

Towards Rationalizing Oil Consumption to Achieve Sustainable Development: A Case Study : Algeria

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Abstract

One of the most serious environmental problems is the depletion of natural resources, especially non-renewable ones. This form of resources play a vital role in the economic and social development necessary to meet the aspirations of peoples in achieving a better standard of living. Forecasts confirm the continued growth in global demand for energy; however, the steady increase in consumption far exceeds oil reserves. This massive depletion contradicts the idea of achieving sustainable development, which is concerned with guaranteeing the rights of future generations.

Therefore, this study propose a remedial strategy that preserves these oil resources from irrational use by adopting the idea of rationalizing consumption. This does not mean a partial or complete cessation of the use of this energy resource, but rather aims to increase returns and efficiency of use, and to find alternative or supporting energy sources that reduce oil depletion and eliminate the prevailing concern about its exhaustion, while also pointing to the efforts made in the case of Algeria regarding this issue.

Keywords: Oil,Sustainable development, non-renewable energy, renewable energy, Algeria.

JELClassificationCodes: Q32, Q42

1. Introduction

Numerous factors have contributed to the increased global and Arab energy consumption, such as economic growth, population growth, and rising levels of welfare. This has begun to threaten oil and gas exports. Furthermore, the decline in Arab countries' exports leads to a decrease in government revenues. Given the almost complete reliance on oil revenues, which constitute more than 90% of total public revenues, government spending is affected by a downward trend. This, in turn, leads to a slowdown in economic growth and an increase in unemployment, followed by numerous economic, political, and social problems, and difficulty in achieving sustainable development. Therefore, solving the energy problem in these countries has become a fundamental requirement that can be achieved by rationalizing consumption and increasing efficiency in use.

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Rationalizing energy consumption is an inevitable necessity at the global level from an economic and environmental standpoint. This importance increases in Arab countries due to the steady increase in population and the exaggerated reliance on oil revenues, coupled with ambitious development programs.

Therefore, the problem statement is as follows: Can rationalizing oil consumption guarantee the achievement of sustainable development requirements in Algeria?

To answer the aforementioned problematic, this research is divided into three sections;

Section 1 explains the theoretical framework of sustainable development. Section 2 presents Oil: characteristics and uses. Section 3 discusses The relationship between rationalizing the petroleum use and sustainable development in the case of Algeria.

2.The Theoretical Framework of Sustainable Development

in the early 1980s, the world began to awaken to the clamor of numerous serious environmental problems that threatened life forms on planet Earth. This was a natural consequence of development neglecting environmental aspects throughout the preceding decades. Therefore, it became necessary to find a new development philosophy to help overcome these problems. International efforts resulted in a new concept of development known as sustainable development. This concept first took shape in the report of the World Commission on Environment and Development, titled "Our Common Future," which was first published in 1987.

In this section, we will address the definition of sustainable development, the evolution of the term "development," as well as its characteristics and dimensions.

2.1.The Definition of Sustainable Development

The first definition formulated for sustainable development is that of the World Commission on Environment and Development. In its report titled "Our Common Future," this commission concluded that there is a need for a new path of development, a path that sustains human progress not just in a few places or for a few years, but for the entire planet and into the distant future. Sustainable development, according to this commission's

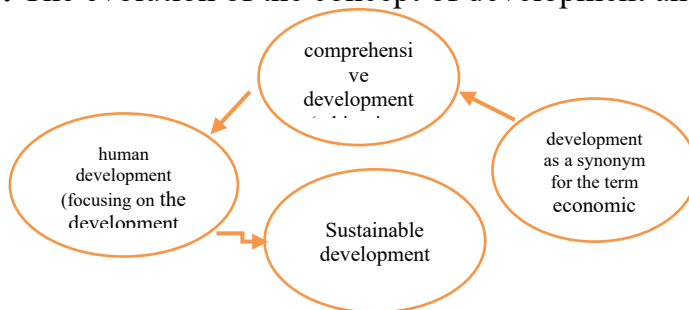
definition in 1978, is: "meeting the needs of the present without compromising the ability of future generations to meet their own needs. (ALSHEIKH, 2007, p. 50)"

It is also defined as: "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations." (ALKHATIB, 2000, p. 220). It is about meeting the needs of current generations without compromising the ability of future generations to meet their needs, meaning responding to the various desires and needs of humans while preserving the environment and without mortgaging the future of coming generations.

Therefore, a comprehensive definition of sustainable development can be given as: genuine development with the ability to continue and be sustained from the perspective of its use of natural resources, which can occur through a strategy that takes ecological balance as its controlling axis. This balance can be achieved through the social and environmental framework, which aims to raise the living standards of individuals through economic, political, social, and cultural systems that maintain the integrity of the environmental framework.

The stages of the development of the concept of development can be summarized, from the first generation that used the term "development" as synonymous with economic growth, up to sustainable development, which is the focus of our research, through the following figure:

Figure N01: The evolution of the concept of development and its content:



Source: Prepared by the researcher based on: Michael P. Todaro(2006), p. 54.

The first stage of development, as synonymous with economic growth, defined development through the criterion of income and fundamental changes in the economic structure.

