Remittances Review
September 2024
Volume: 9, No: 4, pp.2145-2160
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)
Received : 10 May 2024, Accepted: 15 August 2024
DOI: https://doi.org/10.33282/rr.vx9i2.117

The Contribution of Renewable Energies to Achieving the Economic Dimension of Sustainable Development in Algeria

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Abstract:

This intervention aims to show the importance of the transition from depleted energies to renewable energies through their contribution to achieving economic progress, and preserving the environment by exploiting the most important sources of environmentally friendly energies such as solar, wind, hydropower, geothermal and organic energy, in addition to Algeria's efforts in the field of exploiting these energies through the implementation of programs and plans that contribute to achieving sustainable development goals.

Keywords: Renewable Energies, Sustainable Development,Algeria.

Introduction :

The issue of energy is of interest to all segments of society, as it is considered the primary source for meeting its necessary and complementary needs and desires, for this purpose, all available means are used to reach it. At the present time, the international energy situation is going through a phase of new changes and adjustments, as the basic direction of the global energy transition is to achieve a transition from Fossil energy system to a low-carbon energy system, and finally entering the era of sustainable energy based mainly on renewable energy (d.dizdaroglu, 2017),In light of the economic development and the increasing demand for energy through the rapid growth in the field of industry, it has become

necessary to search for alternative sources, especially with research that talks about the depletion of traditional energies (coal, gas, oil...) as well as the worsening environmental damage resulting from excessive use of them. Which prompted international organizations to sound the alarm and the need to turn to exploiting alternative energies in order to achieve sustainable development by ensuring environmental energy security by reducing or limiting the emission of toxic gases (Karfawi, 2022). Algeria is full of great potential, especially in the field of solar energy, where a strategy has been developed to move towards clean energies by launching a program for renewable energies and energy efficiency. This is done by establishing many solar thermal stations, wind fields, and various stations. Investing in renewable energies represents a trend towards energy and economic policies in Algeria towards exploiting energy with renewable origins, starting from solar energy as a sustainable economic resource that stimulates growth on the one hand and extending the life of fuel reserves for a longer period. Not to mention preserving the environment and contributing to achieving sustainable economic development that has an impact on the development of the economic and social aspects; From this, the following problem can be raised: How do clean energies contribute to achieving the economic dimension of sustainable development in Algeria?

Hypothesis of the subject of the study: Clean and renewable energies contribute effectively to achieving the economic dimension of sustainable development.

I -The concept of sustainable development

Over the past few decades, the concept of sustainability has attracted global attention and has been widely discussed by policy makers, decision makers, academics and experts. Sustainable development is now part of almost all political agendas in which a variety of goals and targets have been set in order to make the world a more sustainable place for all. The Millennium Summit held in New York City in 2000 led to the adoption of the United Nations Millennium Declaration which aims to create An international partnership to reduce global levels of extreme poverty. A set of 8 goals, known as the 8 Millennium Development Goals (MDGs) that address various social, economic and environmental problems were introduced as Member States, as well as other organizations, took a number of actions in order to help achieve the eight goals by 2015 (Halkos & Gkampoura, 2021). On September 15, 2015, the United Nations (UN) adopted a comprehensive development plan, the “2030 Agenda for Sustainable Development.” Thus, all 193 countries with membership in the

United Nations have committed to taking action to achieve 17 Sustainable Development Goals. (Kuc-Czarnecka, Markowicz, and Sompolska-Rzechuła, 2023).

I-1 Definition of sustainable development

I -1-1 Definition 1: Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Halkos & Gkampoura, 2021). This definition was laid out in the 1987 United Nations publication "Our Common Future", also known as the Brundtland Report, and is now widely used to define the modern concept of sustainability.

I-1-2 Definition 2 : The World Commission on Sustainable Development: In its report entitled "Our Common Future," the Commission concluded: "There is a need for a new path to development, one that will sustain human progress not just in limited places, or for a few years, but for the entire Earth." All the way to the distant future. According to this committee, sustainable development works to meet the needs of the current generation without destroying the ability of future generations to meet their needs. (Bouhaza and Ben Sedira, 2008, p. 298).

