

Energy Security in Algeria: Opportunities and Challenges

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Abstract

Energy security has become one of the pillars of security concepts that have a scientific and practical dimension and one of the important variables that emerged in its status and role after the Cold War period. Energy security has become one of the important determinants that go into shaping the national security combination. We note that with the increasing pace of scientific and technological development and the advancement of industries, energy in its various forms has become an essential element in moving the wheels of international economies. The state authorities have come to attach the utmost importance to the issue of energy and the factors of the sustainability of its sources to ensure their energy security, and it has become clear that hydrocarbon-importing countries have a great dependence on exporting and producing countries.

Keywords: Energy security, renewable energy, energy transition, Fossil resources, oil and gas.

(JEL) Classification : Q2, Q3, Q4, Q5

1. Introduction:

Energy security is a broad and ever-evolving concept in its dimensions to go beyond military, to non-military, no less important, threats, which varied between political, economic and social threats, so it was the post-Cold War phase and the resulting spread of internal conflicts within the nation-state as well as the globalization of some issues such as the environment, poverty, diseases, trade and the multiplicity of threats and challenges that go beyond the entity of one state to international institutions and bodies with the ability to intervene and impose their agenda.

These changes have complicated the concept of security, and it has become difficult to separate military and non-military threats, as force is no longer represented only in the military aspect, but has extended to other aspects of great impact, including technology, information, education, scientific research and the achievement of continuous economic growth, which in their entirety have become the determinants of the power of the state, and any threat to it represents a clear threat to the security of the state that is no less important than the external military threat to the state, from invasion, aggression and conflict in all its forms and types.

The topic of energy security can be addressed from multiple directions and different angles. It is a comprehensive concept that is difficult to identify, and it is also a constantly evolving concept, as it has gone through several stages from the concept of the security of the means that any State must possess to ensure its energy security, to the concept of the security of the objectives that the State must ensure its achievement to guarantee its security.

It was initially a traditional concept based on the mere provision of energy supplies, a new concept in the post-Cold War era in line with the emergence of nuclear power as a dominant deterrent weapon in

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the field of energy or the military field, and finally emerged its human concept after the advent of globalization, sustainable development and the environmental dimension following the great threats resulting from the use of fossil energy sources such as environmental pollution and global warming.

Thus, the issue has become one of the pillars of security concepts with a scientific and practical dimension and one of the important variables that emerged in its status and role after the Cold War. Energy security has become one of the important determinants that go into shaping the national security combination. We note that with the increasing pace of scientific and technological development and the advancement of industries, energy in its various forms has become an essential element in moving the wheels of international economies. The state authorities have come to attach the utmost importance to the issue of energy and the factors of the sustainability of its sources to ensure their energy security, and it has become clear that the hydrocarbon-importing countries have a great dependence on the exporting and producing countries, the clearest example is the dependence of Europe on Russia gas and oil. Which represents the primary source of energy for the European continent, and this was confirmed in the war raging so far between Russia and Ukraine through the cutting off of Russian supplies to Europe and the entry of Europe and America to the side of Ukraine through Military, media and even moral support.

1.1. Research Problematic:

Based on the above, the problem of research can be formulated in the following main question: What are the most important options available and possible strategies for achieving energy security in Algeria? Several sub-questions can be deduced from this main question, including Is the Energy Transition Vision 2030 a comprehensive strategy that can be adopted to ensure energy security in Algeria? What role can energy diversification and the transition to alternative renewable energies play? To what extent does the impact of external international variables on Algeria's energy security extend? How does Algeria face the challenges and fluctuations of the international market by anticipating various possible scenarios to achieve energy security away from shocks and crises?

1.2. Research Importance:

In the case of Algeria, the research in the field of its energy security lies in its importance in the limited energy sources and their orientation towards depletion, and here it is possible to look at the so-called peak oil, along with Algeria's availability of important resources of alternative energies, on one hand, and on the other hand the increase in domestic consumption, global price instability and the constant fluctuations among the international energy market.

1.3. Research Aims:

The main objective of this article is to highlight Algeria's energy security, threats, challenges and opportunities. In addition, the paper develops some ideas on economic diversification, energy transition, and the shift from fossil to renewable energy.

