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Algeria's Energy program to achieve the 7th Goal of sustainable development

البرنامج الجزائري للانتقال الطاقوي من أجل تحقيق الهدف السابع للتنمية المستدامة

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Article abstract:

Energy resources are one of the greatest challenges faced by States, as all industries are linked to energy and energy exploitation, which subsequently leads to a problem of scarcity in the case of continued exploitation without taking into account the concept of sustainable development and ensuring the sustainability of resources for future generations. Therefore, the orientation towards renewable energy resources had become the ideal solution, also Algeria had pursued a strategy to ensure the transition to the exploitation of renewable resources, in order to achieve sustainable development in this sector by the energy transition program 2011-2030.

Key words : *renewable energy resources; energy security; sustainable development ; seventh goal; energy transition program.*

ملخص المقال:

إن موارد الطاقة من أكبر التحديات التي تواجهها الدول، بما أن جميع الصناعات مرتبطة باستغلال الطاقة، مما يؤدي فيما بعد إلى مشكلة النذرة في حالة الاستغلال المستمر دون مراعاة مفهوم التنمية المستدامة وضمان استدامة الموارد للأجيال المقبلة، بسبب اعتماد الدول على موارد الطاقة الأحفورية التي لا تتجدد ومن المرجح أن تختفي عاجلا أم آجلا .ولذلك، أصبح التوجه نحو موارد الطاقة المتجددة الحل الأمثل، كما اتبعت الجزائر استراتيجية لضمان الانتقال إلى استغلال الموارد المتجددة، من أجل تحقيق التنمية المستدامة في هذا القطاع تحت تسمية برنامج الانتقال الطاقوي 2011-2030.

كلمات مفتاحية: الموارد الطاقوية المتجددة؛ الأمن الطاقوي؛ التنمية المستدامة؛ الهدف السابع، برنامج التحول الطاقوي.

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Introduction:

Algeria is a rich African country with fossil resources such as gas, petroleum and other depleted energy resources, when we talk about the energy resources in Algeria from independence to the present day, the emphasis on the exploitation of depleted resources is very high and the trend towards the exploitation of renewable energy resources has shown no signs. Despite the existence of many models from other States that have successfully exploited renewable resources and that have been able to achieve sustainable development, because they know that fossil energy is not present in large quantities and is a major cause of environmental pollution and that sustainable development is difficult to achieve as long as these resources are not renewable. In addition to preserving the environment from pollution caused by these resources, Algeria strives to exploit renewable resources to achieve the 7th Goal of sustainable development, which is to obtain clean energy at a small cost.

Through this paper, we are going to address the following problems: **How does Algeria plan to achieve the sustainability of energy resources and the exploitation of renewable clean energy?**

In response to this problem, we will first address the concept and objectives of sustainable development, then we will analyze the seventh goal of sustainable development. Finally, we will talk about Algeria's energy mix and the energy transition program that it has developed to achieve the seventh goal of sustainable development.

1. Sustainable development and its objectives:

Exploitation of nature's resources requires consideration for conservation in order to continue to be exploited in line with the continuation of life on Earth. However, with technological development and demographic growth, it has become difficult to control the exploitation of available resources and maintain environmental balance. Therefore, environmental and economic organizations and all views denouncing resource conservation were of the view that they would control such consumption and preserve resources from depletion under the term "sustainable development". Future targets will be set to maintain resource consumption without harming the environment or one of its components. In this segment, we will talk about the concept and objectives of sustainable development.

