

## The Impact of the Transition towards a Renewable Energy Economy to Achieve Diversification of the Algerian Economy (Analytical and forward-looking approach)

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### **Abstract:**

The aim of this study is to foresee and identify the impact of the shift towards the exploitation of solar energy in Algeria as an important source for diversifying the Algerian economy by looking at the resource curse that it is currently suffering from. It has been concluded that solar energy is not expected to become a new curse for Algeria due to the small expected revenue of solar energy, and that oil and natural gas will remain in the future in Algeria, more importantly, the possibility that Algeria may struggle to diversify the economy in the field of alternative energy.

**Keywords:** Renewable Energy, Economic Diversification, Algerian economy.

**(JEL) Classification:** O13, P28, Q20

### **1. Introduction**

Renewable energy plays an important and vital role in achieving sustainable development, as it has become one of the major sources of global energy outside the fossil energy as it is sustainable and clean because it does not contribute in any way to environmental pollution, which has to be relied upon as an alternative to conventional energy and an urgent need to achieve the principles of sustainable development to achieve economic diversification, and due to the great importance played by the oil wealth in the Algerian economy, the search for sectoral alternatives to It is considered a crucial issue for Algeria, which led to the adoption of other methods and thinking about alternative proposals for reliance on alternative energy. The Algerian officials were forced to think about the possibilities of exploiting solar energy, which is the main pillar in most countries of the world as well as the main engine of all sectors, which today has become a major source of developing countries in general and Algeria in particular. It has a vast wealth of various types of natural resources and includes energy sources such as oil and natural gas. Although oil and other natural resources play a key role in the national economy, unfortunately, the term is no longer new and has become prominent in Algeria and the African continent in general.

**1.1. The problematic:** Like many countries, Algeria has changed its policies to promote the use of renewable energy as an alternative to economic diversification. For example, Algeria aspires to 40% of the final energy share through renewable energy by 2030 and has been receiving considerable attention due to its large solar power potential, as well as wind power from the Sahara. Many institutions, such as DESERTEC and Desertec Industrial Initiative (DII), have been paying a

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great deal of attention to the region for renewable energy development projects, with a goal of exporting electricity generated by solar energy in Algeria to Europe.

From the above, we ask the following main question:

**Under the current circumstances, to what extent can renewable energy in general and solar energy constitute a new course for Algeria's future economic diversification?**

### **1.2. Sub-questions for the study:**

Through the previous main question, the following sub-questions can be asked:

- What is the role of renewable energy in covering future demand in Algeria?
- How much does solar energy contribute to energy diversification in Algeria?
- What is the potential impact of the expected increase in solar power rents?

### **1.3. The importance of the study:**

The importance of the study lies in seeking to identify the possibility that Algeria may suffer from the future curse of renewable energy, which is a strategic option for economic diversification, and that the possibility of Algeria becoming a source of renewable energy is a concern for it.

**1.4. Study objectives:** Through this study, we aim to achieve a number of objectives:

- Addressing the concept of resource curses and how they are formed in rent-rich countries, especially those rich in fossil energy resources (non-renewable) such as Algeria;
- Knowledge of the importance of renewable energy and the potential of solar energy in Algeria;
- Measuring revenue from solar energy exports in Algeria, by linking the current rent-generating income to poor quality of enterprises,
- Knowledge of the most important challenges facing solar energy in Algeria.
- Try to figure out the potential impact of the expected increase in solar power rents.

**1.5. Organizing the study** In order to address this study, it was divided as follows:

- The curse of fossil energy resources and the need to move towards energy diversification in Algeria.
- Measuring the size of revenue from solar energy exports in Algeria.
- The impact of the transition to the solar economy in Algeria.

## **2. The summit of fossil energy resources and the need to move towards energy diversification in Algeria**

### **2.1 The curse of Algeria's fossil energy resources:**

Algeria is among Africa's resource-rich countries, so it makes sense for natural resources to play a crucial role in their economic development, yet the question remains whether the production of extractive goods in Algeria, such as oil and natural gas, promotes or harms the country's economic development.

