

## Goals of Sustainable Development and the Importance of Renewable Energies in Achieving and Enhancing Them

أهداف التنمية المستدامة وأهمية الطاقات المتجددة في تحقيقها وتعزيزها

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### Abstract:

The study aimed to clarify and highlight the importance and role of renewable energies in achieving and enhancing sustainable development goals. This was done after addressing the basic concepts and obstacles facing each of them and clarifying the growing interest in renewable energy on the global level by presenting some statistics and graphs.

The study concluded with a set of recommendations that could contribute to enhancing and better exploiting renewable energy and achieving the sustainable development goals related to the three dimensions: the economic dimension, the social dimension and the environmental dimension.

**Keywords:** development; sustainable; energies; renewable; goals.

**Jel Classification Codes :** Q42 ; Q43 ; O013

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### **Introduction:**

Sustainable development has taken a significant place in the thinking of economists, politicians, sociologists, and environmentalists alike, due to its critical importance and impact on all these aspects. It was agreed during the World Summit on Sustainable Development held in Johannesburg in 2002 that there can be no sustainable development without the preservation of the ocean, and there is a mutual relationship between the two: the former includes the preservation of the ocean, and the latter creates the favorable conditions for achieving this development.

The focus of the world in the past century on economic growth, primarily based on gross domestic product, has led to greater attention to technical and economic development at the expense of the ecosystem and the ocean. This has resulted in increased gas emissions, pollution, and has contributed to global warming and climate change.

Today, the world faces a real challenge in achieving a good life for current and future generations on one hand, and preserving the environment and the ocean on the other. Energy is the backbone of the modern economy; through it, investments can be made, innovation can occur, new industries can be developed, job opportunities can be created, and inclusive growth can be achieved, providing prosperity for all. Therefore, it is essential to increase energy access while simultaneously achieving climate goals by enhancing energy efficiency and increasing investment in renewable energy projects that contribute to a gradual reduction in reliance on fossil fuels

### **A. The Problem :**

In light of the above, we pose the following problem:

What is the importance and role of renewable and non-exhaustible energy sources in achieving and enhancing sustainable development goals?

### **B. Secondary questions:**

Through this problem, we raise the following questions:

- What do we mean by sustainable development?
- What are the established goals for sustainable development and what are its dimensions?
- What is the role of renewable energy in enhancing sustainable development goals?

### **C. Research Objectives:**

This research aims to clarify some fundamental concepts related to sustainable development and renewable energy, as well as the key obstacles facing them, in addition to highlighting the importance and role of renewable energy in achieving and enhancing sustainable development goals.

### **D. Importance of the Research:**

The research is significant due to the importance of sustainable development and renewable energy in our time in order to achieve the economic, social, and environmental goals related to ensuring the well-being of both current and future generations.

### **D. Research Plan:**

To address this problem and the sub-questions, we will first discuss some concepts of sustainable development and its established goals, according to the 2023 Atlas of Sustainable Development

Goals published on the World Bank's website. Afterwards, we will clarify the importance and relationship of renewable energy in achieving these goals.

## F. Some previous studies:

\* Larbi HADJAM, Samiha TARI, (2019), ***Sustainable development in Algeria : Analytical reading of the concept and constraints***, They carried out an analytical reading of the concept of sustainable development and the main obstacles it faces in Algeria, which are according to this study mainly represented by air pollution, accumulation of waste, poverty and high unemployment rates, administrative corruption that hinders the implementation of development programs, as well as Algeria's vulnerability to drought and desertification, and its location in a region prone to earthquakes and floods.

\* JOSÉ RAMOS PIRES MANSO, NIAZ BASHIRI BEHMIRI (2013), ***Renewable Energy and Sustainable Development***, They tried to develop the theme of renewable energy and sustainable development, which is an increasingly important subject according to them given the problems facing fossil fuels linked to the depletion of reserves, the high price of new exploration and exploitation, pollution levels and their impact on climate change. The objective of this study was to discuss the adoption or investments in renewable energies and their implications on sustainable development.

The article concludes that clean, environmentally friendly renewable energy should be encouraged, promoted, implemented, and showcased through a large-scale global plan. This creates new job opportunities for youth, reduces greenhouse gas emissions from carbon dioxide, liquid gas emissions, and nitrogen oxides, limits the phenomenon of global warming, mitigates climate change, and produces clean and safe energy that is distributed to all people.

