

Algeria's Renewable Energy Landscape: An Overview

Soumia Belkacemi, * laboratory of investment economics in renewable energy and financing strategies for remote Areas, University of Batna 1, Algeria, soumia.belkacemi@univ-batna.dz

Saida Merzoug, University of Batna 1, Algeria, saida.merzoug@univ-batna.dz.

Received: 29/12/2025

Accepted: 26/05/2026

Published: 10/06/2026

Abstract: As climate change has grown into a significant challenge for humanity, the transition to cleaner, greener energy has become a necessity. Several countries worldwide are already taking steps toward this goal, and Algeria is one of them. Since the COVID19 pandemic, renewable energy has become more cost-effective and widely adopted. The current paper illustrates the status of renewable energy in Algeria, as the government has introduced an ambitious 2030-2035 program aiming at installing around 22 GW of renewable energy capacity, with 12 GW allocated for domestic use and 10 GW for export. That capacity was to be distributed between 62% of solar PV and 23% of wind, and including a target of 2 GW of Concentrated solar power (CSP). In the light of this, progress is being made: 590 MW renewable energy including 451 MW solar energy have been installed in 2023. This places Algeria 22nd in Africa in total renewable energy capacity and 12th in solar energy. Moreover, facilitation policies and investment incentives have been introduced, and many renewable energy projects are underway.

Keywords: Renewable Energy, Solar Energy, Wind Power, Bioenergy, Geothermal, Energy transition, Green Energy.

JEL Codes: Q21 ; Q42 ; Q28; Q48.

Citation: Belkacemi Soumia, Merzoug Saida, (2026). Algeria's Renewable Energy Landscape: An Overview, Journal of economics studies and researches in renewable energies, 13(01), 267-287.

INTRODUCTION

Modern civilization relies heavily on the combustion of fossil fuels, such as coal, oil and gas, a practice that has increased dramatically over time, asserting the potential for irreversible anthropogenic climate change. The consequences of triggering CO₂ tipping points are likely to be dire, leading to a new state to which societies may struggle to adapt. High-energy societies can ensure their survival only by an eventual transition to non-fossil sources (Smil, 2017, p. 18). Moreover, fossil fuels have been and still are ideal energies for diverse countries for economic take-off (Lachal, 2019, p. 6), their crustal abundance notwithstanding, it is apparent to be exhaustible energy sources, and their massive and increasing recovery/consumption to meet nowadays energy needs will ultimately make them depleted in the future (Goyal, 2024, p. 17). Renewable energy could be a more sustainable solution to the aforementioned challenges. Unlike fossil fuels, it is derived from existing natural resources that are replenished at a faster rate exceeding that of consumption, and from a human perspective, are endless or sustainable or renewable (George, 2020, p. 3116), let alone the fact having a greater cost-effectiveness and lower environmental effect (Ahmed I. Osman, 2023, p. 743). Hence, the names “Sustainable Energy” and “Clean Energy” come to use. Examples of renewable energy sources include solar

* Correspondant author

Energy, wind Power, biomass (carbon-based fuel from living organisms), and hydropower, including tidal energy (W.Jong, 2015, p. 17). The International Energy Agency (IEA) predicts that despite the expansion in global installed capacity of the renewable energy, will still fall below the international goal of tripling renewable energy capacity, it will grow however, by 2.7 times by 2030, exceeding present bold state-level targets by 25%. Around 140 countries have adopted policies aimed at climate protection and energy security, which have made renewable energy cost-effective with fossil fuel power plants (International Energy Agency (IEA), 2024, p. 6).

Among those countries, Algeria is making noteworthy strides towards a clean sustainable energy transition, spurred by the necessity for climate commitment, economic diversification and energy security. Whilst facing those challenges, the abundant renewable energy sources endowed to the country and continuing efforts, represent an auspicious route towards a clean sustainable energy future in which persistent investment, promoting policies, and economic cooperation are essential to realizing a full potential energy transition.

As a matter of fact, the current analysis focuses on the following:

what progress has been made in the field of renewable energy in Algeria, and what government policies have been implemented to promote its development?

The following key point are emphasized:

- 1- What is the status and potential of renewable energy in Algeria?
- 2- To what degree does renewable energy help secure energy supplies in Algeria?
- 3- What are the government policies, mainstream technologies deployed, and challenges observed in this field?

To answer these questions, the article has been divided as follows:

I. Energy Transition :

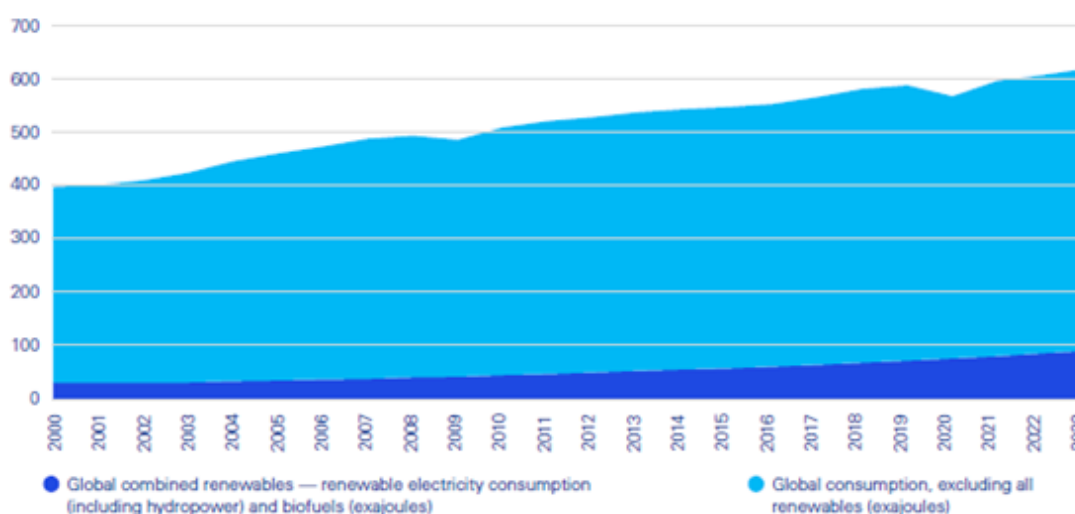
In the midst of a shift towards renewable energy solutions, several interconnected key pillars that highlight critical areas of focus need to be approached holistically with the aim of ensuring a thriving, fair, sustainable, and resilient energy transition. These pillars involve, notably: energy policy frameworks and regulations; sustainable energy economics and demographic trends; available technologies; and the physical infrastructure for renewable energy generation, storage and distribution; among others.

The energy transition towards renewables aims at promoting a more rational use of energy by replacing fossil and fissile energies with renewable sources, while emphasizing energy efficiency and sober consumption (Lachal, 2019, p. 9). Unlike fuel energy sources, which are concentrated in a limited number of countries, renewable resources are spread across vast regions, offering significant opportunities for energy transition and improved energy efficiency. Renewable energy can supply two-thirds of the total global energy demand by 2050 (Dolf Gielen, 2019, pp. 38, 46). Impelled by sustainability awareness, technological developments,

and declining costs, the renewable energy industry has witnessed considerable progress. Renewable energy systems include a quite diverse variety of technologies, many of which are already mature and economically competitive, while others require further development.

The electricity sector continues to be the most promising area for renewables, driven by the rapid expansion of solar photovoltaics and wind energy during the last years, alongside the key role of hydropower. Although, electricity represents just 20% of global energy consumption, making it crucial to find ways to increase the use of renewable energy in transportation and heating to drive the energy transition forward. In 2023, fossil fuels fell to 60% of global electricity generation, their lowest level in five decades, while renewables contributed 30% to the world's power supply during the same period. China drastically represented 60% of the global increase in renewable energy capacity in 2023, and its solar PV generation is projected to surpass the entire electricity demand of the United States by the early 2030s (IEA, 2024, pp. 16, 97).

Fig 1: Total global Energy Consumption: renewables vs all other sources



Source: KPMG International, "Energy transition investment outlook: 2025 and beyond", 2024, p. 12, (<https://assets.kpmg.com/content/dam/kpmg/sq/pdf/2024/11/energy-transition-investment-outlook-2025-and-beyond.pdf>). Retrieved on 02/23/2025.

Fig. 1 shows that the majority of years, from 2001 to 2024, have seen a rise in energy consumption, including renewable energy. The exceptions were 2009 and 2020, which marked by the global economic crisis and the COVID-19 pandemic, respectively, witnessed no increase and both years were followed by significant recoveries in energy consumption. Notably, 2010 and 2021 saw the two highest year-on-year jumps in energy. This persistent growth in energy consumption underscores the significant effort required for the energy transition and the monumental task of decarbonization (KPMG International, 2024, pp. 11, 12).

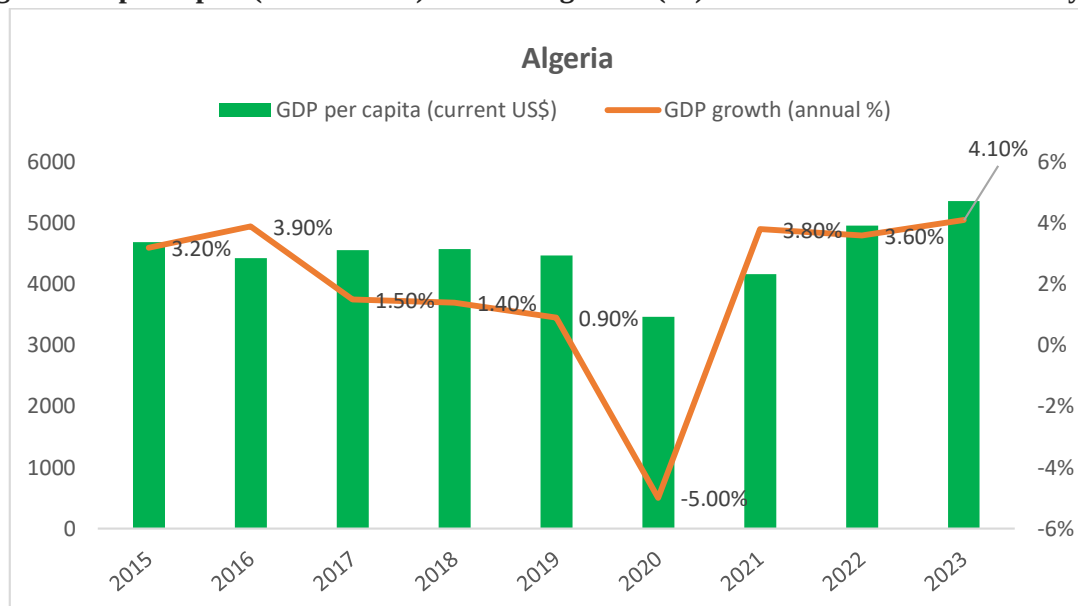
II. Energy landscape in Algeria:

Energy is one of the major inputs that play a crucial role in driving the economic growth and development of any nation. It is used and/or consumed across all power economic activities

namely, manufacturing, agriculture, services, transportation, and technology. The predominant policies implemented by Algeria, like other Northern African states, carry on prioritizing power, with less care to transport, heating and cooling, which indicates the maturity and affordability of the power sector (International Renewable Energy Agency (IRENA), 2023, p. 14).

According to the World bank data of 2023, Algeria has an annual GDP of 247.63 billion US\$ and a GDP growth rate of 4.1%, which makes it the third largest Arab economy, let alone the fact it is the largest Arab and African country (World Bank Group, 2023).

Fig 2: GDP per capita (current US\$) vs annual growth (%) evolution within the last ten years



Source: World Bank Group Data, "Algeria: Overview", 2023, (<https://data.worldbank.org/country/algeria>). Retrieved on 02/23/2025.

Fig 2. Shows the historical trends regarding GDP per capita (current US\$ and annual growth for Algeria during the period 2015-2023. Despite GDP per Capita, decline significantly during 2015-2020 from 4685.1\$ (2015) to 3463.7\$ (2020), due to low oil prices and pandemics, coupled with volatile Grow rates affected by reliance on hydrocarbon revenues, limited Energy diversification and the 2019 political demonstrations, its economy bounced back since effectively, as oil prices starting to rise in 2021 and a new presidential policy. The World Bank reclassified Algeria into the upper-middle-income in 2024 (World Bank Group, 2024).

As a rentier state that relies primarily on the export of oil and gas to develop its economy, Algeria has set a strategy by 2030, enforced by policies aiming at reducing its vulnerability to oil price fluctuations and build a more resilient and sustainable economy. Despite efforts are being made in this context to transition to cleaner energy alternatives, the country is yet to reach its predetermined benchmarks and remains tied to fossil fuels to satisfy its energy needs. When it comes to total energy supply, Algeria ranks fifth in Africa (International Energy Agency (IEA), 2023).

Tabl 1: Share of energy sources in Total Energy Supply in Algeria 2022

Total Energy Supply, Algeria, 2022		
Energy Source	Value (TJ)	Percentage
Coal	8 389	0.3%
Natural gas	1 854 764	64.7%
Hydro	59	0.0%
Geothermal, solar, wind, etc.	2 392	0.1%
Biofuels and waste	741	0.0%
Oil	999 643	34.9%
Total Energy Supply,	2 865 988	100.0%

Source: The International Energy Agency (IEA), "**Algeria: Energy Mix**",2023, (<https://www.iea.org/countries/algeria/energy-mix>). Retrieved on 02/23/2025.

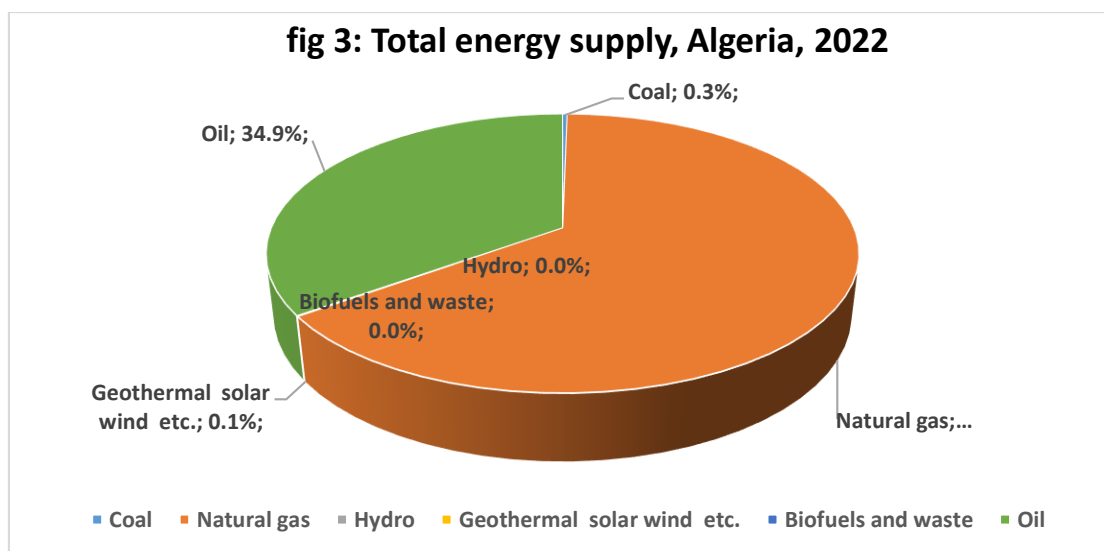


Fig 3: Share of energy sources in Total Energy Supply in Algeria 2022

Source: The International Energy Agency (IEA), "**Algeria: Energy Mix**",2023, (<https://www.iea.org/countries/algeria/energy-mix>). Retrieved on 02/23/2025.