As for the second generation: comprehensive development began to take into account all dimensions of human life, considering it a comprehensive and integrated civilizational change – economically, socially, and culturally – to achieve accelerated and continuous growth in the economy and improve the conditions and standard of human life.

Regarding the third generation: human development is a natural outcome of a series of intellectual adjustments and discussions that shifted the perspective by making development serve people instead of placing people at the service of development. This was followed by the emergence of sustainable development as a product or result of the failure of previous development visions that focused on material capital accumulation at the expense of the human and environmental dimensions necessary for its continuity. Despite this, it cannot be a development approach applicable in all countries, which led to the emergence of the concept of independent or self-reliant development as a development approach that takes into account the features, characteristics, as well as the inherent capabilities of each society.

2.2. The Characteristics of Sustainable Development

There is a set of fundamental characteristics of sustainable development, which are: (ALGHAMDI, 2007)

Sustainable development represents a process of transformation from one generation to another. This means that this development must occur over a period of no less than two generations, and therefore its equivalent timeframe ranges from 25 to 50 years.

1. This lies in the level of measurement. Sustainable development is a process that occurs at several varying levels (global, local, regional). However, what is considered sustainable at the national level is not necessarily so at the global level. This geographical contradiction is due to the transfer mechanisms through which the negative consequences of a particular country or region are transferred to other countries or regions.

2. Multiple domains are a third common characteristic. Sustainable development consists of at least three domains: economic, social, and environmental. The challenge lies specifically in the interconnected relationships between these domains. Although sustainable development can be defined according to each of these domains individually, the importance of the concept lies in identifying the overlapping relationships between them.
3. One of the characteristics of sustainable development is meeting the necessary and basic needs of food, clothing, education, health services, and everything related to human life.
4. It is an integrated development based on coordination and integration between policies for the use of resources, investment trends, technological choices, and the institutional form, making them all work in understanding and regularity.

2. 3. Foundations of Sustainable Development

Sustainable development is based on a set of foundations and components that include:

Frija Hussein(2009) highlight the three foundations and components of foundations and components which are Human, Nature and technology. The human being is the basis of the content of sustainable development. Therefore, the sustainable development strategy should be based on securing human life and addressing population growth. It should prioritize combating poverty, striving for a new quality of life that allows for the provision of basic needs such as food, shelter, health facilities, and education, providing job opportunities, and achieving justice. Moreover, nature is the reservoir of both non-renewable and renewable resources. The latter includes forests, pastures, and fish. All these resources are available to humans and renewable, provided that the ecosystem in which they exist is maintained. As for non-renewable resources, they are stored beneath the Earth's surface, formed and accumulated in past eras over time. What is consumed from them is neither replaced nor renewed, such as petroleum, coal, natural gas, and minerals. Rationalizing these resources involves not depleting them and exceeding the capacity of ecosystems to yield, as well as conserving them by introducing advanced scientific knowledge. Furthermore, Technological developments are inevitable in human life,

with both positive and negative aspects that sometimes have no solution. Technological means may initially appear very beneficial without harm, but with the evolution of this technology and scientific knowledge, serious harm has become apparent, considering that it damages both the environment and humans through the interactions between humans, nature, and technology. The comprehensive solution depends on achieving a balance between these interactions by establishing a legal system and ensuring its strict implementation. (HUSSEIN, 2009, p. 5) .

2.4. Dimensions of Sustainable Development

Through the foregoing, it can be observed that sustainable development encompasses multiple interconnected dimensions, namely the economic, social, environmental, and technological dimensions, which will be outlined as follows:

The Economic Dimension: This includes the following:

- Achieving fairness among the populations of different countries in the world in the exploitation of resources, because reality has proven that the per capita share of natural resource consumption in developed countries is many times greater than what individuals in developing countries obtain.
- Rationalizing the use of natural resources through the continuous and gradual reduction of wasteful consumption levels of energy and natural resources in developed countries, in addition to bringing about changes in consumption patterns that threaten biodiversity.
- Providing the main factors of production, foremost among them organization, scientific knowledge, and capital.
- Trying to improve the level of human well-being by increasing the individual's share of essential goods and services. However, this is difficult to achieve given the limited resources available to many countries, whether developed or developing.

The Social Dimension: Examples of this include:

- Levels of poverty and its occurrence.
- Per capita share of gross domestic product.

- Health and all related aspects such as health services, sanitation, nutrition, etc.
- Education, such as spending on different levels of education as a percentage of government spending or gross national product, and illiteracy rates.
- Demographic conditions and population control.

The Environmental and Technological Dimensions: These include:

- Renewable water resources.
- Air pollution rates from various sources and water pollution (surface and groundwater).
- Climate change and the reduction of gas emissions.
- The status of fish stocks.
- The use of cleaner technologies in industrial facilities.

3.Oil: Uses and Characteristics

Coal was the primary source of global energy supply until World War II. Petroleum and hydroelectricity played a minor role in this supply. With the destruction of coal mines in Western Europe during World War II, the energy balance and supply were affected, necessitating the search for another source of energy. From this point, reliance on petroleum increased, especially with the growing number of discoveries and the availability of numerous advantages in it that coal did not possess. In this section, we will present the concept of petroleum, its importance in the modern economy, as well as petroleum industries.