\* Bożena Gajdzik et Al,(2023), ***Barriers to Renewable Energy Source (RES) Installations as Determinants of Energy Consumption in EU Countries***, The article presents an analysis of the statistical relationship between the determinants and barriers to the development of renewable energy sources (RES) in the macroeconomic context and the development of renewable energy source consumption in each European Union country. It considers four key categories of barriers to RES development in the European Union: political, administrative, grid infrastructure, and socioeconomic. The empirical analysis includes all 27 countries belonging to the European Union. The research aimed to determine the impact of the four types of factors, including socioeconomic, on the development of RES in European Union countries. The analysis revealed that describing the European Union as a consistent region regarding the pace of renewable energy advancement and the obstacles to such progress is not accurate. Notably, a significant link exists between strong societal development and the integration of renewable energy sources. In the less prosperous European countries, economic growth plays a central role in the development of renewable energies. Administrative barriers have a notable influence on renewable energy development, especially in the less wealthy EU countries, while grid-related obstacles are widespread in Southern and Central Europe. In countries where the share of renewable energy sources in electricity consumption is substantial, an excess of capacity in the renewable energy market significantly affects its growth

## I- Concepts of Sustainable Development:

### I-1- Definition of Sustainable Development:

Numerous definitions of sustainable development have emerged, including:

- Sustainable development is the progression and growth in all aspects of life without harming environmental resources, ensuring the continuity of resources for future generations (Al-Shanfari, Al-Abri, Al-Anani, & Al-Sayari, 2022, p. 85) (الشنفري، العبري، العانية، و الصيعرية، 2022، صفحة 85).
- The "Brundtland Report" defines sustainable development as development that seeks to meet the needs of the present generations without compromising the ability of future generations to meet their own needs (Al-Shanfari, Al-Abri, Al-Anani, & Al-Sayari, 2022, p. 85) (الشنفري، العبري، العانية، و الصيعرية، 2022، صفحة 85).
- Sustainable development involves actions aimed at investing in environmental resources to achieve development, reduce pollution, conserve and enhance natural resources instead of depleting them, while ensuring the rights of future generations to these natural resources (Khairi, 2020, p. 11) (خيري، 2020، صفحة 11).

### I-2- Meaning of Sustainability:

Sustainability is a concept that considers development options in terms of meeting current needs while preserving opportunities for future generations to meet their own needs. The term is typically applied to examine the sustainability of various future behaviors or multiple development pathways, where one is compared to another based on sustainability criteria and indicators such as those related to land, air, water, ecosystems, biological and human environments, and non-renewable resources.

Sustainability is not a state but reflects ambitious goals that require the development and use of effective measures by adopting a limited set of indicators; collecting data on appropriate spatial and temporal scales; storing and analyzing that data; engaging relevant stakeholders; and communicating and acting on sustainability results (H, Kline, & Marylun A, 2016).

### I-3- Economic Growth and Economic Development:

There is a significant overlap between the meanings of the two terms among economists, especially in the past, where it was believed that both meant increasing investment and production to achieve a higher real income. However, some view growth as a quantitative, calculable indicator, while economic development relies on qualitative aspects; it encompasses desired goals and planned strategies for advancing the economy and progressing toward improvement.

#### I-3-1- Economic Growth:

Economic growth refers to a continuous and stable increase in the average real income per capita. Two types of growth can be distinguished (Mostafa, 2015, p. 148) (مصطفى، 2015، صفحة 148):

- **Inclusive Growth:** This is achieved through the growth of a country's production as measured by real Gross Domestic Product (GDP). This means that the country is experiencing broad growth even if per capita income from this output does not rise (indicating that this type focuses on the development of GDP rather than the development of GDP per capita).

- **Intensive Growth:** This type is achieved through an increase in REAL GDP per capita. This means that the rate of increase in real GDP is higher than the rate of population growth, resulting in an improvement in individuals' living standards. The real GDP per capita is calculated using the formula:

$$\text{REAL GDP Per capita} = \frac{\text{REAL GDP}}{\text{POPULATION}}$$

### I-3-2- Economic Development:

Today, the concept of development has become broader and more comprehensive than that of economic growth. Economic development is a multidimensional process that involves changes in economic and social structures, customs, as well as accelerating economic growth, reducing income inequality, and eradicating absolute poverty (Mandour, Zaki, and Nasif, 2003, p. 383) (مندور، زكي، و ناصف، 2003، صفحة 383).

## II- Requirements for Sustainable Development:

Sustainable development is a new concept aimed at finding solutions to current and future problems. It focuses on both the quantitative and qualitative aspects of human needs. Its success requires the following (Fatiha, 2018, p. 11) (فتيحة، 2018، صفحة 11):

- Meeting the basic needs of current and future generations for water, food, education, health, and employment.
- Improving the quality of life in terms of social services, housing, culture, and respecting individual rights and freedoms, among others.

## III- Dimensions of Sustainable Development:

From the above, it is clear that sustainable development has three dimensions (Khairi, 2020, p. 12) (خيري، 2020، صفحة 12):

### III-1- Economic Dimension:

This aims to achieve a high income that allows for the reinvestment of a portion of it to facilitate replacement, renewal, maintenance, and the continued production of goods and services, thereby achieving sustainable economic growth.

### III-2- Social Dimension:

This aims for social justice, combating poverty, and providing social services to those in need, considering that humans are the essence and ultimate goal of development.

### III-3- Environmental Dimension:

This aims to preserve the ecosystem and respect environmental limits by not exceeding certain thresholds of consumption and depletion.

## IV- Sustainable Development Goals:

In this section, we will outline the 17 established sustainable development goals as indicated in the 2023 Atlas of Sustainable Development Goals from the World Bank (WorldBank, 2024).

Additionally, we will mention Algeria's status in relation to some of the indicators used to measure these goals.

