

The contribution of renewable energies to achieving the Sustainable Development Goals (SDGs)

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Received : 02.06.2025

Accepted: 26.10.2025

Published : 01.01.2026

Abstract: The aim of this study is to analyze the contribution of renewable energies to the achievement of the Sustainable Development Goals (SDGs) between 2013 and 2023, focusing on SDGs 7, 8, 9, 10 and 13, through indicators of the latter. The analysis period extends from 2013 to 2023, mobilizing a literature review and quantitative data from international bodies such as IRENA, IEA, the World Bank, UNCTAD and the UN. The results showed that policies supporting renewable energies had a positive impact on indicators linked to these SDGs: improved access to electricity, increased employment in the clean energy sector, progress in energy innovation, reduced energy disparities between rural and urban areas, and a relative drop in CO₂ emissions. Thus, the expansion of renewable energies is asserting itself as a strategic lever in favor of sustainable development on a global scale.

Keywords: Renewable energies, Sustainable development, Energy transition, Sustainability indicators.

JEL Classification Codes: Q53, O1.

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1. Introduction

Sustainable development is a fundamental principle of global policies, aimed at promoting inclusive economic growth, preserving the environment and ensuring a better quality of life for future generations.

As part of the Sustainable Development Goals (SDGs) defined by the UN in 2015, access to clean and affordable energy, the reduction of greenhouse gas (GHG) emissions, as well as the creation of sustainable jobs are at the heart of the global energy transition (ONU, 2021).

Renewable energies play a central role in achieving these objectives. They make it possible to reduce dependence on fossil fuels and promote green economic growth, while helping to mitigate climate change and reduce social and economic inequalities.

Renewable energies, as clean and sustainable sources of energy, are essential to achieving several of these goals, including SDG 7, which aims to guarantee access to energy for all ;SDG 8, which focuses on inclusive economic growth and decent work; SDG 9, which supports sustainable industry, innovation and infrastructure ;SDG 10, which seeks to reduce social and economic inequalities ; and SDG 13, dedicated to combating climate change.

In this sense, this study aims to examine the role of renewable energies in achieving the Sustainable Development Goals (SDGs), by analyzing the specific contributions to the main energy-related SDGs to answer the following question: **How do renewable energies contribute to achieving sustainable development, particularly in economic terms?**

From this problematic, several secondary questions emerge:

- What are the main SDGs on which renewable energies can act?
- In what way do renewable energies contribute to achieving the targeted SDGs?
- What are the results of the involvement of renewable energies in terms of achieving the 2030 SDGs?

To answer this question, and based on various theoretical studies, we put forward two hypotheses:

- Renewable energy strategies are mainly geared towards the SDGs where their contribution is most significant.
- The development of renewable energies promotes the achievement of the Sustainable Development Goals (SDGs).

The importance of this study lies in its ability to highlight the strategic role of renewable energy in achieving the Sustainable Development Goals (SDGs). In a global context marked by climate urgency, energy inequality, and inclusive growth challenges, understanding the links between energy policy and sustainable development is essential for guiding effective and lasting action.

In this study, we adopt a quali-quantitative approach aimed at analyzing the role of renewable energies in achieving the Sustainable Development Goals (SDGs), in particular SDGs 7, 8, 9, 10 and 13. The methodology is based on a dual approach: an in-depth literature review on the interactions between renewable energies and sustainable development, and an in-depth analysis mobilizing quantitative data over the period from 2013 to 2023. This analysis is based on a set of key indicators specific to the various SDGs studied.

The data used come from recognized sources such as the World Bank, UNCTAD, the UN, IRENA, IEA, the Global Carbon Atlas and WIPO. The selected indicators cover several dimensions: access to electricity and the share of renewable energies for SDG 7, jobs created in

the sector for SDG 8, energy innovation and logistics performance indices for SDG 9, inequalities in access to electricity between urban and rural areas for SDG 10, and global CO₂ emissions for SDG13.

To this end, we begin by presenting various theoretical and empirical studies dealing with the involvement of renewable energies in achieving the SDGs. Then, using data collected between 2013 and 2023, we analyze the involvement of renewable energies, and the progress made towards achieving the SDGs.

Finally, a discussion on the impact of renewable energies on the representative indicators of the SDGs is conducted in the light of various works.

