ACHIEVING ENERGY SECURITY IN ALGERIA THROUGH HARNESSING RENEWABLE ENERGIES

BELFAR Chaouki[1]

[1]Universityof 8 Mai 1945 Guelma(Algeria)

The E-mail Author:belfar.chaouki@univ-guelma.dz

Received: 07/2024 **Published: 01/2025**

Abstract:

Achieving energy security through renewable energy contributes to diversifying energy sources and improving the sustainability of the energy system in Algeria. It also supports global efforts to combat climate change and achieve sustainable development.

Moreover, the exploitation of renewable energies holds significant importance in our lives due to the global concern over the depletion of traditional energy sources and the various serious environmental issues they cause. Exploiting renewable energies has become an inevitable alternative, and integrating renewable energy has become necessary to achieve energy security. Algeria has worked on developing renewable energies through several national programs, leveraging its significant national potential in this field, furthermore, finding new ways to formulate strategies for solving the financing and development challenges of renewable energy has become imperative.

Keywords: Renewable energy, the problem of the financing, national programs, energy security.

INTRODUCTION:

Recent global economic shifts, particularly affecting oil-producing nations, have compelled governments to seek sustainable energy solutions through the development of renewable energy sectors. The world is gradually transitioning towards a post-petroleum era, a reality recognized by countries striving to ensure energy security tied to non-renewable resources like solar and wind power. Algeria, heavily reliant on hydrocarbon exports (95% of total exports) despite its vast reserves of natural gas and oil, has adopted a similar approach.

Algeria boasts abundant renewable energy potential. Its expansive desert, covering over two million square kilometers, receives approximately 3,600 hours of sunlight annually. Additionally, wind speeds exceeding 7 meters per second in regions like Adrar, home to one of the world's strongest wind corridors, offer significant potential. Hydropower from dams, geothermal energy, biomass, and other eco-friendly, economically viable alternatives further enrich the country's energy mix.

These diverse sustainable energy resources position Algeria as a 'sleeping giant', though it lags behind neighboring countries in harnessing them. Recognizing this, the government has introduced policies to promote and develop the renewable energy sector, attracting investments. This raises the following question:

The Problem: To what extent can Algeria rely on renewable energy sources to ensure sustainable energy security amid growing concerns about the depletion of traditional energy resources?

To address this question, our study focused on:

Chapter One: The legal framework governing renewable energy in Algeria and its role in achieving energy security.

Chapter Two: The national renewable energy program and the incentives offered to attract investment in this sector

Chapter One: The Legal Framework for Renewable Energy to Achieve Energy Security in Algeria

Algeria has placed great emphasis on renewable energy by approving a legal framework that encourages its promotion and the establishment of the necessary structures for this purpose, with the aim of achieving energy security. Before delving into the legal framework for renewable energy in Algeria, which we will address in the second part, it is imperative that we define the concepts of renewable energy and energy security in the first part

Part One: The Concept of Renewable Energy and Energy Security

Initially, we will address the subject of defining renewable energy and energy security in general. These two concepts encompass a wide range of issues that link energy to economic growth, especially since energy is the lifeblood of nations and the primary supporter of the national economy and security. Based on the aforementioned, the definition of renewable energy and energy security can be determined as follows

1. **The Concept of Renewable Energy**

Renewable energy, as defined by the International Energy Agency, is energy derived from recurring or continuous natural phenomena, which in turn result from the workings of the universe, primarily from the sun. Examples include wind energy, solar energy, and biomass energy, as well as energy sourced from the Earth, such as geothermal energy and hydropower. Additionally, it includes tidal energy, which is generated by the movement of the moon.[1]

According to OPEC's definition, renewable energy is energy that naturally and periodically recurs in nature. It refers to energy derived from natural resources that are continuously replenished and cannot be depleted.[2]

Renewable energy is a sustainable form of energy, including wind energy, hydropower, solar energy, geothermal energy, wave energy, and more. It does not produce any environmentally harmful gases during use, which is why it is referred to as clean energy. It is also called green energy because it is environmentally friendly.

