Journal of Politic and Law **Volume: 15 / N°: 01 (2023), p.p478-503**

Towards Sustainable Development and Low Carbon Economy: Algeria's Energy Transition to Prevent Hydrocarbon Risks

نحو تنمية مستدامة واقتصاد منخفض الكربون: تحول الطاقة في الجزائر لمنع مخاطر الهيدروكربون

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Received: 18/03/2022 Accepted: 20/09/2022 Published:31/01/2023

Abstract :
Since its independence, Algeria has relied mainly on hydrocarbon exports to support its infrastructure development and carry out its major projects. Most power plants are natural gas-fired and run continuously, resulting in the emission of large amounts of toxic gases, in addition to carbon dioxide (CO2). Algeria is now considered among the highest CO2 emitting African countries and contributes negatively to the environmental security, essential to the survival of life on the planet Earth. Thus, the transition from fossil fuels towards sustainable and cleaner energy sources has become vital for the Algerian state. Algeria is planning to launch an ambitious program to develop its inexhaustible renewable energy resources to move into the era of so-called green energy, which is the unique solution to achieve sustainable development and protect the environment. This study aims to show how Algeria has tried through many serval legal mechanisms and national programs, especially those related to investment in the energy sector, to achieve sustainable development for the country while preserving the environment, particular from those dangers and risks caused by fossil energies.

Keywords: *Environmental protection; prevention of environments risks; sustainable development, renewable energies; Algeria constitutions 2016 and 2020;*

ملخص
منذ استقلالها، اعتمدت الجزائر بشكل أساسي على الصادرات الهيدروكربونية لدعم تطوير بنيتها التحتية وتنفيذ مشاريعها الكبرى. حيث تعمل معظم محطات توليد الكهرباء وبشكل مستمر بالغاز الطبيعي، مما يؤدي إلى انبعاث كميات كبيرة من الغازات السامة، بالإضافة إلى ثاني أكسيد الكربون (CO2).
وتعتبر الجزائر الآن من بين البلدان الإفريقية ذات أعلى معدلات انبعاث ثاني أكسيد الكربون وتساهم بشكل سلبي في الأمن البيئي الضروري لبقاء الحياة على كوكب الأرض. وبالتالي، أصبح الانتقال من الوقود الأحفوري إلى مصادر الطاقة المستدامة والأنظف أمرًا حيويًا للدولة الجزائرية.
ولتحقيق هذه الاهداف، سطرت الجزائر برنامجا طموحا لتطوير مواردها من الطاقة المتجددة التي لا تنضب للانتقال إلى عصر ما يسمى بالطاقة الخضراء، وهو الحل الفريد لتحقيق التنمية المستدامة وحماية البيئة.

[1] ALAOUI Tayeb

تهدف هذه الدراسة إلى إظهار كيف حاولت الجزائر من خلال دساتيرها والعديد من الآليات القانونية والبرامج الوطنية، وخاصة تلك المتعلقة بالاستثمار في قطاع الطاقة، تحقيق التنمية المستدامة للبلاد مع الحفاظ على البيئة، لا سيما من تلك الكوارث والأخطار التي تسببها الطاقات الأحفورية .
كلمات مفتاحية: *حماية البيئة؛ الوقاية من مخاطر البيئة؛ تنمية مستدامة؛ الطاقات المتجددة؛ دساتير الجزائر 2016 و2020*

I- Introduction:

Energy plays acrucial role in enabling economic growth and social development and is one of the highest priorities for every country in the world. However, the irrational use of this energy leads to serious consequences and disasters that cannot be remedied, and their damage can be challenging to repair.

Most environmental risks, especially natural disasters, are unpredictable and occur suddenly, causing extensive damage leading to the destruction of many living organisms and ecosystems.

Environmental security is undoubtedly closely linked to environmental protection and the achievement of sustainable development goals. This can only be achieved through enforcing rigorous legislation and measures that ensure environmental security to face the global challenges of climate change and global warming of the planet which are having a drastic impact on public health causing a wide range of diseases.

Renewable energy from natural resources such as the sun, water, wind, tide, wave, etc. are being widely exploited across the globe in a way that does not contradict the principles of sustainable development. This type of energy is now commonly known as green energy.

The recent trend towards the adoption of green energy has contributed to the growth of this strategic sector. However, the transition from non-renewable or conventional energy sources to green energy sources is still facing multiple challenges at the economic, organizational, and technological levels, which has prompted governments and key players to promote strategic research and development, to overcome these challenges and develop solutions to ensure efficient use of these resources.

Algeria, like many countries, has been affected by these disasters, which have prompted the country to take preventive measures to preserve its fossil fuel reserves for the future and contribute to ecological security. This has stimulated the development of sustainable energy solutions by harnessing power from renewable energy resources.

The aim of this study is to shed light on the transition of Algeria's energy sector towards the adoption of green energy and the major challenges it will be facing. This study proposes solutions which will facilitate the gradual energy transition and sustainable development of the country while protecting the environment against the dangers caused by fossil fuels.

In this perspective, this article aims to answer the following questions:

How does green energy contribute to the prevention of environmental risks and sustainable development in Algeria?

To address this core question, the following sub-questions need to be answered first:

1. What is meant by green energy, and what are the reasons for its emergence?

2. Why the various initiatives launched in recent years have not succeeded to attract the attention of decision-makers?
3. Has the Algerian legislator put in place the legal and institutional mechanisms to achieve the objectives of green energy?

To answer these questions, we propose the following plan, which consists of two themes:

1. Presentation and analysis of the concepts related to green energy and its potential in Algeria.
2. Investment in green energy and its legal frameworks.

THE FIRST TOPIC : PRESENTATION AND ANALYSIS OF CONCEPTS RELATED TO GREEN ENERGY AND ITS SOURCES IN ALGERIA

1.1. Introduction

Thanks to scientific discoveries and technological development, natural resources such as sun, wind, geothermal energy and biomass are potentially viable sources for electric power generation. These energy sources are renewable and abundant and with lifespans much more extended than human scale and do not cause any emission of pollutants and greenhouse gases. They present a new way of guaranteeing essential electrical energy needs while preserving the environment.

Many countries have set ambitious plans to increase the proportion of their renewable energy production to reach at least 20% of their total energy needs by 2020. Interest in renewable energies has increased in recent years in most countries in the Middle East. While the advantages of renewable energies are numerous, their use faces specific difficulties, especially since it requires substantial initial investment and the recovery of the initial investment takes a long time[1].

Like many countries, since its independence, Algeria had opted for developing the energy sector as part of a national policy aimed at the development of electrical infrastructure. This policy provides the population with access to electricity and natural gas as an absolute priority for improving the quality of life of citizens and the country's economic situation[2]. Aware of this issue and the importance of access to electricity for citizens, the sector has taken the decision to develop all potential energy resources to guarantee the long-term electricity needs of the country, in particular through the diversification of energy sources, the development of electricity production facilities and electricity transmission and distribution infrastructure.

1.2. Evolution of the electrical energy produced

The geographical location of Algeria presents several advantages for the exploitation of renewable energy sources thanks to suitable climate conditions, especially in the Saharan regions[3]. This section reviews the potential of renewable energy in Algeria by highlighting renewable energy resources such as solar, wind, hydroelectric, geothermal and biomass.