In this context, the big push theory emphasizes that poor economies need to expand demand to expand their market size, so that entrepreneurs find it profitable to bear the fixed costs of manufacturing. The logic behind the big pay theory is that anything that stimulates demand is considered acceptable, such as a large public spending program, foreign aid, or a rise in the global price of a natural resource, often called a resource boom (Jeffrey .D & Andrew.M, 1999, p. 43). In other words, with regard to natural resources and the resource boom, the big payment theory provides a mechanism through which resource rents help to stimulate industrialization, and resource

booms lead to industrialization because they can raise income, thereby demand for local manufactures (Tim & Klein, 2005).

But despite the contributions of the big pay theory, it is often claimed that this abundance of resources does not always lead to sustainable economic growth and development of the concerned countries, as in Algeria, i.e., in fact it is possible to see that many resource-poor economies often outperform resource-rich economies in economic growth. Countries that depend on primary export sectors such as oil and minerals often grow slower than their counterparts, and this phenomenon in the prevailing economy is often referred to as resource curse (British Petroleum, 2020). The term resource curse was first used in 1990 by the researcher Richard Auty in his book *Resource-Based Industrialization*, which describes how resource-rich countries such as Algeria are unable to use resource wealth to boost their economies and thus achieve less economic growth than resource-poor countries.

Despite some historical facts that point to the superiority of resource-poor economies such as Japan, South Korea and Taiwan compared to resource-rich and bankrupt countries such as Algeria, Nigeria, Venezuela and Mexico, it is still ironic to see the negative relationship between resource abundance and economic growth. Despite the large revenues from oil and natural gas exports and its ability to help with economic growth and development, Algeria has not been able to achieve the desired results. Consequently, the continued curse of resources and the behaviour of the search for rents in Algeria - as it is totally dependent on energy resources (oil, natural gas) - with negative implications associated with growing social conflict, weak institutions and governance problems, as well as high taxes and debt, and failure to achieve economic diversification outside the hydrocarbon sector due to weak economic links between the resource sector and other economic sectors. The heavy reliance on such volatile natural resources (global oil price fluctuations) would lead to emergency fluctuations in Algeria's government revenues and expenditures, which in turn would create an environment for unsustainable growth.

## **2.2. The importance of renewable energy and the potential of solar energy in Algeria:**

The great global dependence on fossil fuels has become a well-known fact. For example, energy consumption has been dominated for decades, but BP (British Petroleum) predicted that fossil fuel consumption would decline for the first time in recent history due to the strengthening of climate policies for renewable energy, as well as the repercussions of the Covid-19 pandemic on global energy demand (Jean H & Colin J, 1998, pp. 78-83). However, long-term over-reliance on fossil fuels poses significant threats such as climate change. Colin J. Campbell and Jean H. Laherrère published an important article entitled "The End of Cheap Oil." questions future oil supplies and expects world oil production to peak and begin to decline (Fredrik, 2007, p. 58). The Researchers' considerations and expectations in this regard become the basis for a new theory called the "peak oil theory" which was formulated by Colin Campbell later in 2001. Where they defined peak oil as "the maximum rate of oil production in any area under study, while acknowledging that it is a limited natural resource, and is subject to depletion (Roland, 2019). This has led to increased interest in renewable energy, which could be an alternative source of fossil energy, where the focus on renewable energy has grown rapidly around the world, like Algeria, through changes in global policy and increased global renewable energy efficiency.

Thus, the key to decarbonization of the world and the fight against global warming is the desert. Within six hours, deserts receive more energy from the sun than humans consume in a year (Trieb, 2009, p. 27). In other words, solar energy can play a major role in electricity generation, because it depends on converting sunlight into electricity. That is to say, the desert is the basis for future electricity supply. For example, according to Desertic-AFRICA, every square kilometer of desert in the Middle East and North Africa receives solar energy equivalent to 1.5 million barrels of oil per year.

Algeria alone also has an economic potential of 170,000 terawatt-hours/year of solar thermal energy (Peter F, Allan R, & Frank, 2018, p. 12). As an oil-rich country today, its oil export earnings can be directed to invest in solar energy technologies, such as concentrated solar energy, to harness the energy from the sunshine of Algeria's vast desert. In April 2017, Algeria announced plans to complete three solar power plants with a total generating capacity of 4,000 MW (Halvor & Karl, 2006, p. 119). If solar technology is successfully established in Algeria, the northern part of the African continent could become the source of energy.