Solar Energy: The sun emits a total thermal stream of approximately 4×10^{33} kilowatts every second, of which a small portion, valued at 2.16×10^{5} kilowatts, reaches the Earth. The radiative energy sent to Earth by the sun is the most widespread energy source. Its significance lies in its unlimited availability, cost-free nature, ability to reach remote areas inaccessible to other energy sources, and its complete lack of contribution to environmental pollution problems.[3]

Algeria is considered one of the countries rich in solar energy resources, positioning it to rank among the top globally. This is due to its vast land area on the one hand and its strategic geographical location on the other. According to environmental experts, the Algerian Sahara makes up 80% of the country’s total area and is characterized by intense heat, especially in the summer, where temperatures exceed 60 degrees Celsius. Additionally, these areas experience minimal cloud cover throughout the year. As a result, Algeria has the potential to generate enough electricity to meet the needs of the entire world.[4]

---

[1] Mohamed El Amin Gariou, "Exploitation of Renewable Energies in Algeria: An Inevitable Necessity," Journal of Legal and Political Research and Studies, Blida University, Algeria, Volume 7, Issue 1, 2018, p. 58.

[2] Mustafa Al-Kafri, JidayaIssa, "The Role of Renewable Energy in Achieving Energy Security in Syria During the Reconstruction Phase," Journal of Tishreen University for Scientific Research and Studies, Tishreen University, Syria, Volume 39, Issue 6, 2017, p. 498.

[3] BintNawiAicha, "Energy Security in Algeria: An Analytical Perspective on the National Renewable Energy Program for the Period Between 2011-2030," Journal of Legal and Economic Research, Algeria, Volume 4, Issue 2, 2021, p. 112.

[4] Kaddatsa Mohamed, "The Reality of Renewable Energies in Algeria and Its Future Prospects," Journal of Development and Applied Economics, University of M'sila, Algeria, Volume 3, Issue 2, 2019, p. 79. .

Wind Energy: The availability of wind energy resources in Algeria varies from one region to another due to the country's diverse topography and climate. The southern regions experience higher wind speeds compared to the north. For example, wind speeds in Adrar Province exceed 6 m/s. In coastal areas, the winds are saturated with maritime and continental desert air, with an average speed exceeding 7 m/s at a height of 10 meters. This provides the potential for generating an annual energy output of approximately 673 million watt-hours if a wind turbine is installed at a height of 30 meters, assuming wind speeds of 5.1 m/s.[1]

Hydropower: The annual rainfall in Algeria is estimated at 65 billion cubic meters, of which only 5% is utilized for electricity generation. This is due to the limited number of hydropower plants and the inefficiency of energy production from this source. As of 2006, the hydropower capacity was approximately 228 megawatts.[2]

Geothermal Energy: Geothermal energy operates at a much higher capacity factor compared to solar photovoltaic and wind energy. Its source is continuous and uninterrupted, allowing geothermal energy to produce more electricity per 1 MW of installed capacity.[3]

Biomass Energy: Biomass energy is derived from plant residues, wood, animal manure, waste, and grasses, after being converted into liquid or gas through chemical processes or pyrolysis. It can also be utilized by directly burning it and using the resulting heat to heat water and produce steam, which can drive turbines to generate electricity. However, Algeria's potential in this field remains limited compared to other energy sources, despite the significant forested areas the country possesses.[4]

Hydrogen Energy: The use of hydrogen in energy generation remains quite limited due to many obstacles. However, experiments are currently being conducted to use it as a replacement for car fuel.[5]

2. Concept of Energy Security

Energy security in any country is considered one of the most important pillars of societal security, both in developed and developing nations. This is because it plays a role in achieving other components of national or homeland security, such as economic security, food security, health and safety security, social security, and political security. There is difficulty in reaching a specific definition of energy security, due to the varying interpretations of the concept between energy-exporting and energy-importing countries, as well as differences between countries within each group.

However, to achieve energy security, cooperation between producing and consuming countries is necessary. Energy should be approached from an economic perspective, rather than solely from a security standpoint, ensuring the availability of sufficient and secure energy sources for importing

---

[1] ChtibiHanane, "Algeria's Efforts in the Field of Renewable Energies: Between Reality and Prospects," Journal of Management, Higher School of Management and Digital Economics, Algeria, Volume 3, Issue 2, 2016, p. 73.