1. **No Poverty:** This goal calls for the end of poverty by 2030. According to World Bank statistics, on the eve of the pandemic, there were 659 million people struggling to live on less than \$2.15 a day. In Algeria, the number of people living in extreme poverty approached 1 million in 2019.
2. **Zero Hunger:** This goal aims to eliminate hunger and achieve food security for all by enhancing access to healthy food systems. In Algeria, approximately 13.1 million people cannot afford a healthy diet, according to World Bank statistics.
3. **Good Health and Well-being:** This goal aims to ensure that everyone enjoys healthy lifestyles and well-being. The COVID-19 pandemic has inflicted severe losses on global health.
4. **Quality Education:** This goal seeks to provide high-quality education and promote lifelong learning opportunities for all. Globally, 1.6 billion children were affected by school closures during the COVID-19 pandemic, with an average closure of 199 days. As a result, students are about a year behind expected learning levels. In Algeria, school closures lasted a total of 115 days, either partially or completely.
5. **Gender Equality:** Women spend an average of 2.4 additional hours per day compared to men on unpaid care work, and in Algeria, this figure reaches 4.3 hours. As a commentary on this point, Allah, the Wise Creator, has placed numerous responsibilities on women in our glorious Islamic law compared to men, such as personal jihad, congregational prayer, and financial support for the family. Serving their husbands, managing their households, and raising their children are considered acts of worship. Some Western societies now encourage women to stay at home and dedicate themselves to caring for their children, recognizing its significant impact on their upbringing and moral development.
6. **Clean Water and Sanitation:** This goal calls for ensuring the availability of water and sanitation services for all and managing them sustainably. Despite increased access to clean water in recent decades, population growth and climate change threaten to exacerbate water scarcity in many countries.
7. **Affordable and Clean Energy:** This goal aims to ensure universal access to reliable and sustainable energy services at an affordable cost. On average, 91% of the world's population had access to electricity in 2021, and this figure reached 100% in Algeria.
8. **Decent Work and Economic Growth:** This goal seeks to promote inclusive and sustainable economic growth, full employment, and decent work for all. The COVID-19 pandemic caused the largest global recession in decades, resulting in a 3.1% decline in global GDP in 2020. In Algeria, GDP declined by 5.1% during the same year.
9. **Industry, Innovation, and Infrastructure (Sustainable Transport for a Livable Future):** This goal calls for resilient infrastructure, promoting inclusive sustainable industrialization, and encouraging global innovation. However, transportation is an increasingly significant contributor to climate change, with 2020 statistics indicating that average CO2 emissions from land transport reached 706 kg per person. In Algeria, this figure was 872 kg per person in the same year.

10. **Reduced Inequalities:** This goal aims to create a more equitable world. Inequality rates had been declining for decades before the COVID-19 pandemic. The Gini index\* fell from about 0.7 in 1990 to 0.62 in 2019. In Algeria, this index stood at 0.28.
11. **Sustainable Cities and Communities:** This goal aims to make cities and human settlements inclusive, safe, resilient, and sustainable. Today, cities face a crisis of increasing waste, particularly due to the use of plastic materials, amidst growing populations and rising income levels. In 2020, the average waste produced per person was about 376 kilograms annually, while in Algeria, it was 305 kg.
12. **Responsible Consumption and Production, Achieving Sustainable Growth:** This goal calls for sustainable production and consumption of goods and services. Countries have demonstrated that it is possible to achieve economic growth without depleting natural resources.
13. **Climate Action:** This goal urges urgent action to combat climate change and its impacts.
14. **Life Below Water (Ending Overfishing is Urgent for Protecting Our Oceans):** This goal calls for the conservation and sustainable use of oceans and avoiding overfishing, which can jeopardize the livelihoods of millions of people. In 2020, the global average catch was 11.6 kilograms of fish per person. However, in Algeria, the average catch in 2021 was only 1.8 kg per person, according to published World Bank statistics.
15. **Life on Land:** This goal focuses on protecting life on land by combating deforestation, which accelerates climate change and threatens biodiversity.
16. **Peace, Justice, and Strong Institutions:** This goal emphasizes combating violence in various communities.
17. **Partnerships for the Goals:** This goal calls for revitalizing the global partnership for sustainable development, which relies on expanding and sustaining resource mobilization efforts.

## V- Barriers to Sustainable Development:

At the World Summit on Sustainable Development held in South Africa in 2002, the Arab Declaration highlighted the main obstacles to sustainable development facing Arab countries, which still persist today. These include (Mukhlaf, year not specified, p. 381) (مخلف، سنة غير مذكورة، صفحة 381):

- The issue of poverty in most Arab countries, which has worsened with the increase in population, unemployment, and poor exploitation of natural resources.
- Migration from rural areas to cities and the emergence of informal settlements, negatively impacting urban services and leading to waste accumulation and air pollution.
- Climate change and decreasing annual rainfall rates, along with rising temperatures and the exacerbation of desertification and drought.
- Poor exploitation of natural resources, coupled with a lack of utilization of renewable energy sources.
- Insufficient resources allocated to some research and scientific institutions for development, resulting in a failure to keep up with scientific and technological advancements in developed countries.