### **3. Measuring the volume of revenue from solar energy exports in Algeria**

#### **3.1. The volume of rent revenue and its combination with poor quality of institutions:**

Resource revenues are described as the dividing line to measure the extent to which resource revulsion is achieved, for example, Halvor Mehlum and others highlight the importance of institutional quality, and they also point out that the combination of a vast number of resources, rents and weak institutional quality can lead to the country's rent-seeking, one of the indicators of resource curse. (2015, p. 64)

Algeria, as an energy source with poor institutional qualities, seems to be already suffering from resource curses. This means that we should anticipate the number of rents from solar electricity exports and see if they are similar to the current rent volume of natural resources, or fossil energy exports. Therefore, the aim of this section is to compare the volume of rent from exports of natural resources (petroleum and natural gas) with the volume of rent from exports of solar energy electricity, to see if solar energy can produce an enormous amount of rent for Algeria.

#### **3.2. The revenue from solar energy exports to Algeria:**

Algeria has great potential to become a future solar exporter. As it is well known, there are various types of solar energy such as Photovoltaic technology (PV), and concentrated solar energy technology (CSP). Of course, both species are highly valuable sources, and will help meet future energy demand. However, when looking at the case of Algeria, it is noted that the CSP technology is receiving more attention due to several factors such as: its rapid development, energy storage, and its high solar radiation. As some international institutions pay great attention to Algeria and its North African region in general, due to its high ability to produce electricity to meet the local demand for electricity, as well as meet the European demand in the future. Therefore, the solar revenue projection for Algeria will be based on the CSP technology.

**3.2.1 Reasons for increased demand for electricity:** Two important factors were considered the main drivers of energy demand. One of them is population growth. This is important because its size affects the size and composition of energy demand directly, and through its impact on economic growth and development (United Nations, 2015). The world population is projected to reach 9.3 billion by 2050, and most of the population growth is expected to occur in developing

countries. For example, the population of the least developed regions is expected to increase from 5.7 billion to 8 billion between 2011 and 2050, and that the population of the least developed countries will grow from 851 million to 1.7 billion. Conversely, the population of the more developed regions will remain around 1.3 billion

. (IEA, 2009, p. 58)

The second factor is economic growth as a major driver of energy demand. According to the International Energy Agency IEA, the energy projections take into account the underlying assumptions of GDP growth, which is the main driver of demand for energy services. They also find that the pattern of economic development affects excess energy demand and fuel mix. The relationship between GDP growth and energy demand was determined between 1971 and 2007, with annual global GDP rising by 1% with a 0.7% increase in primary energy consumption (Green, 2012, p. 54), and Green Peace Organization also sees that since 1971, every 1% increase in GDP has been accompanied by a 0.6% increase in primary energy consumption until the last years. (IEA, 2009, p. 62)

Furthermore, over the period 2007-2030, world GDP growth is expected to increase at a rate of 3.1% per annum (Gus, 2010, p. 15), which indicates the growth in energy demand. Since expectations regarding the main drivers of energy demand, population growth, and economic growth are expected to increase in the future, it can be said that energy demand is also expected to increase.

**3.2.2 Electricity exports from Algeria to Europe:** When considering electricity exports from Algeria, they are intricately linked to Europe because they are expected to become the largest importer of electricity from Algeria. We expect that the transmission of electricity between Algeria and Europe will play an important role in projecting and predicting the volume of solar electricity and, of course, CSP technology is at the heart of this issue.

According to Schellekens and others, current energy systems and energy consumption between Europe and Algeria vary greatly because of the differences in their economic development, and the abundance of oil and natural gas in Algeria. The current energy consumption in Europe is much higher (3300 TWh per year), compared to Algeria, which has a consumption of 180 TWh per year. (Gus, 2010, p. 15)

Regarding the growth of electricity demand, in Algeria it has increased rapidly and doubled in size in the past 20 years, and demand growth continues to grow by up to 8% annually in North Africa. By contrast, electricity demand in Europe increased by 1-2% annually, which increased by 30% between 1990 and 2006. However, when calculated in absolute numbers, the growth of electricity demand is growing faster in Europe because the growth rate of 1.5% in 2005 is equivalent to an increase of 50 terawatt hours per year, while the growth rate of electricity demand from 8% per annum is equivalent to only 15 terawatt hours per year in North Africa. According to Gus Schellekens projections, it is predictable that electricity imports from Algeria and North African countries could meet about 20% of European electricity demand (TRANS, 2006, p. 78). It is expected that the main reason for the increase in demand for electricity in Europe is the shift from fuel to electricity, such as the introduction of electric cars, while population growth and economic growth are the main reasons for the growth of electricity demand in Algeria (See Table No. (01).