[2] Amish Aicha, TarshaniSihem, "Energy Transition as a Mechanism for Sustaining Energy Security in the Maghreb Countries: Prospects and Challenges," Journal of Economic Studies and Research on Renewable Energies, Batna 1 University, Algeria, Volume 8, Issue 1, 2021, p. 211.

[3] Mustafa Al-Kafri, JidayaIssa, ibid, p .499

[4] ChtibiHanane,ibid, p76.

[5] RahailiyaSeifEddine, Boudah Abdel Jalil, "Investment in Renewable Energies and the Requirements for Achieving Energy Security: Learning from the American Experience and Referring to the Case of Algeria," Journal of Economic and Administrative Research, Mohamed Khider University of Biskra, Algeria, Volume 12, Issue 1, 2018, p. 166 .

countries while ensuring that producing countries maintain control over their national energy resources. This control allows them to achieve a better international and regional standing in line with their energy resources.[1]

Energy security refers to the availability of energy sources in sufficient quantities, with relative stability and acceptable prices for importing and consuming countries. Therefore, if these resources face significant shortages, reduced quantities available for sale, or price increases, it indicates a shortfall in energy security.[2]

Second Requirement: The Legislative Framework for Renewable Energies in Algeria

Algeria has given significant importance to the subject of renewable energy by adopting a legislative framework that encourages investment in this sector. This requirement addresses the key laws issued at the national level to support and promote the use of renewable energy in various applications.

The energy diversity policy in Algeria has been translated into action through the provision of the necessary legal mechanisms to promote renewable energies within the framework of a series of reforms initiated at the beginning of the first decade of the 21st century. Algerian interest in renewable energies began to emerge in 1983, marked by an agreement with Belgium on February 19, 1983, between the two countries in the field of renewable energy development. This agreement aimed to encourage scientific, technological, and industrial cooperation related to implementing projects associated with the development and advancement of new and renewable energies. Specifically, it focused on studying and executing pilot projects for electricity generation and rural energy supply according to needs such as water pumping, desalination, water heating, drying and exporting agricultural products, and developing equipment manufacturing for energy generation to exploit new and renewable energy sources.[3]

From a legal perspective, the starting point was the old Environmental Law 03-83, dated February 5, 1983. However, this law did not specifically address renewable energies but rather focused on preserving and adding value to natural resources. Therefore, in this section, I will address the laws related to this field.

- The most important laws related to renewable energy in Algerian legislation.

Law 98-11: The framework law and the five-year program on scientific research and technological development for the period 1998-2002, dated August 22, 1998. Among its objectives are ensuring the promotion of scientific research and technological development, as well as the economic and social development of the country. This law also focuses on the development of natural resources, the environment, and ecological diversity.

This law also emphasized the necessity of incorporating scientific research and technological development programs in the field of renewable energy, creating high-quality projects with a direct impact on the social and economic realities of the country. Additionally, it called for the rational use of our renewable energy resources and the establishment of a dedicated regulatory framework for them.

Law 99-09: On Energy Management, This law aims to establish the conditions for the national energy management policy, the means to regulate it, and its implementation. Energy management encompasses all procedures and practical activities aimed at rationalizing the use of renewable

[1]BintNawiAicha, ibid, p76.

[2]Moudden Omar, Ben AbdelfattahDhamane, "The Future of Energy Security in Algeria: Between Renewable Energy and Shale Gas," Al-Basha'er Economic Journal, University of Béchar, Algeria, Issue 1, 2018, p. 356.

