

# Energy Security in Algeria: in Post Oil Era.

## الأمن الطاقوي في الجزائر في مرحلة ما بعد البترول.

### Abstract:

This study aims to shed some light on the reality of energy security in Algeria. In view of the standards adopted by the International Energy Organization (IEA). Algeria is able to ensure its energy security, but only in the short term, this due to the fast growth of domestic energy consumption at a faster pace than production. Consequently, Algeria will fail to meet the domestic demand in the forthcoming years. This study proposes a model of energy governance by which the state-owned companies will not be the only responsible of elaborating energy policy by involving civil society and private sector, in addition to the reinforcement of accountability mechanisms to prevent corruption within state-owned company. It also affirms that ensuring energy security in Algeria depends mainly on the achievement of energy transition through reliance on renewable resources.

Keywords: energy security, energy transition, energy governance.

ملخص:

تهدف هذه الدراسة إلى إلقاء الضوء على واقع الأمن الطاقوي في الجزائر. تجادل هذه الدراسة أن الجزائر وبالنظر إلى المعايير المعتمدة من قبل منظمة الطاقة الدولية فإن بإمكانها ضمان أمنها الطاقوي ولكن على المدى القصير فقط. وهذا في ظل تنامي الطلب الداخلي على المواد الطاقوية بوتيرة أسرع من الإنتاج. مما قد يؤدي في المستقبل إلى عدم قدرة الجزائر على تلبية طلبها المحلي، في مواجهة هذا الوضع تقترح هذه الدراسة نموذجا لحكومة قطاع الطاقة يتضمن مشاركة القطاع الخاص و المجتمع المدني في بلورة السياسة الطاقوية للجزائر بالإضافة إلى تفعيل آليات المحاسبة داخل المؤسسات الوطنية المسؤولة عن قطاع الطاقة. كما تؤكد أن تحقيق الأمن الطاقوي مرتبط بدرجة أساسية بتحقيق انتقال طاقوي من خلال الاعتماد على الموارد المتجددة، وهذا في ظل ما تمتلكه الجزائر في هذا القطاع.

الكلمات المفتاحية: الأمن الطاقوي، الانتقال الطاقوي، حوكمة قطاع الطاقة.

### Introduction:

The steady decline of oil prices has propelled energy security back to the top of the energy agenda in Algeria. This has not only dented Algerian budget, which depends largely on the oil and gas revenue but also the energy sector itself. The Algerian government could not increase its oil and gas production due to the increasing domestic demand, and to the volatile state of its oil installations that is still in its

early stage despite the government effort to develop those installations by investing more than 100 billion Dollars.

Today, the Algerian government is struggling to keep its production quota in the OPEC, which estimated at 1 million barrels per day. Moreover, Algeria needs to invest around 50 billion Dollars in fuel energy, in order to keep its quota, which is a large sum comparing with the continuing decline of oil. In facing this predicament, the Algerian government decided to tap the country's shale resources hoping that the successful exploitation of its substantial resource potential would reverse a decline in oil/gas production and safeguard the Algerian economy. The decision was highly criticized by experts and was met by protests whose organizers fear that the substantial amount of water needed to access shale gas will decrease water supplies, especially in regions that largely depend on agriculture.

The energy policy of "total reliance on fossil fuels " will put the country in a vulnerable situation, which led the government to think seriously about the necessity of making energy transition ; and in this respect, one questions : how can Algeria achieve its energy security in the post-oil era?

#### **01-Conceptualizing Energy Security:**

The concept of security—one of the most controversial concepts in international politics— has been widely discussed by scholars of international relations , yet it is still under developed concept something to deduce easily by reviewing security literature, therefore one could not expect to find a harmonized definition of security with all trends of international relation theories.

Traditionally, security was related to state and it was a mere synonym of national security, hence the state is secured as far as it can maintain its autonomy and territorial integrity. According to this line of argument, realism claims that states are the « referent object » of security, similarly argued the liberalism theory in international relations. Yet, they disagree on the ways of maintaining peace while realists emphasize that security is related directly to power- the more powerful they are, the more secure they will be. The liberalists seem to have other ways to keep the state secure such as developing economic interdependence between states, which will make war more costly or democracy because they notice that democracies do not fight each other.