**Table(01): UNDP forecasts for population growth in Algeria compared to North African countries with the mediterranean variable (thousands)**

2050	2040	2030	2020	2010	
46522	45490	43475	40180	35468	<b>ALGERIA</b>
123452	116232	106498	94810	81121	<b>EGYPT</b>
8773	8360	7783	7083	6355	<b>LIBYA</b>
39200	38806	37502	35078	31951	<b>MOROCCO</b>
124649	12533	12212	11518	10481	<b>TUNISIA</b>
230596	221421	207470	188669	165375	<b>TOTAL</b>

**Source:** United Nations, Department of Economic and Social Affairs Population Division, Population Estimates and Projections Section.

The German Air Transport Agency (DLR) also projected to gradually increase the amount of electricity transferred from Algeria and North Africa to Europe from 2020 to reach 700 terawatt-hours per year with a total transport capacity of 100 GW in 2050 (Gus, 2010, p. 21). As mentioned earlier, electricity consumption in Europe and North Africa will reach 5,000 TWh per year by 2050. It is also expected that 750 terawatt-hours of electricity will be exported annually from North Africa to Europe. The North African energy system is expected to be based in 2050 mainly on wind and solar energy, including CSP concentrated solar technology with storage and photovoltaic power, with differences based on resource availability. (Franz, 2012, p. 349)

Trieband others also expect the five North African countries, including Algeria, to export 632 terawatt-hours per year by 2050. (EIA, 2011, p. 55)

### 3.3. Revenues from Algeria's natural resources:

This section aims to measure the amount of revenue from the export of natural resources in Algeria in order to compare it with the expected volume of solar rents. The volume of rents from natural resources will be referred to as the volume of rents from the export of energy sources. Here, oil and natural gas will be energy sources, as they are important and critical sources of energy in electricity production.

**Table(02): Average GDP oil revenues, natural gas revenues, total oil and natural gas revenues in Algeria, Egypt and Libya (1993-2009)**

(\$1 billion)				
RENTS COMBINED	NATURAL GAS RENT	OIL RENT	GDP	
23.2	10.8	12.4	77.1	<b>ALGERIA</b>
12.11	5.18	6.93	94.5	<b>EGYPT</b>
18.32	1.42	16.9	39.3	<b>LIBYA</b>

**Source:** World Development indicator (WDI)

Table No. (02) displays the average GDP, the volume of oil rents, and the volume of natural gas rents for Algeria during the period 1993-2009.

As noted, oil and natural gas rents take very high proportions of their GDP. Although it is only possible to make comparisons between energy exporters, the result of this comparison may be as accurate as it is for each country.

The projected volume of solar energy rents estimated at US\$1.18-3/kWh for North African energy-exporting countries can also be compared to the expected volumes of the revenues to North African countries, with the expected volume of the imports to North African countries at 1.18-3 kWh. As mentioned in the study by Trieb, it is possible to predict the size of the rent from solar energy for Algeria compared to North African countries. Table No (03) displays its forecast for Algeria compared to other North African countries.

**Table 03: The amount of electricity exported from Algeria compared to north African countries in 2050**

States	Algeria	Egypt	Libya	Morocco	Tunisia
Expected amount of electricity exported in 2050T/h	230	74	71	213	71

Source: (Franz, 2012, p. 349)

With the data in this table, the volume of Algeria's solar energy revenues can be expected compared to individual North African countries. Table 04 shows the projected rent volume for solar energy, the average volume of oil revenues, the rents of natural gas and the total of oil and natural gas revenues during the period 1993-2009 for Algeria compared to the North African countries.

