



*Investing in renewable energy as an urgent approach to  
mitigate the effects of climate changes*

*– with special reference to the case of Algeria –*

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**Abstract**

Our aim through this study is to bring to light the importance of the climate driver and the extent of its persistency in the direction of countries towards investing in renewable energies, together with emphasizing on the case of Algeria, by use of the analytical descriptive approach. More to the point, our study concluded that the shift towards renewable energies has shown to be driven by global climate motives and national development motives; besides, these motives do not contradict each other, but rather that renewable energies stand for the basis for sustainable development as they provide economic, social, political and environmental advantages that fossil energy was unable to provide.

✓ **Keywords:** Algeria, Climate Change, Development, Renewable Energy.

✓ **JEL Classification:** Q42; Q54.

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## **1. INTRODUCTION**

Undoubtedly, the globe witnessed many climate changes that had devastating effects both on civilizations and nations that had been existing at the time. Nonetheless, no serious attention had been given to this phenomenon until the nineteenth century, whereat studies and researches proved that the climate change that the earth was experiencing during such period will have very negative effects on the earth and its inhabitants in every single respect. More to the point, the intense human activity during the last century was the main cause of the acceleration of such current climate change compared to its predecessors; hence, the importance of humanitarian climate action emerged, from this standpoint, to mitigate the effects of climate change together with the adaptation to the same, the fact of which was symbolized in international, national and even local strategies and policies that shed light on several areas of climate action such as the energy sector, on top of them, throughout the improvement of energy efficiency and shifting towards the exploitation of renewable energies instead of fossil energies which, in addition to being one of the most important human causes of global warming and environmental pollution, have alike ignited wars and caused geopolitical conflicts between countries, together with entering the economies of countries into crises as a result of the volatility and instability of prices, which are at the present time threatening them to collapse due to the possibility of its exhaustion during the decades to come. In virtue of which, and in the face of such serious and urgent effects and motives, we come to inquire:-

**To which extent the climate drives influences on the decision of countries – inclusive of Algeria – to move towards developing their investments in terms of renewable energy?**

As an answer to the main problem, we will start from the two hypotheses listed below:-

- The importance of climate drivers to invest in renewable energy varies between the international level and national levels;
- Algeria endeavours, through its direction towards the investment in renewable energy, to attain development and diversify its economy.

In light of which, we aim through this study to bring to light the importance of the climate driver and the extent of its persistency in the direction of countries towards investing in renewable energies, together with emphasizing on the case of Algeria. For which purpose, we adopted the analytical descriptive approach. As a consequence, we divided our study into three chapters, as we dealt with climate change and the repercussions thereof in the first chapter, and devoted the second chapter for addressing the concern of investment in renewable energies as one of the most prominent global solutions to the climate crisis; as for the third chapter, we concentrated on the importance of the climate dimension in the direction of Algeria towards investing in renewable energies.

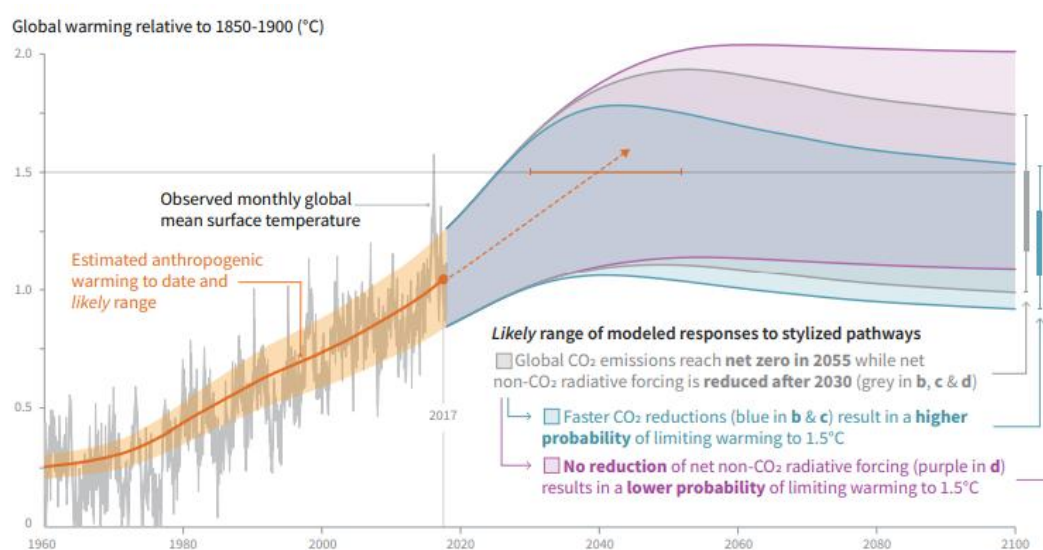
## **2. Climate change and the repercussions thereof:**

In accordance with the United Nations Convention on Climate Change in the second paragraph of its first article, climate change is defined as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (United Nations, 1992, p. 3). More to the point, this term refers, according to the Intergovernmental Panel on Climate Change (IPCC), to “Climate change Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations

of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use” (IPCC, 2018, p. 544).