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[1]NoamanShehadeh and DalalZureikat , Environmental risks and disasters, First edition, 2018, Dar Safaa for publishing and distribution, Amman, JORDAN, page 41.
[2]https://www.energy.gov.dz/, Accessed November 20, 2021, 19:40.
[3]Blal, M., Belasri, A., Benatillah, A., Hamouda, M., Lachtar, S., Sahouane, N., Laribi, S., Mostefaoui, M., Assessment of solar and wind energy as motive for potential hydrogen production of Algeria country; development a methodology

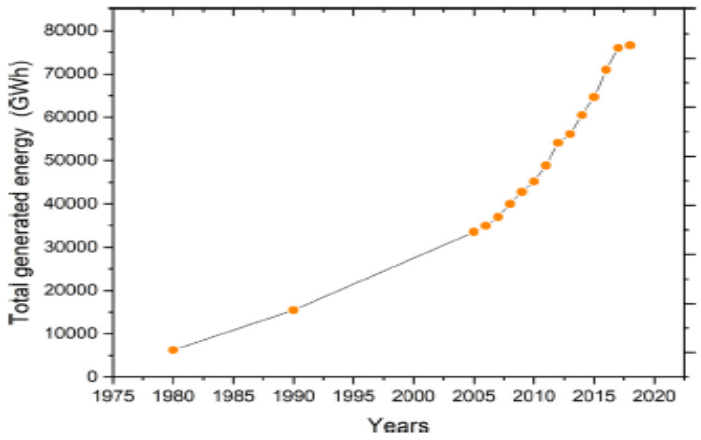

Figure .1. Global energy production during the period (1980-2018)[1]

Given the wide availability of natural gas compared to other fossil energy sources, Algeria has opted for using natural gas as primary energy to produce electricity. On the other hand, sustainable development also requires the adoption of different so-called clean and renewable energies such as solar and wind energy, which are available in abundance across the country[2]. Figure 2 shows the share of each type of energy in the general mix with a very fine 2% stake provided by renewable energies of all forms. In recent years, the generation capacity from renewable energy has seen a considerable increase in the installed power generation capacity. This increased from 7,492 MW in 2005 to 17,238.6 MW in 2015, or nearly 10,000 MW (Table 1) additional commissioned in ten years.

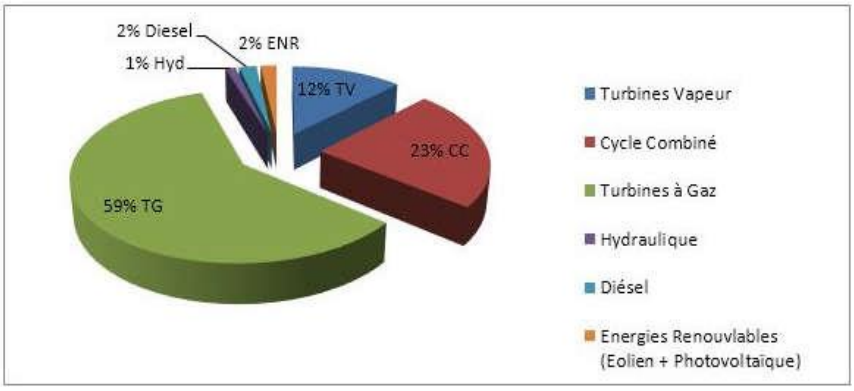

Figure .2 Installed power by type of equipment for the year 2017[3].

for uses hydrogen-based fuel cells. Int. J. Hydrogen Energy 43, 2018, https://doi.org/10.1016/j.ijhydene.2018.03.200.).

[1] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of leaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011.

[2] https://www.energy.gov.dz/ , Accessed 2018

[3] https://www.energy.gov.dz/ , Accessed 2018

Types of energy	1980	1990	2000	2006	2010	2016	2017
Steam thermal	3 621	8397	15 757	14 558	9692	11 512	10 074
GAS Thermal	2 223	6704	8 830	16 463	19 564	24 441	31 009
Combined cycle	-	-	-	3 419	15 341	28 899	29 508
Hydraulic	251	135	54	218	173	72	71
Diesel	125	216	368	264	403	281	286
Wind	-	-	-	-	-	19	21
Photovoltaic	-	-	-	-	-	205	500
Total	6 220	15 452	25 008	34 922	45 171	66 263	71 470

Table 1: Trend of installed capacities of types of energy over the years[1].

1.3 Potential of renewable energies in Algeria

1.3.1 Solar potential in Algeria

Solar energy is used today for power generation, seawater desalination, public lighting and signage, satellites, and space stations, etc. in addition to its domestic use for water heating, heating, lighting, etc. The Bloomberg Center for New Energy Finance predicts that the era of significant dependence on coal and oil will gradually diminish. Solar and wind renewables will account for around 60% of the energy produced globally by 2040 [2].

Due to its geographical location, Algeria has one of the most important solar fields in the world. The duration of sunstroke across almost the entire national territory exceeds 2,000 hours annually and can reach up to 3,900 hours in highland areas and Sahara region. The energy received daily on a horizontal surface of $1m^2$ is in the order of 5 KWh across the country, i.e. nearly 1700 KWh / m^2 / year in the North and 2263 kWh / m^2 / year in the South of the country, with ambient temperatures reaching 48 ° C. This energy can be harnessed in two forms: (i) Solar thermal energy for heating using several technologies (heating, drying, etc.) or (ii) solar photovoltaic, which converts solar radiation directly into electricity (electricity production)[3].

Due to the large area and climatic diversity, Algeria has enormous potential in solar energy, especially in the Saharan region (Southern regions) (which is suitable for solar energy applications like photovoltaic (connected to the grid), electrification of villages, water pumping, etc.) or concentrated solar energy (CSP) Details of this potential are given in table 2 and figure 3[4].

[1]https://www.energy.gov.dz/ , Accessed 2018.
[2]NoamanShehadeh and DalalZureikat , Environmental risks and disasters, First edition, 2018, Dar Safaa for publishing and distribution, Amman, JORDAN, page 41.
[3]Ministry of Energy and Mines, National Agency for the Promotion and Rationalization of Energy Use (APRUE), Final Energy Consumption of Algeria , 2009, http://www.aprue.org.dz, Accessed 2017.
[4] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16.
https://doi.org/10.1016/j.jclepro.2019.119011.

Table 2: Solar potential in Algeria[1]			
Areas	Coastal area	High plains	Sahara
Surface (%)	4	10	86
Area (km2)	95.27	238.174	2 048 29
Mean daily sunshine duration (h)	7.26	8.22	9.59
Average duration of sunshine (h/year)	2650	3000	3500
Received average energy(kWh/m2/year)	1700	1900	2650
Solar daily energy density(kWh/m2)	4.66	5.21	7.26

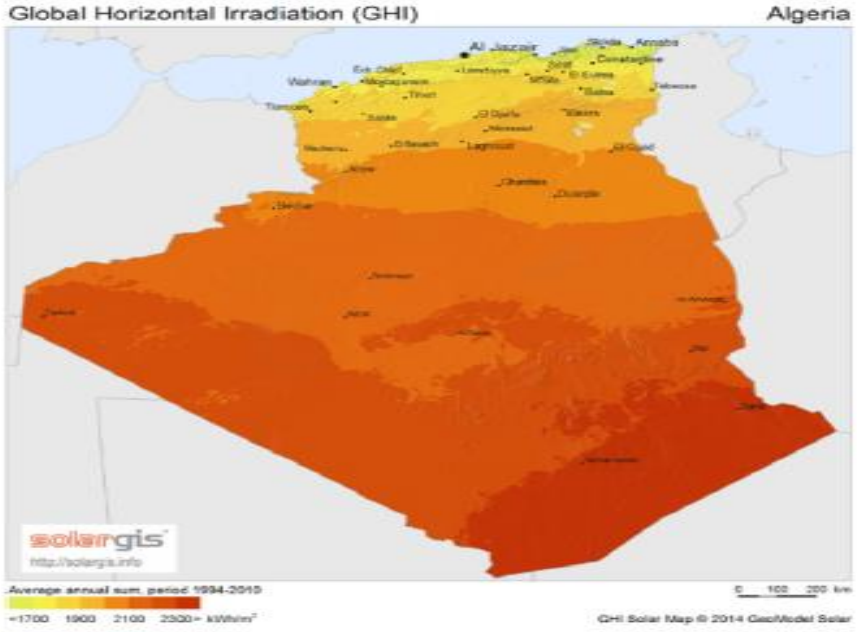

Figure .03. Algeria global horizontal irradiation[2]

1.3.2 Wind potential in Algeria

With very diverse topography and climate, the wind resource varies significantly from place to place. There are two distinct areas, an area of vast and high plateaus limited to the North by the mountain ranges of the Tellian Atlas adjoining the Mediterranean Sea with 1200

[1] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011

[2] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011.

km of coastline and to the South on the gates of the desert, a chain of the Atlas Saharan, another area of ~~the~~ dry and hot climate is the Sahara.