**Table (04): Expected revenues from Algeria's solar electricity exports compared to North African countries in 2050, average volume of oil and natural gas revenues, and total revenues from oil and natural gas 1993-2009 (US\$1 billion)**

States	Algeria	Egypt	Libya	Morocco	Tunisia
The government's policy of "re-establishing" the state of the state of the country is a very good one.	77.1	94.5	39.3	49.5	26.6
The volume of rents from the export of solar electricity in 2050 (US\$1 billion)	2.7-6.9	0.87-2.2	0.84-2.1	2.5-6.4	0.84-2.1
Volume of oil rents	12.4	5.18	1.42	-	-
Volume of rents from natural gas	10.8	5.18	1.42	-	-
Total volume of rents from oil and natural gas	23.2	12.1	18.32	-	-

Source: World Development indicator (WDI).

It is noted from the table that the expected volumes of rent from solar energy exports to energy exporters in Algeria and North African countries are far from the volume of rent from fossil fuel

exports. The volumes of oil, oil and natural gas rents are considerably higher than the expected size of solar energy rents. In the case of the size of the natural gas rents, the volume of the expected solar revenue could be sold from the natural gas rent in Algeria. Nevertheless, as the table shows, the main rents of fossil fuels in Algeria are from oil and the volume of their rent is much higher than that of natural gas. Thus, by looking at a comparison of the volume of rent, even under conditions where the quality of institutions is poor in the future, It is difficult to see the possibility of solar energy turning into a new curse, given that the projected volumes of solar energy rents are far below the average volumes of oil and natural gas rents.

#### **4. The impact of the transition towards a solar energy economy in Algeria**

##### **4.1. Potential impact of increased revenue expected from solar energy:**

From what was presented earlier, it can be said that Algeria is less likely to suffer from the curse of solar energy. Even though it suffers from poor institutional quality, as the projected rents for solar energy are not as much as those generated by fossil fuels, but despite all this, we should not underestimate the chances of increasing the expected volumes of solar energy in the future, especially given the expectations that oil production will peak, as well as the decline in the amount of global oil, and based on the assumption that oil demand will continue to rise, there is potential for increasing both its value and the volume of oil revenues. However, the world is aware of the importance of renewable energy, and there are global strategies to expand the use of alternative energies, which explains why Algeria is also aiming to increase the share of renewable energy.

Previous studies have predicted that 90% to 100% of electricity could be saved from renewable energy by 2050, and if this forecast is to be achieved, it means that the need for electricity through renewable energy must increase. In this case, since the need for fossil fuels is declining or may not be abundant, and the price of renewable energy may rise because it will be the main sources of electricity generation, so solar energy and other renewable energy volumes can increase.

However, when these possibilities are excluded, if you imagine the cause of the resource curse as a combination of poor institutional quality and enormous rents from natural resources, then previous findings indicate that there is little chance of Algeria suffering from the solar curse.

##### **4.2 Algeria's heavy dependence on fossil fuels for electricity generation:**

The expected volume of solar energy rents shows that there is a possibility that the volume of natural gas revenues will be exceeded as in the case of Algeria, and the expected solar revenue does not appear high enough to be considered a significant threat to solar energy to become a new curse, yet it may also be questioned what kind of impact this solar strategy will have on Algeria as a north African energy exporter, in other words, the result that the expected solar rents will be similar, or slightly above the current average of natural gas revenues.

Given the expected rent volume of solar energy, it can be predicted that the success of a solar strategy does not mean that Algeria, as an energy exporter in North Africa, will be transformed from the export of fossil fuels to the export of solar electricity. In other words, the curse of existing resources will not simply fade as a result of the development of solar energy. For example, despite the assumption that fossil fuels will survive in the future, the "**rent-seeking behavior**" can continue to retain the cursed resources in countries that rely heavily on the export of fossil fuels to