I -1-3 Definition 3: United Nations: The third principle was defined in the United Nations Conference on Environment and Development, which was held in Rio de Janeiro in 1992, as: "the necessity of realizing the right to development" so that the highest growth is achieved, equal to the development and environmental needs of present and future generations. The fourth principle approved by the conference stated: "In order for sustainable development to be achieved, environmental protection must represent an integral part of the development process, and it cannot be thought of in isolation from it." (Senussi and Bozian Rahmani, 2008, p. 126).

I-2 Dimensions of Sustainable Development: Sustainable development is one of the most pressing challenges facing humanity. Its basic principle is to improve and maintain people's well-being over time. In 2015, the United Nations agreed on 17 Sustainable Development Goals (SDGs) to ensure a better and sustainable future for all, balancing economic, social and environmental development. The SDGs create an "indivisible whole." (Kuc-Czarnecka, Markowicz, and Sompolska-Rzechuła, 2023).

I-2-1 The economic dimension: The economic dimension of sustainable development is mainly related to issues of selecting, financing, and improving industrial technologies in various fields of natural resource employment. This dimension also aims to increase the welfare of society to the maximum possible extent by reducing the phenomenon of poverty and exploiting natural resources in an optimal manner. (Masoudi, 2019, pp. 202-203).

The economic dimension of sustainable development revolves around the processes of improvement and change in production patterns (the use of clean energies, the introduction of improved technologies, the issue of selecting, financing and improving industrial technologies in the field of employing natural resources); In addition to activities related to consumption (sustainable management of natural resources); As well as starting to embody strategies and directions that involve all segments. This view was confirmed by the Rio de Janeiro Conference (United Nations Conference on Environment and Development 1992), which decided that the process of sustainable development as a new principle of economic development does not require absolute emphasis on economic considerations, without taking into account social justice, the fight against poverty, and the protection of the environment and resources. Natural. According to the economic dimension, sustainable development works to develop economic development, taking into account environmental balances in the long term. (Milous, 2006, p. 45)

I-2-2 The social dimension: Sustainable development is characterized by this dimension in particular, and it represents the human dimension in the narrow sense, as it makes growth a means of social cohesion, and the necessity of choosing equity between generations. Current generations must consider the task and necessity of the process of equity and justice, and make growth choices according to their desires and the desires of future generations. Thus, both the environmental and economic dimension are closely related to the social dimension represented by the human being or the individual. (Harfouche, Sahraoui, and Bubaia, 2008, p. 45), as this dimension is based on the human being being the focus of development and its essence in social justice. This dimension also emphasizes the participation of peoples together in making common fateful decisions that affect their lives with transparency and honesty. High service for everyone. (Hussein Al-Tamimi and Muhaisen Al-Saadi, 2020, page 32)

I-2-3 The environmental dimension: The environmental dimension is the preservation of natural resources, the optimal use of them on a sustainable basis, and the prediction of what may happen to environmental systems as a result of development. (Shaat, 2019), the fair demand for energy and related services is increasing to keep pace with social and economic development and improve people's well-being and health. All societies need energy services to meet basic human needs (for example, lighting, cooking, creating comfort in places, mobility and communication, and for service operations Productivity), and since

approximately 1850, the global use of fossil fuels (coal, oil and gas) has increased to dominate the energy supply, resulting in rapid growth in carbon dioxide emissions. (IPCC, 2011, p. 7).

Achieving sustainable development depends on combating the manifestations of environmental degradation by combating pollution, erosion and desertification, which are basic processes for protecting the environment and ensuring its balance. This cannot be achieved in an effective manner except by adopting and intensifying preventive measures. (Al-Alami, 2012-2013, page 58)

- The concept of renewable energies: It is almost impossible to modernize every energy system that relies on fossil fuels, especially since renewable resources generally have lower efficiency and fluctuate in prices compared to their traditional counterparts. (n.abas, a.kalair, & n.khan, 2015). But in terms of its decentralized nature, its spread allows expanding access to energy, especially to rural areas, which will subsequently improve human well-being, productivity and quality of life. As poverty decreases, health conditions improve, employment opportunities are enhanced and equality among citizens is enhanced. (kim & park, 2016).