3.1. The Concept of Oil

The words "oil" and "petroleum" are synonymous and refer to the same substance. The word "petroleum" has Arabic origins from the Latin "petroleum," which is composed of two parts: "petro," meaning stone or rock, and "oleum," meaning oil. Therefore, the word "petroleum" means rock oil, given that it is found in rocky places beneath the Earth's surface. As for the word "oil" (نَفْط), its origin is Persian "naft" (نافتا), meaning the ability to flow. (ALDOURI, 1993, p. 8)

Oil is a simple substance composed of two elements: hydrogen and carbon, in addition to some organic and inorganic impurities, such as natural gas separated from it or mixed with it, water, salts, sand, wax, sulfur, and small amounts of gases such as vanadium or nickel. Such elements do not exceed 1% of the oil's composition. (SAIF, 2021)

3. 2. Characteristics of Oil as a Commodity

Petroleum as a commodity is distinguished from other goods by certain characteristics that have given it importance in increasing its utility and maximizing its competitiveness with its substitutes. These characteristics are related to the nature of petroleum or how it is exploited, and among the most prominent, we mention the following: (naima, 2009, p. 6)

The Technological and Technical Advantage: This refers to the various means used in exploiting petroleum and reducing its production costs, including equipment and methods, which subsequently reflects on the price. In this regard, we note that most developing countries suffer from high oil production costs, and the reason for this is the lack of technical expertise and technology within them.

The Productivity Advantage: The oil industrial sector is characterized by the widespread use of technology, which reflects on high productivity. Labor costs in developing countries are usually lower than in developed countries.

The Advantage of Oil Movement Flexibility: This means that oil is a commodity that is easy to transport from producing countries to its consumption centers globally. This is due to the liquid nature of oil, which allows it to be stored for a long period without causing damage to its structure.

The Advantage of Wide Usage: Oil enters into all fields and economic activities, making it a vital resource for the global economy. Moreover, petroleum derivatives, in their various forms and diversity, are widely used and enter into all aspects of contemporary life

3.3.The importance of Oil in The Economy

Oil is a crucial pillar of modern civilization, not only as an energy source but also in terms of its economic, political, and social significance, as will be highlighted below:

Oil as a Primary Energy Source: Energy is a key element of the production process, and oil is the most important energy source in the economy. This is due to the high calorific value generated by oil, exceeding that of any other known energy source until the first decade of the 21st century. The cost of producing petroleum is also significantly lower than the cost of producing all its energy alternatives. Furthermore, oil is a source of many other products (petroleum derivatives).

Oil as a Fundamental Raw Material in Industry: Oil is a raw material that cannot be used until several processes are carried out on it. The petroleum industry itself, both extractive and transformative, is a vast industrial activity, occupying an effective position in the industrial sector as a whole. In addition to this, various industrial activities rely on petroleum products, such as petrochemical industries (fertilizer industry, synthetic rubber industry, synthetic textile industry, pharmaceutical industry, etc.), making oil a source of many necessary industrial production processes.

Oil as a Source of Financial Revenue: Oil revenues constitute the largest proportion of public revenues for producing countries, especially Arab ones. As for consuming countries, they obtain oil revenues by imposing taxes on its consumption in the form of petroleum derivatives, not as crude oil.

Oil and Trade Exchange: Oil and its derivatives are an international commercial commodity that plays a significant role in stimulating trade exchange. This is because it is a material traded in various forms and in all countries of the world, occupying the largest share of internationally traded goods. Its importance in international trade is particularly significant for producing countries whose balance of payments relies entirely on oil revenues, due to their dependence on its export over other materials.

The Role of the Oil Sector in Employment: Given that companies operating in the oil sector are large corporations, they contribute to employing a large number of workers across various levels and specializations. Despite the oil industry being capital and technology-intensive, this does not negate the sector's contribution to employment. (report, 2010, p. 120)

Furthermore, oil plays a significant role in political decision-making and is referred to as the basis of power in the world. This is because the distribution of oil is uneven; while it is only available in Russia, the United States, Britain, and Canada among industrial nations, Arab countries, especially the Middle East region, are among the richest regions in the world in terms of oil reserves. This has led the policies of the world's industrial nations towards developing producing countries to be based on the necessity of obtaining it by any means, even through wars. The political importance of oil emerged starting with the 1973 war, passing through the Iran-Iraq War of 1980, the Gulf War of 1990, and reaching the Iraq War of 2003, for which oil was the direct cause of each.

4 .Global Oil Reserves

Reserves refer to the petroleum wealth that can be exploited in an integrated manner on both economic and technical levels. The issue of determining petroleum reserves is influenced by changes in the technology used in exploration and extraction operations, as well as the cost and price levels of this primary material.

- 4 .1. Types of Global Oil Reserves:** These reserves can be divided into three types as follows: (naima, 2009, p. 8)

Proved Reserves: These are the quantities of petroleum that can be accurately extracted from discovered oil fields in light of known technology and prevailing price and cost levels.

Probable Reserves: These refer to the additional quantities that can be extracted from a well after the proved reserves have been extracted.