1.1 Concept of sustainable development:

Sustainable development is often referred to as a combination of the economy and the environment. In the sense of achieving economic development without

Compromising environmental balance (Tomislav, 2018, p. 77), also the Sustainable development contains various decisions relating to maintaining a balance between resource consumption and the quantity of resource presence without depletion (Santhanalaxmi, 2020, p. 70), Therefore, the consumption of natural resources of all kinds requires submission to this balanced equation in order to achieve the principle of sustainable development; Fossil resources are considered to be the most complex in terms of balancing consumption and non-depletion; Depleted resources and their modest rate of replenishment compared to their consumption rate, and herein lies the bet on the sustainability of resources, so we will resort to an accurate definition of sustainable development developed by the World Commission on Development and Environment in 1987 as sustainable development as meeting today's needs without destroying the interests of future generations of a particular resource (بن صويلح، 2014، صفحة 60), we note in this definition the element of "taking into account the interests of future generations", these interests are linked to sustainable development through important norms that determine the future environmental, economic and social development orientation of the Earth.

Some researchers argued that the technological dimension of the definition of sustainable development should be added to include the rapid transformation of the technological base of industry's development (بن صويلح، 2014، صفحة 61) so they are noting that cleaner new technology, more efficient and more capable of saving natural resources, reducing pollution, stabilizing climate and absorbing population and economic growth, it means that Sustainable development requires dissemination of values that encourage content. Thus, production identifies specific consumption patterns that reduce the margin of reverse effect on natural elements.

So we can say that sustainable development reflects a strategy for joint action, organized and based on rationale, and it relates more to actions and activities that are essentially linked to the processes of production and human consumption than to the goal in itself.

Ultimately, a clear and concise definition of everything we talked about at the beginning is that; sustainable development is the idea that human societies must live and meet their needs without compromising future generations' ability to meet their own needs, and we cannot considered Sustainable development as a simple issue of rational resource exploitation, but we must take all aspects into account. More importantly, humankind's thinking of the way of life must change, and everyone must think about a better future and better living conditions and forgo thinking about the race to exhaust resources.

1.2 Sustainable development norms:

Sustainable development is a means of organizing society so that it can continue to live well in the long term. This requires taking into account current and future imperatives, such as the preservation of the environment and natural resources or social and economic equity.

Therefore the sustainable development is a development that takes into account three dimensions: economic, environmental and social. The three standards of sustainable development that are traditionally used to define it are: economy, social and environment, which we are going to explain now (Harid, 2017, pp. 46-47):

1.2.1 Economic standard:

It means the economic efficiency standard includes promoting optimal management of various resources in order to regulate current resource consumption and take into account the needs of future generations; Through the adoption of appropriate government policies such as an environmental tax on ocean pollution in order to reduce the production of environmental pollutants and thus maintain a clean current and future environment. It is therefore a matter of economic equality between developed and developing countries, so that developing countries use resources to keep pace with the world's progress while developed countries reduce their exploitation of resources so that the imbalance does not occur, thereby bringing the entire world to the same economic level.

1.2.2 Social standard:

It means the standard of social justice, which seeks to respect human rights in terms of providing for life and meeting society's present and future needs, and to provide for health; Education; Labor; Housing; All the human needs of the present and future generations, so we can say for sure that this is about stabilizing demographic growth so that the size of the population is in line with the amount of resources available so that everyone has a good standard of living, everyone has access to the right to education and health as well as the right to development and to get rid of the idea of the city and the countryside.

1.2.3 Environmental standard:

It means the environmental conservation standard, which is to use methods to preserve the Earth from pollution and to participate in all actions that are concerned with preserving the lives of fauna and flora as

well as the atmosphere in order to ensure a pure life for future generations of the world, It therefore concerns the optimal use of vegetation and water resources and the investment of these resources in multiplying green spaces to ensure that the environment is preserved from pollution and that the ozone layer is preserved for future generations.

Finally we can say that these standards are the determinants of future generations' interests. They reflect their social right, their right to economic well-being and their right to live in a healthy, uncontaminated and depleted environment. Also these criteria that determine the course of sustainable development have gained rapid importance in the face of the multiplication of some ecological crises and their consequences for human societies. As scientific knowledge progresses on issues such as the ozone layer, climate change or the disappearance of biodiversity, the international community has become aware of the need to create an economic model that can guarantee our needs without destroying our ecosystem.