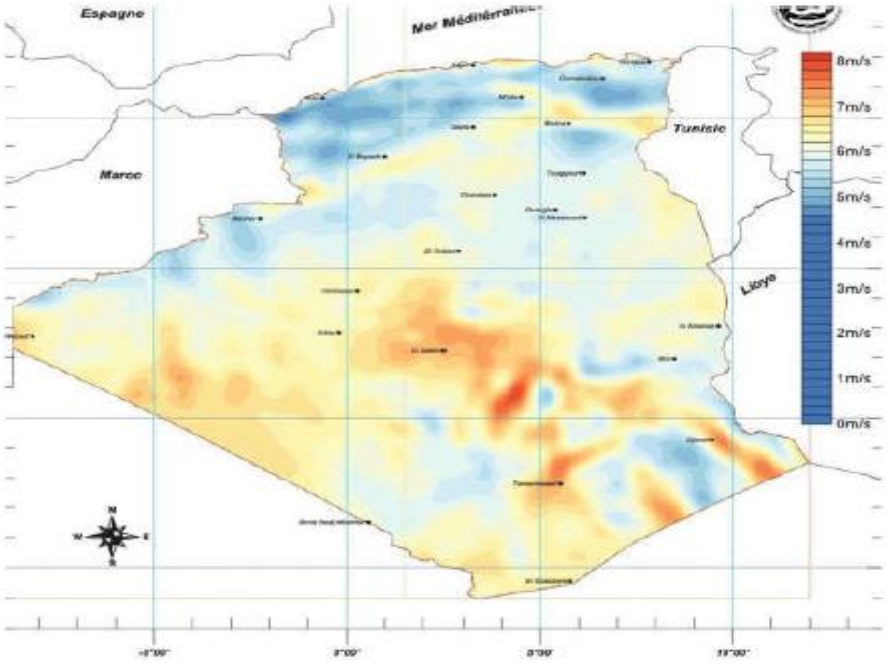

Figure. 04 Average annual wind map at 50 m (period 2001-2010)[1].

The map ~~is~~ shown in Figure 04 indicates that the South is characterized by higher wind speeds than the North, more particularly in the South-East, where wind speeds can exceed 7 m / s and even exceed 8 m/s in the region of Tamanrasset (Ain m'guel). In the North, the average wind speed is low. However, we can note the existence of microclimates on the coastal sites of Oran, Bejaïa and Annaba, on the highlands of Tébessa, Biskra, M'sila and El-Bayad where wind speeds are in the range 6 to 7 m / s, and the Great South exceeding 8m/s. As can be observed from Figure 13, Algeria has a moderate wind regime ranging between 2 and 6 m/s [2].

According to a study carried out by Chellali, F.[3], wind resources in Algeria are characterized by significant variations from one place to another (see Figure 05), 78% of the area of Algeria is characterized by speeds greater than 3 m / s with about 40% of these speeds exceeding 5 m/s.

The South region is characterized by higher speeds (more than 6 m / s) than the North[4], which makes it suitable for the installation of wind power plants or hybrid systems[5].

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[1] https://www.energy.gov.dz/ , Accessed 2018.

[2] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16.
https://doi.org/10.1016/j.jclepro.2019.119011.

[3]Chellali, F., Khellaf, A., Belouchrani, A., Recioui, A., 2011. A contribution in the actualization of wind map of Algeria. Renew. Sustain. Energy Rev. 15, 993e1002,
https://doi.org/10.1016/j.rser.2010.11.025.

[4] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011.

[5] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011

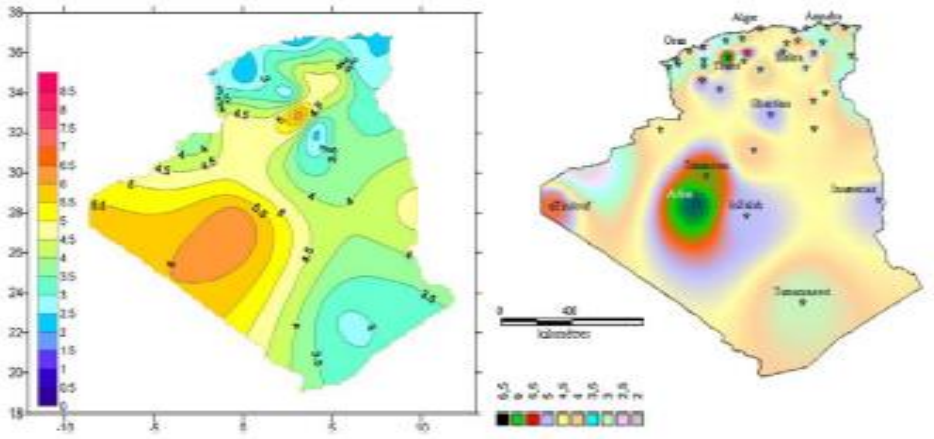

Figure. 05. Wind energy maps in Algeria[1]

1.3.3 Potential of geothermal energy in Algeria

Geological, geochemical and geophysical studies and data have identified more than two hundred (200) hot springs in the northern part of the country. About a third of them have temperatures above 45 ° C. In the region of Biskra, hot springs temperatures can reach up to 118 ° C.

Studies on the thermal gradient have identified three zones with a gradient exceeding 5 ° C / 100m:

- Relizane and Mascara regions
- Zone of AïnBoucif and SidiAïssa
- Zone of Guelma and Djebel El Onk

The location of the main geothermal areas in Algeria is illustrated in Figure 06.

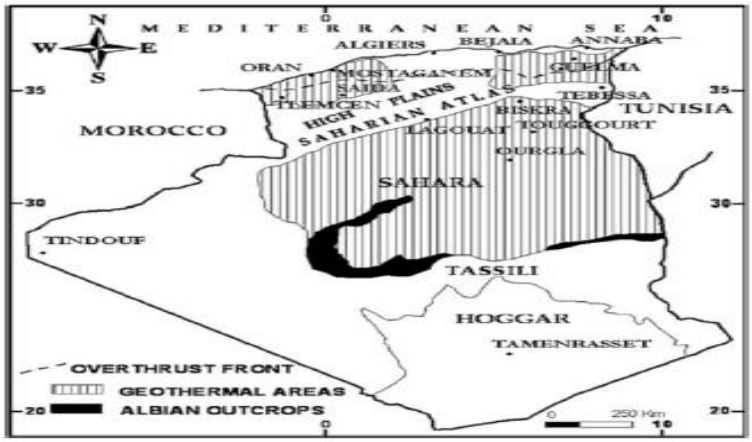

Figure. 06 Main geothermal areas in Algeria[2]

[1]Chellali, F., Khellaf, A., Belouchrani, A., Recioui, A., 2011. A contribution in the actualization of wind map of Algeria. Renew. Sustain. Energy Rev. 15, 993e1002, https://doi.org/10.1016/j.rser.2010.11.025

[2] Ahmed Bouraiou and all, Status of renewable energy potential and utilization in Algeria, Journal of Cleaner Production 246 (2020), 2-16. https://doi.org/10.1016/j.jclepro.2019.119011.