Fig 3. clearly shows that oil and gas dominate the overall energy supply in Algeria, by a substantial share of 99.6%. All Renewable energies represent only a tiny fraction (0.1%).

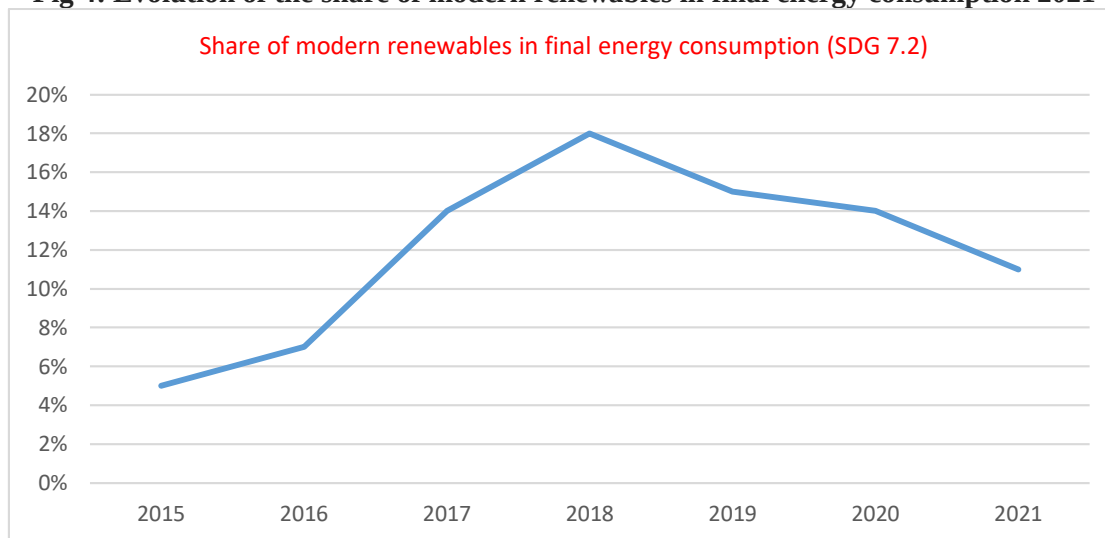
III. Renewable Energy in Algeria:

Algeria's greenhouse gas emissions are modest compared to major industrialized countries, its ranking is 39th amongst 58 countries responsible for 90% of global emission, which even though underscores its importance in taking actions in investing in Renewable Energy in accordance with the Sustainable Development Goal (SDG 7.2). That is part of the United Nations' Sustainable Development Goals (SDGs), which focuses on increasing the share of renewable energy in the global energy mix. From its side, Algeria set targets to cut electric energy consumption by 9% and substantially boost the renewables' share in electricity production to 27% by 2030 (UNDP, 2023, p. 2).

Tabl 2: Evolution of the share of modern renewables in final energy consumption 2021

Share of modern renewables in final energy consumption (SDG 7.2)	
Year	Share
2015	5.0%
2016	7.0%
2017	14.0%
2018	18.0%
2019	15.0%
2020	14.0%
2021	11.0%

Source: The International Energy Agency (IEA), "**Algeria: Renewables 2023**",2023, (<https://www.iea.org/countries/algeria/renewables>). Retrieved on 02/23/2025.

Fig 4: Evolution of the share of modern renewables in final energy consumption 2021


Source: The International Energy Agency (IEA), "**Algeria: Renewables 2023**",2023 (<https://www.iea.org/countries/algeria/renewables>). Retrieved on 02/23/2025.

Fig 4. highlights within the period 2018-2018, the increase of the share of renewable energy in final energy consumption that reached a peak of 18% in 2018 but has since experienced a decline, dropping to 11% by 2021.

In its 2015 Renewable Energy Roadmap, the Algerian government established an ambitious goal of installing around 22 GW of Renewable Energy capacity by 2030, with 12 GW allocated for domestic use and 10 GW for export (Nora Aboushady, 2024, p. 7). That capacity was to be divided between 62% of solar PV and 23% of wind, and including a target of 2 GW of Concentrated solar power (CSP) (International Renewable Energy Agency (IRENA), 2023, p. 12).