2. Concept of the Algeria's Energy mix:

Energy resources in many countries, including Algeria, are the primary sector on which most sectors depend, Electricity and gas are the foundation of each society's social and economic infrastructure, especially with the ongoing technological development, where energy needs to be exploited in order to properly access the exploitation of technology, but their lack of availability will stop the exploitation of technology. So these countries have to diversify energy sources.

2.1 Definition of energy resources:

In general, the resource is every element of nature that is exploited for a particular benefit, where the resource in human life is considered a variety of circumstances; Objectives; Characteristics; means or even positive social or material qualities that human beings can use to meet their life needs and pursue their daily goals (Schubert & Knecht, 2021, p. 5). In the economy, energy refers to both raw materials or natural phenomena that can provide work, productive work and the sector of activity responsible for its conversion (production of hydrocarbon or uranium ores, coke and nuclear industry, oil refining…) (connaisance des energies, p. 01). So, Energy is the ability to function and is found in several kinds of thermal, electrical, chemical, nuclear or other different forms that also reflect the transition process from one object to another, after transport the energy is always adjusted according to its nature; Thus, the movable movement may be transformed into thermal energy, while the work performed may appear in the form of mechanical energy.

Accordingly, when we talk about the energy resource, we combine the two previous terms to produce the following definition of energy resource and we can say in this range that the energy resource is any energy source that can be used to produce electricity or to meet energy needs in industrial processes, household uses, transportation or any other use, also the energy resource is generally divided into two parts (Alix willemez, 2018, pp. 27-28): a depleted energy resource and a renewable energy resource, when type (I) represents fossil energies of limited quantity that do not achieve sustainable development and their continued consumption leads to their end, including oil and natural gas, and type (II) represents the alternative energies of fossil energies found in unspecified quantities because they are constantly renewed such as solar energy and others.

2.2 Fossil Energy Resources in Algeria:

Primary energy is the energy available in the environment and directly usable without conversion. Due to the loss of energy at each phase of manufacturing, storage and transportation, the amount of primary energy is always higher than the final energy available and this also contributes to its finish (université de la reunion espe, s.d.), Fossil energy also represents a type of energy source derived from stable organic materials formed in the Earth over millions of years through natural processes such as degradation of plants and marine

organisms, it means a raw energy, that is, not transformed after extraction (coal, lignite, crude oil, natural gas, primary electricity) (Hebri, 2018, p. 352).

Algeria is one of the countries rich in fossil resources because it is located on the African continent and is the richest continent with fossil energy resources and minerals, in addition to Algeria's large area containing a large volume of fossil resources. Algeria's fossil energy mix contains the following elements:

a- Coal: A non-renewable fossil fuel used mainly in electricity generation and the steel industry. Although Algeria has coal resources, coal production has been suspended due to its negative environmental impacts and contribution to global warming. (وزارة الفلاحة تجمد مؤقتا نشـــاط إنتاج الفحم :مكافحة حرائق الغابات, 2022). Because of the danger it poses to the environment as the main cause of global warming, although electricity production through coal is less expensive than other methods, Algeria does not rely on it as a supplier of electricity production.

b- Oil: A major fossil energy resource and a key pillar of Algeria's economy. The country possesses significant oil reserves and production capacity, but as a finite resource, it should be exploited rationally to ensure sustainability and environmental protection. (ORGANISATION OF ARAB PETROLEUM EXPORTING COUNTRIES, 2021, p. 8), However, since this fossil wealth is depleted, it must be rationally exploited to preserve it for future generations as well as to preserve the environment.

c- Natural gas: Algeria's most important energy resource, widely used for electricity generation, heating, and exports. The country holds substantial reserves and continues to discover new gas fields, making natural gas a strategic component of its energy sector. (ORGANISATION OF ARAB PETROLEUM EXPORTING COUNTRIES, 2021, p. 11). In addition, there were discoveries in the natural gas fields during that year. But according to statistics, there has been no change in the reserve rate which may be due to the lack of methods to quantify natural gas in those fields discovered.

d- Shale gas: An unconventional fossil fuel extracted through hydraulic fracturing. Algeria has large shale gas reserves, but commercial production has not been developed due to environmental concerns, particularly regarding water consumption, pollution risks, and potential health impacts (US ENERGY INFORMATION ADMINISTRATION); However, Algeria does not produce it because it affects the environment, human health and water waste.