In fact, human activities cause the Earth’s temperature to increase as an inevitable result of an increase in the concentration of greenhouse gases in the atmosphere, as the concentration of carbon dioxide in the atmosphere, which has the largest role in this phenomenon, has increased by more than 40% between 1800 and 2019. In this respect, more than half of this increase has taken place since 1970, and other greenhouse gases have alike increased, particularly methane, which has increased by more than 150%, alongside the nitrous oxide which has increased by nearly 20% (National Academy of Sciences, 2020).

**Fig.1.** Global Mean Temperature Change, Modelled Responses to Anthropogenic Typical Emissions and Short Pathways



**Source:** (IPCC, 2018, p. 6)

In the light of the Figure 1, we note that anthropogenic warming has witnessed a gradual increase over the past 50 years, which has reach in 2017 about 01°C above pre-industrial levels, and it is expected to reach 1.5°C above pre-industrial levels in 2040 in the event that the current rate of warming would continue. Further, the models determining the future changes, that could affect the

anthropogenic warming, vary according to the speed and quantity of emissions that have been reduced, which alike vary according to the pathways and policies followed in this regards.

From this standpoint, the vast majority of countries (159 countries) at the Eleventh Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC), held in Paris in December 2015, endorsed the historic Paris Agreement, whose aim was traced to maintain the increase in the global average temperature within much less than 02°C above pre-industrial levels, together with pursuing the efforts to limit the global warming to 1.5 °C above pre-industrial levels (United Nations , 2016).

This is even with the fact that climate statistics – vide Table 1 – confirm that the emissions that cause global warming, they are, in fact, emanating from a very limited number of major countries with great economies in the world.

**Table 1.** Classification of the top five countries in the world contributing the most to carbon emissions, from 1960 to 2020

Classification	Country	MtCO <sub>2</sub> value	Rate %
1	China	10668	30,64
2	USA	4713	13,54
3	India	2442	7,01
4	Russia	1577	4,53
5	Japan	1031	2,96
-	World	34807	100

**Source:** Prepared by the researchers based on: (Global Carbon Atlas, 2021)

In light of which, we note that the first five countries mentioned in Table No.01 contribute with more than 58% of the total carbon emissions in the world; as consequence, it is supposed that these countries pay the tax of development and well-

being in which they are living, and that they bear more than others the responsibility for the climate crisis that we live in. Nonetheless, the effects resulting from this phenomenon have shown to be unfair and do not distinguish between countries, but rather threaten small and poor countries, in particular tropical and island countries, more than other countries, as per illustrated in Table 2 hereunder.

**Table 2.**Classification of the top five countries most affected by climate change, from 2000 to 2019

Classification	Country	Climate Risk Index
1	Puerto Rico	7,17
2	Myanmar	10,00
3	Haiti	13,67
4	Philippines	18,17
5	Mozambique	25,83
6	Bahamas	27,67

**Source:** (Eckstein, Künzel, & Schäfer, 2021, p. 13)

Indeed, it is expected that the effects of climate change will significantly intensify in the whole world in case the global warming exceeds two (02) degrees Celsius, the fact of which will surely pose a danger to human health, livelihoods, food security, water supply, human security and economic growth. Moreover, we will experience extreme heat waves in most populated areas, together with heavy rainfall in some areas and drought in others, as this will negatively affect ecosystems, including their loss and extinction; more and more, sea level will continue to rise as a result of increases in the ocean temperatures and the associated increase in ocean acidity and decrease in ocean oxygen levels that will affect as we might expect the marine biodiversity and fisheries (IPCC, 2018).