1.3.4 Hydraulic Potential in Algeria

The overall rain quantities falling on Algerian territory are significant and estimated at 65 billion m3, but ultimately provide a minor benefit to the country; this is due to the reduced number of days of precipitation, concentration in limited spaces, intense evaporation, and rapid evacuation to the sea.

Schematically, surface resources decrease from North to South. The valuable and renewable resources are currently estimated at around 25 billion m^3, of which about 2/3 are for surface resources. A total of 103 potential dam sites have been identified. More than 50 dams are presently in operation.

1.3.5 The potential of biomass in Algeria

Algeria has various forms of flora (tree, steppe, etc.). The current potential is estimated at around 37 million TOE (tons of oil equivalent). The recoverable potential is in the range of 3.7 million TOE. The current recovery rate is approximately 10%[1].

Among the components of biomass is urban and agricultural waste, almost 5 million tonnes are destroyed but not recycled. This represents a potential of 1.33 million Tep / year [2].

It can be concluded from the above that Algeria has enormous renewable energies of all kinds, which should be accompanied by a certain number of laws and legislation, particularly in internal and external investments.

This is what we will discuss in the next topic.

THE SECOND TOPIC : INVESTMENT IN GREEN ENERGY AND ITS LEGAL FRAMEWORKS

2.1. Introduction

Aware of the growing importance of renewable energies and energy efficiency in the achievement of sustainable development on the one hand, and in the prevention of various environmental risks resulting from the increasing use of fossil fuels on the other hand, in particular for the production of electrical energy, Algeria has integrated the principle of development of renewable energies into its energy policy through the adoption of a legal and institutional system.

This has been put in place explicitly, through laws and regulations that have a direct link with the incentive to use and invest in green energy, either implicitly from specific articles of the constitution or other laws related to the environment, such as Law 10/03 on the protection of the environment within the framework of sustainable development[3].

2.2. The consecration of the environment in the provisions of the constitution is an implicit call for the use of green energy

The consecration of the Algerian constitution to the theme of the environment involved two fundamental stages. The first was characterized by the implicit blessing of this theme[4],

[1]http://www.dgf.org.dz/fr, Accessed 2018.
[2]Characterization of household and similar waste in the northern, semi-arid and arid areas of Algeria 2014, National Waste Agency.
[3]Law No. 03-10 of July 19, 2003: relating to the protection of the environment within the framework of sustainable development, Official journal issued on July 20, 2003 No. 43.
[4]Hassouna Abdel-Ghani - Ammar Al-Zoghbi, Constitution of the subject of the environment in Algeria, Journal of Legal and Political Sciences, El Wadi University, Algeria, Issue 14 October 2016, p. 111.

which continued with the constitutional amendments that Algeria experienced until 2016, then the second phase, which saw the blatant and direct devotion to the question of the right to the environment through the constitutional amendment of 2016 and 2020.

2.2.1 Consolidate the environment in the preamble of the 2016 constitutional amendment

The constitutional amendment of 2016 reflects the willingness of Algeria to empower the rights and freedoms values and give them more space that is more significant. Perhaps the most important and most important of these rights is the right to the environment as a basis for achieving development. On this basis, the protection of the domain environment has been emphasized in the preamble to this amendment. "*The Algerian people remain committed to their choices in order to eliminate social differences and regional inequalities, and work to build a productive and competitive economy within the framework of development and environmental preservation*"[1] .

This statement clearly emphasizes that a link has been established between the preservation of the environment and sustainable development, which means reconciling sustainable social and economic development while protecting the environment. That is to say, the inclusion of the environmental dimension in a development framework that will address the needs of present and future generations. "Development and environment," the first relies on the resources of the second. Development cannot be achieved without depending on environmental resources. Consequently, any violation of the environmental resources will have a negative impact on the development process by terms of level and achievement of its objectives. Moreover, not disrupting environmental resources requires thinking about alternative renewable energies because it is an implicit call to move towards green energy of all kinds [2].

The citizen's right to live in a healthy environment is clearly emphasised in Article 19, which reads as follows: "*The State guarantees the rational use of natural resources and their preservation for the benefit of future generations,The state protects agricultural land,The state also protects public property,The law defines the modalities for the implementation of this article* "[3].

From reading this article composed of four paragraphs, we note that the constitutional founder in the first paragraph devoted the environment from the point of view of the protection that the State must ensure. Among the aspects of protection is the rational use of natural resources, and given the strategic importance of these resources in the achievement of sustainable development, the constitutional founder underlined through the text of Article 19 that the State is committed to preserving it and not to harm it as it is an integral part of the development path, and to develop strategies that will ensure the optimal use of these resources in a way that does not infringe the rights of future generations.

One of the imperatives of sustainable development is the preservation of fossil resources, in particular natural gas, which is the least polluting of the environment, by using renewable energies.

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[1]Preamble to the Algerian constitutional amendment promulgated by Law 16-01 On 6 March 2016.
[2]El-Marakby, Legal Protection of the Environment from Pollution, Dar Al-Nahda Al-Arabiya, Egypt, 2010, p.17.
[3]Article 19 of the Algerian constitutional amendment of 2016.

We can also discern the implicit call of the Algerian legislator to use alternative energies by including the environment in Chapter four on rights and freedoms, the text of article 68 being the following: " The citizen has the right to a healthy environment,The State works for the preservation of the environment,The law defines the duties of natural and legal persons to protect the environment".[1]

It is clear, through the provisions of this article, that the constitutional amendment recognized the citizen's right to a healthy environment because it is an implicit call to preserve his environment from all kind of pollutions, and this can only be achieved by reducing hazardous emissions and promoting the adoption of green energy.

2.2.2 Consolidate sustainable development in the preamble of the 2020 constitutional amendment

The recent constitutional amendment 2020 paid much attention to the environment, compared to the 2016 amendment and the constitutions that preceded it, as it expanded the circle of rights and freedoms and explicitly enshrined the right to a healthy environment and decent living in line with the requirements of development and protection of the environment from dangers. By extrapolating the document of this constitution, we find that he added a set of elements and principles that give the right to a healthy environment other comprehensive and complete dimensions[2], as this era linked other fields and rights, such as the right to health, the right to safe drinking water, sustainable development and the protection of major environmental sectors.

The preamble to the 2020 constitutional amendment stated: "*The Algerian people adhere to their choices in order to reduce social disparities and eliminate regional inequalities, and work to build a productive and competitive economy within the framework of sustainable development. The people also remain preoccupied with the deterioration of the environment and the negative consequences of climate change, and are keen to ensure that Protecting the natural environment and rational use of natural resources, as well as preserving them for the benefit of future generations. In acknowledgment of the enormous potential of the Algerian youth, their aspirations and insistence on raising the political, economic, social and cultural challenges of the country, it has become necessary to actively involve them in the process of building and preserving the interests of future generations, by guaranteeing them the formation of qualitative institutions and society''.*

By extrapolating the first and second paragraphs of this preamble, we see that a link has been established between preserving the environment and sustainable development, which means reconciling between sustainable social and economic development and environmental protection, that is, the inclusion of the environmental dimension in a development framework that includes the needs of current and future generations, "development and the environment." It is not possible to achieve development without relying on environmental resources, and it follows from this statement that any violation of environmental resources will have negative

[1]Article 68 of the Algerian constitutional amendment of 2016.
[2]JalehSama'in, The Strategic Dimensions of the Constitution of the Right to a Sound Environment in the Framework of Sustainable Development, http://www.ech-chaab.com/ar Accessed on 9/19/2021 at 17:47.

effects on the development process. And because sustainability refers to meeting the needs of the present without compromising the capabilities of future generations[1].

There is no need to adopt legislation and regulations that seek to achieve a balance between development requirements, environmental protection, and building an alternative economy that goes beyond the economy that depends mainly on income from natural resources such as oil and gas. Algeria has so far consumed half of its underground wealth that it has discovered, which makes this addition in the 2020 amendment, it is necessary to maintain energy security and rationalize the country's resources by moving towards alternative energies[2].