1.4. Research methodology:

The study follows the descriptive and analytical approach with the case study, which is appropriate for the subject of energy security in Algeria.

Following the general line of some previous studies on energy security and the intensifying conflict over energy sources and the security of its resources. Furthermore, regarding the importance of the issue to Algerian security, this study can be divided into three main axes, which we list below:

2. Literature review:

The concept of "energy security" has become one of the basic concepts in the post-Cold War era, and it is noticeable that conflicts nowadays find that energy security has become like other traditional

determinants such as the preservation of international standing, expansion, securing borders that shape the foreign policy of major and emerging industrial countries, which creates a wide field of international competition aimed at securing oil and gas supplies. (Algerian Journal of Security and Development)

Energy is an essential commodity for the proper functioning of all structures and sectors of the economy. Historically, the availability of low-cost energy has been one of the main factors contributing to economic development and improving the standard of living. At the same time, energy contributes significantly to many of the most important environmental problems, especially climate change in the forms of environmental pollution, global warming and others.

2.1 Energy security definitions:

The United Nations defined energy security in 1990 as: "the situation in which energy supplies are available at all times, in multiple forms, in sufficient quantities and at affordable prices." The previous definition refers to the security of supply.

Tracing the uses of the term energy security, the concept of energy security is often highlighted in policy texts and academic literature, but with different connotations depending on the professional, political and geographical background of users of the concept. Hence, there are many considerations based on which the concept of energy security can be defined.

2.1.1 First perspective: exporting and importing countries:

The concept of energy security can be seen from the perspective of dividing countries into two parts:

a. From the perspective of exporting-producing countries, energy security is achieved by keeping supply below the demand at the maximum level (supply security) to achieve an increase in the life of reserves and availability of oil and gas and ensure an affordable price, which leads to high financial revenues, improve economic growth and increase the gross domestic product per capita. In this context, IEA defines energy security as the "uninterrupted availability of energy sources at an affordable price" (International Energy Agency, 2014).

b. From the point of view of importing countries, the conditions for achieving energy security are through the use of demand reduction policies so that the level of supply is greater than the level of demand, allowing a kind of price stability at lower levels, while diversifying alternative energy sources to gradually replace fossil energies, thus reducing dependency relatively as a guarantee of their energy security, and thus their national security.

2.1.2 Second perspective:

An energy system is an object exposed to security threats or a subject that produces insecurity.

a. The energy system as an object under threat: securing the supply and demand of energy: Supply security. The definition of energy security can be achieved from this perspective in three ways: the ability to provide all varieties of energy at affordable prices and without interruption.

b. Energy is a generator of insecurity or Threat Multiplier: Energy can be seen as a generator of insecurity and increased risk in several ways:

b.1. Economic and political risk factors: International conflict resulting from competition over energy resources to ensure energy supplies. For instance, France, Russia and USA's military interventions in the world.

b.2. Technological risk factors: They are inherent in energy's physical and technological properties, generating multiple potential natural, technical or hostile threats. Damage to hydroelectric dams, oil

tankers, gas depots and nuclear plants, resulting from technical and operational errors, can have devastating effects on both near and far areas.

b.3. Environmental risk factors: In these cases, it is often said that climate change acts as a multiplier of the threat. Since the combustion of fossil fuels is the most important factor in climate change by contributing to the increased concentration of carbon dioxide. Energy exploitation also puts pressure on water resources. (Johansson, 2013), (Brock, 2011), (Abdelrahman, 2017)

2.2. Energy security in Algeria:

According to the International Monetary Fund (IMF), Algeria is the fourth largest economic power in Africa, but it is vulnerable to fluctuations in energy prices, and its hydrocarbon resources represent more than 90% of its external revenues.

Despite the major tremors and multiple crises to which the Algerian economy has been exposed, which were the result of the repercussions of the world oil markets and the decline in global demand along with price fluctuations, it has shown development given the gross domestic product (GDP). In terms of revenues, Algeria remains the largest and most developed economy in the African continent according to the (IMF) 2019 report, in the following table Algerian GDP evolution is shown from 2008 to 2018: **Figure (01):** ((IMF), 2019)

Figure(01): Algeria's GDP evolution from 2008 to 2018



Source: International Monetary Fund (IMF) 2019 report

However, the Algerian economy relies heavily on the export of hydrocarbons, which account for more than 95% of external revenues. This places the energy security of the state as the cornerstone in making policies, strategies and the whole national security among political, social, food and military securities. Given the historical trajectory, Algeria's energy security has gone through several major milestones that we can summarize in the next paragraph.