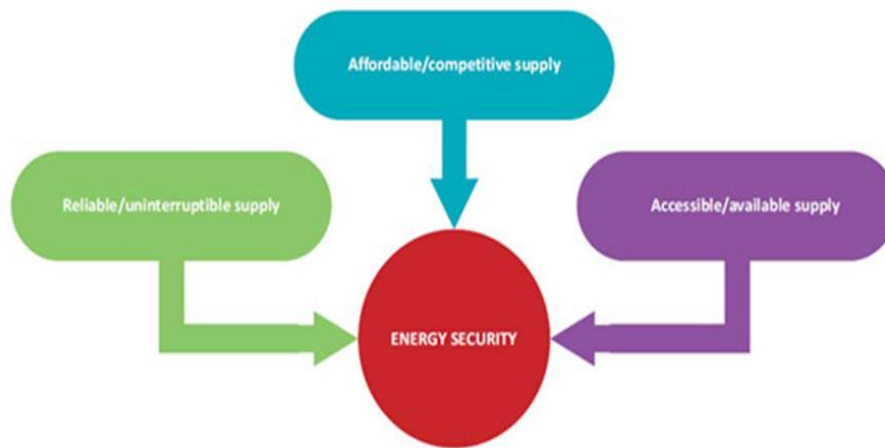
Although the state was supposed to secure its citizen, maintaining state security was, in some cases, coupled with the violation of individual security. Consequently, the assumption of state as referent object of security was called into question and new approaches of security studies have appeared with new referent objects. Barry Buzan, pioneer of Copenhagen School, points out that the concept of security was "too narrowly founded", by virtue of this anomaly, he called for application of security in a wide range of issue and sectors such as : environment, economy , society , politics and military sector. The latter shows that Buzan does not deny the importance of state security. However, he added that individual and society are like referent objects, and he argues that security is about the pursuit of freedom from

threat and the ability of states and societies to maintain their independent, identity and functional integrity against forces of change, which they see as hostile. The bottom line of security is survival, but it also reasonably includes a substantial range of concerns about the conditions of existence. Quite where this range of concerns ceases to merit the urgency of the "security" label (which identifies threats as significant enough to warrant emergency action and exceptional measures including the use of force) and becomes part of everyday uncertainties of life is one of the difficulties of the concept (Buzan, 1991, pp. 432-433).

Thus, security becomes more and more relevant to individual rather than state, it is related also to several areas besides the military area. Its importance is diminishing in the era of globalization where the economic factors play a vital role; consequently, more focus has been devoted to the economic security and more specifically to energy security.

Historically, energy security has emerged as an issue of great importance, after the Arab oil production resorted to "the oil weapon" to punish the United States and other West countries because of their support to Israel. Since then exporters related the energy security to the stable supply of cheap oil under threats of embargoes and price manipulations. This incident fuelled the creation of international energy agency (IEA) in 1974, which relates the concept of national security and the availability of natural resources for consumption. Members of IEA have taken measures to reduce their reliance on oil. The energy security at that stage aimed to insure stability in oil price (Skindilias and Chia, 2013, p.156), but this challenge seems to be classical one in contrast with new challenges, which have appeared in post-cold war. Traditional understanding must be expended to include new factors and challenges for that energy security is now closely entangled with other energy policy problems such as providing equitable access to modern energy and mitigating climate change thereby. Thus, the concept of energy security implicit in the classic studies has become a subject of intense re-examination (Chero and Jewel, 2014 ,p.416.).Accordingly the IEA has taken those two aspects in its definition of energy security which emphasize on the uninterrupted availability of energy sources at an affordable price from one hand; the long term availability of energy which meets the requirements of economic developments and sustainable environmental needs on the other hand (see figure:01) (International Energy Agency, Energy security). This definition will serve as basis for analysis of Algerian's energy security challenges in the rest of the study.