2.3 Renewable energy in Algeria:

Renewable energy is a kind of energy source that is naturally renewable quickly enough to meet people's sustainable needs. These sources are usually base on natural factors that we are going to identify, also renewable energy is more environmental and sustainable than conventional energy sources such as coal, oil and natural gas, as its use reduces greenhouse gas emissions and environmental pollution. Renewable energy includes the generation of electricity from the sun and wind (solar and wind), the production of electricity from waves and marine currents (marine energy), the use of organic plants and residues to produce biofuels, the use of terrestrial heat (geothermal energy), and the reliance on rivers and rain to generate electricity (hydraulic power).

Renewable energies are sometimes also referred to as "green energy" or "clean energy", while renewable energies often have environmental benefits, they are not "green" or "clean" in the sense that they also have significant environmental consequences (youmatter, 2023), due to its low energy efficiency compared to fossil fuels, production costs are often considered to be higher in the short term. But above all, it is characterized by

its wobbly availability. In addition to other sources of inexhaustible energy resources that were confined to the Algerian Energy Atlas in 2019 and which we will identify in the following (Zaatri, 2018, pp. de 16 - 18):

a- **Solar energy**: The most promising renewable energy source in Algeria. It is used to generate electricity through photovoltaic panels and heat through solar thermal systems. Thanks to its vast desert areas and high solar radiation levels, Algeria has exceptional solar energy potential. (الفدرالية الجزائرية للمستهلكين، 17 ماي 2022). Given Algeria's vast area, we can say that solar energy will make a difference in Algeria.

b- **Wind energy**: Electricity is generated through wind turbines that convert wind movement into electrical power. Wind energy offers an economic advantage because its production costs are generally lower than those of conventional fossil-fuel-based electricity generation. (موقع مركز تنمية الطاقات المتجددة, s.d.), and therefore, the use of wind energy in electricity production will have an economic advantage, as the cost is low, saving the cost of electricity production.

c- **Hydropower:** Energy generated from water resources, including dam water flows, tidal movements, and pressure differences caused by variations in seawater salinity. It contributes to renewable electricity production.

d- **Biomass energy**: a resource of energy based on the conversion of organic materials into energy using specific technology (Y.Himri, 2009, p. 1587); However, this type of energy is not fully renewable because it is mainly linked to organic materials and because its consumption rate exceeds its renewal rate, as Algeria is overcrowded in the north, the majority of the country's bioenergy will be concentrated in the north on the basis of overpopulation and frequent consumption of waste that can be exploited as biomass and converted into energy.

e- **Geothermal energy**: is an energy resource derived from the extraction of the soil's energy; Heat from radioactive degradation of fissile atoms in rocks is extracted by certain technology that converts heat into electricity (Y.Himri, 2009, p. 1586), in this area, Algeria has more than 240 thermal springs (centre de développement des énergies renouvelables, 2019, p. 35).

3. Algeria's Energy Transition Program:

Since 2010, Algeria has moved towards renewable sources of energy, essentially called renewable energies, because their refurbishment rate exceeds their consumption rate and is therefore inexhaustible as a result of their consumption. Algeria seeks to exploit and produce renewable energy, especially after numerous studies that Algeria has vast amounts of renewable energy resources distributed throughout the country. As mentioned above, the Renewable Energy Program 2011-2030 has begun here, with a delay of 4 years until the program's amendment and launch in 2015 to achieve energy security and the 7th goal of sustainable development, and we are going to talk about them later.