2.2.1 Historical overview: The hydrocarbon sector in Algeria enjoys the advantage of geographical proximity to consumer markets, especially the European market, as well as the quality of Algerian oil compared to many types of oil exported from OPEC countries. In this context, it should be noted that Algeria's energy policy is based on three pillars: energy security, economic growth, social responsibility and environmental protection.

Given the chronology of history, Algerian energy security has developed according to three stages, the first stage, which is represented in the period after independence and was characterized by the nationalization of wealth, including the nationalization of hydrocarbons in 1971, and then the stage of the eighties, characterized by economic and political conditions that negatively affected the economic balance due to market fluctuations and instability of oil and gas prices, which prompted the government to develop a long-term energy policy. The third phase began by the third millennium, when there were

major developments and profound changes locally and internationally, which prompted decision-makers to adopt necessary structural reforms in the energy sector along with other sectors, to make them more adapted to new conditions.

And to make the energy system at the level of the challenges posed by the free economy and openness to world markets and what this requires of the need to possess a competitive advantage in the global markets with the commitment of the state to carry out its three roles as the owner of the mining and hydrocarbon sector, protector of the public benefit, and the engine of investment. As a result, Algeria relies heavily on exports of hydrocarbons to ensure its economic, political and national stability, and therefore energy security becomes a critical issue in protecting and determining its national security, especially with its energy needs constantly increasing as it is noted that the path of energy consumption follows an upward trend.

It is important to differentiate between proven reserves and expected oil and gas reserves. The first is determined by depth, size, area, energy and all the data about the well or reservoir, while in the second it is known that there are fuels in an area but there is no specific data. It is important to mention that official statistics are always prepared by competent authorities based on confirmed reserve data only. It is accredited in theoretical and applied studies on energy and energy security. (Stambouli, 2011)

In addition, there are important factors that drive the retention of fossil energy, the rationalization of its consumption as well as the development of investment in hydrocarbons. First, the availability of Algeria's infrastructure with a known production capacity, second, the availability of hydrocarbons on derivatives that are not found in others and cannot be dispensed with, moreover, confirmed discoveries continue with increased research and excavation. This means that hydrocarbon reserves are constantly increasing with the pace of exploration, and as a result, the peak oil is also changing in both directions with the extent of investment in research and exploration and access to the exploration of proven reserves. This confirms that the value of fossil energies continues to increase continuously and steadily over time following the law of scarcity, which makes hydrocarbons deservedly grab the title of black gold.

Despite the multiple challenges that threaten Algeria's national energy security from Algeria's dependence on oil rents to a large extent to ensure imports and meet needs, along with the fluctuations of the international market for hydrocarbons, and the tendency of prices to fall and instability, many factors constitute a safety valve to avoid many threats and challenges. These include the rationalization of energy consumption and the parallel transition towards renewable energies where Algeria provides important resources. investment in advanced technology, while providing an environment conducive to attracting foreign investment, diversifying the economy, and the basis of all this is a rational pragmatic political will. (Eduardo G Pereira et al., 2015)

2.2.2 Energy security components in Algeria: The energy sector in Algeria is operated under the Ministry of Energy and Mines (MEM). Which is the supervisor of different structures and instruments in the energy sector. First is SONATRACH SPA which is a national company of hydrocarbon research, production, transport, transformation and marketing. The Algeria electricity firm is SONELGAZ SPA. It is the Algerian company of electricity and gas, while the Algerian energy company is AEC SPA. IAER stands for "Institut Algerien des Energies Renouvelable" in French and represents the Algerian Renewable Energy Institute.