II -1- Definition of renewable energy: There are many definitions of renewable energy. Some researchers define it according to the degree of its continuity, and some define it according to its sources. Below are some of the definitions that I discussed:

II -1-1 Definition 1: According to the United Nations, renewable energy is defined as energy resulting from natural sources that is renewed at a rate greater than what is consumed. For example, sunlight and wind are sources that are constantly renewed. Renewable energy sources are abundant and found everywhere around us. (Belasal, 2023, p. 70)

II-1-2 Definition 2: Renewable energies mean the energy acquired from natural processes that are constantly renewed, and therefore they are permanent, non-pulsating natural sources that are available in nature, whether limited or unlimited, but they are constantly renewed, and they are clean and do not result from Their use causes continuous environmental pollution, and the most important of these sources are: solar energy, wind energy, tidal energy, and waves. (Muwafaq, 2020, page 52).

II-1-3 Definition 3: Renewable energy is defined as energy that does not run out over time and is environmentally friendly green energy that is found in abundance in nature. Renewable energy is those resources that we obtain through energy streams that occur automatically and repeatedly in nature. Cyclic. (Bouhala and Harati, 2021-2022)**.**

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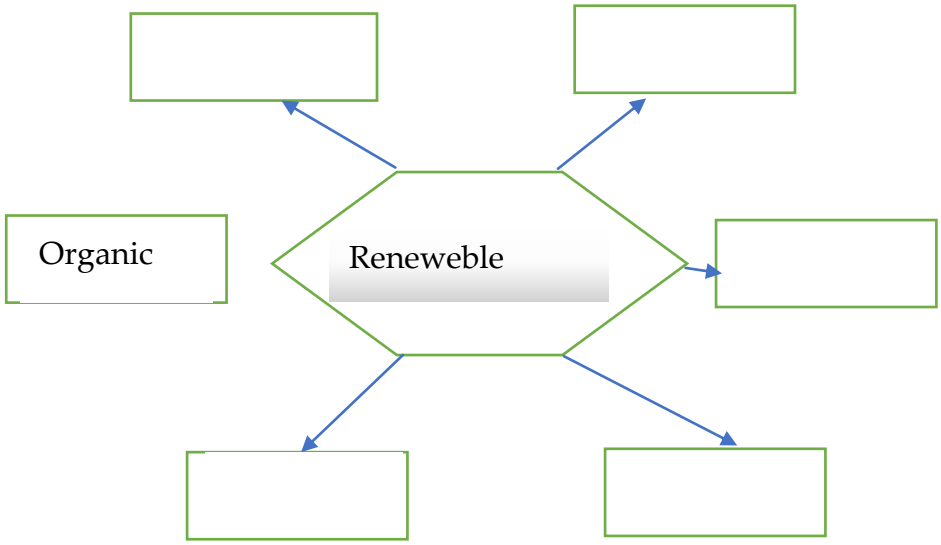
II -2 Renewable energy sources

Figure 01: Renewable energy sources



Source:(Bakhoush and Battash, P.T., page 04)

II -2-1 Solar energy

Solar energy is classified as one of the first renewable and alternative energies to oil, due to its characteristics that distinguish it from other renewable energies (Bouhala and Harati, 2021-2022), and solar energy is the light emitted and the heat resulting from the sun, which man has harnessed for his benefit since the ages. Using a range of ever-evolving technologies, most of the renewable energy available on Earth is derived from solar radiation as well as secondary energy sources such as wind energy, wave energy, hydroelectricity, and biomass. (Ismail Ramadan, 1986, page 31).