In Article 21 of the General Principles Governing Algerian Society Chapter Two, entitled The State, Constitution of 2020, states: "*The state ensures: the protection of agricultural lands, ensuring a sound environment in order to protect people and achieving their well-being, ensuring continuous awareness of environmental risks, rational use water, fossil energies and other natural resources, protect the environment in its land, sea and air dimensions, and take all appropriate measures to punish polluters*."

It is also clear to us through the provisions of this article that the constitutional amendment recognized the right to a healthy environment, by calling the Algerian legislator in the same article to rationalize the use of fossil energies, which is an implicit call to preserve the environment from all pollutants, and this is only done by reducing dangerous emissions Gradually reducing the use of this energy and returning to renewable energies or the so-called green energy.

Article 64 of Chapter One, entitled Fundamental Rights and Public Freedoms, Chapter Two of the 2020 Constitution, states: "Citizens have the right to a healthy environment within the framework of sustainable development. The law defines the duties of natural and legal persons to protect the environment"[3].

Since sustainability refers to meeting the needs of the present without compromising the resources the capabilities of future generations, it follows that the legislation, regulation, and adoption of business models are forced to strike a balance between the requirements for sustainable development and environmental protection and to build an alternative economy that outperforms the current economy which relies mainly on revenues from fossil fuel resources such as oil and natural gas. Algeria has already exhausted around 50% of its underground oil and gas reserves discovered by it, which makes the application of this legislation a matter of urgency to guarantee the preservation of energy security and rationalize the country's resources by moving towards alternative energies.

The term "sustainable development" added by the legislator in the text of article 64 encourages the addition of new laws which will define, for example, the protection of the environment in various projects, regulations which promotes the transition from oil and gas towards the adoption of renewable energies. It also encourages the emergence of new businesses waste management, recycling and environmental protection and accredited

[1] Article 04 of law n ° 03/10, relating to the protection of the environment within the framework of sustainable development.
[2]https://www.energy.gov.dz Accessed on, September 19, 2021, at 22:15.
[3]JalehSama'in, The Strategic Dimensions of the Constitution of the Right to a Sound Environment in the Framework of Sustainable Development, http://www.ech-chaab.com/ar Accessed on 9/19/2021 at 17:47.

organisations to offer funding and national awards to support outstanding research and technological innovation.

With the same environmental considerations and efforts to involve everyone, one can also take care to develop and evaluate applied and standard research and studies in the fields of environment and agriculture, and to stimulate and vitalize the institutes for agricultural and environmental studies and renewable energies and to consider them as strategic institutions to undertake research studies related to food and energy sovereignty of the country. It is also essential to support educational programs and cultural activities related to sustainable development, including climate change, renewable energies, and the environment[1].

As well as raising awareness against excessive energy consumption and CO2 emissions, and the need to use alternative materials and energies and environmentally friendly building materials to reduce energy intensity and costs carbon emissions.

Therefore, we can say that the principle of "sustainable development" proposed by the constitutional amendment of 2020 aims to promote and popularize the use of alternative energies to achieve energy security, as energy is at the heart of economic development[2].

The constitutional provisions relating to the safeguard of the environment have increased its importance in a way that makes it a constitutional value, which further supports the rights of environmental defenders. Indeed, these associations and organizations will be able to defend these rights in the same way him for the environment, since his dedication raises him to the rank of important constitutional issues such as the fundamental human rights. It forces public authorities to recognize environmental factors as an integral part of their political, economic and social agendas.

2.3 An implicit call for the use of green energy in laws relating to the environment

2.3.1 Consecration of the principles of prevention and precaution

The consecration of the principle of prevention in international environmental law within the framework of international agreements and declarations has a significant impact on the development of national legislation by urging the existing public authorities in environmental protection to take preventive measures and put in place the necessary means to protect ecological resources before damage occurs or reduce it.

The Algerian legislator[3], like others, has enshrined the principle of prevention as a means of preserving environmental resources and reducing the dangers that threaten them. This is what appeared in the new ecological law 10/03 relating to environment protection within the framework of sustainable development, which explicitly stated this principle in

[1]JalehSama'in, The Strategic Dimensions of the Constitution of the Right to a Sound Environment in the Framework of Sustainable Development, http://www.ech-chaab.com/ar Accessed on 9/19/2021 at 17:47.
[2]The Constitution of Algeria 2020, published by Presidential Decree No. 20-251 of September 15, 2020, Official Gazette No. 54 of September 16, 2020.
[3]The United Nations Framework Convention on Climate Change، approved by the United Nations General Assembly on May 09, 1992, ratified by Algeria by Presidential Decree No. 93/99 of April 10, 1993, The official journal No. 24 issued on April 21, 1993.

article 02/02: "*Prevention of all forms of pollution and damage to the environment, by ensuring the preservation of its components* "[1].

We also find article 03/05 of the same law as mentioned above, which states: "*The principle of preventive action and the correction of environmental damage with priority at the source, by using the best techniques available at an acceptable economic cost. This is done using the best available technologies at an acceptable economic cost. Any activity that is likely to cause serious damage to the environment should take into account the interests of others before taking action*"[2] .

It can be concluded from the above that the Algerian legislator calls for the protection of the environment and the fight against all forms of pollution as a preventive solution to the dangers it raises by putting in place the appropriate technological means.

This is an implicit call to reduce the use of fossil fuels and replace it with green energy, that is, renewable energies.

2.3.2 Inclusion of the environmental dimension in the development framework

Sustainable development is the urgent need for development that meets the needs of the present generation without compromising the ability of future generations to meet their needs[3]. Future generations should not suffer from the development efforts of the current generation but should benefit from the same conditions, including equal access to resources[4]. This requires the cessation of all activities that lead to the depletion of non-renewable resources[5]. To achieve sustainable development, it is urgent to balance population growth rates on the one hand and to increase the productive potential of environmental elements on the other[6] .

The Algerian legislator has dealt with the issue of sustainable development through Law No. 10/3, as stipulated in Article 04/04 thereof, which has been defined here as "a concept which means reconciling between social and sustainable economic development and environmental protection, that is to say the inclusion of the environmental dimension in the framework of development guaranteeing the satisfaction of the needs of present and future generations. "[7]

The relationship between the principle of prevention and sustainable development lies essentially in the fact that the main objective of the establishment of preventive mechanisms

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[1]Paragraph 02 of article 02 of law n ° 03/10, relating to the protection of the environment within the framework of sustainable development.
[2]Paragraph 03 of article 05 of law n ° 03/10, relating to the protection of the environment within the framework of sustainable development.
[3]HERVE Deville, Economics and environmental policy, LHarmattan, Paris, 2010, p.14.
[4]Karbali Baghdad and Hamdani Muhammad, Strategies and policies for sustainable development in light of economic and technological transformations in Algeria, Journal of Humanities, Faculty of Economics, No. 45, Oran University, ALGERIA, 2010, p. 10.
[5]Karbali Baghdad and Hamdani Muhammad, Strategies and policies for sustainable development in light of economic and technological transformations in Algeria, Journal of Humanities, Faculty of Economics, No. 45, Oran University, ALGERIA, 2010, p. 10.
[6]Abdullah Ramadan Abdullah Al-Kandari, Environment and Sustainable Development, Al-Mohanad Library, Kuwait, 1992, p. 165.
[7]Paragraph 04 of article 04 of law n ° 03/10, relating to the protection of the environment within the framework of sustainable development.

and environmental protection measures is to achieve sustainable development, enabling sustainable ecological resources to meet the needs of present and future generations.

En conséquence, l'utilisation d'énergies renouvelables est l'un des moyens préventifs les plus importants pour protéger l'environnement des dangers des combustibles fossiles.