2. Literature review

Several studies have highlighted the central role of renewable energies in transforming the world's energy systems, thereby contributing to a sustainable future.

Firstly, the International Energy Agency (IEA, 2020) states that renewable energies play a key role in achieving SDG 7, by promoting universal access to energy. The report stresses that increased investment in renewable energies can solve the challenges of energy access in the poorest regions.

Secondly, other works, such as those by (Kuzemko, Lockwood, Mitchell, & Hoggett, 2020), argue that the transition to renewable energies is essential to achieving global sustainability goals. These authors emphasize the importance of public policy and international cooperation in promoting the adoption of renewables, particularly in developing countries.

In the same vein, (Bazilian, et al., 2019) also argue that clean energy is not only a key driver for SDG 7 but interacts with other sustainable development goals. Their study shows that renewable energies contribute to reducing inequalities (SDG 10), foster technological innovation (SDG 9), and are essential for mitigating the effects of climate change (SDG 13).

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As asserted by (Fragkos, Kouvaritakis, Siskos, & Capros, 2022), investments in renewable energies generate 2.7 times more jobs per dollar invested than those in fossil fuels.

In another sense, according to (Kumar & Jain, 2022), the expansion of renewable energies has positive implications for the reduction of CO₂ emissions and directly supports MDG 13.

Others such as (Miremadi, Saboohi, & Arasti, 2019) confirm that technological innovations in renewable energy significantly reduce emissions while improving industrial efficiency, both contributing to the achievement of (SDG 9).

Also, (Sovacool, Turnheim, Hook, Brock, & Martiskainen, 2021) specify that technological innovation is a pillar of sustainable energy ecosystems, enabling the effective integration of renewables into industrial systems.

A report by (UNIDO, 2022) shows that solar mini grids enable energy inclusion of rural populations and reduce inequalities in access to basic services. Similarly, (Aklin, Bayer, Harish, & Urpelainen, 2017) show that solar electrification improves well-being and school enrolment in disadvantaged regions, contributing to the achievement of SDG10.

(UNDP, annual report 2023, 2024) Notes that countries that have increased the share of renewable energies in their energy mix have seen a significant drop in their carbon footprint. According to (Fankhauser & Jotzo, 2022), increasing the share of renewable energies by 10% will reduce GHG emissions by 4 to 5% in industrialized countries, thereby contributing to the achievement of MDG13.

In addition, several international institutions have highlighted the structuring effects of renewable energies on sustainable development.

The World Bank study (World Bank, 2021) highlights the role of investment in renewable energies in strengthening universal access to energy and promoting energy efficiency. These investments are also a lever for supporting inclusive growth, particularly in low-income countries.

For its part, the United Nations Conference on Trade and Development (UNCTAD, 2022) emphasizes the link between green investment and economic resilience, highlighting the importance of sustainable energy policies in the development trajectories of emerging countries.

Accordingly, the main SDGs targeted by renewable energies are: contributing to universal access to energy (SDG 7), increasing sustainable and inclusive economic growth (SDG 8), stimulating sustainable and innovative industrialization (SDG 9), reducing inequalities in access to energy (SDG 10), and combating climate change by reducing CO₂ emissions (SDG 13).

3. Results and discussion

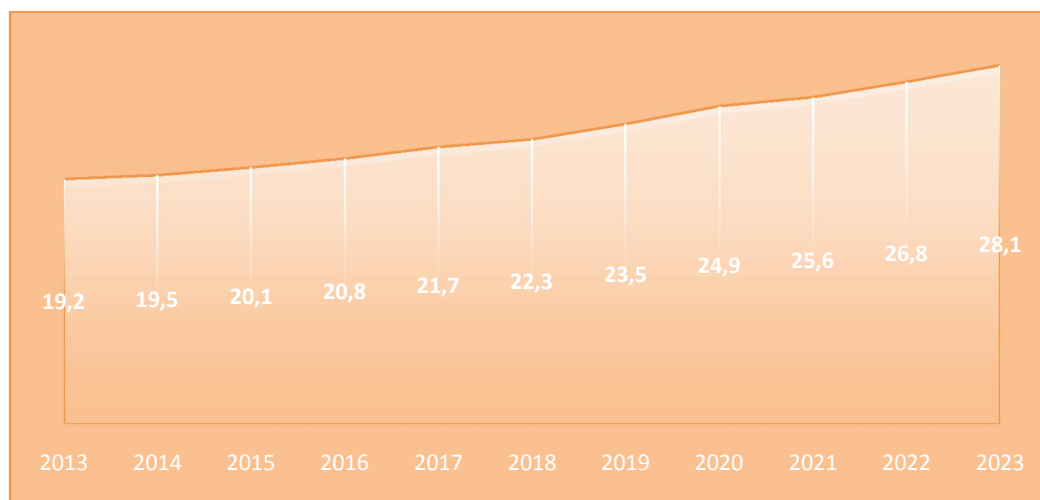
In the following we present the results and discussions obtained for each goal separately:

3.1. SDG 7 - Access to clean and affordable energy

Universal access to energy is a fundamental pillar of sustainable development. SDG 7 aims to ensure affordable, reliable, sustainable and modern energy for all.

The graphic illustration below will present data on the evolution of the share of renewable energies in global electricity production (%), as well as the global rate of access to electricity (%), in relation to the progress made towards universal access to clean, affordable energy.

Figure 01. Share of renewable energies in global electricity production (2013-2024)



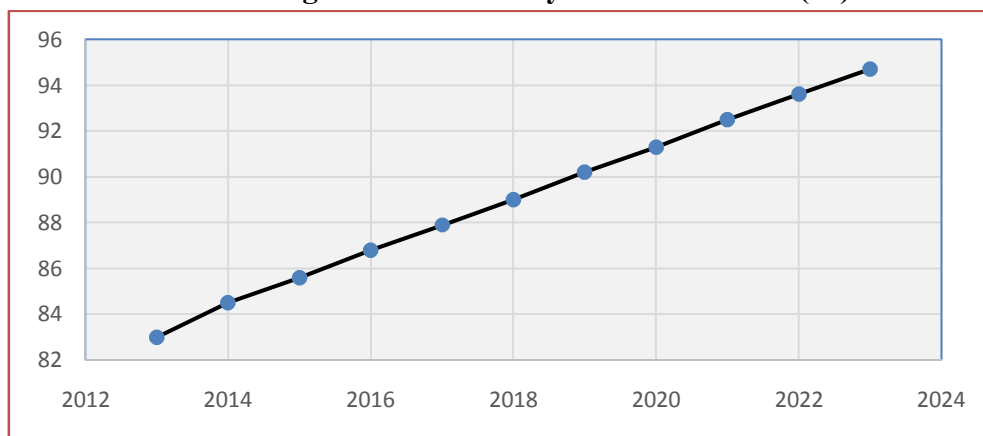
Source: IRENA (2023).

The share of renewable energies in global electricity production has grown significantly over the past decade. In 2013, renewable energies accounted for around 19.2% of global electricity production.

This proportion has risen steadily to reach around 28.1% in 2023, marking an important milestone in the global energy transition.

Between 2013 and 2023, the share of renewables in the global mix rose from 18.5% to 29.3% (IRENA, 2024) enabling a significant improvement in access to electricity in low-income countries. This development is consistent with the analyses of (Kumar & Jain, 2022) which identify clean energy as the foundation of sustainable development.

Figure 02. Electricity rates worldwide (%)



Source: IEA (2023).

Over the period 2013-2023, the global rate of access to electricity rose from 83% to 94.7%, marking significant progress towards the goal of universal access to affordable, reliable and modern energy by 2030, as stipulated in MDG 7. This growth is particularly remarkable in historically under-equipped regions, such as sub-Saharan Africa and South Asia as highlighted (Kuzemko, Lockwood, Mitchell, & Hoggett, 2020).

This progress is partly attributable to the expansion of decentralized renewable energies, such as solar mini-grids, which have made it possible to electrify isolated rural areas, as mentioned in studies by (IRENA, 2024) and (UNDP, annual Report 2023, 2024).