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\* The Gini index is a measure used to quantify inequality in the distribution of income or wealth within a specific community. It is used in various studies and analyses to assess the level of equality and fairness in distribution. A Gini index value of zero indicates no inequality in distribution, while a value of one signifies very high inequality.

- The lack of security and political stability in most Arab countries has been a significant barrier to implementing development programs.

Algeria, like other countries, strives to achieve sustainable development, but it faces several barriers and challenges that it is trying to overcome. Among the main ones are (Hajam and Tari, 2019, p. 137) (حجام و طري، 2019، صفحة 137) :

- **Environmental Pollution:** This issue is exacerbated by the increasing population and the rising number of cars and vehicles, which contribute to air pollution, in addition to the pollution caused by medical waste that is burned in an improper and unhealthy manner.
- **Rising Unemployment and Declining Purchasing Power:** This is due to the high inflation rates affecting citizens.
- **Weak Industrial Base and Lack of a Sound Strategy:**

It is also important to note that Algeria is among the countries that primarily rely on fossil fuel exports, which are less costly compared to renewable energy sources. This reliance has hindered progress in the utilization of renewable energies.

#### VI- Definition of Renewable Energy:

Definitions of renewable energy appear in various forms in multiple references, including:

- Renewable energy refers to energy derived from sources that nature replenishes over time; it is perpetual and inexhaustible, such as sunlight, wind, rain, tides, waves, and geothermal heat (H, Kline, & Marylun A, 2016).
- The U.S. Energy Information Administration defines renewable energy as energy resources that renew their flow in nature and are inexhaustible, though they may be limited. Renewable energy sources include biomass, water, solar energy, geothermal energy, wind, wave movement, and tides (Al-Rouh, 2013, p. 1070) (الرؤوف، 2013، صفحة 1070) .

#### VII- Increasing Interest in Renewable Energies Currently:

There has been a growing interest in renewable energy and its utilization due to the rising population and the increasing demand for energy, while also considering the need to avoid depleting natural resources and ensuring the rights of future generations to these resources.

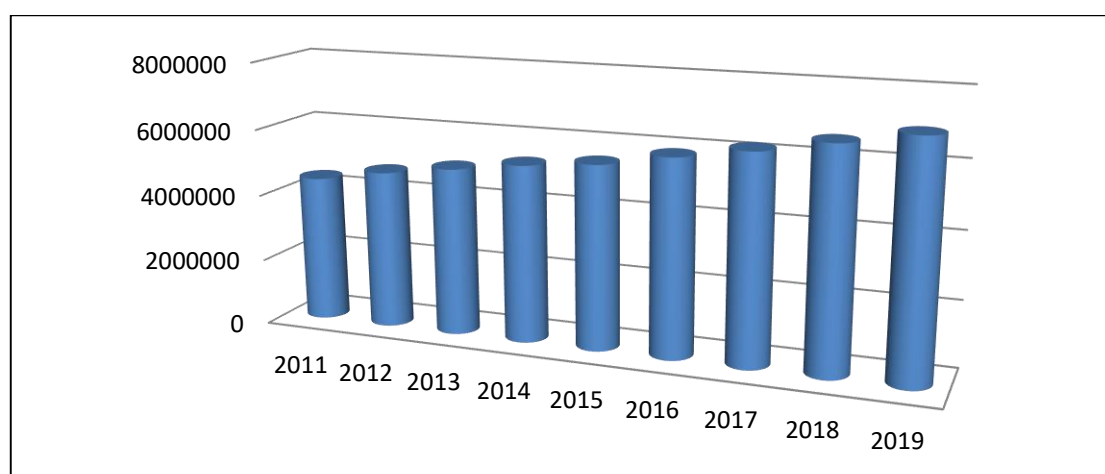
**Table n° 1: Development of Total Renewable Energy Production in the World from 2011 to 2019 (Kilowatt-hours)**

| Years                              | 2011    | 2012    | 2013    | 2014    | 2015    | 2016    | 2017    | 2018    | 2019    |
|------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Global Renewable Energy Production | 4401683 | 4753448 | 5035767 | 5319299 | 5516427 | 5893848 | 6222600 | 6602443 | 6963450 |

Source: Alaa Wajih Mahdi, Nada Suhail Satam, "The Role of Renewable Energies in Achieving Sustainable Development: An Analytical Study," *Kirkuk University Journal for Administrative and Economic Sciences*, Special Issue, Year Not Specified, p. 95.

علاء وجيه مهدي، ندى سهيل سطوم دور الطاقات المتجددة في تحقيق التنمية المستدامة دراسة تحليلية ; مجلة جامعة كركوك للعلوم الإدارية والاقتصادية، عدد خاص، سنة غير مذكورة، ص 95.