Figure 1 Defining energy security



Source: International Energy Agency, What is Energy Security,

<https://www.iea.org/topics/energysecurity/subtopics/whatisenergysecurity/>

**02- The Energy Policy Evolution in Algeria:** before speaking about the nature of energy policy, it is worth mentioning some apparatus responsible for elaborating energy policy in Algeria:

**2/1/Ministry of Energy (ME):** M.E. is one of the most important players in the Algerian energy sector. Its mandate has given by decree no. 07-266 of 2010, assuring the ministry's responsibility of elaboration and implementation of policies and strategies in the context of research, exploitation, production and usage of energy sources. M.E. is assuring control of the energy sector. Public institutions and organizations are subordinated to it.

**2/2/The National Energy Council (NEC):** established by presidential decree N°95-102, the NEC is charged with supervising and controlling Algeria long-term national energy policy. The NEC is presided over by head of state in addition to other members such as Ministers of energy, defense, finance and the governor of Algerian central bank.

**2/3/SONATRACH:** National Company for Research, Production, Transport, Transformation, and Commercialization of Hydrocarbons. Is a state-owned company formed to exploit the hydrocarbon resources of the country, It was mandate by Decree 63-491 of 31 December 1963 and by law 86-14 of 10 August 1986. Under which it was mandated to act both as a commercial entity handling government participation in petroleum contracts and as the regulatory agency for

the entire hydrocarbon sector, including the upstream and downstream components(Luce et.al,2014 , p. 213).

**2/4/SONELGAZ:** National Society for Electricity and Gas is a state-owned company for the construction, distribution, generation, and transportation of electricity as well as the distribution and transportation of natural gas in Algeria. The Sonelgaz group of companies comprised 36 subsidiaries, including Sonelgaz Holding, which is the sole owner of company .In 2010; Sonelgaz Holding issued the guideline for the development of Algeria’s national renewable energy program (Mowafa, 2010, p.2.1).

**2/5The Renewable Energies Development Center (CDER):** is a research center, established on 22 March 1988. Its main responsibility is conducting research and development programs, scientific and technological, of energetic systems using solar, geothermal and biomass energy (The EPST CDER, Renewable energy development center).

**2/6/The Algerian National Agency for Promotion and Rationalization of Energy Use:** created in 1985, this institution has been restructured by law N° 99-09 dating to 1999 . According to this law the main tasks include the implementation of the National Plan of control of energy and sectorial projects involving partnerships with other sectors (e.g. industry, transportation) (Energylopedia, Algeria Energy Situation)

**2/7/New Energy Algeria (NEAL) :** NEAL is a company which was founded in 2002 as a subsidiary of Algerian energy incumbent Sonatrach (45%) and Sonelgaz (45%) with 10% extra capital from privet investor SIM , Its function mainly involves the production and development of renewable energies.( Kumetat, 2015,p.p.164-165)

Through these apparatus we can notice that there is a diverse institutions charged in elaborating Algerian energy policy. Although Sonatrach, Sonelgaz and M.E still the most dominant actors in which could be called "energy policy network", Sonatrach enjoyed the regulatory mandate despite the fact that Algeria had already the NEC, which, as mentioned above, has mandated the power to monitor all of Sonatrach activities. To date, however, the NEC has never met. This situation spurred Abdelaziz Bouteflika, during his first term to tenet to reform the hydrocarbon sector and open it to foreign investment. In 2005, the former Minister of Energy and Mines has introduced to the government a project to reform the hydrocarbon sector to emulate the most attractive global regulatory frameworks in order to further expand exploration and production. The law was passed in 2005 by the parliament, but its more liberal provisions were watered down by amendments by the time it was published in 2006 (Gonzalo, p. 14.). Consequently, Sonatrach has kept its position as the exclusive responsible of hydrocarbon sector, but the different corruption scandals incriminating Sonatrach top executives, has almost paralyzed the company.