Undiscovered Reserves: These are the quantities of petroleum that are anticipated to be obtained from locations

where well drilling operations have not yet been carried out to determine the quantities of reserves present. These quantities are not precisely known.

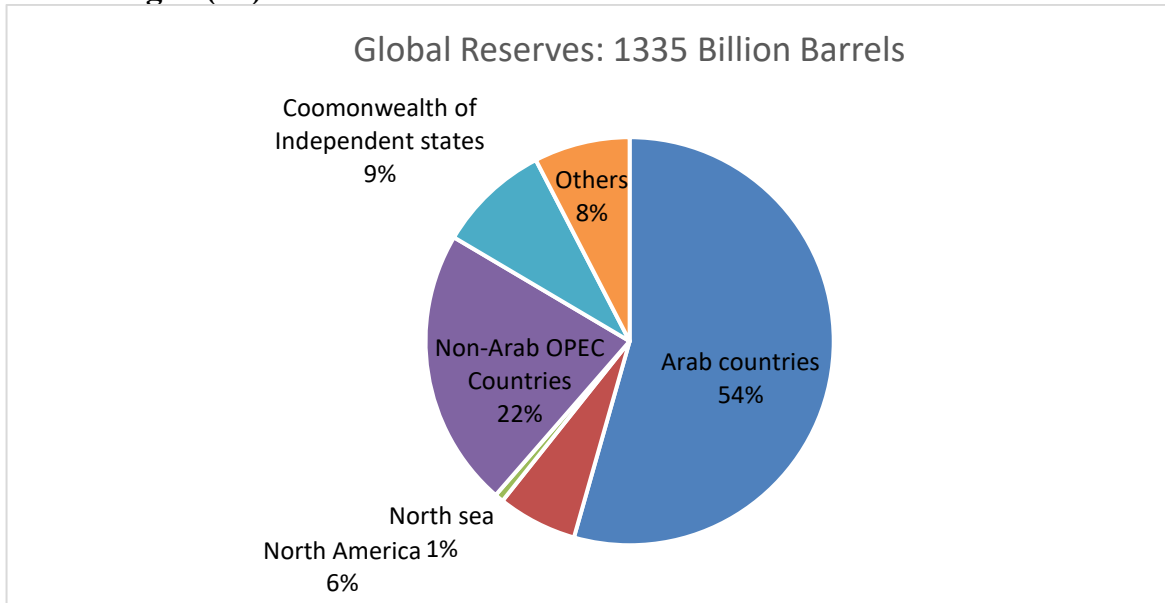
4. 2. Estimation of Global Oil Reserves: Proved reserve estimates are subject to change, either increasing or decreasing, according to factors, the most important of which are:

Annual Production Rate: The proved oil reserves decrease by the amount extracted from them.

New Discoveries: Proved oil reserves increase by the amount discovered. That is, there is a direct relationship between new discoveries and proved oil reserves.

Expansions: The process of expanding and developing previously discovered fields, using modern technology in that field, leads to an increase in proved oil reserves.

Re-evaluation: The re-evaluation of proved reserves in drilled wells within an oil field leads to an increase in oil reserves, especially when better new geological information about the oil field becomes available in terms of the thickness of the oil-bearing layer and the porosity of this layer. It is worth noting that about 80% of what was added to the proved reserves in the United States was due to the re-evaluation of the reserve size, which expanded the estimated value to a greater extent than additions resulting from new discoveries. The following figure illustrates the distribution of oil in the Middle East region.

Fig N (02): Global Crude Oil Reserves for the Year 2023

Source: Organization of Arab Petroleum Exporting Countries (OAPEC).
Annual Report of the Secretary General. 2023.

Proved crude oil reserves are concentrated, with 54.4% located in five Arab countries. Saudi Arabia holds the largest share at 36.8%, followed by Iraq at 19.8%, the UAE at 15.6%, Kuwait at 14%, and finally Libya at 6.7%.