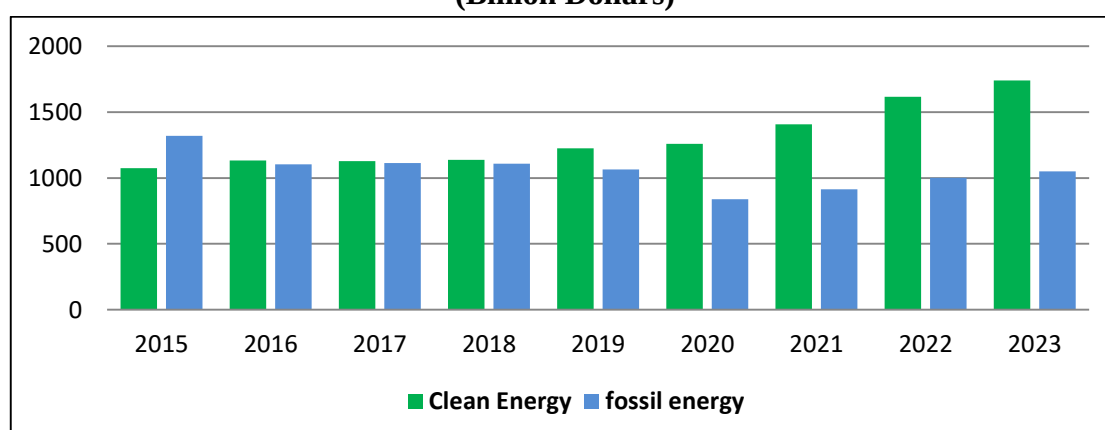
Total global renewable energy production, according to the above table (01), has seen a significant increase of approximately 58.2% between 2011 and 2019, which is clearly illustrated in the following figure.

**Figure n° 1: Development of Total Global Renewable Energy Production (Kilowatt-hours)**

Source: Prepared by the researchers based on Table n°1.

Regarding the share of electricity production from renewable energy sources globally, a notable increase was recorded during the period from 1970 to 2015, rising from less than 1% to approximately 7% in 2015, according to statistics published on the World Bank's website. This confirms a gradual trend towards reliance on renewable energies.

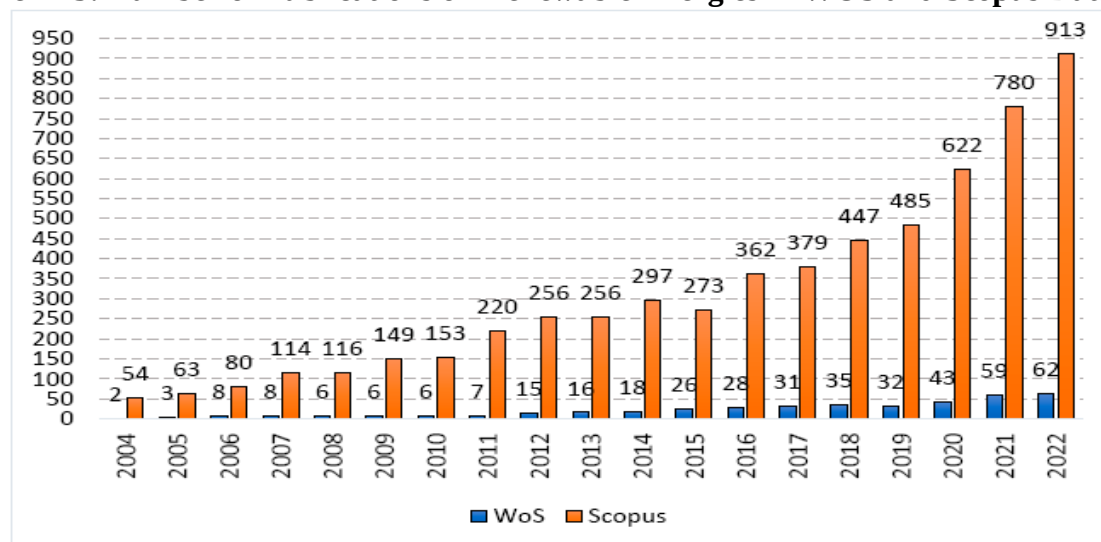
Additionally, investments in green technology have significantly surpassed spending on fossil fuels since 2019. According to the International Energy Agency's World Energy Investment Report 2023, annual investments in clean energy are expected to rise by 24% between 2021 and 2023, driven by renewable energy and electric vehicles, compared to a 15% increase in fossil fuel investments during the same period. However, over 90% of this increase comes from advanced economies and China, posing a serious risk of new divides in global energy if the transition to clean energy does not accelerate in other regions.

**Figure n° 2: Development of Global Investment in Clean Energy and fossil energy, 2015-2023 (Billion Dollars)**

Source: International Energy Agency, In the link, <https://www.iea.org/data-and-statistics/charts/global-energy-investment-in-clean-energy-and-in-fossil-fuels-2015-2023> accessed on 13/07/2024.

Researchers have also given significant attention to the topic of renewable energies due to their importance and current necessity, resulting in a notable increase in the number of publications on this subject in well-known global databases such as WOS and Scopus, as illustrated in the following figure.