Algeria has great potential for renewable energy, especially solar energy, due to its area and geographical location, as it is considered one of the richest solar fields in the world, as the amount of energy received is estimated at 5 kilowatt-hours/m2 and reaches 7 kilowatt-hours/m^2. (Osrir and Shamani, 2016). Solar energy can also contribute to generating electrical energy directly, which reduces the use of fossil energies. Algeria benefits from 2,000 to 3,000 hours of sunshine annually, which can produce 2,500 kilowatt-hours per square meter per year, as solar energy annually in Algeria represents the equivalent of 47 thousand billion cubic meters of gas. (Ben Nima, 2023, p. 88)

Regions	The desert	High plateaus	Coastal
Percentage % of total area	**86%**	**10%**	**4%**
Sunshine rate(hours/year)	**3500**	**3000**	**2650**
The rate of energy obtained (kilowatts/hour/m^2/year)	**2650**	**1900**	**1700**

Table 01: Solar energy potential in Algeria.

Source: (Sands, 2017) The economic movement of renewable energy sources and their future prospects in Algeria

From the table it is clear that:

The desert represents the largest percentage of Algeria's area and has a capacity of 86%, which made it occupy the lead in the production of the obtained energy, which was estimated at 2650 kWh/m2/year. It also enjoys the highest duration of solar radiation, estimated at 3500 hours per year, followed by the high plateaus region, then coastal area.

The solar potential in Algeria is considered the most important in the Mediterranean basin region: (Kaouane and Djaba, 2015)

- 169440 TWh/year.
- 5000 times the Algerian consumption of electricity.
- 60 times Europe’s fifteen (15) consumption estimated at 3000 terawatt-hours/year.

II-2-2 Hydroelectric energy.

Hydroelectric energy is considered a clean, non-polluting energy that is widely used in the process of generating electricity. This energy is produced from water located in high places inside dams, as the water contains a large amount of potential energy that is easily converted into kinetic energy when the water falls to the bottom through the turbines. This energy is then converted into electrical energy through an electrical generator. Therefore, electrical energy has a great relationship with the role of water, as the amount of rain that flows into rivers, seas, and oceans in a specific geographical area is what determines the amount of water available for the production of hydroelectric energy. The greater the quantity, the greater the amount. Mass increases the force of gravity, which increases the flow and thus increases the production of electrical energy. The kinetic energy produced also depends on the

height of the water level according to a direct relationship: the higher the water level, the greater the energy production. (Karfawi, 2022, p. 161).

II -2-3 Wind energy:

Wind is the movement of air resulting from warm air rising and being replaced by cold air. Wind energy has been used to sail ships in ancient times, and wind energy has been used in the form of windmills for centuries for tasks such as grinding grains and pumping water. Today, wind energy is obtained by turbines and used to generate electricity. Modern commercial wind turbines also produce electricity by using rotational energy to drive an electric generator. (Belassal, 2023, p. 71), wind energy is considered one of the most efficient technologies in generating renewable energy. The system uses kinetic energy from the wind to operate turbines to generate energy. The amount of wind energy available varies daily and seasonally, and the total amount of wind energy that can be harnessed depends greatly on On the characteristics, performance and size of wind turbines. (Zahraoui, Basir Khan, AlHamrouni, Mekhilef, & Mahrous, 2021).

II-2-4 Geothermal energy:

The Jurassic limestone in northern Algeria constitutes an important reserve of geothermal heat, and leads to the presence of more than 200 hot mineral water sources located in the northeastern and northwestern regions of the country. These springs are found at temperatures that often exceed About 40°C, and the hottest source is the Al-Maskhoutin source, at 96°C. These natural springs, which are generally leaks from reservoirs located in the ground, alone flow more than 2 m/s of hot water, which is only a small part of what the reservoirs contain. The captive continental formation also forms a reservoir. This reservoir is called the alpine layer, as the temperature of the water in this layer reaches 57 degrees Celsius. If the flow resulting from the exploitation of the alpine layer and the total flow of hot mineral water springs is combined, this represents a capacity level of more than 700 degrees Celsius. MW. (Farohat, 2012, pages 153-154).