On the 28th of July 2002, the first public-private partnership has been created under the authority of the joint-stock company NEAL with registered capital of up to 200 million Algerian Dinars shared

between Sonatrach, Sonelgaz and SIM with capital participation of 45 %, 45 % and 10 % respectively. The main investment sectors that NEAL participate in are electricity production and heat using sources of renewable energies such as photovoltaic solar, biomass, thermal solar, geothermic and wind. In addition, NEAL has a mission of fighting deforestation in the Sahara of Algeria. (Stambouli, 2011)

2.2.3 Energy transition in Algeria:

To organize national renewable energy, the Algerian government created three regulatory and institutional structures: a new ministry, a new national renewable energy company and a regulatory reform.

- 1- Ministry of Energy Transition and Renewable Energies (METRE): METRE has been created by the government in June 2020. Its mission is to manage the energy transition following an adopted plan.
- 2- Regulatory Reform: The Ministry of Energy approved on January 25th, 2021 some regulatory reforms to promote renewable energy production to reduce the consumption of natural gas and encourage small and medium-sized enterprises (SMEs) to accede to the market of renewable energies. Moreover, MEM announced that in case of changes in the prices of electricity, it would apply only to sizable consumers and operators.
- 3- National Renewable Energy Company: the government established the National Renewable Energy Company (SHAEMS) on April 19th, 2021, which is the only one-stop shop for all expected investors and players in the renewable energy sector. This new institution will operate under METRE authority. In addition, SHAEMS could issue tenders, power purchase agreements and award contracts.

The renewable energy transition plan consists of three programs and models:

- 1- National Energy Conservation and Efficiency Program: it aims to promote energy efficiency in the sector of industry, transportation and housing by 10%.
- 2- National Renewable Energy Development Program: its target is to develop solar resources in regions of Sahel and high plateaus, and diminution of gas consumption by green and blue hydrogen use substations.
- 3- National Energy Mix Model (a new one): with the objective of the achievement of 30% renewable energy use in the generation of power by 2030, and the production of 25 gigawatts of power using hydrogen by 2050.

Although the Algerian renewable energy exploitation plan for the last decade has been quite ambitious, the outcome was below the objectives. For instance, the goal of the 2011 plan was to achieve 22 gigawatts by 2030, but only 411 megawatts generate until now. Compared to Egypt and Morocco which have 5,800 MW and 3,447 MW respectively installed renewable capacity, Algeria is still at the beginning.

The energy transition greatly contributes to ensuring Algerian energy security through a variety of strategies. First, diversifying alternative energy sources to gradually replace fossil energies, thus reducing dependency relatively. Second, the rationalization of energy consumption and investment in advanced technology, while providing an environment conducive to attracting foreign investment, and diversifying the economy. Furthermore, develop a wise policy for investment in oil and gas derivatives, which will

bring Algeria more profitability and self-sufficiency in these derivatives. Algeria has great energy power resources. It divides into Non-renewable and renewable energies as follows: (Stambouli, 2011)

2.2.4 Energy resources of Algeria:

It consists of the production of crude oil, condensate with a production capacity of about 12 to 15 million tons of oil equivalent per year, where Algeria is the first exporter of condensate in the world, then the production of natural gas, as well as the refining and dilution energies nuclear energy by owning uranium mines in the mountain range of Hogar, Aghlab, and Tahbili.

In addition, alternative energy resources are available. For instance, shale gas and renewable sources such as Photovoltaic, Wind energy, Thermal solar, Geothermic, Biomass, Solar Hydrogen and Hydroelectricity energy.

a. Fossil resources: Algeria holds considerable reserves of oil and natural gas.

a1. Oil: As of 2016 statistics, Algeria's proven oil reserves stood at 12,200,000,000 barrels, ranking sixteenth globally representing about 0.7% of the world's total oil reserves of about 1,650,585,140,000 barrels. (worldometers.info, 2022)

Table (01): Oil-proven reserves in Algeria in 2016

	Barrels	Global Rank
Oil Reserves	12,200,000,000	16th in the world
	Barrels per Day	Global Rank
Oil Production	1,698,786	17th in the world
Oil Consumption	429,000	35th in the world
Daily Surplus	+ 1,269,786	
Oil Imports	139	
Oil Exports	633,800	
Net Exports	633,661	

Source: <https://www.worldometers.info/oil/algeria>

The following figure N*02 shows reserves of proven oil from 1980 to 2016:

Figure (02): proven oil reserves in Algeria from 1980 to 2016



Source: <https://www.worldometers.info/oil/algeria-oil>

a2. Gas: Based on 2017 statistics, Algeria's proven gas reserves amount to 159 trillion cubic feet, ranking 11th in the world. Gas reserves account for about 2% of the total global reserves of 6923 trillion cubic feet.