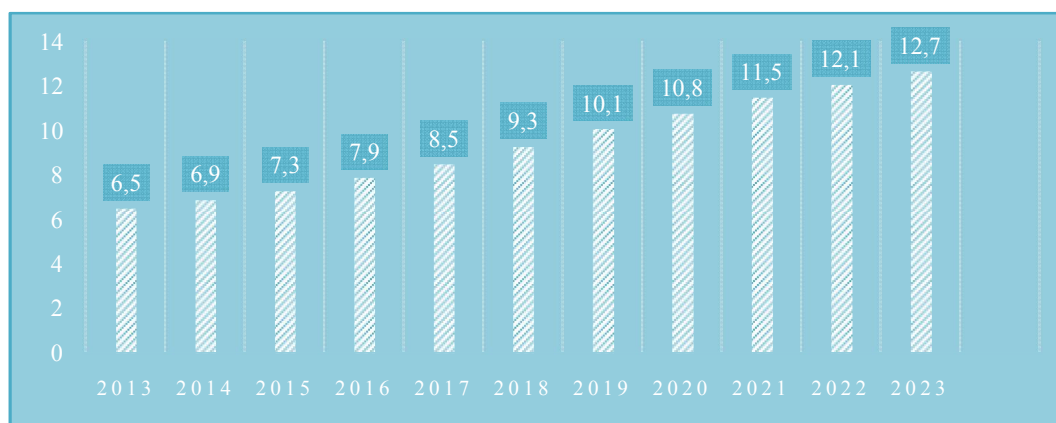
These infrastructures act as a lever for energy inclusion, reducing inequalities in access between urban and rural areas, which also establishes a cross-link with MDG 10.

Growing investment by international donors, notably the World Bank and development agencies such as UNCTAD, has contributed to this dynamic, with developing countries the priority target.

3.2. SDG 8 - Decent work and economic growth

The green energy transition is part of a dynamic transformation of labor markets on a global scale. SDG 8 highlights the need to promote sustained, inclusive and sustainable economic growth, accompanied by the creation of decent jobs.

The graphic illustration that follows will present data on global jobs in the renewable energy sector (in millions), in connection with this sector's growing role in promoting decent work and inclusive economic growth.

Figure 03. Renewable energy jobs worldwide (in millions)

Source: IRENA (2023).

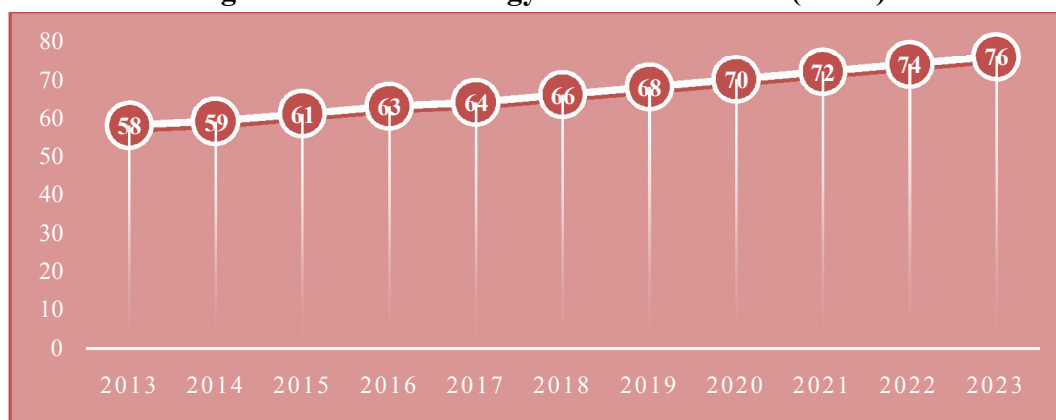
Between 2013 and 2023, the number of jobs worldwide in the renewable energies sector rose from 6.5 to 12.7 million, more than doubling in a decade. This growth testifies to the multiplier effect of investment in green industries on the labor market, particularly in the fields of solar photovoltaics, wind power, bioenergy and hydroelectricity, which is in line with (Fragkos, Kouvaritakis, Siskos, & Capros, 2022).

In other words, (IRENA, 2024) shows that solar photovoltaics alone account for over a third of jobs, particularly in China, the USA, India and Brazil. This dynamic demonstrates that energy transition policies have a strong potential to create sustainable, skilled jobs, thus contributing directly to the achievement of SDG 8.

3.3. SDG 9 - Industry, innovation and infrastructure

Technological innovation is an essential lever for strengthening sustainable energy infrastructures and accelerating the transition to renewable energies. The Global Energy Innovation Index measures the global effort in research, development and dissemination of clean technologies.