3.1 concept of energy security and the 7th goal of sustainable development:

In examining the sustainable development goals, we found that one of the goals we seek is access to clean and affordable energy. To achieve this goal, States must build on a strong and diverse mix of energy. Since the diversity of energy sources enables States to provide much of this important resource, and thus to increase supply compared to demand and lower prices, it is necessary to achieve this dependence on unlimited energy, the amount of energy that is inexhaustible. The only solution in this case is to move towards the production of renewable energy, and during this segment, we will try to understand the true meaning of energy security and how to achieve it. And the sustainability of energy resources.

Each country's goal, or the global community as a whole, is to maintain an adequate supply of energy. Measures include ensuring access to energy resources; enabling the development and diffusion of technologies; building adequate infrastructure to generate, store and transport energy supplies; ensure implementation; Access to affordable energy for certain communities or groups in society.

The definition of energy security has expanded beyond the initial focus on supply security to a wider range of factors, often referred to as "**four A**" energy security - availability, affordability, accessibility and acceptability (Jones & Dodds, 2017, p. 23)

The factors addressed are the following:

- **Availability**: The power source ensures that the power supply is available in abundant quantities;
- **Affordability**: in the sense that the supplier is affordable to reduce the supplier's exploitation costs;
- **Access to the resource**: means easy access to the energy resource. This relates to the extent to which energy resource supply infrastructure is improved (e.g., means that can produce renewable energy resources and means that transfer resources to end-consumer exploitation)
- **Acceptance feature**: Energy supplier does not have a negative impact on any field of life either on the environment or on the human person or even on the effectiveness of this energy product. In other words, this resource must be accepted by the consumer and the environment.

3.2 Overview of the renewable energy's program 2011-2030:

Algeria's energy transition program is part of the Government's efforts to improve the sustainability of the energy sector and the transition to clean and sustainable sources of energy. This program usually consists of setting goals and plans to develop the energy sector such as solar, wind, nuclear power and improving energy efficiency in industry and buildings.

Energy effectiveness in the economy is the ability to optimize the management of energy resources in the context of sustainable development challenges and significant disincentives in the quantity of energy resources. To this end, Algeria has made efforts to exploit renewable energy resources in order to meet these challenges. The first effort was the development of the Renewable Energies Program 2011-2030, which was discussed in the Energy Sector Management Phases Section and then amended in 2015 to make the program's content as follows:

- The program aims to dynamic green energy through the development of renewable energy and energy efficiency.
- Build a strategy focused on developing inexhaustible resources and using them to diversify energy sources and achieve the principle of sustainable energy.
- Reducing CO2 emissions by 193 million tons.
- Energy provision within 2030 through the introduction of technological equipment for all sectors and the exploitation of clean fuels.

The objective of this program is to achieve 40% of renewable electricity by 2030 with a total capacity of 22,000 MW, of which 10,000 MW is for export, through which Algeria then aspired to (Site du ministère de l'énergie et des mines, 2020):

- Production of electricity from photovoltaic and wind energy, integrating biomass, co-generation and geothermal energy;
- Electricity generation from solar thermal power beginning in 2021;
- Implementation of power generation projects such as wind farm projects as well as experimental projects in the field of geothermal and co-generation, which were planned in two phases:

* **Phase I**: From 2015 to 2020, plans to achieve 4,010 MW between photovoltaic power and wind, as well as 515 MW between biomass, co-generation and geothermal.

* **Phase II**: From 2021 to 2030, plans were made to develop the North-South desert connection to Algeria by installing large renewable energy plants and integrating them into the national energy system.