The early outlook government plan, revised in 2015, aimed to achieve around 37% of installed capacity by 2030, with 27% of electricity generated for domestic consumption coming from renewables. As per the Algerian Ministry of Energy, the authorities are rolling out the initiative

in two sequential steps. The planned breakdown capacity by sector, was as follows: (Ministère de l'énergie, des mines et des énergies renouvelables (Algérie), 2022)

Tab 3: Scope of the Renewable Energy Development Program

Energy type (MW):	2015-2020	2021-2030	TOTAL
Wind	1010	4000	5010
Photovoltaic (PV)	3000	10575	13575
Concentrated Solar Power (CSP)	-	2000	2000
Cogeneration (Combined Heat and Power, or CHP)	150	250	400
Biomass	360	640	1000
Geothermal	5	10	15
TOTAL	4525	17475	22000

Source: Ministère de l'énergie, des mines et des énergies renouvelables, "**Programme de développement des énergies renouvelables**", Algerie, 2022, (<https://www.energy.gov.dz/?article=programme-de-developpement-des-energies-renouvelables>). Retrieved on 02/23/2025.

In February 2020, the government adopted a long-term initiative designed to foster renewable energy, with a target of 16,000 MW renewable energy, 15,000 MW of which integrated into the national power grid by 2035. Priority would be given to produce off-grid 1,000 MW of renewable energy per year (Direction Générale de la Recherche Scientifique et du Développement Technologique (DGRSDT), 2021, p. 3).

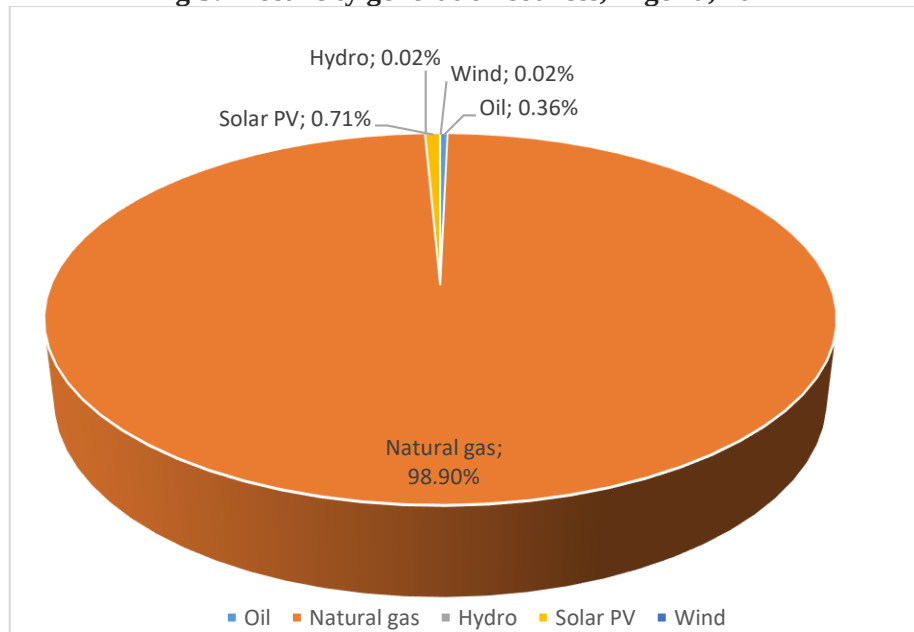
Algeria is ranked among the top electrified countries in the continent, with a national electricity access rate of 99.8%. Rural areas have an access of 99.6% while urban areas reach 99.9% (Egypt Energy, 2024, p. 10). Yet, combustibles account for 99.3% of electricity generation, whereas renewables constitute only 0.7% (The International Energy Agency (IEA), 2023).

Tab 4: Electricity generation sources, Algeria, 2022

Electricity generation sources, Algeria, 2022		
Electricity generation sources	Value (GWh)	Percentage
Oil	328	0.36%
Natural gas	90221	98.90%
Hydro	16	0.02%
Solar PV	648	0.71%
Wind	15	0.02%
Total Electricity generation	91228	100.00%

Source: The International Energy Agency (IEA), "**Algeria: Electricity 2023**", 2023, (<https://www.iea.org/countries/algeria/electricity>). Retrieved on 02/23/2025.

Fig 5: Electricity generation sources, Algeria, 2022



Source: The International Energy Agency (IEA), "*Algeria: Electricity 2023*", 2023, (<https://www.iea.org/countries/algeria/electricity>). Retrieved on 02/23/2025.

Fig 5. highlights the overwhelming reliance on fossil fuels as the primary generation energy sources in this sector, with natural gas making up 98.9% and oil accounting for 0.4%. However, the solar photovoltaic (PV), despite standing far less than the natural gas, with a contribution of 0.7%, with a reasonable amount of energy of 648 GWh, it remains a notable source of energy.