The graphic illustration that follows presents data on the global energy innovation index (score from 0 to 100) and the development of industrial infrastructure in the context of the energy transition is as follows:

Figure 04. Global Energy Innovation Index (0-100)

Source: WIPO (2023).

Between 2013 and 2023, the Global Energy Innovation Index rose steadily from 58 to 76 points out of 100, reflecting an intensification of global efforts in research, technology development and the adoption of clean energy solutions.

The World Economic Forum report (World Economic Forum, 2024) points out that this growth is due to several factors, including increased public and private spending on green R&D, the rise of clean energy patents, and the development of smart infrastructure.

R&D investment and increased patenting in green technologies (WIPO, 2023) reflect a profound industrial transformation. These results support the findings of (Sovacool, Turnheim, Hook, Brock, & Martiskainen, 2021) on the structuring role of green innovation.

This significant improvement in the index also reflects the growing role of public-private partnerships, technology clusters and green industrial policies in stimulating innovation. In this sense, strengthening energy innovation contributes to the achievement of SDG 9, by catalyzing industrial modernization, economic competitiveness and technological resilience.

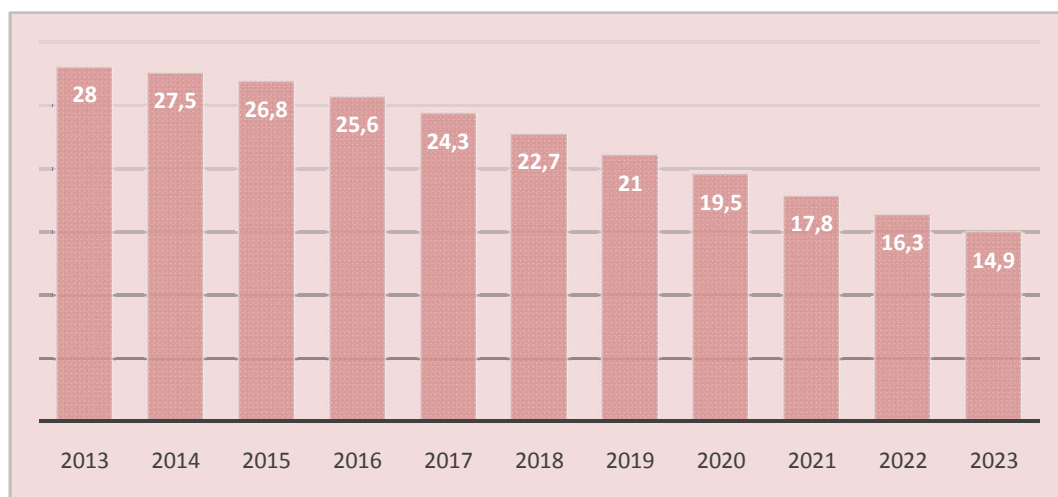
Alongside energy innovation, the development of industrial infrastructure remains a central pillar of SDG 9. The value added of manufacturing as a percentage of GDP quantifies the growing role of industry in the global economy. From 2013 to 2023, several developing countries saw this share increase, in line with industrial policies supporting the integration of green technologies. This dynamic reflects a growing synergy between sustainable industrialization and energy transition (UNIDO, 2022).

3.4. SDG 10 - Reduce inequalities

SDG 10 aims to reduce inequalities in all their forms, including those linked to access to basic services such as electricity. Access to energy is often marked by an imbalance between urban areas, which are generally well served, and rural areas, where energy infrastructures are less developed.

The following graph highlights the evolution of the gap in access to electricity between rural and urban areas, illustrating the contribution of renewable energies to reducing territorial disparities in access to basic services.

Figure 05. Gap in access to electricity between rural and urban areas (% points)



Source: World Bank (2023).

Over the period 2013-2023, the gap in access to electricity between rural and urban areas in developing countries fell from 28% to 14.9%, reflecting a significant reduction in territorial inequalities in access to basic services.

This progress is largely attributed to the spread of decentralized renewable energies, notably solar mini-grids and off-grid solutions, which have made it possible to cover remote rural areas, these results confirm the analyses proposed by (UNIDO, 2022) et (Aklin, Bayer, Harish, & Urpelainen, 2017) confirming that the targeted expansion of electricity infrastructure in rural areas has therefore been a major lever in the fight against energy inequalities.