### 3. Investment in renewable energies as a cure for the climate crisis in the world

In reality, the seriousness of the climate crisis we are nowadays facing requires us to hasten to find successful solutions to mitigate the consequences thereof, the process of which can in no way be performed without analyzing the package of our human activities and extracting the most harmful and contributing among which in the greenhouse gas emissions. In addition, the entire international literature that we have dealing with have commonly agreed that the energy use process contributes to more than 73% of greenhouse gas emissions, as this includes the energy production process by the energy sector together with all the components thereof, and the energy consumption process by all sectors, as well, as per illustrated in Table 3 hereunder:-

**Table 3.**Global distribution of the greenhouse gas emissions by sector and sub-sectors using energy

Activities	
Energy use 73.32 %	Transportation 16.32% Road transport 11.9%, Aviation 01.9%, Freight 01.7%, Railways 0.4%, Pipeline 0.3%
	Buildings 17.5% Residential 10.9%, Commercial 06.6%
	Industrial energy 24.2% Iron and steel 07.2%, Food and tobacco 01.0%, Other industries 10.6%, Non-ferrous metals 0.7%, Paper, pulp and printing 0.6%, Chemicals and petrochemicals (energy) 03.6%, Machinery 0.5%
	Energy directed to agriculture and fishing 01.7%
	Unallocated fuel combustion 07.8%
	Fugitive emissions from energy production 05.8% Coal 01.9%, Oil and natural gas 03.9%
<b>Agriculture, forestry and land use 18.4%</b>	
<b>Industrial operations 05.2%</b>	
<b>Residuals 03.2%</b>	

**Source:** (Climate Watch, the World Resources Institute, 2020)

In the light of the Table 3, we note that the energy consumption process generates more polluting emissions than the production process, the fact of which

enhances the importance of the role of consumers, whether they are individuals or institutions, in reducing emissions all the way through changing their consumption behaviours and making them more efficient. Moreover, they can alike become productive consumers in the energy system through the possibility of their investment in renewable energies and contribution to climate endeavours. Nevertheless, the shift of energy sources requires the adaptation of traditional consumption systems for the entire sectors in accordance with the specificities of the renewable energy sources; at this juncture, the importance of achieving a balance between the renewable energy production systems that have attained tangible progress and the energy consumption systems, some of which still remain in the stage of research and development, comes into view.

Although renewable energies generate emissions of greenhouse gases, contrarily to what is rumoured in this issue; for instance, to produce 01 kilowatt-hour of electricity, wind energy stations export between 01 and 06g of carbon equivalent, and water plants export 1.1 g, whilst hydropower plants export 01.1g, as for the solar plants, they export 16 – 41g due to the need for silicon production. Nonetheless, these numbers have shown to be extremely different from the numbers for emissions resulting from fuel; for instance, natural gas produces 120g of carbon equivalent per kilowatt-hour, which number doubles to 250g for coal (Sciamma, 2015/2010). In virtue of which, the shift towards renewable energies will have a significant impact on reducing the concentration of greenhouse gases in the atmosphere.

This being said, scientists and specialists in the field of energy and climate underline a very important issue that appertain to the extent to which climate change will influence on renewable energy sources; although no studies of concern have been conducted in this regards, capital attention must be paid to such issue for the reason that should the impact be proven correct, future generations will be facing the problem of exhaustion of fossil energy, together with the fluctuation of renewable energy due to climatic factors; hence, this gives us another more persistent climatic



reason to accelerate the transition towards renewable sources for preservation purpose of the climate stability and the preservation of renewable resources, accordingly.

#### **4. The climate dimension of the trend towards investing in renewable energies in Algeria**

Indeed, fossil energy symbolizes the main engine of the Algerian economy, as it stands for the main energy source to supply various activities within the country, and represents, on the other hand, the most important source of financing the State budget through perception of taxes levying, export and other revenues, according to the latest report issued by the Ministry of Energy on 2020 (Ministère de l'Energie, 2020). Additionally, the national energy production is assessed to 157.3 million tons of oil equivalent, about 57% of which is intended for export in the form of crude oil, condensates, petroleum and gas products, fuel and electricity, whilst the remaining quantity is allocated to meet the national consumption, as it is assessed to 66.9 million tons of oil equivalent, about 24% of which is being used in energy industries and as intermediate products in other industries. Further, most of such quantity is directed to final consumption by three main sectors: The household sector and the like (which includes both of the residential and agricultural sectors) with a rate of 46.62%, followed by the transport sector with a rate of 30.55%, and finally the industry and construction sector with a rate of 22.61%.

More to the point, the total primary energy supplies in Algeria depend on each of natural gas by about 67% and petroleum by 32%, as the two most important sources of energy, with the microscopic contribution of other energy sources, in respect such as coal and renewable energy sources, whereat we uncover that solar energy represents 68% of the total renewable energy supplies, followed by vital energy by 21%, and then comes hydropower by 11%, whilst the contribution of wind energy in the renewable energy mix does not exceed 01%, even though the potentials

of the Algerian State from this source have shown to be much greater (IRENA, 2021).