In its latest energy report for 2023, The Algerian Energy Ministry highlighted significant growth in renewable energy sources. Hydroelectric power production surged by 77%, climbing from 16 GWh in 2022 to 29 GWh in 2023, supported by moderately higher rainfall compared to the foregoing year. Similarly, photovoltaic (PV) solar installations saw a 4.8% increase, rising from 668 GWh in 2022 to 700 GWh in 2023, bringing the total photovoltaic capacity to 402 MW, including the solar share from SPP1. These developments contributed to an overall 6.1% rise in primary electricity production, which reached 723 GWh in 2023 compared to 2022 (Ministère de l'Energie et des Mines et des Energies Renouvelables, 2024, pp. 8-9). The installed capacity from renewable sources in 2023 accounts for 0.56 GW, representing only 2% of the total installed capacity (28 GW) in that year. This makes reaching the target of 37% installed renewable energy capacity by 2030 daunting, at the least (International Renewable Energy Agency (IRENA), 2024). According to the head of the Commission for Renewable Energies and Energy Efficiency (CEREFEE), the projects initiated in 2024, totaling 3 GW, are expected to bring the total installed renewable energy capacity to around 4 GW by late 2024 or early 2025.

Tab 5: Electricity capacity, Algeria, 2023

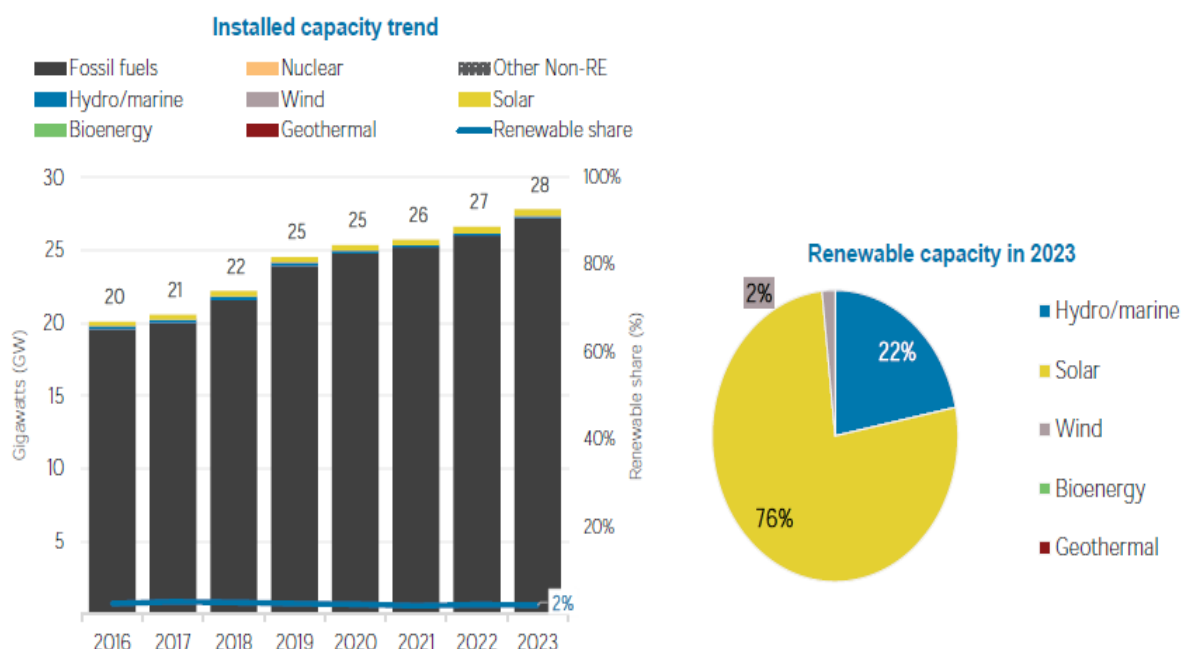
Total renewable energy (MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hydropower	228	228	228	228	228	228	209	129	129	129
wind energy	10	10	10	10	10	10	10	10	10	10
Solar energy, including:	28	61	261	354	366	366	366	366	451	451
Solar photovoltaic (PV)	3	36	236	329	341	341	341	341	426	426
Concentrated solar power (CSP)	25	25	25	25	25	25	25	25	25	25
Total	266	299	499	592	604	604	585	505	590	590

Source:- IRENA , "Renewable Capacity Statistics 2024", 2024 , pp. 2-44, on:

(https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Mar/IRENA_RE_Capacity_Statistics_2024.pdf).

Retrieved on 02/23/2025.

- IRENA , "Energy Profile: Algeria", 2023, p. 2, on: (https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Algeria_Africa_RE_SP). Retrieved on 02/23/2025.

Fig 6: Electricity capacity, Algeria, 2023


Source: - IRENA , "Renewable Capacity Statistics 2024", 2024 , pp. 2-44; on:

(https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Mar/IRENA_RE_Capacity_Statistics_2024.pdf).

Retrieved on 02/23/2025.

- IRENA , "Energy Profile: Algeria", 2023, p. 2, on: (https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Algeria_Africa_RE_SP). Retrieved on 02/23/2025.