The energy policy in Algeria reflects the state policy of maintaining the social peace, for that the government adopt a short-term policy of total reliance on oil, which has helped the regime to survive in the middle of an unstable region especially

after what so-called « Arab Spring ». Thanks to the high oil prices, Algeria escaped the turmoil experienced by the Arab countries. However, the cost of social stability was very high and a large part of Sonatrach's income was devoted to subsidy system, which has affected the company investment.

To sum up, the energy policy is characterized by the dominance of state-owned companies (Sonatrach and Sonelgaz) which in its turn reflects regime policy in maintaining the social peace, with the absence of private sector and civil society in elaborating energy policy, thus the reliance on fossil fuels is the hallmark of energy policy from independence to now.

Algeria has managed to ensure its energy security over the past decades, the energy prices was affordable and in large quantities. However, at the start of 2016, the Algerian government raised the price of gasoline and other energy products for the first time since 2005, the prices were affordable and the availability of energy is still guaranteed, Nevertheless the rising levels of domestic consumption call into question this capacity. In 2016, domestic natural gas consumption reached 40 bcm (Tabel.01) and, according to Sonelgaz, it grew by an average 10% annually, almost tripling between 2004 and 2014. Electricity consumption, which has been steadily increasing by an annual average of 6.6% over the past 10 years, also contributed to rising domestic gas consumption, as 93% of the country's power generation outputs comes from natural gas (table.3). As domestic gas, consumption has risen faster than production (Oxford Business Group, The report: Algeria 2015). Algeria is confronted with the challenge of preserving the balance between domestic gas consumption and gas exports. In a study published by the Oxford Energy Institute, Ali Aissaoui has advanced three scenarios about the future of gas production in Algeria. In the first scenario, he expected that the gas export would be by 2030 approximately at the same level as it was in 2010. In the best scenario Algeria's export potential could double by 2030 and remain above 60 bcm by 2040s , in contrast with the worst scenario in which he expected that Algerian gas production will be reduced to some 15 bcm/year by 2030 which means that the local demand will be more than production (Aissaoui, 2016,p. 15. ) .

Additionally, the field of gas exportation is highly competitive, with Russia supplying roughly 160 bcm of natural gas into Europe. It is clear that even under the most optimistic scenarios Algeria would not be able to fully substitute for Europe's imports of Russian gas.'(Oxford Business Group, The report: Algeria 2015)

| <b>Table 01. Natural gas indicator, 2010-2016</b> |              |               |
|---|--------------|---------------|
|   | Production * | Consumption * |
| <b>2010</b>                                       | 80,4         | 26,3          |
| <b>2011</b>                                       | 82,7         | 27,8          |

|  |      |      |
|--|------|------|
| <b>2012</b>                                  | 81,5 | 31,0 |
| <b>2013</b>                                  | 82,4 | 33,4 |
| <b>2014</b>                                  | 83,3 | 37,5 |
| <b>2015</b>                                  | 84,6 | 39,4 |
| <b>2016</b>                                  | 91,3 | 40,0 |
| <b>* Billion cubic meters of natural gas</b> |      |      |

Source: Statistical Review of World energy underpinning data 1965-2016, BP Global,

<http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

As for oil, Algeria consumed 412,000 bpd of the 1.5 bpd it produced in 2016, leaving 1.1m bpd for export (Table02). Domestic consumption was 230.000 bpd in 2003, which points to more than 70% rise over the past decade. According to the US Department of Energy, Algeria's domestic oil consumption has increased by 5.5 % annually over the 10 years, due in part to a rise in the vehicles from 2.9m a decade ago to 6m in 2016(TSA ,parc national automobile : près de 6 millions de véhicules).

| <b>Table 02.Oil production and Use 2010-2016</b> |              |               |
|--|--------------|---------------|
|  | Production * | Consumption * |
| 2010   | 1689         | 327           |
| 2011   | 1537         | 350           |
| 2012   | 1642         | 370           |
| 2013   | 1485         | 387           |
| 2014   | 1589         | 390           |
| 2015   | 1558         | 425           |
| 2016   | 1579         | 412           |

\* Barrel per day.