**Figure n° 3: Number of Publications on Renewable Energies in WOS and Scopus Databases**



Source : Bo'zena Gajdzik , Radoslaw Wolniak et autres, Barriers to Renewable Energy Source (RES) Installations as Determinants of Energy Consumption in EU Countries, <https://www.mdpi.com/journal/energies>, Energies 2023, 16, 7364. <https://doi.org/10.3390/en16217364>, p4

### VIII- The Role of Renewable Energy in Promoting Sustainable Development Goals:

Renewable energies play a significant role in enhancing sustainable development goals through the following (Nyebuchi, Bakar, & Onyebuchi, 2024, p. 124):

#### VIII-1- Access to Energy and Poverty Reduction:

- Renewable energy can help provide universal access to modern, reliable, and affordable energy services, which is one of the sustainable development goals.
- Renewable energy can also help reduce poverty by enabling income-generating activities, improving education and health outcomes, and promoting social inclusion.
- Renewable energy can particularly benefit rural and remote communities by providing decentralized and off-grid solutions, such as home solar systems, microgrids, and biogas plants.

#### VIII-2- Mitigation and Adaptation to Climate Change:

- Renewable energy can contribute to mitigating climate change by reducing greenhouse gas emissions from the energy sector.
- Renewable energy can also help adapt to the impacts of climate change, such as extreme weather events, water scarcity, and food insecurity, by enhancing resilience and reducing vulnerabilities in energy systems and communities.
- Renewable energy can support the implementation of the Paris Agreement, which aims to limit global temperature rise to below 2 degrees Celsius, by providing low-carbon pathways for development and transition.

### VIII-3- Economic Development and Job Creation:

- Renewable energy can contribute to enhancing economic development, reducing reliance on energy imports, and diversifying energy sources.
- Renewable energy can also create job opportunities by stimulating innovation, entrepreneurship, and investment in the renewable energy sector.
- Renewable energy can promote inclusive and sustainable manufacturing by enhancing the productivity, competitiveness, and efficiency of industries, especially in developing countries.

Employment in the renewable energy sector has continued to rise globally since the International Renewable Energy Agency (IRENA) began conducting its annual review. The first edition of the review estimated that there were 7.3 million jobs in this field in 2012. In contrast, the tenth edition of the IRENA report series titled "Renewable Energy and Jobs: Annual Review 2023," prepared in collaboration with the International Labour Organization (ILO), estimates that there are at least 13.7 million jobs in renewable energy globally.

This significant increase in employment reflects the ongoing growth of the renewable energy sector and the advancement of its technologies worldwide over the past few years. These jobs are distributed by type of renewable energy\* as follows:

- **4.9 million:** Jobs in photovoltaic (PV) solar energy in 2022, making it the fastest-growing sector, representing over one-third of the total workforce in renewable energy. Women occupy 40% of these jobs.
- **1.4 million:** Jobs in wind energy in 2022. China and Europe lead in this field, although there is diversity in the regions producing components.
- **2.5 million:** Direct jobs in hydropower in 2022, an increase of 2.3% from 2021. Operations and maintenance account for nearly two-thirds of direct jobs, while around 30% are related to construction and installation, and about 6% are in component manufacturing.
- **2.5 million:** Jobs in biofuels in 2022, most of which are in the agricultural supply chain.

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\* **Photovoltaic Solar Energy:** Generating electricity using photovoltaic solar panels that convert direct sunlight into electrical energy.

**Wind Energy:** Using wind turbines to generate electricity from wind power.

**Biofuels:** Liquid fuels produced from biological sources such as plants, agricultural residues, and organic waste.

**Hydropower:** Generating electricity using the force of flowing water in rivers, dams, and lakes.

**Solid Biomass:** Includes wood, agricultural residues, and other waste from solid biological sources. This renewable energy source is one of the most commonly used forms of biomass worldwide.

**Solar Heating and Cooling:** Utilizing solar energy for heating and cooling purposes in residential and commercial buildings.

**Biogas:** A biofuel produced from the fermentation of organic materials such as agricultural and animal waste, as well as municipal waste.

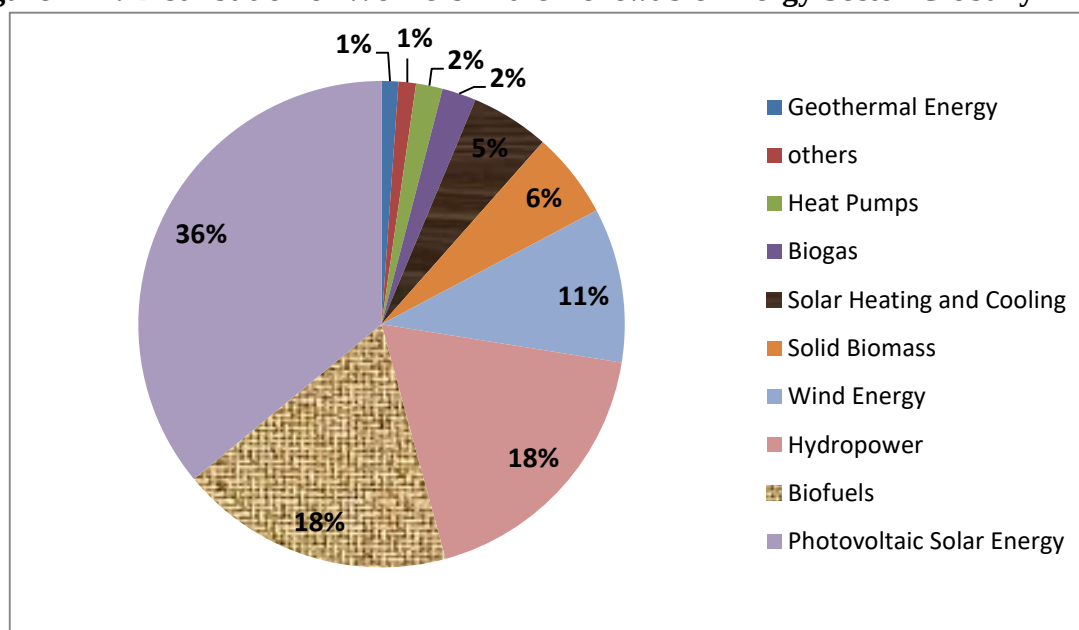
**Heat Pumps:** Systems that use thermal energy from sources like the ground, air, and water to generate heating or cooling.