Compared to its annual consumption, Algeria has proven reserves equivalent to 109.1 times. Thus, gas reserves can live about 109 years. (worldometers.info, 2022), Algerian gas data is in the table and the graph below:

Table (02): Algerian gas reserves data

	Million Cubic Ft (MMcf)	Global Rank
Gas Reserves	159,054,000	11th in the world
Gas Production	6,491,745	5th in the world
Gas Consumption	1,399,216	26th in the world
Yearly Surplus	+ 5,092,529	
Gas Imports	0	
Gas Exports	1,533,342	
Net Exports	1,533,342	

Source: <https://www.worldometers.info/gas/algeria-natural-gas/>

Figure (03): Proven gas reserves in Algeria (Million Cubic Feet (MMcf)).



Source: <https://www.worldometers.info/gas/algeria-natural-gas/>

b. Renewable and alternative resources: Although renewable resources are significant in Algeria, they represent a small portion of Algeria’s energy system compared to the hydrocarbon sector. Prediction from experts argues that by 2035 Algeria must use the mixt energy model. Knowing that oil and gas are gradually diminishing.

The German Space Centre (DLR) assessment of the Algerian economic potentials revealed the following outcome: Photovoltaic: 13.9 TWh/year, Wind energy: 35 TWh/year and Thermal solar: 169 440 TWh/year. In the table below is the Algerian renewable energy program for 2030: (Cecilia Camporeale et al.)

Table (03): Algerian renewable energy program by 2030

	1 st step: 2015–2020	2 nd step: 2021–2030	Total
Photovoltaic	3000	10,575	13,575
Wind	1010	4000	5010
CSP	-	2000	2000
Cogeneration	150	250	400
Biomass	360	640	1000
Geothermal	5	10	15
Total	4525	17,475	22,000

Source: Beyond the hydrocarbon economy, the case of Algeria

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To achieve objectives, the Algerian government has taken several policies to encourage and promote investment in the renewable energy sector, the table N* 04 below shows these different policies over many years:

Table (04): Algerian renewable energy policies

Title	Year	Policy type
Renewable Energy and Energy Efficiency Development Plan 2015–2030	2015	<i>Policy support: strategic planning</i>
Feed-in tariff for solar PV installations	Apr 2014	<i>Economic instruments: fiscal/financial incentives</i>
Renewable Energy and Energy Efficiency Development Plan 2011–2030	Feb 2011	<i>Policy support: strategic planning</i>
Renewable Energy National Fund	2009	<i>Policy support: institutional creation, Economic instruments: fiscal/financial incentives</i>
Law 04-92 on the Diversification of Power Generation Costs (REFIT)	2004	<i>Economic instruments: fiscal/financial incentives</i>
Law 04-90 on Renewable Energy Promotion in the Framework of Sustainable Development	2004	<i>Regulatory instruments: codes and standards Policy support: institutional creation Research, development, and deployment (RD&D): research program, technology deployment, and diffusion</i>
Law 99-09 on the Management of Energy	1999	<i>Policy support: strategic planning, institutional creation</i>

Source: Beyond the hydrocarbon economy, the case of Algeria
DOI: <http://dx.doi.org/10.5772/intechopen.91033>

b1. Solar energy: The use of solar energy in Algeria back to 1954 with the solar heater used in the industry of ceramic fabrication. Algeria has a great insulation time, over 2000 hours per year among the total Algerian territory. At Sahara and high plains could reach the amount of 3900 hours annually. The daily insulation for each one-meter square is about 5 kWh. However, it is around 2263 kWh /m²/ year in the south and 1700 kWh/ m² / year in the North of Algeria. (Stambouli, 2011)

Table (05): Solar potential in Algeria

Areas	Coastal area	High plateau	Sahara
Surface (%)	4	10	86
Average duration of sunning (Hours/year)	2650	3000	3500
Received average energy (KWh/m ² /year)	1700	1900	2650

Source: (Stambouli, 2011)