[3]See Decree No. 83-131 dated February 19, 1983, which sets the conditions for granting rewards for the costs of diversifying electricity production, Official Gazette No. 8, dated February 22, 1983.

energy and reducing the impact of the energy system on the environment. This includes lowering greenhouse gas emissions and vehicle emissions in cities, while promoting and developing exploitable renewable energy sources. The law explicitly addresses renewable energy in Article 4, where it defines the development of renewable energy as the introduction and promotion of sectors for converting renewable energy sources that are exploitable, particularly solar, geothermal, hydroelectric, and wind energy. Through this article, it is evident that the legislator not only defined these energy types but also emphasized their development through their promotion and utilization. Based on the above, this law shows significant interest in renewable energy, calling for its development and promotion by funding it and integrating it into the national economic sector. The National Energy Management Program is also seen as a means of encouraging the exploitation of renewable energy sources.

Law No. 01-20: This law concerns territorial planning and sustainable development. It sets forth the guidelines and tools related to territorial planning, which aim to ensure the development of the national space and form a sustainable and harmonious development based on principles defined by the law. Among these principles is the adoption of policies that help achieve sustainable territorial planning. Article 33 of the law outlines the objectives of this plan, including the rational exploitation of energy resources and the development of renewable energy. It also contributes to combating environmental pollution and the effects of global warming caused by the use of fossil fuels. Furthermore, it links energy to the economy and sets conditions for the state and regional authorities to follow in managing energy control efforts, as well as the production and use of renewable energy.

Law No. 04-09: On the Promotion of Renewable Energy** This law explicitly defines renewable energy in Article 3 as follows: forms of electrical, kinetic, thermal, or gaseous energy obtained from the conversion of solar radiation, wind power, geothermal heat, organic waste, hydropower, and biomass utilization techniques.

It also includes various methods that enable significant energy savings by applying bioclimatic engineering techniques in the construction process.

This law also addresses the National Program for the Promotion of Renewable Energy. This program consists of a set of activities aimed at promoting renewable energy. It is a five-year program that is part of future plans focused on territorial planning and sustainable development.

Based on the previous discussion in this chapter, it can be said that the Algerian legislator has paid attention to renewable energy, striving to promote and integrate it into national planning for territorial development. Furthermore, it has linked sustainable development to renewable energies, as these are inexhaustible and do not pollute the environment, unlike fossil fuels, which have caused significant environmental damage. Despite the issuance of several laws in this area, they are insufficient to develop renewable energies, and with these laws, a country rich in abundant renewable energy resources cannot compete in the global economy.

Chapter Two: The National Renewable Energy Program and Incentives for Investment in It

Algeria's commitment to developing the use of renewable energy is reflected in future programs, making this direction the primary driver for sustainable economic development to achieve energy security. The National Program, established under the provisions of Article 6 of Law 04-09, includes various activities such as information dissemination, training, and awareness, as well as stimulating research, production, and development. It also promotes the use of renewable energy as a complementary or alternative source to traditional energy. This program has been made a national priority in response to the current phase's requirements for activating the national economy, with a focus on encouraging investment in renewable energy.

Section One: The National Renewable Energy Program

The National Renewable Energy Program aims to generate 32,000 megawatts of electricity from renewable sources such as solar energy and wind energy. Of this, 22,000 megawatts will be for the domestic market and 10,000 megawatts for export, especially to Europe. This represents twice the

current electricity production in Algeria and about 27% of the total expected production by 2030. The investments required for this project reach 120 billion dollars.[1]

The program also includes a plan to gradually convert one million cars and 20,000 buses to consume liquefied natural gas, along with thermal insulation projects for approximately 100,000 homes annually. These projects will create about 180,000 job opportunities. The government has worked on introducing specializations to qualify human resources and elites to implement the program's phases. Specialized institutes have also been announced for training these elites in partnership with leading institutions in the field of renewable energy equipment manufacturing. Through the implementation of the National Renewable Energy Development Program, Algeria aims to ensure the continuity of energy independence and foster economic development dynamics around renewable energy projects. Among the objectives is to reduce energy consumption by 9% by 2030, which will save 63 million tons of oil equivalent and recover over 42 billion dollars. The plan allows for a savings of 300 billion cubic meters of gas between 2021 and 2030, which will be directed toward export.[2]

The National Renewable Energy Development Program in its updated version was approved by the Ministry of Energy with the government's consent. Integrating renewable energy into the national energy mix is a key issue aimed at preserving fossil resources, diversifying electricity production methods, and contributing to sustainable development. The program underwent an initial phase dedicated to carrying out pilot projects and testing the various available technologies. This phase highlighted elements related to technological developments in the energy sectors, which led to a review of the program.