Geologically rich regions

The investments efforts in estraction technology and infrastructure

Low population this will reduce domestic consumption

These countries play strong role in opec

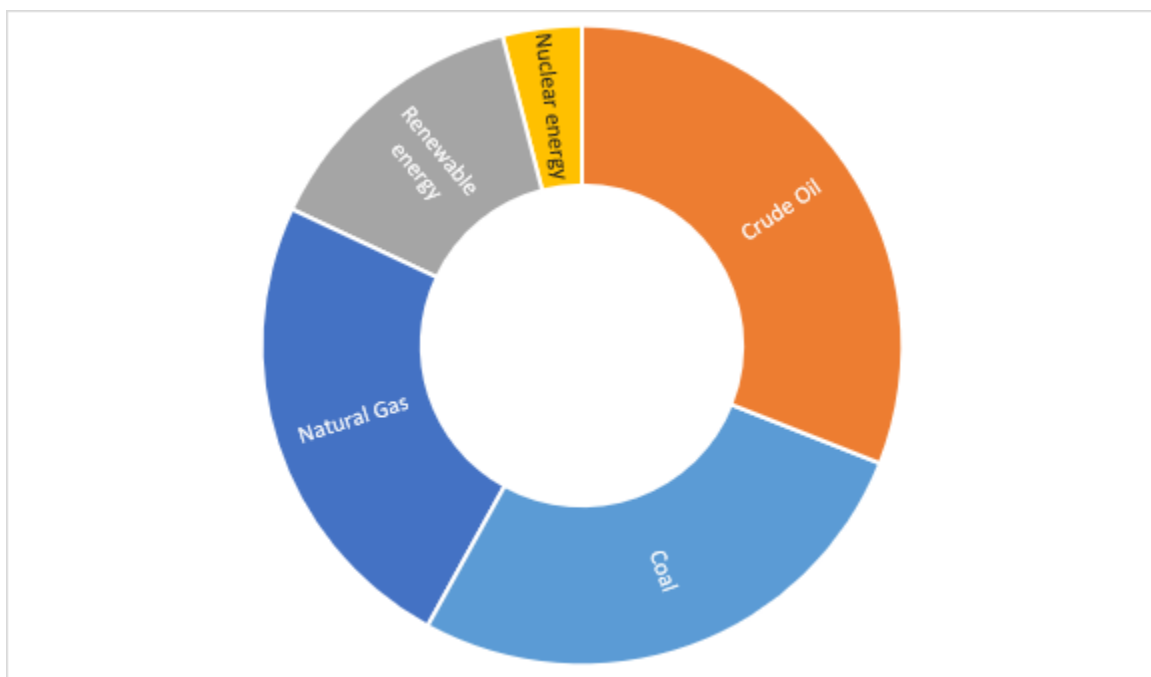
Low production costs.

5.Global Oil Consumption

Global oil consumption is constantly increasing. Its total was estimated at 653 billion barrels up to 1992, at a rate of 65 million barrels per day. This trend continues upwards, reaching about 84.62 million barrels per day in 2006, after not exceeding 76.66 million barrels per day in 2000. Major industrial countries, led by the United States of America, account for the highest percentage of global oil consumption. The consumption of OECD countries in 2007 was approximately 49.33 million barrels per day out of

the total global daily consumption, which grows at a rate of 1.6 million barrels annually. Regarding Saudi Arabia's consumption of crude oil, it is equivalent to 94.7% of the consumption of the rest of the Middle East countries, 85.5% of the consumption of the African continent, and 46.1% of South America. The value of local market consumption of oil derivatives exceeded 420 billion riyals during 2011 based on global prices, which is more than a third of the state's public revenues in 2009. Approximately 400 million barrels were consumed for electricity generation in the Kingdom. In 2030, Saudi Arabia is expected to consume all of its production. The following figure shows the structure of energy consumption at the global level for the year 2021.

Figure No. (03): Global Energy Consumption Structure for the Year 2021



Source: BP Statistical Review of World Energy, 2022

It is observed from the figure above that crude oil (petroleum) and natural gas cover more than half of the global energy consumption in 2021,

while coal contributes 27%. As for the remaining renewable energy sources, they do not exceed 14% of global energy consumption.

Furthermore, research at the University of Cambridge has confirmed that Saudi Arabia is at risk of losing its reserve margin (considering it ranks first globally with an estimated reserve of 260 billion barrels). The Energy Institute in Tokyo, Japan, added that the estimated lifespan of oil is much shorter than previously expected, emphasizing that global reserves will be depleted by 2030. This is due to the significant increase in production by some oil-exporting countries in the past five years, with the aim of meeting increasing global demand and limiting the rise in prices that reached record levels, which has affected the size of reserves that forecasts indicate are smaller than previously believed.

6.The relationship between rationalizing oil consumption and sustainable development (regarding to the case of Algeria)

The importance of oil stems from its provision of financial surpluses which are considered necessary for financing economic and social development plans. This energy source has played a major role in determining the course and nature of development since the early 1970s until the present time, especially in the Arab oil-producing countries. Since oil is a depleting resource, it is necessary first to rationalize its use and then resort to alternative energy sources to reduce dependence on it. In this part, we discussed the role of oil revenues in achieving development, rationalizing the consumption of oil resources, and the Resource Regulation Fund in Algeria.

6.1.The role of oil revenues in achieving development.

Oil revenues have a significant impact on various aspects of development, which we will highlight as follows:

The impact of oil revenues on human development:

The impact of employing oil revenues on human development in the Arab oil-producing and exporting countries has been evident since the early seventies. This impact coincided with the proposals and trends that emerged at that time, which focused on the necessity of paying attention to raising

the standard of living of individuals, so that development strategies would be comprehensive, including social aspects, especially the human element.

There are several indicators for measuring human development, but the measure issued by the United Nations Development Programme (UNDP) is considered one of the most important because it consists of indicators that measure three elements of human development: that people live long and healthy lives (indicator of life expectancy at birth), that they acquire knowledge (indicator of literacy rate), and that they obtain the resources necessary to achieve a decent standard of living (indicator of GDP per capita). (TAHER, 2013)

According to the GDP per capita indicator in Arab countries, the GCC (Gulf Cooperation Council) oil-exporting countries ranked in the top five in terms of the level of human development, which are, in order: Kuwait, Qatar, Bahrain, the UAE, and Saudi Arabia. This ranking reflects high income and the volume of spending in general, and on health and education in particular, which has led to an increase in life expectancy at birth, a decrease in infant mortality rates, and an improvement in overall health and living environment indicators.