2.4 The legal framework and incentives directly linked to renewable energies

The adoption of the legal framework favourable to the promotion of renewable energies and the construction of infrastructures relating to the production of electricity from renewable energy sources are defined mainly by executive decrees and ministerial orders[1]:

- Law n ° 99-09 of July 28, 1999, Official Journal n ° 51, relating to energy control: This law defines the general framework of the national policy on energy control and specifies the means which lead to it as well as the economic management of the energy which allows its realization. Article 33 of this law provides the possibility of granting customs tax advantages for projects related to the development of renewable energies. Within the framework of this law, the National Energy Management Fund (FNME) was created, which provides funding to energy management projects[2].
- Law n ° 02-01 of February 5, 2002, Official Journal n ° 08, relating to the public distribution of gas by pipeline: This law generally on electricity and gas distribution liberalizes this sector and establishes the promotion procedures. The production of electricity from renewable energies as well as their integration into the electric power network[3].
- Law n ° 04-09 of August 14, 2004, Official Journal n ° 52, relating to the promotion of renewable energies within the framework of sustainable development: This law, relating to the advancement of renewable energies within the framework of sustainable development, provides for the formulation of a national program for the promotion of renewable energies. It also includes the creation of a national observatory to encourage and promote the development of renewable energies.
- Law n ° 09-09 of December 30, 2009 on the 2010 law, including Article 64 on creating the National Fund for Renewable Energies and Cogeneration (FNER).
- Law n ° 11-11 of July 18, 2011 on the complementary financing law for 2011, in particular article 40 amending article 63 of law NO. 09-09.
- Law n ° 14-10 of December 30, 2014 on the 2015 law, including Article 108, provides for the merger of the two Funds. The National Energy Management Fund (FNME) and the National Renewable Energies and Cogeneration Fund
- Executive Decree No. 11-423 of December 8, 2011, setting the terms and conditions for the operation of dedicated account No. 302-131 entitled “National Fund for Renewable Energies and Cogeneration”

[1] https://www.energy.gov.dz/, Accessed 2018.
[2]Ministry of Energy and Mines، Renewable Energy Guide, ALGERIA, p. 35.
[3]Ministry of Energy and Mines، Renewable Energy Guide, ALGERIA, p. 36.

- Executive Decree No. 13-218 of June 18, 2013 setting the conditions for granting bonuses for the costs of diversification of electricity production was adopted by the government and published in the Official Journal No. 33 of June 26, 2013.[1].
- Executive Decree No. 15-69 of February 11, 2015, fixing the procedures for certifying the origin of renewable energies and using these certificates. This mechanism governs the granting of bonuses relating to the costs of diversification of electricity production. The Electricity and Gas Regulatory Commission issue the certificate[2].
- Executive Decree No. 15-319 of December 13, 2015, setting the operating procedures for particular account No. 302-131 entitled "National Fund for the Control of Energy and Renewable Energies and Cogeneration"
- Executive Decree No. 16-121 of April 16, 2016, amending and supplementing Executive Decree No. 15-319 of December 13, 2015, fixing the terms of account No. 302-131 entitled "National Fund for Energy Efficiency and Energy renewables and cogeneration "
- Ministerial decree of February 21, 2008, setting the technical rules for connection to the electricity transmission network and the rules for the electrical system
- Inter-ministerial decree of April 19, 2008, adopting the regulation on the "Photovoltaic module (PV) with crystalline silicon for terrestrial application."
- Ministerial decree of October 28, 2012, determines the Loire future project and the expenses to be debited from the FNER.
- Ministerial decree of October 28, 2012, specifies the methods and conditions for monitoring and evaluating the FNER.
- Ministerial decree of February 02, 2014 fixing the guarantee of purchase prices and the conditions of their application to electricity produced from installations using wind energy.
- Ministerial decree of February 02, 2014 setting the guarantee of purchase prices and the conditions for their application to electricity produced from installations using solar photovoltaic
- Ministerial decree of September 01, 2014 fixing the purchase price guarantee and the conditions for their application to electricity produced from installations using cogeneration.

The fund will be governed by two new inter-ministerial decrees approved in 2017, including a law on determining funding sources, how to monitor the spending and evaluate the outcome. them and monitoring and evaluation. Regarding renewable energies and cogeneration, the fund is mainly supplied by 1% of oil royalties. Concerning sources for energy efficiency, revenue comes primarily from state subsidies and proceeds from the national energy consumption tax and taxes on energy-using devices[3].

[1]Ministry of Energy and Mines، Renewable Energy Guide, ALGERIA, p. 36.
[2]Ministry of Energy and Mines،RenewableEnergy Guide, ALGERIA, p. 36.
[3]Ministry of Energy and Mines، Renewable Energy Guide, ALGERIA, p. 36.

The feed-in tariffs set for renewable energies are based on the installed capacity and differ from phase I to phase II (phase I corresponds to the first 5 years of operation and the second phase to the remaining 15 years). The rates are determined based on the number of operating hours per year, thus, the maximum tariff corresponds to the lowest operating hours of a year and vice versa.

2.5 Organizations and institutions for the development of renewable energies

The mechanisms for developing renewable energies are set by national bodies and institutions, each within its competence and expertise. These centres have conducted several research studies[1].

2.5.1 Organizations and institutions

In what follows, we will give an overview of the different organizations and institutions for the research and development of renewable energies in Algeria[2]:

- Center for the Development of New and Renewable Energies (CDER)

The missions of the CDER can be summarized as (i) collecting and processing data to accurately assess solar energy, wind energy, soil, and biomass, (ii) undertake the research work related to the development of the production and use of renewable energies, (iii) Setting standards for renewable energy equipment and their use.

- Solar equipment development unit (UDES)

This unit is responsible for developing solar luminaires and implementing experimental models: thermo-efficient solar luminaires for domestic, industrial, and agricultural use, solar-based lighting for domestic and agricultural use, and electrical equipment and systems.

- The Agency for the Promotion and Rationalization of Energy Use (APRUE)

This agency was created by the government to activate and implement the energy conservation policy. Its main role is to coordinate and monitor energy management measures and implement the various programs approved in this context with different sectors.

- Niall (New Energy Algeria)

It is a mixed company between the national company Sonatrach and Sonelgaz and the group of food products SIM. Created in 2002, its mission is to promote renewable energies, design and implement renewable energy solutions and projects.

- National Agency for Development and Investment (ANDI.)

- National Statistics Office (ONS).

- Algerian Institute for Standardization (IANOR).

The scientific research network**:** Currently, under supervision, the scientific research network has eighteen (18) establishments. It brings together ten (10) research centers, five (05) research units, and three (03) research agencies in addition to research laboratories[3].

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[1] BoudoraRamzy, Renewable energies and their role in achieving sustainable development, Milaf Journal of Research and Studies, No. 5, June 2017, ALGERIA, p. 616.
[2] https://www.energy.gov.dz/ , Accessed 2018
[3] https://www.energy.gov.dz/ , Accessed 2018.

In addition, several universities have research laboratories working in renewable energies and their various applications[1], through their postgraduate research projects at the Doctorate and Master levels.

Article 2 of Executive Decree No. 21-89 of March 2021 explicitly stated the trend of scientific research towards the protection of the environment and green energy, and this through the lines of research approved by the Ministry of Higher Education and Scientific Research:

- Development of food security, improvement of nutrition, and promotion of agriculture Leveraged.
- Preserve and improve the health of citizens.
- Strengthen energy security.
- Diversify energy sources, improve their efficiency and take into account
- Consideration of reciprocal needs at all levels.
- Development of alternative energy production technologies, processes, and their applications.
- Contribute to the protection of the environment and the promotion of the blue and green economy.