The amount of solar radiation in Algeria represents a potential energy source to ensure energy for different sectors in the form of individual photovoltaic solar panels or systems. The domain for which solar photovoltaic energy is used in Algeria are as follows: Information and telecommunication, Domestic application, Water pumping, Electrification of remote villages, Streets and roads lighting and freezing and air conditioning.

b2. Biomass energy: Biomass consists of solid waste. It is the oldest source to generate energy by burning waste. Algeria has a great unenhanced and unconsumed potential for biomass, forests offer around 3.7 million of TOE per year, and agricultural and urban wastes deliver almost 1.33 million of TOE per year, which is the equivalent of 365 kg of urban waste per citizen. Oued Smar discharge in the capital Algiers could generate up to 6MW according to a pre-survey. (Hasni, 2006). In addition, energy production from biomass is relatively cheap and quite attractive. (Stambouli, 2011)

b3. Geothermic energy: Usually, from the core of the earth, geothermal energy is derived. It is a source of sustainable, abundant and clean energy. Usually, people use it for physical therapy, cooking, medical treatment and heating cold areas purposes. Moreover, geothermal resources become generators of electricity, heat pumping and so on.

Algeria is the leader in using geothermal energy in Africa. The amount reached 54,64 MWt of installed thermal power, and Algeria is placed among the five top countries using geothermal energy as a source of energy to power air conditioning. The greater amount is used in balneology reaching 82% of the total power, however, the rest 18% serves as energy to generate power for heating cold areas, fish farming and pumping. (Nacer Lebbihiat, 2021).

b4. Hydroelectric potential

Table (05): Hydroelectric production park

Plant	Installed power (MW)	Plant	Installed power (MW)
Darguina	71.5	Ighzernechebel	2.712
Ighil Ernda	24	Gouriet	6.425
Mansouria	100	Boohamfia	5.700
Erraguene	16	Oued Fodda	15.600
Souk El Djemaa	8.085	Beni Behde	3.500
Tizi Meden	4.458	Tessala	4.228
Ghrib	7.000	Total	269.208

Source: (Stambouli, 2011)

b5. Wind energy: The windy locations are in the Sahara at the west-south of Algeria. The law of Weibull distribution is used to evaluate the variation of wind speeds in the state. The wind speed in the Algerian center is from three to four m/s. However, it goes up moving toward the southwest of the country. The highest speed is located in the Adrar region estimated at 6 m/s. the overall speed in the remaining regions is almost more than 3 m/s. (Kasbadji, 2010)

b6. Solar Hydrogen Energy: Algeria has great potential for sunshine around the globe. But solar hydrogen production through cycles of thermo-chemical could be a good alternative to improve energy security efficiency in Algeria. Hydrogen has two main characteristics, the possibility of storage and its high calorific value.

The production of hydrogen from solar energy over thermochemical cycles (photothermocatalysis) by conversion of methane (CH₄) to value-added fuels and chemicals, for instance, hydrogen (H₂), using solar light, would slow down environmental effects caused by fossil fuels, establish renewable energy systems permanently, export toward Europe, and improve overall Gross National Product (GNP). For this aim, an Algerian association has been established during the Algiers hydrogen conference in June 2005 called Algerian Hydrogen Association (2AH), it cooperates with the International Energy Agency (IEA). The association starts its primary step in hydrogen generated from solar energy (CDER) for fuel cells but the work is still in its starting stages. (Nacer Lebbihiat, 2021)

According to experts, Tamanrasset is the best region in Algeria to produce solar hydrogen. The hydrogen amount that could be produced from solar energy in Algeria through stream methane reforming is estimated at a 1.6million Tons per year. (Chawki A.M, Aug12-15, 2019)

3. Challenges and future of Energy security in Algeria: This part offers some insights into Algeria's energy security challenges and future.

3.1. Algerian energy security Challenges:

They are represented by oil price fluctuations, fossil resources depletion, and a steady increase in domestic demand leaving only a few choices and pushing up authorities to a narrow way.