Source : Statistical Review of World energy underpinning data 1965-2016, BP Global,  
<http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

Table 3 shows that domestic consumption of gas will increase in the coming years because the natural gas is still the predominant feedstock for electricity, which has been steadily rising over the past decade. According to Sonelgaz, electricity consumption through the country grew by an average of 5% per year between 2004 and 2009 (Oxford Business Group, The report: Algeria 2015), the rise of domestic demand is coupled with Sonatrach incapacity to meet its production quota in the OPEC. Algeria's oil production has declined after peaking in the mid-2000s and it is expected to continue to fall. The production fell to a daily average of 1.07 million barrels in July 2017, making the country the only OPEC member unable to meet its quota, which estimated at 1.085 million barrels per a day. (E-Bourse d'Algerie, Sonatrach: l'alarmante baisse de la production de pétrole)

| Production from  | in GWh | In %  |
|------------------|--------|-------|
| Oil              | 1163   | 6.49  |
| Gas              | 62823  | 92.42 |
| Hydro            | 254    | 1.08  |
| Nuclear          | 0      | 0.0   |
| Wind             | 0      | 0.0   |
| Solar thermal    | 0      | 0.0   |
| Total production | 64242  | 100   |

Source: "Algeria: Electricity and Heat for 2014", International Agency of Energy  
<http://www.iea.org/statistics/statisticssearch/report/?year=2014&country=ALGERIA&product=ElectricityandHeat>

**3. Energy transition opportunities, challenges and solutions:** in the wake of Arab Oil embargo of 1973, Western countries have tried to break its dependency to fossil fuel and since then much progress has been achieved towards a variety of



renewable. However, the growth of world population, industrialization and improvement in the standard of living, has increased consumption of energy, and making the conventional energy (fossil fuel, nuclear power and hydro resources) the best solution available. To overcome this challenge Germany has adopted a new system depends mainly on renewable energy which called « energy transition » (Energiewende) , the aim of this transition is to increase the share of renewable energies and the promotion of energy efficiency combined with phasing out fossil energy strategies to balance the country energy needs.

The success of German experience has encouraged other countries to follow its path. Algeria in its turn has adopted plans of energy transition by launching an ambitious program of development of renewable energy and energy efficiency in 2011, which seems very promising due to its potential.

Algeria has enormous potential for renewable energy resources; it resides within the so- called solar belt of the world. According to the German Aerospace Center (DLR) Algeria has the largest solar potential in the Mediterranean Basin with 169,440 TWh/year. Sunshine duration on almost all the country is over 2000 h/year and can reach 3900 h in the highlands and Sahara. The daily energy obtained on a horizontal surface is about 5 kWh on most national territory, about 1700 kWh/m<sup>2</sup>/year for the south (Kamel et .al, 2014, p.p. 440-441). The disequilibrium in population distribution in Algeria between the south and the north helps to install concentrated solar power in the south where the population density is very low and the individual photovoltaic solar modules in the north where the population density is high.

The second largest bet for Algeria in terms of renewable energy is wind. The wind speed varies between 1 and 6 m/s(Kasbadji, 2000. p. 553) , which means that Algeria has good prospects for wind energy utilization especially in the south of the country , and gives the country the possibility of producing around 35TWh per year (Oxford Business Group, The report: Algeria 2015 ). Consequently, wind and solar energy could reduce the proportion of electricity generated by gas and water vapor turbines, create thousands of wind/solar-related jobs and above all reducing public expenditure; the production cost savings will be highly visible, especially in the remotely located community and rural areas where there is no main grid line and the extension of the conventional utility is uneconomical. This could boost the Agriculture field.

Algeria has announced many pilot projects <sup>(\*)</sup>whether on rationalization of the use of energy or on the promotion of use of renewable energy, it sets many institutional frameworks <sup>(\*\*)</sup> and legislative and regulatory text <sup>(\*\*\*)</sup>. In 2011, Algerian government has come up with one of North Africa's most ambitious plans for clean energy, aiming to deploy around 22 GW of renewable energy sources by 2030, thus supplying up to 40% of domestic energy with almost half left for export. Beyond this, Algiers hopes that the project will create 100,000 jobs and free up around \$200bn worth of domestically earmarked gas for export between now and 2040 (James, Solar in Algeria).

