

- The second phase 2014-2015: The second phase aims to start publishing the approved program;
- Third phase 2016-2020: dissemination of the program on a medium scale;
- Fourth phase 2021-2030: The program will be widely disseminated, as many projects in the field of renewable energies will be completed within this program in two phases, and for reference, the National Electricity and Gas Company "SONALGAZ" will be at the core of the program due to its experience and expertise in the field of production and Electricity distribution. It is dependent on three energy sources as follows: (CEREFE, 2020, pp. 46-47)

The government aspires to implement this program according to the following:

Table (2): Outline of the National Renewable Energy and Energy Efficiency Program

Phase	Plan
2011-2013	Executing experimental projects with a total capacity of 110 MW to test different technologies
2014-2015	The deployment of the program began with the installation of a total capacity of approximately 650 megawatts
2016-2020	Deployment by 2020 with a capacity of no less than 4600 MW, of which 2600 MW is for the local market and 2000 MW is for export.
2021-2030	2030 The program will be widely deployed with the aim of achieving its planned targets, which are 12,000 MW for local consumption and 10,000 MW to be launched on the international market.

Source: CEREFE, Energy Transition in Algeria, Commission for Renewable Energies and Energy Efficiency, Edition 2020, Alger, p 47.

However, this ambitious program was not followed from the first stage. In fact, out of all the pilot projects totaling 110 MW planned, only three were implemented with a total capacity of 36.3 MW: Hassi R'Mel Hybrid Power Plant (Gas Solar Thermal), 25 MW CSP (operated in 2011);

-The 1.1 MW PV plant in Ghardaia, which includes the four PV technologies, with or without sun tracking (started operation in 2014);

-wind power plant with a capacity of 10.2 MW in Cabertein (Adrar), which includes 12 wind generators with a capacity of 850 kW each (operated in 2014);

- For the rest, a program with a total capacity of 343 MW of solar PV plants was launched at the beginning of 2014 by SKTM of SONALGAZ. Its main task is to operate insulated electric power grids in the south (conventional production) and renewable energies throughout the national territory. In this context, ten solar photovoltaic plants were built with a total of 265 MW divided into three plots (East, Central, and West) in the highlands, while ten other plants were built in the south with a capacity of 78 MW. (CEREFE, Energy Transition in Algeria, 2020, pp. 47-48)

During the year 2015 and as a result of the change in the costs of investment and production of energies from renewable sources - especially solar photovoltaic energy - the government re-updated the previous program in line with the new costs, whereby the production line will be according to the following:

Table (3): The updated National Renewable Energy and Energy Efficiency Program 2015-2030

	2015-2020	2021-2030	Total
photovoltaic solar energy	3000	10575	13575
Wind Energy	1010	4000	5010
Thermal solar energy	0	2000	2000
co-generation	150	250	440
biomass energy	360	640	1000
geothermal energy	05	10	15
Total	4525	17475	22000

Source: CEREFE, Energy Transition in Algeria, op.cit, p 50

Despite this modernization as a result of the failure to achieve the first program, this program also did not achieve its ambitions and remained far from reality, as it was limited during the year 2017 to some solar photovoltaic power plants with a total of 343 megawatts from the program launched by SKTM in 2014. Besides That is, in 2018, Sonatrach adapted the first 10 MW solar photovoltaic plants in Bir Rabaa Nord, Ouargla, as part of its strategy that aims to deploy a total capacity of 2,300 MW in solar energy by 2030. However, in general, and according to the governorate of renewable energies and energy efficiency for the year 2020

4- Conclusion:

The energy sector in Algeria has undergone several reforms in recent years, and this has helped to advance its electricity and natural gas markets and adjust prices. However, the country still lags behind other emerging economies in terms of efficient uses of its energy, due to an outdated transmission and distribution network for heating and electricity, as well as industry inventory and obsolete power plants while the sector's focus is increasingly on improving the energy efficiency of the economy,

In order to achieve a viable and resilient energy transformation, some requirements must be met, which can be summarized in the following

- Availability and technological abundance: Technology plays a crucial and important role in the process of energy transition, as during the transition technology is compatible from one energy alternative to another alternative, as there is a reciprocal relationship between the alternative energy source and technology. Therefore, many say that the challenge the world faces during the transition is a technological challenge rather than an energy problem. Because what the world witnessed in the race was a result of the weak technological capabilities to benefit and exploit the various sources of energy, and the availability and abundance of the new source in order to expand its exploitation for a longer period by making a qualitative transformation, that this source contributes to meeting the needs required by specific technology in order to achieve an economic boom and service in the medium used, as well as the possibility of relying on it to meet the demand for energy at the time of need and to avoid the shortage of supplies that confuse the demand side;

- Human efficiency: Despite the important countries that technology plays in the case of the energy transition, this does not cancel the role of the human resource in the process of that transformation, because the trend towards alternative energies requires the availability of resources and frameworks, the qualified human resources that supervise the provision of this resource for exploitation. on a large scale with the help of available technology;
- Economic feasibility: The most important thing that controls the transformation of any country from its main source of energy towards alternative sources, whatever their nature, is the level of economic feasibility of exploiting those sources, and this depends on the ease of obtaining the level of obtaining the alternative energy source at an economic cost that is available to large groups of consumers benefits.

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