Among these new elements, it is worth noting:

A better understanding of the national potential in renewable energies, particularly solar and wind energy, following the studies conducted. However, the high costs of Concentrated Solar Power (CSP) have resulted in very slow growth in the development of this market worldwide.

In order to build a cohesive national system that attracts investors, the review of this program focuses on the large-scale development of photovoltaic energy, wind energy, combined heat and power generation, and geothermal energy. The implementation of this program is open to both national and foreign investors from the public and private sectors. This program aims to achieve significant benefits in terms of job creation, manufacturing, technological development, knowledge acquisition, and environmental preservation. To encourage and support industrialists in implementing this program, laws have been enacted to reduce customs duties and value-added tax (VAT) on imports of components, raw materials, and semi-manufactured products used in the manufacturing of renewable energy equipment in Algeria, thereby promoting investment in this sector.

The second requirement: Encouraging investment in renewable energy.

To encourage investment in the renewable energy sector, the authorities have worked on providing incentives and facilitation for both Algerian and foreign investors. The concept of energy efficiency has been integrated into the work of all sectors, especially the agricultural sector, which has had experience in this field through the use of solar panels to generate electricity and irrigate in isolated desert areas. Additionally, other sectors such as transportation, industry, and housing have also been involved.

Algeria launched an invitation to both Algerian and foreign investors to invest in the sustainable energy sector during the Algerian-European Forum on Renewable Energy and Energy Efficiency, held in May 2016 in the capital, Algiers. The government is working to strengthen the current program,

[1]Jedi Sara, Jedi Tarek, "The Reality and Prospects of Renewable Energies in Algeria," Journal of Economic Reforms and Integration into the Global Economy, Algeria, Volume 10, Issue 20, 2015, pp. 46–47.

[2]BintNawiAicha, ibid, P 116.

which includes the construction of 15 solar power plants and 4 wind power plants in the southern regions and the high plateaus.

Algeria issued Law No. 04-09 of 2004, which promotes the spread of renewable energy uses. This law concerns any activity related to electricity production from renewable energy sources, as well as the production of electricity from combined generation systems under certain conditions. It operates under a new regulatory framework based on an incentive mechanism, which determines the purchase tariff for electricity produced by investors, depending on the technology used in energy production and the percentage of renewable energy contribution to the thermal component if the applications are hybrid. Based on the application of Article 178 of Law 02-01 related to electricity and gas distribution through pipelines, Decree No. 13-218 was issued, which specifies the conditions for granting bonuses for the costs of diversifying electricity production. According to this decree, electricity producers can benefit from bonuses by selling the electricity they produce at a guaranteed purchase price. Two ministerial decisions, dated February 1, 2014, were issued to define the following:

The guaranteed purchase tariffs applicable to the photovoltaic solar branch:

The guaranteed purchase tariffs for selling electricity produced by facilities using photovoltaic energy are determined based on the facility's capacity and the solar energy potential at the site. The latter is expressed as the equivalent number of full-load hours of operation during the year. A purchase contract is concluded for a period of 11 years from the date of connection to the grid. During this period, the producer benefits from a guaranteed purchase tariff for the first five years of the contract. This tariff is calculated based on a reference energy capacity of 150 full-load hours, set at 15.94 DZD/kWh for facilities less than 5 MW, and 12.75 DZD/kWh for facilities larger than 5 MW. In the second phase of the remaining duration, this tariff can be adjusted.[1]

The guaranteed purchase tariffs applied to the wind sector:

The procedures followed for the guaranteed purchase tariffs in the wind sector are similar to those in the photovoltaic solar sector. The difference lies in the guaranteed purchase tariff, which is calculated based on a reference energy capacity estimated at 1900 full-load operating hours. The guaranteed purchase tariff is set at 13.10 DZD/kWh for facilities with a capacity of less than 5 MW, and 10.48 DZD/kWh for facilities larger than 5 MW.