**Geothermal Energy:** The thermal energy stored in the Earth, which can be used for electricity generation or for heating and cooling purposes.

**Others:** Includes other renewable energy sources such as tidal, wave, and ocean energy, as well as the use of municipal and industrial waste as fuel for renewable energy.

**Concentrated Solar Power (CSP):** A technology that uses mirrors to focus sunlight to generate steam and produce electricity.

Figure n° 4: Distribution of Workers in the Renewable Energy Sector Globally in 2022

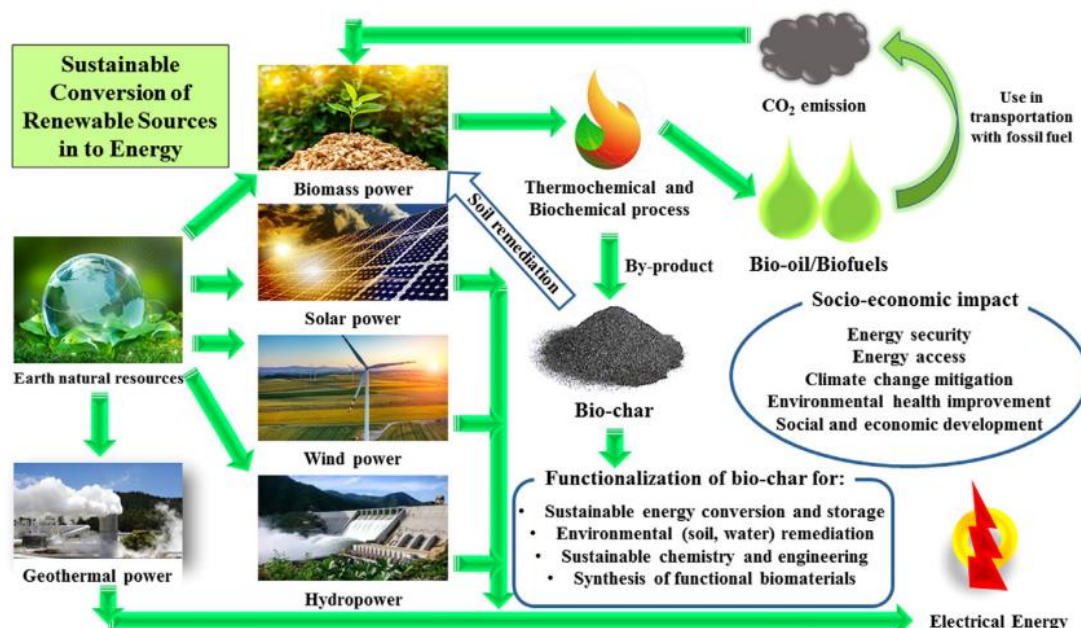


Source: Prepared by the researcher based on data available at the following link, <https://www.irena.org/Energy-Transition/Socio-economic-impact/Energy-and-Jobs> ; accessed on 07/07/2024

#### VIII-4- Environmental Sustainability and Health Benefits:

- Renewable energy can contribute to ensuring environmental sustainability by reducing air pollution, land degradation, water consumption, and biodiversity loss caused by fossil fuels.
- It can also help improve health and well-being by preventing premature deaths, diseases, and injuries caused by indoor and outdoor air pollution, which is estimated to cause around 7 million deaths annually.
- Renewable energy can contribute to the sustainable conservation and use of water resources by reducing water withdrawals and consumption for energy production, which accounts for approximately 10% of the global total.