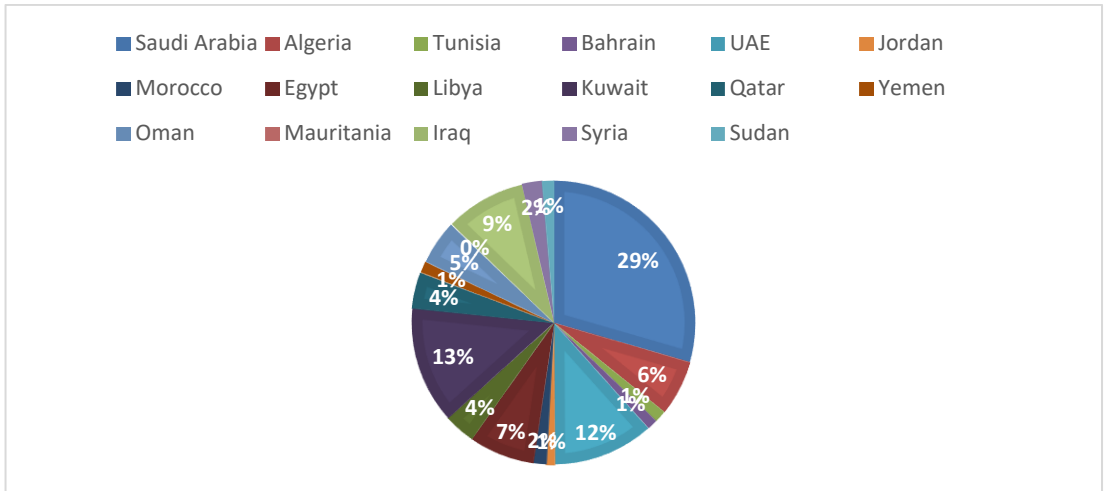
1. The impact of oil revenues on GDP performance:

Estimates indicate that the GDP of Arab countries at current prices reached about \$1.276 trillion in 2009, achieving a growth rate of 16.9%. The continued rise in oil prices to record levels in light of global economic growth contributed to the growth of the total GDP of Arab countries. Qatar, the UAE, and Kuwait ranked first in terms of average per capita income.

The impact of oil revenues on the performance of the industrial sector:

The performance of the industrial sector in the 2000s witnessed a continuous improvement as a result of the rise in global oil prices, which was accompanied by an increase in the production of crude oil, condensates, and gas in Arab countries. This led to an increase in the output of strategic industries and thus an increase in the total industrial output of Arab countries as a group and a rise in its contribution to the GDP.

Figure No. (04): Distribution of oil refining capacity percentages in Arab countries during the year 2023



Source: Arab Economic united Report ,p.124

It's fascinating how the petrochemical industries have risen to prominence in Arab nations, particularly within the GCC! The \$100 billion revenue generated by this sector in these countries during 2023 really underscores its economic significance.

The drive among Arab nations to boost their production capabilities and expand petrochemical projects signals a clear strategic direction. The news of Algeria's Ministry of Energy and Mines exploring collaboration with Qatar, specifically regarding Sonatrach, points towards potential growth and partnerships in this vital industry. (report, 2010, p. 120)

The impact of oil revenues on the performance of Arab countries' foreign trade:

The overall foreign trade performance of Arab countries during this period was characterized by improvement, driven mainly by the increased value of Arab oil exports due to the rise in the quantities of oil exported by Arab countries and the steady increase in global oil prices. The growth in total Arab exports resulted in an increase in their share of global exports. Arab imports also increased due to the continued high pace of economic activity and its demand for increased imported production inputs. (BOUASLA, 2009, p. 132)

Total investment and savings:

The value of investment at current prices for Arab countries recorded an increase of 15.6% in 2006, and the ratio of investment to GDP in the same year reached about 21.6% compared to 20.8% in 2005.

Mauritania and Algeria held the highest ranks among Arab countries. This improvement is attributed to the high rates of construction and building, in addition to increased investment in the oil sector in Algeria.

Enhancing savings through the establishment of sovereign wealth funds:

Sovereign wealth funds are defined by the International Monetary Fund as "special purpose investment funds or arrangements owned by the general government. The general government establishes sovereign wealth funds for macroeconomic purposes. These funds hold, manage, or administer assets to achieve financial objectives, using investment strategies that include investing in foreign financial assets. Sovereign wealth funds are usually established based on balance of payments surpluses, official foreign exchange operations, privatization proceeds, public finance surpluses, or revenues generated from commodity exports, or a combination of all these resources." (KADDI, 2009)

Oil revenues also boost foreign exchange reserves at central banks and contribute to a significant reduction in public sector debt, which was particularly evident in the case of countries such as Yemen and Algeria.

Rationalizing the use of oil resources.