Table 02. Production and sources of renewable energies in Algeria during the period: 2015_2019 Unit (GW)

Sources	2015	2016	2017	2018	2019
Hydraulic energy	145	218	56	117	152

Sources	2015	2016	2017	2018	2019
Photovoltaic energy	58	87	572	655	657
Wind Energy	19	29	8	11	10
The total	222	335	636	783	819

Source: (Latif, 2022, p. 330), Evaluation of investment policies in renewable energies: The National Program for Promoting Renewable Energies and Energy Efficiency in Algeria 2011_2020

From the table, we notice a significant increase in primary electricity production, which rose from 222 GW to 335 GW in 2016 after many photovoltaic power plants entered production within the national framework. In contrast, hydropower production declined sharply to 56 GW due to the lack of rainfall in 2017, reducing its share to less than 20% of primary electricity. It is worth noting the sharp increase in primary electricity production, which rose from 635 to 783 GW in 2018, driven by a doubling of the hydraulic sector's production and 17% of solar energy production. The increase in hydroelectric power production was recorded as a result of significant rainfall in 2018, when production reached 117 GW compared to 56 GW in 2017.

III -The Algerian national program for exploiting renewable energy to achieve sustainable development.

III-1 Prospects for alternative energies in Algeria:

Algeria enjoys an important geographical location and enormous energy capabilities that qualify it to become an important economic power in the Mediterranean region in the field of renewable energy, especially solar energy. This supports its income from oil, and it is expected that by 2040 it will provide 35% of its energy needs. It also intends to produce more than 30% of its electrical energy from solar energy by the year 2050. (Osrir and Shamani, 2016, p. 43).

Under the cover of the Renewable Energy Development Program for the year 2011/2030, which was adopted by the government in February 2011, renewable energy sources are at the heart of the energy and economic policies directed by Algeria. (Ben Nima, 2023, p. 93).

The renewable energy program came to meet market needs with a capacity of 22,000 megawatts during the period 2015/2030. It should be noted that the distribution of this program is through technological processes, which are as follows:

- Solar photovoltaic energy: 5010 MW
- Wind energy: 2000 MW.
- Bioenergy: 1000 MW.
- Joint power generation: 400 MW.
- Ground power: 15 MW.

Table 03: Prospects for alternative energies in Algeria.

Date Target	Energy Wind	Photovoltaic cells	energy concentrated solar	The Total
2015	**10**	**182**	**325**	**557**
2020	**270**	**831**	**1500**	**2601**
2030	**2000**	**2800**	**7200**	**12000**

Source: (Rimal, 2017), the economic implications of renewable energy sources and their future prospects in Algeria

It is expected that this program related to alternative energies will benefit, generate large revenues, and absorb a large group of job seekers, in addition to developing the industry and achieving one of the goals of sustainable development, represented by the environmental dimension through renewable and clean energies, and then contributing to the development of the national economy.

III-2 The solar energy program in Algeria (Solar 1000):

The solar energy project in Algeria (Solar 1000) is the first project launched within the country's renewable energy program, which aims to generate 15 gigawatts by 2035. According to data from the World Wind Energy Council, Algeria had In 2016, it set a plan to generate 22 gigawatts of electricity from renewable energy sources by 2030, but this target was not achievable, which prompted the government to amend the program to aim to generate 15 gigawatts of electricity through renewable sources by 2035, which includes a solar energy project in Algeria (Solar 1000) Establishment of special-purpose companies that undertake the implementation of solar photovoltaic stations with a total capacity of 1,000 megawatts,

distributed among 5 different states, with shares ranging between 50 and 300 megawatts for each station (Ben Nima, 2023, p. 94).