Consequently, such nearly total dependence on fossil energy sources for the production and consumption of energy for decades has contributed to increasing the proportion of greenhouse gas emissions between 1960 and 2020 to approximately 155 million tons of equivalent carbon dioxide, which represents 0.44% of the total global emissions; thus, it is ranked thirty-second (32) out of 220 countries (Global Carbon Atlas, 2021). Nevertheless, Algeria does not significantly contribute to the global warming phenomenon, the reason for which “the Kyoto Protocol classify it among the countries that are not bound to reduce greenhouse gas emissions, whilst it is required to prepare periodic reports that include a comprehensive inventory of greenhouse gas emissions” (BOUSBAINE, 2015/2014, p. 200).

On the other hand, Algeria is considered amongst the countries exposed to the risks of climate change, as it was ranked 101 out of 180 countries according to the Climate Risk Index (Global Carbon Atlas, 2021). Above and beyond, it is expected that the effects of climate change will continue to increase further in the future if the concentration of anthropogenic greenhouse gases in the atmosphere continues to rise, as the average temperatures are expected to rise by 2.6°C by 2050. More to the point, Algeria will become warmer, with more frequent heat waves and fewer frost days, and precipitation periods are alike expected to diverge in the future by an increase assessed to 06% by 2050, but with a 05% decrease in average values, whereat the largest reductions will take place in period extending from March to May by 16% and the largest increases will take place during the period extending from September to November by 22%. Moreover, the daily rainfall intensity will alike increase by 07% (The World Bank, 2021).

Subsequent to which, Algeria will be more vulnerable to the phenomenon of drought and scarcity of water resources, mainly surface ones, as groundwater is less

affected by climate changes, and desertification will expand to several regions. Likewise, the rise in temperature will lead to increased seismic activity, forest burning, sea level rise and erosion of the Algerian coastal strip due to the melting of ice in the (North and South) poles; furthermore, the possibility of floods shall alike increase due to the increased intensity of rainfall over short periods. Besides, these frightening weather forecasts will extend their effects to every single sector in the country, and will generate very high costs that the State will be unable to cover.

In the light of which, Algeria launched an ambitious program for development purpose of renewable energies and energy efficiency for the period of 2020 – 2030 (Ministère de l'énergie, 2016) that seeks to install energy of renewable origin with a capacity of 22.000 MW by 2030 for the national market, which will be 37% of the installed capacity and 27% of the electricity production devoted for national consumption from renewable sources by 2030. More to the point, the implementation of such energy efficiency program will alike lead to attain cumulative energy savings assessed to approximately 90 million tons of oil equivalent for all sectors (construction, public lighting, transportation and industry), inclusive of 60 million tons of oil equivalent during the period of 2015 – 2030, and 30 million tons of oil equivalent after 2030, for the period corresponding to the life span of the equipment used and the facilities constructed, as a consequence, energy demand will decrease by about 10%.

Certainly, this program will contribute to reducing carbon dioxide emissions by 193 million tons (Ministère De L'énergie, n.d); however, this quantity remains very weak and useless should not be accompanied by a reduction in greenhouse emissions by all countries, particularly the countries that contribute the most thereto.

#### **4.CONCLUSION**

In closing, the endeavoured through our paper to search for the importance and impact of climate drivers on the direction of countries towards investing in renewable energies, which indeed allowed us to confirm the validity of the two hypotheses set forth in the beginning of this study, as climate drivers at the international level have shown to be stronger than national climate drivers, since climate policy will not have the desired effect without the contribution of all countries. Nevertheless, with regards to the national level, countries tend further to think about developing their own economies and achieving their energy security, inclusive of Algeria, which seeks to powerfully invest in renewable energy so as to diversify its economy and meet its internal needs through renewable energy; as consequence, reduce its internal consumption of fossil energy and direct the same towards export to double its income. Notwithstanding, it is compelled, in return, to abide by the international climate treaties and agreements being ratified by Algeria.

In this view, Algeria is amongst the countries whose development motives prevail over its climate motives, as it does not cause several emissions, and even its failure to comply with its climate obligations, this will not have a significant impact; subsequently, its climate orientations must be more selective, seeing that if the required action encourages development in the country, in respect such as investment in renewable energies, it will adopt the same and endeavour to the attainment thereof. Nonetheless, in case the required measure restrains development or constitutes exorbitant costs for a specific country, such as reducing the production of fossil energy, which represents the most important resource for the State, then it will not be subject to ratification, as the US President Donald Trump did when he announced in 2017 the United States' withdrawal from the Paris Agreement; providing then such a justification that its course is undermining the American economy, despite the fact that the United States of America is considered one of the countries that contribute

most to the phenomenon of global warming, together with China and the countries of the European Union.

In general, the investment in renewable energies as a solution to the climate crisis does not contradict the development motives and endeavours of countries, but rather represents the basis for sustainable development and provides economic, social, political and environmental advantages that fossil energy failed to make available.

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