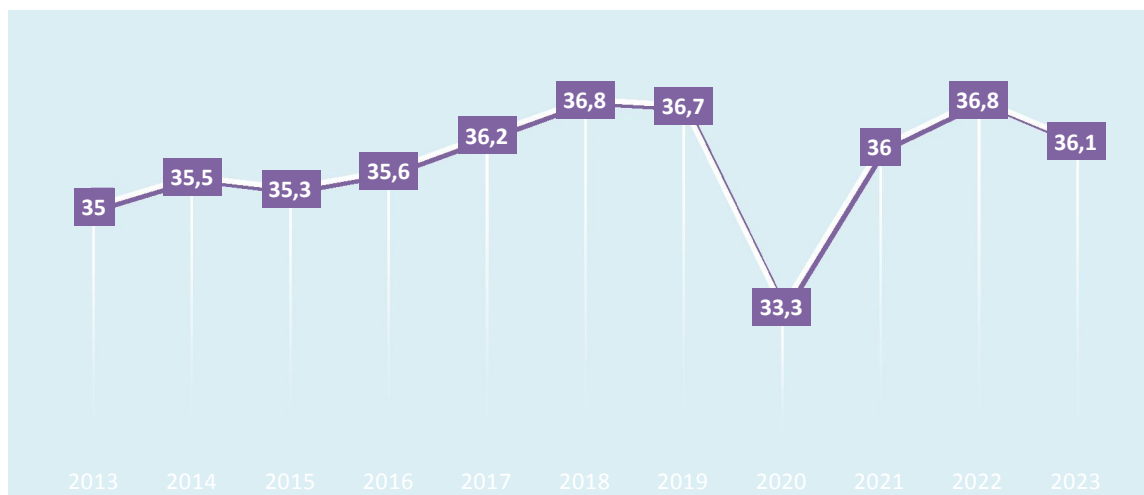
According to (IEA, 2023) these solutions have been particularly effective in sub-Saharan Africa and South Asia, where governments have benefited from international funding for inclusive electrification. This illustrates how sustainable energy policies can reduce social and geographic disparities, thus contributing to the achievement of SDG 10.

3.5. SDG 13 – Climate Action

Climate action is one of the central pillars of sustainable development policies. SDG 13 emphasizes the urgent need for action to mitigate environmental impacts, particularly through the reduction of greenhouse gas (GHG) emissions.

The graph below illustrates the evolution of global CO₂ emissions (in gigatonnes), highlighting the impact of energy transition strategies on the global decarbonization trend.

Figure 6: Global CO₂ emissions (in gigatonnes)



Source: IEA (2024).

From 2013 to 2019, global CO₂ emissions generally increased, peaking at 36.8 Gt in 2018, reflecting a persistent reliance on fossil fuels despite international climate commitments.

In 2020, the COVID-19 crisis led to an exceptional drop in emissions, falling to 33.3 Gt, before rising again in 2021 and 2022. However, in 2023, emissions slightly declined to 36.1 Gt, driven by an accelerated energy transition in certain regions (IEA, 2024).

This supports the findings of (Friedlingstein, et al., 2023) who argue that the growth of renewable energy is one of the key factors contributing to the slowdown in global emissions growth.

These findings also align with the (IEA, 2024) report, which highlights that countries increasing the share of renewables in their energy mix experienced more significant decarbonization, reducing their CO₂ emissions by an average of 3 to 5%.

Overall, the results indicate that the transition to renewable energy is an effective lever for achieving SDG 13, contributing to the reduction of greenhouse gas (GHG) emissions while supporting more sustainable economic growth.

4. Algeria's Energy Transition Aligned with the SDGs

Historically reliant on hydrocarbons, Algeria has embarked on an ambitious energy transition aligned with the Sustainable Development Goals (SDGs), particularly those related to energy (SDG 7), employment (SDG 8), innovation (SDG 9), inequality reduction (SDG 10), and climate action (SDG 13). This strategic reorientation reflects the country's intention to diversify its energy mix and progressively integrate clean energy into public policy.