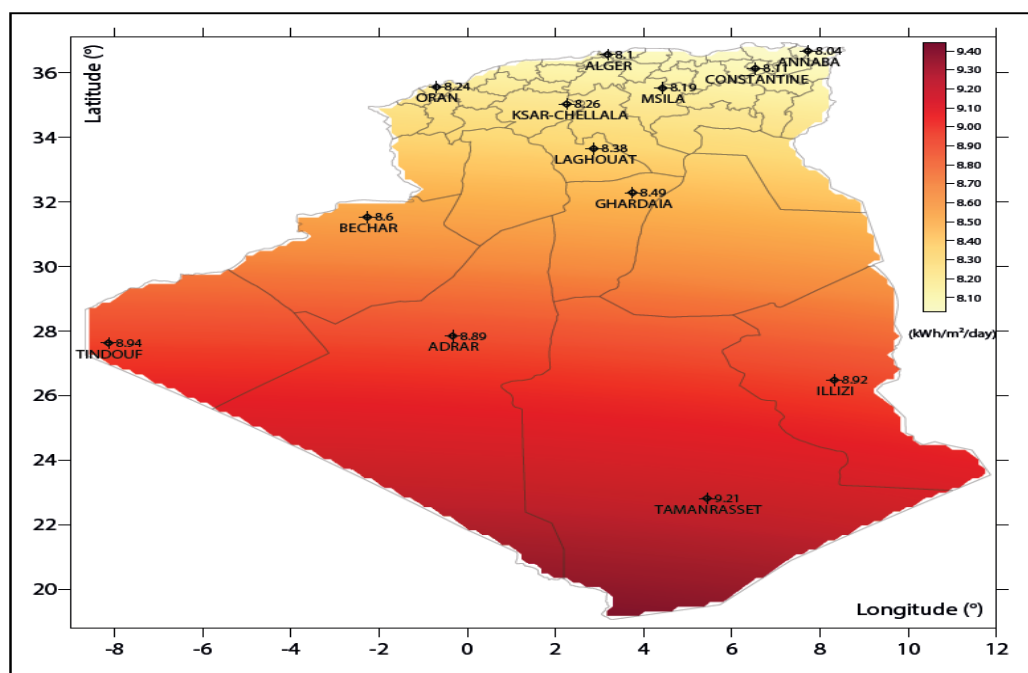
Fig 6. exhibits a steady upward trend in electricity installed capacity during the 2016–2023 period, with an increase from 20 GW in 2020 to 28 GW in 2023. In the same year, the Renewable sources represented only 2% (590 MW) of the total installed capacity, comprising 76% solar energy, 22% hydro, and 2% wind energy.

Though Algeria is taking advantage of the recent fall in production costs for solar photovoltaic and wind energy infrastructure focusing on meeting domestic energy needs. In order to incentivize investment, the government has introduced favorable pricing schemes under long-term power purchase agreements (PPAs) spanning 20 years, negotiated with electricity distribution operators. Producers, provided they meet specific eligibility requirements such as securing regulatory clearance and undergoing environmental reviews, may apply for these rates, which range from 12.75 DZD/kWh à 15.94 DZD/kWh for solar photovoltaic projects, and from 10.48 DZD/kWh à 13.10 DZD/kWh wind power projects. The eligibility is determined by the installed capacity of the facility, whether the production facility falls within the range of 1 MW to 5 MW, or has an installed capacity exceeding 5 MW (Journal Officiel de la République Algérienne, 2014, pp. 23, 26).

1. Solar Energy:

Algeria possesses outstanding opportunities for generating renewable energy especially solar and wind energy investments, which are among the highest potentials in the world. Located inside the global Sun Belt, with a high solar irradiance, around 3 KWh/m² in the north and exceeds 5.6 KWh/m in the far south (~169,440 TWh/year), making it ideal for solar energy projects (Ministère de l'énergie, des mines et des énergies renouvelables (Algérie), 2022).

Fig 7: Outer space solar irradiation map in Algeria



Source: Abdelhak, Razagui, Abdeladim, Kamel, "Solar energy, In: Centre de Développement des Energies Renouvelables (CDER), "Algerian Renewable Energy Resource Atlas", 1st Edition, Alger, 2019, p. 5, (<https://www.cder.dz/download/ATLAS%20final.pdf>). Retrieved on 02/23/2025.

Fig 7 emphasizes the outer space irradiation across the Algerian territory that receives high solar irradiance, chiefly in the southern desert regions where it can reach up to 9kWh/m².

Among the largest solar power plants completed and already operational is the Hassi R'Mel power plant, located near Hassi R'Mel in the Wilaya of Laghouat, which is a hybrid power plant combining a solar thermal power plant with a conventional combined cycle gas-steam power plant (CCGT power plant). It has a total capacity of 150 MW, of which 30 MW can be supplied by solar energy, and is the first CCGT-solar hybrid power plant in the world, first commissioned in 2011 (Ministère de l'énergie, des mines et des énergies renouvelables (Algérie), 2022).