2.5.2 Studies

Several studies have been conducted with many collaborators to integrate renewable energies in Algeria[2]:

• updating of the national wind atlas, in collaboration with the National Meteorological Office (ONM);

• identification of sites eligible for the establishment of wind farms in the area of Touggourt, Hassi Messaoud, and Ghardaïa, in collaboration with the Center for the Development of Renewable Energies (CDER) ;

• development of the Solar Atlas of Algeria, in collaboration with the Algerian Space Agency (ASAL);

• identification of a set of sites with high solar potential that can accommodate solar power plants, in collaboration with the Algerian Space Agency (ASAL);

• impact of integrating renewable energies on the Algerian electricity grid, Sonelgaz in collaboration with RES4MED / CESI.

2.6 Some projects and achievements under the national renewable energy program:

According to the National Renewable Energy Development Program (2011-2030), the budget of which is estimated between $ 80 and $ 100 billion (pilot projects and experiments are currently underway in various sectors)[3], the share of renewable energies in the national electricity consumption rose from 02% in 2011 to 05% in one year. In 2015, 14% in 2020 and

[1]Executive Decree No. 21-89 of March 2021, includes a multi-year development plan to implement national programs for scientific research and technological development.
[2]https://era.dz/era/wp-content/uploads/2017/10/SKTM.
[3]Ministry of Energy, New and Renewable Energies and Energy Management, PP: 14.

40% in 2030, the program will also create 200,000 direct and indirect jobs and save around 600 billion cubic meters of natural gas.[1]

According to the Algerian Program for the Development of Renewable Energies and Energy Efficiency (PNEREE) of 2012, Algeria aims for an installed capacity of renewable origin of 22,000 MW by 2030, of which 12,000 MW will be intended to cover national demand in electricity and 10,000 MW for export.

For 2015, the annual report of the International Energy Agency (IEA) on solar mentions Algeria, announcing that it installed 270 MWp during the year, bringing its total solar power to 300 MWc, however the GWEC (Global Wind Energy Council) report on wind power does not mention Algeria.

The Algerian government adopted at the end of February 2015 its program for the development of renewable energies from 2015 to 2030. The first phase of the program started in 2011, had made it possible to carry out pilot projects and studies nationally. The new program indicates the planned installation capacities by 2030 see Table 3.

Table 3: Renewable energy development program[2]

Unity: MW	**1st phase 2015-2020**	**2nd phase 2021-2030**	**TOTAL**
Photovoltaic	3 000	10 575	13 575
Wind	1 010	4 000	5 010
Concentrated solar power	-	2000	2 000
Cogeneration	150	250	400
Biomass	360	640	1 000
Geothermic	05	10	15
TOTAL	**4 525**	**17 475**	**22 000**

The total capacity thus amounts to 22 GW, of which more than 4.5 GW must be achieved by 2020. Therefore, by 2030, 37% of the installed capacity and 27% of the electricity production intended for national consumption will be from renewable energy.

Sonelgaz group has invested in the field of new and renewable energies. The group plans to carry out 67 solar power plant projects in its renewable energy development program, including 27 photovoltaic plants, 27 hybrid plants, 6 solar thermal plants, and 7 wind power plants. The most powerful solar power plants will be of the thermal solar-type, with a maximum capacity of 400 MW for one of them. For optimal efficiency, they will all be installed in the southern regions, particularly in the wilayas of Adrar, Ghardaïa, El Oued, and Béchar. Figure 16 represents the renewable energy development agenda by 2030.

[1]United Nations, Economic Commission for Africa, North Africa Office, Green Economy in Algeria, p: 09.
[2]Enerray. Algeria Starts its Renewable Energy Future with a 150 MW Solar PV Tender; Enerray: Bologna, Italy, 2018; Available online: https://www.enerray.com/solar-company/ (accessed on 12 December 2019).

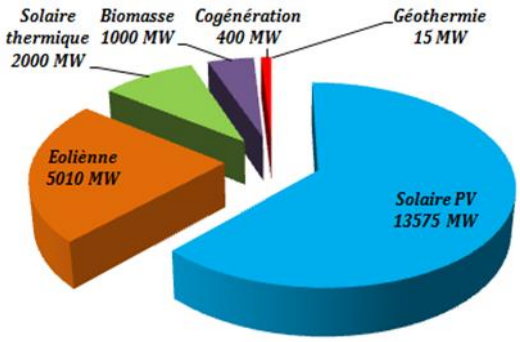

Figure. 07 Powers of renewable energies by 2030 in Algeria[1].

Initially, 23 photovoltaic plants will be put into service:

- West Pole (Sidi-Belabes, Saida, Nâama, and El Bayadh) which will be installed by the German manufacturer, i.e., a power of 85 MWp.

- East and South Poles (Batna, Souk Ahras, Setif, BourdjBouararidj, Mila, Msila, Djalfa, Laghouat, Ouargla, Adrar, Aoulef, Reggane, In Salah and Timimoune), as well as the three (03) isolated power plants located in Tindouf, Djanet and Tamanrasset which will be installed by the Chinese manufacturer, i.e., a power of 258 MWp.

In what follows, we will present the various projects and actions carried out during the 2011-2014 phase as part of the national renewable energy program (2011-2014)[2].

• 150 MW HassiR'mel Hybrid Solar-Gas Plant (Laghouat):

- Technology: ISCC system (Integrated solar Combined Cycle), 120 MW combined cycle, 30 MW Solar Thermal (parabolic CSP);
- HTF system (Heat Transfer Fluid) 393 ° c;
- Sun tracking system (Tracker);
- Commissioning: July 2011.

• Kabertène 10.2MW Wind Farm (ADRAR):

- Capacity: 10.2 MW
- Technology: Gamesa 850 KW (12 x 850 KW)
- Commissioning: June 2014

• OuedN'Chou 1.1 MWp Photovoltaic Pilot Plant (Ghardaïa):

- Capacity: 1,131,816 Wp;
- Technology: eight subfields of the four technologies (Monocrystalline, Poly crystalline, amorphous and CdTe thin film) mounted on fixed and motorized structures;
- Commissioning: June 2014.

• 343 MWp project in photovoltaic power plants

The table below shows the progress report for photovoltaic power plants in Algeria.

Table 4: Progress report for photovoltaic power plants[3]

Wilaya	Location	Installed Capacity (MW)	Commissioning

[1] https://www.energy.gov.dz/ , Accessed 2018.
[2]https://era.dz/era/wp-content/uploads/2017/10/SKTM.
[3]https://era.dz/era/wp-content/uploads/2017/10/SKTM

ILLIZI	Djanet	03	19/02/2015
ADRAR	Adrar	20	28/10/2015
ADRAR	Kabertene	03	13/10/2015
TAMANRASSET	Tamanrasset	13	03/11/2015
TINDOUF	Tindouf	09	14/12/2015
ADRAR	Zaouiet.Kounta	06	11/01/2016
ADRAR	Reggane	05	28/01/2016
ADRAR	Timimoun	09	07/02/2016
TAMANRASSET	In-Salah	05	11/02/2016
ADRAR	Aoulef	05	07/03/2016
LAGHOUAT	El Khnag (I)	20	08/04/2016
LAGHOUAT	El-Khnag (II)	40	26/04/2017
DJELFA	Ain-El-Ibel (I)	20	08/04/2016
DJELFA	Ain-El-Ibel (II)	33	06/04/2017
SOUK AHRAS	Oued El Keberit	15	24/04/2016
NAAMA	SedrateLeghzal	20	03/05/2016
SAIDA	Ain-Skhouna	30	05/05/2016
SIDI-BEL-ABBES	Telagh	12	29/09/2016
EL BAYADH	Biodh Sidi Chikh	23	26/10/2016
M'SILA	Ain-El-Melh	20	26/01/2017
OUARGLA	El-Hdjira	30	16/02/2017
BATNA	Oued El-Ma	02	16/01/2018

2.7 Renewable energy development program

Algeria is committed to the path of renewable energies to provide comprehensive and sustainable solutions to environmental challenges and to the problems of preserving its fossil fuel resources through the launch of an ambitious program for the development of renewable energies, which was adopted by the Government in February 2011, revised in May 2015 and placed as a national priority in February 2016.