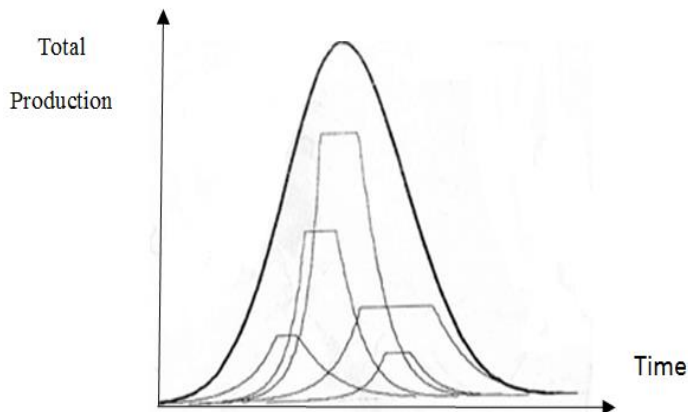
One of the most serious environmental problems is the depletion of natural resources, especially non-renewable ones. The rate of their consumption far exceeds their rate of renewal. This significant depletion contradicts the concept of achieving sustainable development, which is concerned with guaranteeing the rights of future generations. Therefore, there must be a remedial strategy that at least preserves these resources until an alternative solution is available to compensate for them, alleviating the prevailing concern about their depletion or extending the life of non-renewable resources for a certain period.

There is no doubt that the quantity of oil in nature is limited, and therefore it is considered a depleting resource. Talk about reaching the "peak" in its production journey is not new. The geological definition of the peak concept is reaching the production of half of the recoverable reserves from a given field.

Peak Oil Production Theory:

The originator of this theory is the petroleum expert M. King Hubbert, who served as the chief consultant for the Exploration and Production Division of Shell Oil Company. He presented a research paper at a conference held in Texas from March 7-9, 1956, titled "Nuclear Energy and the Fossil Fuels." In that paper, Hubbert showed how the change in production over time from any group of many adjacent oil wells in one location follows the shape of a bell curve, as illustrated in the following figure:

Figure (05): Illustrates how oil production evolves over time for any group of adjacent wells.



Source: Hatem Al-Rifai, *Petroleum Peak Production and the Repercussions of Decline*, NahdetMisr for Printing, Publishing and Distribution, Cairo, 2nd Edition, 2009, p. 61.

That is, productivity will increase in the early stages of a well's life until it reaches a maximum value, and then it will begin to decline until all the oil is depleted. From the previous curve, the following can be concluded:

- The area under the curve represents the total amount of oil that will be extracted from those wells until they run dry.

- The oil depletion curve (called the Hubbert curve) has a peak point, and when oil production reaches its maximum value, approximately half of the total oil volume has been depleted, with the other half remaining in the wells and not yet extracted.
- This curve also applies to the total productivity of any single country, as well as to global oil production.

Rationalizing Energy Consumption:

The non-renewable nature of conventional energy, coupled with the increasing demand for this type of energy on one hand, and the environmental challenges resulting from its intensive use on the other, have prompted many countries around the world to conduct studies, develop policies, enact laws, and take practical measures across various sectors to conserve energy and rationalize its consumption.

Rationalizing Consumption as a Temporary Solution to the Energy Problem:

Until research and studies lead to a radical and practical solution to the energy problem, it is necessary to economize on its consumption. There are two ways to achieve this:

- a. The first method: is to economize on energy consumed in transportation and in homes for heating, warming, or cooling, by using more energy-efficient appliances such as (air conditioners, heat pumps) instead of electric ones, as they consume less energy. Additionally, using solar heaters and biogas for heating, cooking, and warming, especially in new cities and rural areas.
- b. The second method: conducting more research on machinery to make it more energy-efficient and choosing energy-saving industrial processes, and intensifying research and applications related to alternative energy sources.

Adopting the Concept of Rationalizing Energy Consumption in Algeria:

Given the increasing importance of the energy sector in the Algerian economy, and considering it a rentier economy that relies on oil revenues by 97%, Algeria has adopted an energy control policy through:

The National Energy Consumption Model: As Algeria is a producer and exporter of liquid and gaseous hydrocarbons, its energy consumption model is based on certain general characteristics. This is in preparation for

developing a long-term strategy regarding energy development and use.

These characteristics include the following (AKILA, 2009, p. 200) :

- After focusing on supply more than demand for a long period, there is now an increased focus on rationalizing and streamlining energy demand.
- Efforts are being made to cover domestic energy consumption, which has seen a continuous and steady increase since the 1960s. National energy consumption reached 5 million tons of oil equivalent in 1970 and exceeded 30 million tons of oil equivalent in 1990, further surpassing 39 million tons in 2007.
- Optimal use of various energy sources and combating extravagance in their consumption.
- Establishing a suitable pricing system and paying attention to other, more appropriate forms of energy.
- Rational use of energy.
- Developing renewable energies.
- Protecting the environment from the effects of excessive energy use.

The use of oil as an energy source in Algeria faces several challenges. Firstly, it is considered a depleting resource that diminishes with use, necessitating its support with other renewable sources. Secondly, the continuous fluctuation in its prices poses a threat to the public budget. On another front, the carbon tax that European Union countries intend to impose on oil consumption to reduce pollution is a concern. Added to this is the competition in production from Saudi Arabia and other producing countries, and the trend towards rationalizing its consumption in European countries and supporting it with other renewable sources. All of the above compels Algeria to move towards rationalizing consumption to address these challenges.

Rationalizing Energy Consumption in Various Sectors: The sectors with the highest energy consumption are the industrial sector and the buildings sector.