By relying on alternative renewable energy sources, Algeria is preparing to activate and translate the energy transition program, to combat the repercussions of climate change and achieve carbon neutrality by the middle of the current century, as there is a need to activate and translate the energy transition program, according to the speech of the Minister of Energy on March 4, 2023. He stressed that Algeria is cooperating with the World Bank in scientific and technological research to measure and monitor methane gas emissions, in order to permanently reduce them. 22 photovoltaic power plants have also been established, within the framework of the National Renewable Energy Program, with a total capacity estimated at about 344 megawatts, in addition to the launch of hybridization projects under the 50 program. megawatts, and the first stations entered into operation in 2021 and 2022, and the rest of the stations are expected to be operated during 2023, as well as the implementation of Sonelgaz's program of 15,000 megawatts at an accelerated pace in more than 40 states, before the end of the current decade, confirming the activation of Sonelgaz's program to t implement pilot projects to establish 1,000 charging points for electric cars. (Sherif, 2023).

VI - Implications of programs on the economic dimension of sustainable development

These implications related to the economic field in light of sustainable development are manifested as follows: (Touat and Zerrougui, 2022, pages 77-78)

- Creating appropriate conditions for local products and encouraging them, especially those related to collection for investors working in the field of renewable energies.

- Support provided to industries interested in developing and encouraging the national program for renewable energy by reducing customs duties and fees related to value added for raw materials and imported semi-finished products used in the manufacturing processes of devices related to renewable and environmentally friendly energies.

- Using solar energy in Algeria, which is characterized by its abundance as the most powerful alternative to oil, in order to export it to Europe and other countries.

- Providing consumption of traditional energies, which leads to achieving export surpluses, and that the program aims to produce a value of 22 thousand megawatts, of which 12 thousand megawatts will be allocated to the national market and 10 thousand megawatts will be directed towards export, which will enable the provision of 300 billion cubic meters of gas. , which equates to a value ranging from 80 billion to 100 billion dollars.

- Diversifying sources of income from renewable energies, as production from solar energy in 2013 approached about 37% of the total electricity production. Wind energy constitutes the second place of clean energy, and its share should reach about 3% of the total electricity production during the year 2030.

- Strengthening the industrial fabric in Algeria to take the lead in positive-oriented changes, whether on the industrial and technical level or in terms of engineering and research operations.

- Integrating the Algerian industry into clean and renewable energies. This ambitious goal will be reached through the construction of a factory dedicated to photovoltaic panels with a production capacity equivalent to 120 megawatts.

-Renewable energies provide the opportunity to develop some small activities, which constitutes an economic impetus for rural and isolated areas.

- Establishing salty seawater desalination plants by controlling engineering activities related to it.

- It allows achieving an 80% integration rate for Algerian enterprises by increasing efficiency related to technical activities, design capabilities and implementation capabilities.

- By using solar energy, it is possible to reduce the cost of lighting in villages and remote areas, as well as improve performance in some public facilities such as hospitals and schools.

Conclusion:

Given the environmental protection characteristic of clean energies, according to experts and specialists, Algeria has developed programs and plans to implement projects in solar energy, bioenergy, and wind energy to meet the market's needs for clean energy sources, and other future programs that extend to the horizons of 2035 while mobilizing the material and human capabilities necessary to achieve These are for goals. Because they are the best alternative to traditional fossil energies due to the instability of their prices, as well as their damage to the environment, it has become necessary to pay more and more attention to renewable energies, which leads to diversifying the sources of the national economy and preserving the environment through these sustainable resources such as solar thermal energy, solar photovoltaic energy, wind energy, energy Bio, hydrogen energy, which contributes to achieving the trend towards achieving sustainable development.

Recommendations:

- Developing modern technologies in the field of renewable energy, stimulating research in the fields of solar energy, while updating studies on the uses of solar energy.

- Encouraging cooperation and scientific exchange with developed countries in the field of clean and environmentally friendly energies and benefiting from their experiences by holding regular seminars and meetings.

The Algerian government must work to support the renewable energy sector by conducting forward-looking studies for the future of the national economy, which is built on inexhaustible energies over the years, achieving more income than it currently has, and preserving the needs of future generations.

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