However, the results are still far from expectations, the renewable energies represent only 0, 2% of the electrical consumption, which puts Algeria in inferior rank compared to its neighbors, for example the renewable energies represent 2.6%, 4.8%, 0.8% in Tunisia, Morocco and Libya respectively (The World Factbook. Electricity from renewable sources). The delay in renewable energy use is due to three main reasons:

Firstly, the short-term availability of fossil energy and its high prices provide the regime with a comfortable economic situation. Hence, the renewable energy project has not been accomplished and it knew considerable delay.

Secondly, the renewable energy policy and investment is still dominated by state-owned companies, the elaboration of this policy is a top-down process, which ignores the civil society and private sector, in contrast to German experience, which was a bottom-up process with highly engaged civil society.

Thirdly, we can notice that there is a lack in solar and wind technology-related except Condor. There is no other company specialized on the production of solar photovoltaic, in addition to the absence of highly qualified specialists in renewable energy.

To tackle such challenges and adequately deal with the reasons led to the failure of implementation of renewable energy there are several steps to implement in order to achieve the energy transition.

First, Algeria should improve transparency and accountability in the oil/gas sector. It is clear that Sonatrach's reputation has suffered because of corruption scandals. For that, accountability of decision-making and performance is the efficient way to provide assurance to Sonatrach/Sonelgaz that decision-makers (individuals and institutions) are identified and that their performance is assessed objectively, in addition to empowerment of regulators such as the National Energy Council. Whatever the precise mechanisms of accountability in their effectiveness depends on transparency in decision-making actors. It is broadly known that Sonatrach and Sonelgaz enjoy limited political autonomy and operate under multiple political principals, which arguably undermines its operational efficiency.

Second, a participative process in the elaboration of energy policy is crucial because energy transition cannot be achieved without effective participation of private sector and civil society. By the virtue of growing consumption of electricity Sonelgaz takes steps to raise awareness about the rationalization of electricity use, it is making some progress albeit rather slowly because it is limited to traditional ways without the participation of societal actors, in other words any energy policy in the next stage should be a bottom-up process.

Third, Sonatrach has to adopt policy of increasing energy efficiency, which will lead to an increase in the energy return on investment (EROI).

Fourth, The outputs of university and professional centers should meet the requirement of energy transition, i.e. the training of highly qualified specialists

(workers/technicians, engineers and researchers) , in addition to the promotion research related to solar energy, optimization of combustion processes, energy efficient materials, efficient lighting, industrial biotechnologies, biofuel production, hydrogen technologies and other relevant studies to renewable energy.

#### Conclusion:

Through the examination of the evolution of energy policy in Algeria, one can trace back one period of energy policy from independence until now. This period is characterized by the dominance of conventional resources as the only source to guarantee state's energy security. Nonetheless, Algeria has introduced ambitious plans to overcome this depends, but the highly centralized political system and the high oil price in the former years have led these plans to dead end.

Algeria, has guaranteed its energy security in the past decades but the total reliance on fossil fuels will call this capacity into question. Even more, the economic situation became more alarming, and the continued decline in oil prices will oblige the government to adopt plans to enforce more budgetary restrictions and impose new taxes with such situation and plans the chances of social unrest increase , especially that Algeria has witnessed several social unrests in the past years.

Considering the low cost of investment in renewable energy comparing to unconventional oil, and to the Algerian potential in renewable energy, the adoption of energy transition seems to be the best solution to guarantee the Algerian energy security and to diversify its economy

#### Notes

(\*) Pilot projects: eco-light , prop-air , eco-bat, Alsol program and Top-industry .