Under SDG 7, Algeria's updated national program aims to raise the installed capacity from renewable energy sources to 22,000 MW by 2030. The goal is for approximately 37% of installed capacity and 27% of national electricity production to come from renewables. Solar photovoltaic energy forms the core of this plan, with installed capacity reaching 402 MW in 2023—an increase of nearly 5% compared to the previous year (Ministère de l'Energie et des Mines, 2023).

In relation to SDG 8, renewable energy is seen as a driver of green growth and sustainable job creation. The energy efficiency program, which complements clean energy development, aims to save up to 63 million tonnes of oil equivalent (TOE) by 2030. This strategy indirectly supports employment in key sectors such as construction, industry, and transport.

From an industrial and technological perspective (SDG 9), efforts are underway to modernize energy infrastructure by promoting high-performance solutions such as energy-efficient lighting, thermal insulation, and high-efficiency industrial equipment. These actions are part of a broader strategy for structural transformation and capacity building in national innovation systems (Ministère de l'Energie et des Mines, 2023).

SDG 10 is also addressed, as current energy policies aim to ensure equitable access to electricity, particularly in rural and remote areas. Algeria's exceptional solar potential—exceeding 2,000 hours of sunshine annually—offers considerable opportunities for decentralized solar installations, which can help reduce disparities in access to basic energy services (Centre de Développement des Energies Renouvelables, 2022).

Finally, climate action (SDG 13) is integrated through Algeria's target of reducing 193 million tonnes of CO₂ emissions by 2030. The country is also exploring the development of green hydrogen as a complementary decarbonization pathway, in line with global climate mitigation commitments (Ministère de l'Energie et des Mines, 2023).

5. conclusion

Renewable energies offer a strategic alternative to fossil fuels in a global context marked by the climate crisis, energy poverty, and socio-economic inequalities. Their role in achieving the Sustainable Development Goals (SDGs) is crucial, as they directly contribute to reducing greenhouse gas emissions, creating sustainable jobs, and improving access to energy.

In this sense, the research problem addressed in this study was to analyze the contribution of renewable energy to sustainable development, particularly from an economic perspective. First, through the literature review, we found that renewable energies contribute to the achievement of five key SDGs, as emphasized in several international reports.

Based on the results and discussions presented earlier, the two hypotheses formulated at the beginning of the study are confirmed. Data analyzed between 2013 and 2023 show that renewable energy has a significant and measurable impact on several SDGs, particularly SDGs 7, 8, 9, 10, and 13. For example, the increase in electricity access rates, especially in developing countries, reflects the effectiveness of sustainable electrification policies (SDG 7).

Similarly, the continuous growth of employment in the renewable energy sector highlights a multiplier effect on the green economy (SDG 8). In terms of innovation, the rise in the global energy innovation index and investments in clean infrastructure confirm the sector's structural role in supporting sustainable industrialization (SDG 9).

Furthermore, the gradual reduction in the energy access gap between rural and urban areas demonstrates the capacity of renewable energies to reduce energy inequalities (SDG 10). Finally, the decrease in global CO₂ emissions over the study period highlights their direct contribution to climate change mitigation (SDG 13).

These findings confirm that renewable energies effectively target goals where they can have a direct impact, while also making a positive, integrated, and cross-cutting contribution to the implementation of the SDGs.

In this context, Algeria's experience illustrates a relevant case of progressive alignment between national energy policy and the SDGs. By leveraging its solar potential, Algeria has launched ambitious programs aimed at increasing the share of renewables in its energy mix. The goal of reaching 22,000 MW of installed capacity by 2030, improving access to electricity in remote areas, modernizing energy infrastructure, and exploring green hydrogen development all reflect a growing commitment to a more resilient, low-carbon, and socially equitable energy model. Despite challenges related to financing, governance, and intersectoral coordination, these initiatives demonstrate a coherent approach to the SDGs, particularly SDGs 7, 8, 9, 10, and 13.

Through this study, renewable energies can further contribute to achieving the SDGs by supporting more ambitious public policies, such as increased investment in clean energy infrastructure, especially in developing countries.

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To cite this article according to (APA):

Guechairi Farah Naima. (2025). The contribution of renewable energies to achieving the Sustainable Development Goals (SDGs). *Journal of New Economy*, Vol 17 / (Issue 01-2026).