The Table presents the main indicators of Algeria's Renewable Energy Program between 2011 and 2023. It compares the planned targets with the capacities actually achieved, providing an overview of the progress made in developing renewable energy and the extent to which the program's objectives have been met :

Table (01): Implementation of Algeria's Renewable Energy Program (2011–2023)

Indicator	Planned Target (2011–2030 Program)	Achieved Capacity by 2023	Achievement Rate
Total Renewable Energy Capacity	22,000 MW	600.9 MW	2.7%
Renewable Capacity (excluding hydropower)	22,000 MW	472 MW	2.1%
Solar Photovoltaic (PV)	Main component of the program	436.8 MW	—
Concentrated Solar Power (CSP)	Pilot and development projects	25 MW	—
Wind Energy	Development of wind farms	10.2 MW	—
Biomass Energy	Planned contribution	Negligible	≈ 0%
Geothermal Energy	Planned contribution	Pilot projects only	Very low
Phase I Target (2011–2013)	110 MW	Nearly achieved	—
Phase II Target (2014–2015)	650 MW	Not fully achieved	—
Phase III Target (2016–2023)	2,600 MW	Around 390 MW by 2019	15%

Source: Ministry of Energy and Mines of Algeria, National Renewable Energy and Energy Efficiency Program (2011–2030), annual reports and renewable energy statistics (2023).

The statistical indicators reveal a significant gap between the objectives of Algeria's Renewable Energy and Energy Efficiency Program (2011–2030) and the actual achievements recorded by 2023. Although the program aimed to install **22,000 MW** of renewable energy capacity by 2030, only **600.9 MW** had been achieved by 2023, representing an achievement rate of merely **2.7%**. When hydropower is excluded, the installed renewable capacity falls to **472 MW**, corresponding to only **2.1%** of the planned target.

Solar photovoltaic (PV) technology has been the most successful renewable energy source, reaching **436.8 MW** and accounting for the majority of the installed renewable capacity. In contrast, other renewable energy sources have experienced limited development. Concentrated Solar Power (CSP) reached only **25 MW**, while wind energy contributed **10.2 MW**, reflecting the slow pace of diversification within the renewable energy sector. Biomass and geothermal energy remained largely undeveloped, with only pilot projects or negligible contributions recorded.

Regarding the phased implementation strategy, the first phase (2011–2013), which targeted **110 MW**, was nearly achieved, demonstrating initial progress. However, subsequent phases witnessed considerable delays. The second phase (2014–2015), with a target of **650 MW**, was not fully achieved, while the third phase (2016–2020), which aimed to reach **2,600 MW**, achieved only about **390 MW** by 2019, representing approximately **15%** of the planned capacity.

These results indicate that Algeria has faced several challenges in implementing its renewable energy strategy, including financing constraints, administrative procedures, delays in project execution, and continued dependence on fossil fuel resources. Nevertheless, the recent launch of large-scale solar projects under the national energy transition strategy may contribute to accelerating renewable energy deployment in the coming years and improving progress toward the 2030 objectives.

Conclusion:

As a conclusion we have noted that the concept of sustainable development concerns optimal resource management to ensure that it is not drained. It is therefore a comprehensive approach aimed at achieving economic, social and environmental progress without negatively affecting the environment and without sacrificing the possibility of meeting the needs of present and future generations. Sustainable development also depends on the concept of integrating environmental, economic and social objectives in a balanced manner to ensure the sustainability of resources.

We have concluded that sustainable development has 17 goals, each of which relates to a particular area of people's lives, and that one of its objectives, which requires that United Nations Member States achieve is the sustainability of resources, is to move towards the exploitation of clean renewable energies, taking into account the low prices of these resources.

At the end of this article, we have reached several important results:

- Renewable energy resources are characterized by:
    1. Produce clean energy that contributes to the reduction of carbon dioxide in the atmosphere;
    2. High regeneration rate ensures the sustainability of energy resources in the future;
    3. Help protect other natural resources from access for future generations;
    4. Reduce the proportion of waste generated by fossil energy production.
- Inexhaustible energy resources respect sustainable development standards and achieve the seventh sustainable development goal.
- Algeria seeks to achieve the seventh goal of sustainable development through the implementation of the Energy Transition Program by the end of 2030.

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