This dramatic situation has made huge pressure on policymakers on whether they start investing and exploitation of the potential shale resources which faced high opposition from experts and local citizens, or promote the energy transition and encourage investments toward renewable energy. In addition, they struggle to diversify the Algerian economy as another alternative. The challenges and difficulties that energy security in Algeria is facing are summarized as follows:

- 1- Price fluctuation in the international market:** Price fluctuation in the international market: oil prices decline and uncertainties which impact the state revenue and disrupt investments.
- 2- The declining fossil resources (resources depletion):** the energy sector in Algeria suffers from a sharp depletion which affects the production of oil and gas. The exportation decreases and the annual domestic demand steadily go up by the rate of 7%. (Saliha Haddoum, 2018)
- 3- Decline in oil incomes:** Algerian energy security is at stake and previous challenges lead to a

considerable decline in exportation revenues.

- 4- **The shortcomings and delays in the renewable energy program deployment:** many factors affect the renewable energy program negatively. Mainly, weak institutions and economic structures, poor market attractiveness, and information and skills shortcoming, are all of these factors that hinder the progress of the transition plan related to renewable energy.
- 5- **Increase in domestic energy consumption:** Algerian domestic energy consumption becomes more upwards.
- 6- **Non-diversification of the economy:** Economies of rent are usually suffering from a lack of diversity which exposes their countries to many risks. When oil price decreases all economic sectors are affected negatively, and economic performance goes down.
- 7- **Policy incoherence, and the lack of foresight: weak strategies,** and the lack of an effective solution to the challenges, and there is pursuing a solution to one type of challenge that often occurs at no coordination between economic sectors when making plans.
- 8- **The reliance on hydrocarbon revenues:** the Algerian economy is highly linked to fossil resources revenues for decades, and there is no economic diversification. The oil price fluctuation in the international markets has a direct negative effect.
- 9- **Energy subsidies:** subsidies in the Algerian energy sector have negative effects on the economy, it reduces revenues of exportation and represents a double cost in the period of hydrocarbon price decline. (Ghandir Hatem Siagh, 2020)

3.2. Future of energy security in Algeria:

To save energy security, the Algerian economy must build strategies and policies that lead to economic diversification and the shift from a rentier model to a real multisectoral economy. Change must undertake some structural and regulatory reforms during the period of oil price increases. Here are some of the national goals, policies and strategies that Algerian policymakers should consider when it comes to protecting national energy security from sudden threats in the short and long term:

- 1- To mitigate future threats to energy security, strategies must link different economic sectors to ensure energy security, mainly the security of agriculture, food and water.
- 2- **Energy transition:** The main goal of the transition plan is to change the energy model from the current model which relies heavily on the export of hydrocarbons to a new model. To achieve the energy transition, the national economy must move away from current energy consumption and energy production. Algeria's new model of energy security must follow a transition process that ensures diversification of resources, provision of fossil resources, reduction of depletion, diversification of energy sources, transition to renewable energy and contribution to environmental protection.
- 3- **Economy diversification:** This is the cornerstone of Algeria's economic transition towards a new model that keeps energy security away from internal and external threats. The economy should plan to increase investment in other sectors such as tourism, agriculture, food, etc.
- 4- **Policy efficiency:** Policy efficiency: For example, energy pricing and tax policy, to be effective, must be applied along with other additional tools, distinguishing between individuals, households and large industrial consumers. The policy of energy subsidy should be revised.
- 5- **Communication and dialogue:** to allow an interdisciplinary dialogue among different economic sectors in order to develop and reach a comprehensive and integral strategy that takes into account

the various economic security sectors, energy, food and water security. This comprehensive vision could lead to energy security and consequently, save national and broader regional security.

4. Conclusion:

Algerian energy security model must be built following the new inter and global circumstances and changes. To overcome challenges that threaten national energy security policymakers should opt for economic, social and political measures. Those measures as policies and strategies contribute to elevating market fluctuation and geopolitical disturbances.

Algeria should adopt a model of economic diversification and try to pursue a transition plan that will lead to a shift from the model of oil and gas revenues. The new economic pattern can open up alternatives within different parts of the economy. Algeria has a lot of natural resources, which opens a great gateway for investment. For example, tourism, agriculture, renewable energy and small and medium-sized enterprises (SMEs).

In addition, climate investment should be attractive for foreign direct investment (FDI) as well as local investors. Moreover, the economy of knowledge is a new stage for the human species where information and communication technologies (ICT) are means to shift toward a digital era that Algeria should develop to reach energy security and sustainable development.

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