Algeria is embarking on a new era of sustainable energy. In its updated version, the renewable energies program consists of an installed capacity from renewable energy sources of up to 22,000 MW by 2030 for the national market, with potential export of energy if market conditions allow[1].

Through this renewable energy program, Algeria intends to position itself as a significant player in producing electricity from photovoltaic and wind energy resources by integrating biomass, cogeneration, geothermal energy, and beyond 2021, solar thermal. These alternative and renewable energy resources will be the engines of sustainable economic development capable of stimulating a new economic growth for the country[2].

It is expected that, by 2030, 37% of the total installed capacity will be from renewable energy and 27% of which will be used for electricity production intended for national consumption.

[1]https://era.dz/era/wp-content/uploads/2017/10/SKTM
[2]https://era.dz/era/wp-content/uploads/2017/10/SKTM

As the national renewable energy potential is strongly dominated by solar energy, Algeria considers this energy an opportunity and a lever for economic and social development, mainly through establishing industries that create wealth and jobs[1].

However, this does not exclude the launch of numerous projects to build wind farms and the implementation of experimental projects in biomass, geothermal energy, and cogeneration. The renewable energy production projects dedicated to the national market will be carried out in two stages:

- First phase 2015 - 2020: This phase will see the deployment of 4010 MW capacity between photovoltaic and wind power, as well as 515 MW, between biomass, cogeneration, and geothermal energy[2].

- Second phase 2021 - 2030: The development of the electrical interconnection between the North and the Sahara (Adrar) will allow the installation of large renewable energy plants in the regions of In Salah, Adrar, Timimoune, and Bechar and their integration into the national grid. By this time, solar thermal could be economically viable[3].

Algeria's strategy in this area aims to develop a genuine renewable energy industry associated with a training and knowledge capitalization program, which will ultimately make it possible to employ local Algerian engineers, particularly in engineering and project management. The ENR program will create several thousand direct and indirect jobs for the needs of the national electricity market.

Consistency of the renewable energy development program.

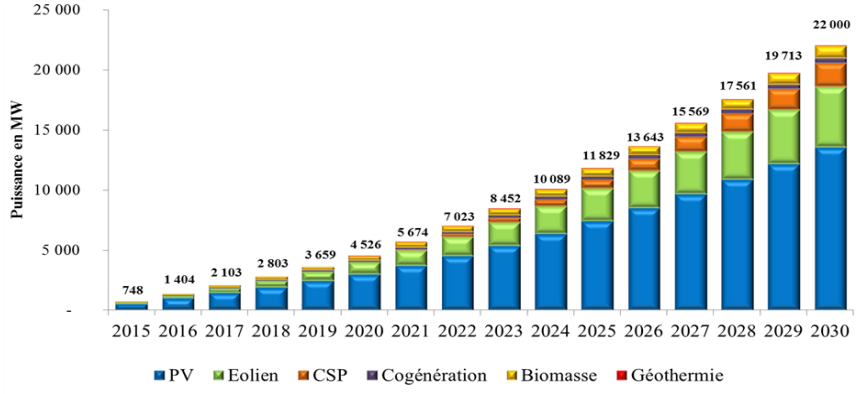

Figure. 08 Renewable energy program to be carried out for the national market over the period 2015-2030[4]

[1]https://era.dz/era/wp-content/uploads/2017/10/SKTM
[2]Enerray. Algeria Starts its Renewable Energy Future with a 150 MW Solar PV Tender; Enerray: Bologna, Italy, 2018; Available online: https://www.enerray.com/solar-company/ (accessed on 12 December 2019).
[3]Enerray. Algeria Starts its Renewable Energy Future with a 150 MW Solar PV Tender; Enerray: Bologna, Italy, 2018; Available online: https://www.enerray.com/solar-company/ (accessed on 12 December 2019).
[4]https://era.dz/era/wp-content/uploads/2017/10/SKTM

Conclusion

The world is in general, and Algeria in particular, are facing serious significant and different climate challenges resulting from greenhouse gas emissions, which have led to dangerous phenomena and global warming, posing a danger to the planet, environment and living organisms. Algeria is among the largest contributors to CO_2 emissions in the African continent because its economy is entirely reliant dependent on fossil fuels.

The Algerian state has made great efforts in recent years to invest in renewable energies for diverse applications, including the generation of electricity. Important funds and financial incentives are provided from the state and made available to legislators to promote investment in the renewable energy sector to protect the environment as well as preserve oil and gas reserves. because it has accumulated funds from mechanisms These funds, whether legal or institutional, or even financial incentives are provided from the state and used the Algerian legislator to promote green energy, as a preventive solution to protect the environment from the dangers that threaten its security, and on the other hand, to preserve energy resources, in particular the natural gas, for sustainable development.

However, the current installed capacity of renewable energy production remains low compared to the enormous potential that characterizes Algeria, particularly solar energy, which is an abundant resource across all the country including the desertand a promising source of clean energy due to the abundance and the vastness of the desert lands.

As for the legal side, the Algerian legislator, who became involved in the international public track, directed Algeria to ratify many international conventions on the environment and renewable energies, and set the texts of the regulations, and urged the advancement of the environment to a decent position and this by including the environmental issues constitutionally and implicitly, the trend towards the use of green energy and was evident in its texts, and after realization, conviction and urgency Researchers and those in charge of environmental affairs have finally joined the vanguard of promoting a healthy environment to a right in the Algerian constitution, awaiting the outcomes of this right, including the acquisition of the status of any citizen in the establishment as a party before any judicial authority to address any violation that affects the environment.

The constitution of environmental protection and the use of renewable energies within the Algerian constitutional amendment of 2020 is in line with international efforts aimed at expanding the circle of human rights, and is in line with international and regional charters and treaties that are keen to protect it from environmental damage and risks. This constitution also emphasizes the relationship between environmental protection, sustainable development, health and environmental safety.

The main reasons that prevent Algeria from achieving the stated objectives:

• Lack of sufficient awareness of the authorities concerned and their lack of conviction that renewable energies will be one of the most important tributaries of the national economy and may even be an alternative to fossil fuels.

• Large-scale deployment of solar energy requires large land areas which are available in the desert.

• The absence of clear laws for investment, especially regarding small-scale prosumers who will have the ability which concerning the sale of properties to export their surplus of

generation production when connecting to the electricity grid, "The export of surplus electrical energy production from a particular owner to the national grid".

Besides the efforts made to promote the development of renewable energies, Algeria requires additional reforms based on the following points:

• Convince Engineering businesses and technologists on the importance of developing and investing in renewable energies technologies.

• Improvement of the regulatory frame work to facilitate the implementation of Algerian renewable energy programs.

• Promote and facilitate medium and long-term private investments in the field of renewable energies.

• Support and encourage initiatives such as the Mediterranean Solar Energy Plan (MSP) and DESERTEC to connect the Middle East and North Africa (MENA) to Europe and transport electricity from the south to the northern Mediterranean countries via HVDC links.

• Issue illustrative laws and regulations indicating the terms and conditions for connecting different sources of renewable energy to the electricity grid, especially those owned by individuals, to sell electrical energy. This initiative will undoubtedly attract foreign investment in such projects.

Finally, to conclude, preserving environmental safety and the sustainability of environmental resources requires the strict application of these measures and legal measures, particularly in a country like Algeria, which has various and numerous renewable resources. However, the multiplicity and diversity of laws and systems of prevention and protection are not considered as an appropriate method if this intervention is not reinforced by a strict institutional apparatus.

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