(\*\*)Institutional framework :Agency for the Promotion and Rationalization of the Use of Energy (APRUE) , Commission for Energy Management (ICEM), Renewable Energies Development Center (CDER) and New Energy Algeria (NEAL)

(\*\*\*) Legislative and regulatory texts : 99-09 act of July 28th, 1999, related to energy efficiency ; 02-01 act of February 5th, 2002 related to electricity and gas distribution pipeline; 04-09 act of August, 14th 2004, related to the promotion of renewables in the context of sustainable renewable energies and sustainable development; 04-92 decree of March 25th, 2004 that defined the costs of diversification of electricity generated by renewable energies; 05-495 decree of December 26th, 2005 related to energy efficiency.

#### References:

- 01.Aissaoui, A., (2016).Algerian Gas: Troubling Trends, Troubled Policies. Oxford Institute for Energy Studies .
- 02.Buzan.B. (1991). New Patterns of Global Security in the Twenty-first Century. International Affairs, 67(3), 431-451.
- 03.Chero , A., & Jewel, J. (2014). The concept of energy security: Beyond the four As, Energy Policy (75).

- 04.E-Bourse d'Algerie.Sonatrach: l'alarmante baisse de la production de pétrole. retrieved 11.08.2017.  
<http://bourse-dz.com/2017/07/24/sonatrach-lalarmante-baisse-de-la-production/>
05. Energypedia.Algeria Energy Situation. retrieved on June 2nd, 2017  
[https://energypedia.info/wiki/Algeria\\_Energy\\_Situation](https://energypedia.info/wiki/Algeria_Energy_Situation)
- 06.Gonzalo,E.,(2016). The Impact of Low Oil Prices on Algeria , Center on Global Energy Policy.
07. International Energy Agency. Energy security. (Retrieved August 22, 2017, from <https://www.iea.org/topics/energysecurity/subtopics/whatisenergysecurity/>
- 08.James,T. Solar in Algeria. retrieved 11.07.2017.  
<https://www.eiuperspectives.economist.com/sustainability/solar-algeria>
- 09.Kamel,A., Hadj,A., Chouder,A., Cherfa,F., Bouchakour,S., & Kerkouche,K., Contribution For Solar Mapping in Algeria . In . Dincer,I., Midilli, A . & Kucuk,H., (eds.) (2014), *Progress in Sustainable Energy Technologies Generating Renewable Energy*.  
New york Springer cham Heidleberg.
- 10.Kasbadji, N.,(2000). Wind energy potential of Algeria. *Renewable Energy*, 21 (3).
- 11.Kumetat,D., (2015). Managing the Transition : Renewable Energy and Innovation Policies in the UAE and Algeria. New York : Routledge.
- 12.Luce, A., Watson, T., & Kimmel, E. Regulating Multistage Hydraulic Fracturing: Challenges in a Mature Oil and Gas Jurisdiction. In: Zillman,D., McHarg ,A., Barrera-Hernández,L. & Bradbrook , A.(eds.) (2014), *The Law of Energy Underground : Understanding New Developments in Subsurface Production, Transmission, and Storage*. London : Oxford University Press.
13. Mowafa,T.,(March 2015) . The Mineral Industry of Algeria .Retrieved August 22, 2017, from  
<https://minerals.usgs.gov/minerals/pubs/country/2013/myb3-2013-ag.pdf>
- 14.Oxford Business Group.The report: Algeria 2015. Retrieved June 22, 2017  
<http://www.oxfordbusinessgroup.com/algeria-2015>
- 15.The CDER.Renewable energy development center. Retrieved on May 15th, 2017  
<http://www.cder.dz/spip.php?rubrique87>
- 16.The World Factbook, "Electricity from renewable sources" , retrieved 15.07.2017  
<https://www.cia.gov/library/publications/theworldfactbook/rankorder/2240rank.html>
- 17.TSA .Parc national automobile : près de 6 millions de véhicules. retrieved 11.08.2017.  
<https://www.tsa-algerie.com/parc-national-automobile-pres-de-6-millions-de-vehicules/>

18.Skindilias, K & Chia, C. (2013).Energy Security: Stochastic Analysis of Oil Prices. ,  
In : Walter, F. & Vlasios ,V., *Global Energy Policy and Security* , London : Springer-  
Verlag.