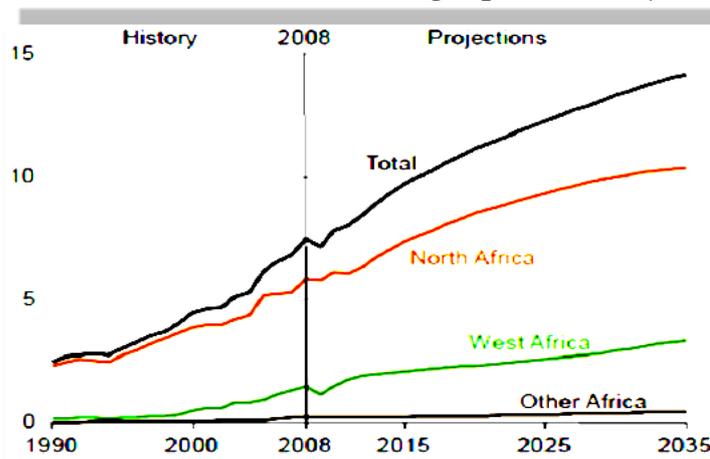
their economies, because the proceeds from fossil fuels are much higher than the expected return on solar energy.

As mentioned earlier, electricity demand in North Africa is expected to reach 1,250 trawpers per hour/year in 2050, and 2,000 terawatt hours per year are expected to be produced in the region through renewable energy. In other words, if the solar and other renewable energy plan were settled in the region to its full potential, solar energy could become an alternative to all fossil fuels used to meet its demand for electricity. Accordingly, it can be assumed that Algeria can save its fossil fuel (oil, natural gas) used to produce electricity. In other words, as an energy exporter, Algeria could export more energy because it had additional resources under the conditions that would enable it to retain a huge amount of fossil fuels that would survive in the future, and therefore more revenues.

#### 4.3. Natural gas production and consumption forecasts in Algeria:

Most reports indicate that the production and consumption of natural gas for north African energy-exporting countries, including Algeria, is expected to increase, according to the EIA report, the high expectation of growth of natural gas production in Africa from 7.5 trillion cubic meters in 2009 to 14.1 trillion cubic meters in 2035 (IEA, International Energy Agency Are we Entering a Golden Age of Gas?, 2011, p. 27), and the International Energy Agency (IEA) Through the Golden Age gas scenario, it also expects africa's natural gas production to grow in the future, from 207 billion cubic meters in 2008 to 438 billion cubic meters in 2035 (EIA, 2011, p. 55). Although annual natural gas production growth is expected to be 3.1% higher in West Africathan North Africa, by 2.2%, natural gas production in North Africa is expected to rise as shown in figure (01):

**Figure (01): North Africa's natural gas production (1990-2035)**



Source: (IEA, International, 2011, p. 59)

Various indicators of fuel sources for electricity generation in the region also show that natural gas will continue to play a crucial role in meeting future electricity demand, and although natural gas production and consumption in Algeria is expected to increase, the expected amount of natural gas used in electricity production will decline (40.3% in 2015 and 34.9% in 2020), and it is also predictable that Algeria is likely to produce and consume a large amount of gas. However, additional natural gas could also mean that solar energy could prolong Algeria's dependence on its energy exports, thereby reproducing existing resources. Of course, the results of this section are based on the assumption that Algeria will still lack good institutional quality and that it will continue to be abundant with fossil fuels in the future.

## 5. Conclusion:

Through the presentation, it was found that Algeria has enormous potential in the field of solar energy, as it is necessary to develop a regulatory and operational structure to speed up the implementation of the renewable energy system and build national capacities to move towards sustainable development to diversify the Algerian economy and incorporate a concept of clean renewable energy, but despite the possibility of positive effects From the exploitation of solar energy in Algeria, special attention should be paid to the possible negative effects in this case renewable energy may become a new curse, and the problem of institutional vulnerability must be addressed, with the need to resort to the policy of economic diversification in other sectors, and one of the most important results reached is:

- The factors influencing Algeria's resource curse are poor institutional quality and the huge amount of revenue from the export of fossil fuels (oil and natural gas). However, these reasons cannot act individually as the ultimate cause of resource retribution alone, but by combining them;
- Assuming Algeria's future institutional weakness, and the high volume of solar energy rents such as fossil energy rents, it can be argued that it may suffer from the backsliding towards solar energy exploitation;
- Solar energy alone is not likely to become a new curse, as Algeria is less likely to suffer from the curse of solar energy. However, this does not mean that they should not be interested in important issues relating to retribution;
- If solar or renewable energy becomes an alternative source of natural gas or fossil fuels to meet domestic electricity demand, assuming continued institutional poor quality in the future, it could play a role in prolonging Algeria's current resource crisis as a major source of energy. Despite the oil peak theory, there are expectations that oil production will increase in the future, and natural gas production is also expected to increase;
- The above projections do not reflect the expected rates of oil and natural gas production in Algeria, the outlook for 2050. However, it can be doubted that assuming that oil and natural gas production will continue to grow, or remain similar to the expected production growth rate, solar or renewable energies as an alternative source of oil or natural gas in domestic electricity production may contribute to prolonging Algeria's dependence on fossil fuel exports. In other words, prolonging the curse of resources;
- Although the possibility of obtaining positive effects from the exploitation of solar energy in Algeria, special attention should be paid to the potential negative effects, in which case renewable energy may become a new curse, and the problem of institutional vulnerability must be addressed, with the need to resort to a policy.

## 6. Bibliography List:

- British Petroleum. (2020). Consulté le 1 5, 2021, sur BP Energy Outlook: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2020.pdf>
- Brunel. (2015). Consulté le 4 2, 2021, sur Green peace, Energy revolution :A sustainable World Energy outlook: [https://www.brunel.net/en/energy-outlook-report-2021?utm\\_source=googleleads&utm\\_medium=cpc&utm\\_campaign=energy\\_outlook\\_report&utm\\_ter](https://www.brunel.net/en/energy-outlook-report-2021?utm_source=googleleads&utm_medium=cpc&utm_campaign=energy_outlook_report&utm_ter)

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- EIA. (2011). Energy Information Administration. Consulté le 1 24, 2021, sur <https://www.eia.gov/>
- Franz, T. (2012). Solar electricity imports from the Middle East and North Africa to Europe. *Energy Policy* , 42.
- Fredrik, R. (2007). *Giant Oil Fields--The Highway to Oil: Giant Oil Fields and Their Importance for Future Oil Production*. London: Coronet Books Incorporated.
- Green, p. (2012). *A sustainable World Energy outlook, Energy revolution, (Vol. 4)*. world energy Scenario.
- Gus, S. (2010). *100% renewable energy : a roadmap to 2050 for Europe and North Africa*, Report, PricewaterhouseCoopers (PwC), Potsdam Institute for Climate Impact Research (PIK). London, Potsdam, Laxenburg: International Institute for Applied Systems Analysis.
- Halvor, M., & Karl, M. (2006). Cursed by Resources or Institutions. *The World Economy* , 29 (8).
- IEA. (2009). (International Energy Agency). Consulté le 2 19, 2021, sur *World Energy Outlook*: <http://large.stanford.edu/courses/2013/ph241/roberts2/docs/WEO2009.pdf>
- Jean H, L., & Colin J, C. (1998). *Scientific American*. Consulté le 2 2021, 20, sur *The End of Cheap Oil*: [https://nature.berkeley.edu/er100/readings/Campbell\\_1998.pdf](https://nature.berkeley.edu/er100/readings/Campbell_1998.pdf)
- Jeffrey .D, S., & Andrew.M, W. (1999). The big push, natural resource booms and growth. *Journal of Development Economics* , 59 (1), 43-76.
- Peter F, V., Allan R, H., & Frank, W. (2018). *the sun is rising in Africa and the Middle East : On the Road to a Solar Energy Future*. Singapore: Jenny Stanford Publishing.
- Roland, B. (2019). *desertec Foundation*. Consulté le 12 28, 2020, sur *What is Desert Energy?:* <https://www.desertec.org>
- Tim, H., & Klein, M. (2005). *Aid and the Resource curse:: How Can Aid Be Designed to Preserve Institutions?* *World Bank Private Sector Development* , 291.
- TRANS, C. (2006). *Trans-Mediterranean Interconnection for Concentrating Solar Power*. German Aerospace Center (DLR) Institute of Technical Thermodynamics Section Systems Analysis and Technology Assessment. Germany: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.
- Trieb, F. (2009). *Clean Power from Deserts:The DESERTEC Concept for Energy, Water and Climate Security (Vol. 4)*. Hamburg: WhiteBook.
- United Nations. (2015). Consulté le 12 19, 2020, sur *Department of Economic and Social Affairs Population Division, Population Estimates and Projections Section*: <https://www.un.org/en/development/desa/news/population/2015-report.html>