- Buildings and Services Sector: National energy consumption in this sector constitutes about 71% of the total energy consumption, thus occupying the largest share among the various sectors. Within the framework of the partnership with the European Union through the (MEDA-MEDENEC) project, several proposals have been put forward to achieve energy efficiency in this sector. This involves the transition from buildings with intensive energy consumption towards buildings with lower and more efficient energy consumption that are more environmentally friendly. This is being achieved by introducing some changes, including:
 - Using building materials with low thermal conductivity, which can achieve thermal insulation of walls and roofs in the building. This helps maintain heat and prevents it from escaping to or entering the building, whether the building is cooled or heated.
 - Using solar energy for building heating, in addition to providing hot water for domestic use.

Evaluating the Experience of Adopting the Concept of Rationalizing Oil Consumption in Algeria: The results of rationalization in Algeria are almost negligible due to:

- Lack of information and awareness campaigns in this area.
- Absence of an institutional and regulatory framework that works to disseminate methods and means of rationalizing energy consumption.
- Very low prices due to subsidies, and a tax system that does not encourage rational energy consumption.
- Insufficient and non-permanent aid (especially for the southern provinces).
- Insufficient programs and projects in this field.

D. Renewable Energy Applications in Algeria:

Several projects have been launched in the field of developing and using renewable energies. The most important of these include:

- The Special Program for the Great South (1985-1989): Funded by the state and dedicated to the southernmost provinces of Adrar, Béchar, El Oued, Illizi, Tamanrasset. This program enables the provision of potable water to the inhabitants of these regions (pumping or desalination, providing lighting, air cooling inside buildings during the summer).
- Wind Farms for Water Pumping: Located in the provinces of Djelfa and Saïda to meet agricultural needs. This involves providing 80 wind-powered pumps with a capacity of 120 kW/h and 160 solar-powered pumps with a capacity of 240 kW/h within the framework of developing the steppe and pastoral areas.
- The South Development Program "Solar Villages": The actual launch of this project took place in 1998. Sonelgaz is responsible for its implementation, and it is dedicated to deserted and sparsely populated areas in the far south. A rural electrification program using solar photovoltaic energy, funded by state allocations, was implemented for 1000 families across 4 provinces in the far south (Tamanrasset, Adrar, Illizi, Tindouf).
- National Electricity Supply Project via Solar Energy: (16 villages within the framework of the National Rural Electrification Program 2006-2009). This project aims to supply electricity to 16 isolated villages through solar photovoltaic energy and complements the South Development Program "Solar Villages 1998."

In the same context, Algeria has established a group of entities responsible for rationalizing consumption and developing renewable energy sources, most notably (QASHROU, 2018):

- The Agency for the Promotion and Rationalization of Energy Use (APRUE): Established by the government to coordinate and monitor energy control measures and implement various approved programs in this framework.

- New Energy Algeria (NEAL): Established in 2002 as a partnership between Sonatrach, Sonelgaz, and the SIM food processing group. Its mission is to promote renewable energy sources.
- The Renewable Energy Development Center (CDER): Its tasks include data collection, conducting research, and accurately evaluating renewable energies.
- The Solar Equipment Development Unit (UDES): Its main tasks include developing solar equipment with thermal effects for domestic and industrial use, and improving this equipment using renewable energies.

Conclusion:

Rationalizing oil consumption will contribute to achieving the following advantages:

- The optimal path for sustainable development, leading to the provision of the necessary natural resources for investment to increase the productive capacity of the economy in the present and the future.
- Improving the efficiency of energy use in economic activities means reducing the cost of producing goods and services in light of the continuous increase in energy costs, which represent a significant part of the cost elements, thus allowing for the strengthening of the national economy's competitiveness.
- Sustainable development of national wealth resources through rational use, ensuring the continuity of their supply for present and future generations.
- Preserving the environment by reducing air-polluting emissions and greenhouse gases.

Recommendations: Among the most important policies necessary for implementing an oil consumption rationalization program are:

- Activating the role of scientific research in technology fields to raise the efficiency of energy use.
- Taking the necessary measures to complete the issuance of standard specifications in the field of energy efficiency.
- Implementing pilot projects for energy efficiency.
- Developing the market so that supply is limited to energy-saving appliances, lighting equipment, etc., within a suitable timeframe.
- Encouraging the expansion of renewable energy use in all energy-consuming activities, not limited to production areas, while granting rewarding incentives for its use.
- Providing financial, tax, and customs incentives to energy-consuming entities to improve energy efficiency.
- Encouraging the local manufacturing of all energy-saving equipment and renewable energy equipment.
- Supporting institutions that implement ideas to improve energy efficiency and encouraging them by providing preferential credit facilities from banks.
- Preparing a comprehensive database on energy efficiency that includes methods for managing energy systems and means of improving their efficiency.
- Developing the necessary plans to train personnel working in the field of improving energy efficiency.
- Conducting a continuous media campaign to raise awareness about the issue of energy and the importance of its conservation and the rationalization of its consumption.
- Agreeing with the Ministry of Education and Higher Education on materials and standards related to the importance of rationalizing energy consumption, preserving natural resources, and preventing environmental pollution at all educational levels.

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