Figure n° 5: renewable and sustainable clean energy conversions and applications



Source: K.K. Jaiswal, C.R. Chowdhury, D. Yadav et al, Renewable and sustainable clean energy development and impact on social, economic, and environmental health, Energy Nexus 7 (2022), p3

## IX- The Harmonious Relationship Between Renewable Energies and Achieving Sustainable Development:

The relationship between renewable energies and the three dimensions of sustainable development—social, environmental, and economic—can be summarized in the following points (Sharif, 2018, p. 196) (شريف، 2018، صفحة 196) :

- The relationship between renewable energies and human development is reflected in the strong correlation between average per capita energy consumption and the Human Development Index. Energy sources have a significant impact on all aspects of human life. For example, electricity is used for lighting, refrigeration, air conditioning, and essential devices in hospitals and educational institutions, among others.
- Renewable energies contribute to changing unsustainable patterns of production and consumption. With the increasing global population, it is essential to promote the efficiency and sustainability of energy resources and to seek out inexhaustible energy sources.
- Renewable energy connects economic growth with social equity. Access to energy is a prerequisite for achieving development, which aims to eliminate poverty, provide food and clean water, improve public health, enhance education, and create economic opportunities. Therefore, there can be no sustainable economic development without sustainable energy.

#### **X- Barriers to the Use of Renewable Energy:**

A common question arises: If renewable energies are so important, why hasn't there been a complete shift away from fossil fuels? In reality, there are several obstacles and challenges to the effective use and exploitation of renewable energies, summarized in the following points (Sattam and Mahdi, year not mentioned, p. 97) (سطوم و مهدي، سنة غير مذكورة، صفحة 97) :

1. **High Costs:** The costs of producing electricity from renewable energy sources are high due to the expensive equipment and technology compared to fossil fuel electricity production. Additionally, skilled technical personnel are needed, which many countries lack.
2. **Irregular Availability:** Renewable sources are not consistently available. For example, there is variability in sunlight intensity throughout the day and differences in wind strength. Therefore, developing renewable energy sources requires advancements in energy storage technology.
3. **Negative Impact on Fossil Fuel-Producing Countries:** The use of renewable energy can adversely affect countries that produce finite resources like oil and natural gas.
4. **Need for Advanced Technology:** Generating energy from renewable sources requires sophisticated technological equipment.
5. **Low Prices of Traditional Energy:** The prices of conventional energy are kept low due to government subsidies.
6. **Technical Challenges:** There are technical obstacles to generating electricity from wind and solar energy, including noise from wind turbines and the visual impact of reflected light from mirrors used in solar energy generation. As a result, these facilities need to be located away from populated areas.

**Conclusion:**

Sustainable development, which considers the three dimensions—social, economic, and environmental—has become a priority for many countries worldwide. This shift comes after last century's focus on economic aspects, such as increasing production rates and raising annual per capita income, which led to environmental degradation and climate changes due to pollution and the greenhouse effect.

Today, all aspects of life are linked to access to essential energy for human well-being and fulfilling needs. There can be no sustainable development without sustainable energy. Therefore, reliance on fossil fuels threatens the comfort of current generations, especially future ones. It is crucial to seek and move towards the exploitation and development of inexhaustible and environmentally friendly renewable energies.

**Recommendations:**

The study presents the following recommendations to promote renewable energy and achieve sustainable development goals:

**A. Strengthening Policies and Regulatory Frameworks:**

One recommendation for enhancing renewable energy and achieving sustainable development goals is to strengthen policies and regulatory frameworks that support the development and deployment of renewable energy technologies, such as solar, wind, hydropower, and bioenergy. This can be achieved by:

- Setting ambitious and clear targets and indicators for the contribution of renewable energy to the national and global energy mix, in accordance with the 2030 Sustainable Development Plan;
- Providing stable policies and incentives for renewable energy investments, such as tax exemptions, subsidies, and grants;
- Streamlining and simplifying legal and administrative procedures for renewable energy projects;
- Improving coordination and cooperation among ministries, departments, and agencies involved in renewable energy development, as well as with regional and international partners.

**B. Improving Financing Mechanisms and Investment Incentives:**

The study also recommends enhancing financing mechanisms and investment incentives that mobilize and utilize public and private capital for renewable energy projects. This can be achieved by:

- Increasing public funding and support for renewable energy projects through budget allocations, development aid, and climate financing.
- Attracting and facilitating private sector participation and investment in renewable energy projects through public-private partnerships.

- Improving access to financing and its availability for renewable energy projects, especially for small and medium-sized enterprises and rural communities.

### **C. Investing in Research and Development:**

Another essential recommendation for promoting renewable energy and achieving sustainable development goals is to invest in research and development to improve the performance and cost of renewable energy technologies, as well as to integrate and adapt them to local contexts. This will require the following actions:

- Increasing public and private spending on research and development in the field of renewable energy, and fostering innovation and entrepreneurship in the renewable energy sector.
- Addressing technical and infrastructure challenges related to renewable energy, such as intermittency, energy storage, grid connectivity, and the associated environmental and social impacts.

### **D. Enhancing Capacity Building and Public Awareness:**

The study also recommends strengthening capacity building and public awareness to improve the skills, knowledge, and attitudes of relevant stakeholders and the general public towards renewable energy. This can be achieved through the following steps:

- Providing training and education for the workforce in the renewable energy sector, such as engineers, technicians, managers, and regulators, as well as creating jobs and opportunities in the renewable energy field.
- Raising awareness and understanding of the benefits and challenges of renewable energy, as well as the opportunities and incentives for adopting renewable energy among consumers, investors, and policymakers.
- Encouraging the participation and engagement of local communities and civil society organizations in the planning and implementation of renewable energy projects.

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