Taking all necessary measures to generate electricity according to the conditions outlined in the operating license, equipping its facilities with devices for measuring electrical and thermal energy in accordance with applicable regulations to determine the injected and withdrawn flows from the grid, as well as the useful heat (see Article 14 of Executive Decree No. 13-218 issued on June 18, 2013); Establishing a system for the graphical and electronic registration of all data to read invoices and quantities of electricity produced from renewable energy sources or from combined generation (see Article 15 of Executive Decree No. 13-218 issued on June 18, 2013); Producers' rights under the specific system include benefiting from priority in market placement for electricity production. A producer of electricity from renewable energy-based generation facilities, selected through the bidding procedure outlined in Executive Decree No. 17-98, may benefit from selling electricity at a guaranteed purchase price resulting from the bidding procedure.

Conclusion:

In conclusion, Algeria faces significant challenges in the field of renewable energy, which has led the country to focus on energy issues by exploiting all its energy resources in light of the decline in the prices and reserves of conventional resources. Overall, through this research paper, we have reached a set of key findings, the most important of which are:

- Renewable energy is a true alternative and complement to fossil energy, and one of the most important future energy sources.
- Algerian legislation exempts renewable energy equipment and devices from taxes and customs duties.

[1]Kaddatsa Mohamed, ibid, P 840.

- The exploitation of renewable energy in Algeria faces several challenges, the most significant of which are the high capital costs for investment in renewable energy projects and the slow pace of transition toward this type of alternative energy. Based on the above, we can offer a few suggestions:

- Establish research centers in the field of renewable energy that involve both the public and private sectors to promote the renewable energy project in Algeria.

- Encourage cooperation with foreign scientific institutions to implement training programs for Algerian personnel in the field of renewable energy.

- Focus on developing energy technologies in Algeria.

REFERENCES:

1. Mohamed El Amin Gariou, "Exploitation of Renewable Energies in Algeria: An Inevitable Necessity," Journal of Legal and Political Research and Studies, Blida University, Algeria, Volume 7, Issue 1, 2018.
2. Mustafa Al-Kafri, JidayaIssa, "The Role of Renewable Energy in Achieving Energy Security in Syria During the Reconstruction Phase," Journal of Tishreen University for Scientific Research and Studies, Tishreen University, Syria, Volume 39, Issue 6, 2017.
3. BintNawiAicha, "Energy Security in Algeria: An Analytical Perspective on the National Renewable Energy Program for the Period Between 2011-2030," Journal of Legal and Economic Research, Algeria, Volume 4, Issue 2, 2021.
4. Kaddatsa Mohamed, "The Reality of Renewable Energies in Algeria and Its Future Prospects," Journal of Development and Applied Economics, University of M'sila, Algeria, Volume 3, Issue 2, 2019.
5. ChtibiHanane, "Algeria's Efforts in the Field of Renewable Energies: Between Reality and Prospects," Journal of Management, Higher School of Management and Digital Economics, Algeria, Volume 3, Issue 2, 2016.
6. Amish Aicha, TarshaniSihem, "Energy Transition as a Mechanism for Sustaining Energy Security in the Maghreb Countries: Prospects and Challenges," Journal of Economic Studies and Research on Renewable Energies, Batna 1 University, Algeria, Volume 8, Issue 1, 2021.
7. RahailiyaSeifEddine, Boudah Abdel Jalil, "Investment in Renewable Energies and the Requirements for Achieving Energy Security: Learning from the American Experience and Referring to the Case of Algeria," Journal of Economic and Administrative Research, Mohamed Khider University of Biskra, Algeria, Volume 12, Issue 1.
8. Moudden Omar, Ben AbdelfattahDhamane, "The Future of Energy Security in Algeria: Between Renewable Energy and Shale Gas," Al-Basha'er Economic Journal, University of Béchar, Algeria, Issue 1, 2018.
9. Jedi Sara, Jedi Tarek, "The Reality and Prospects of Renewable Energies in Algeria," Journal of Economic Reforms and Integration into the Global Economy, Algeria, Volume 10, Issue 20, 2015.