One can also draw attention to the following PV plants, which are already operational, with the two largest among them ranking as the top in Africa in terms of power output (Ebhot, 2019, p. 35) (Tab 6):

Tab 6: Largest operational Algerian photovoltaic power stations

PV Power station	Capacity in MW	Developer	Owner	Completed
High Plateaus East, Adrar	90	Sinohydro Corp (PowerChina), Yingli Green Energy Holding, HydroChina - Three party consortium	SKTM (Sonelgaz)	2016
High Plateaus Centre, Adrar	90	Sinohydro Corp (PowerChina), Yingli Green Energy Holding, HydroChina - Three party consortium	SKTM (Sonelgaz)	2016
High Plateaus West, Adrar	85	Belectric GmbH	SKTM (Sonelgaz)	
High Plateaus South-West, Adrar	53	Sinohydro Corp (PowerChina), Yingli Green Energy Holding, HydroChina - Three party consortium	SKTM (Sonelgaz)	
Hdjira, Touggourt	30			2015
Adrar	20			2015
Souk-Ahras	15	Sinohydro Corp (PowerChina), Yingli Green Energy Holding, HydroChina - Three party consortium	SKTM (Sonelgaz)	2016

Sources: - List Solar, "Largest solar power stations in Algeria", October 2024, (<https://list.solar/plants/largest-plants/algeria/>). Retrieved on 02/23/2025.

- OTEC Engineering, "Hdjret - Ouargla - Centrale solaire - 30MW - Algérie", (<https://fr.otec-engineering.com/project/hdjret---ouargla---solar-plant---30mw---algeria>). Retrieved on 02/23/2025.

Tab 6. shows the largest PV plants in Algeria. These include two plants in the High Plateaus region, located in the east and west of Adrar province, each with a capacity of 90 MW. Those were developed by PowerChina for the Company of Electricity and Renewable Energy (SKTM):

Shariket Kahraba wa Taket Moutadjadida) a subsidiary of Sonelgaz Group. In addition, another plant in High Plateau West Adrar, with a capacity of 85 MW, was built by Belectric for SKTM (Sonelgaz). Furthermore, PowerChina constructed two more plants: one in High Plateau South Adrar with a capacity of 53 MW and another in Souk Ahras with a capacity of 15 MW. Lastly, a 30 MW plant in the commune of Hedjira (Wilaya of Tougourt) and a 20 MW plant in the commune of Adrar have been completed and operational in 2015 and 2016 respectively and are still in operation.

In December 2021, Algeria launched a tender for the development of a 1,000 MW solar energy production project, named 'Solar 1000 MW.' This project involves the building of solar photovoltaic power plants with a total capacity of 1,000 MW, distributed across the national territory in lots ranging from 50 to 300 MW each, all owned by Algerian Renewable Energy Company ("SHAEMS, Spa"). In February 2023, the Algerian public company of Electricity and Gas (Sonelgaz) opened 73 local and international bids for 14 solar power projects in 12 wilayates, with a generation capacity of 80-220 MW each, and a total combined generation capacity of 2,000 MW for the entirety of the project (Note: One of the originally planned 15 projects was canceled.). The project, referred to as "2,000 MW", with a total capacity of 1,920 MW (14 lots), is expected to cost 171.7 billion DZD (equivalent to 1.145 billion US \$). The contractors were announced in March 2024. For the "1,000 MW" project, five lots were assigned, among them The construction group Ozgun won 300 MW. As regards the tender "2,000 MW", primarily, the Chinese concessionaires swept the board by awarding five solar energy projects with a combined capacity of 780 MW (Klein, 2025) (Tab 7).

Tab 7: Future Largest Algerian photovoltaic power stations

PV Power station	Capacity in MW	Developer	Owner	Expected Completion	Comments
Batna	220	Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC)	SKTM (Sonelgaz)		
Guellet Sidi Saad, Laghouat	200	Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC)	SKTM (Sonelgaz)		
Douar El Maa, El-Oued	200	Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC)	SKTM (Sonelgaz)		
Ouled Djellal Wilayte	80	Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC)	SKTM (Sonelgaz)		

Abadla Wilayate	80	Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC)	SKTM (Sonelgaz)		
Hassi Delaa, Laghouat wilayate	362	Özgün İnşaat under "Groupement Ozgun-Zergoun"	SKTM (Sonelgaz)	by late 2025 or early 2026	
El Oued Wilayate	300	Construction Engineering Corporation (CSCEC)	SKTM (Sonelgaz)		
El M'Ghair Wilayate	200	Construction Engineering Corporation (CSCEC)	SKTM (Sonelgaz)	Began construction in March 2024, expected completion within 14 months	
Ouargla Wilayate	300	COSIDER Canalisations, a subsidiary of the COSIDER Group	SKTM (Sonelgaz)	Began construction in March 2024, expected completion within 12 to 14 months	
Touggourt & Béchar	400	COSIDER Canalisations, a subsidiary of the COSIDER Group	SKTM (Sonelgaz)	Began construction in March 2024, expected completion within 12 to 14 months	1 plants in Touggourt and another in Béchar, with capacities of 150 MW and 250 MW, respectively.
Bir Naam , Biskra Wilayate	220	PowerChina	SKTM (Sonelgaz)	Started in in April 2024, completion completion within 16 months	
Khenguët Sidi Sadj, Biskra Wilayate	150	PowerChina	SKTM (Sonelgaz)	Started in in April 2024, completion completion within 16 months	

Source: Klein, A. L, "Top 5 Solar Projects to Watch in Algeria", *Energy Capital & Power*, 2025, <https://energycapitalpower.com/top-5-solar-projects-to-watch-in-algeria/> Retrieved on February 19, 2025

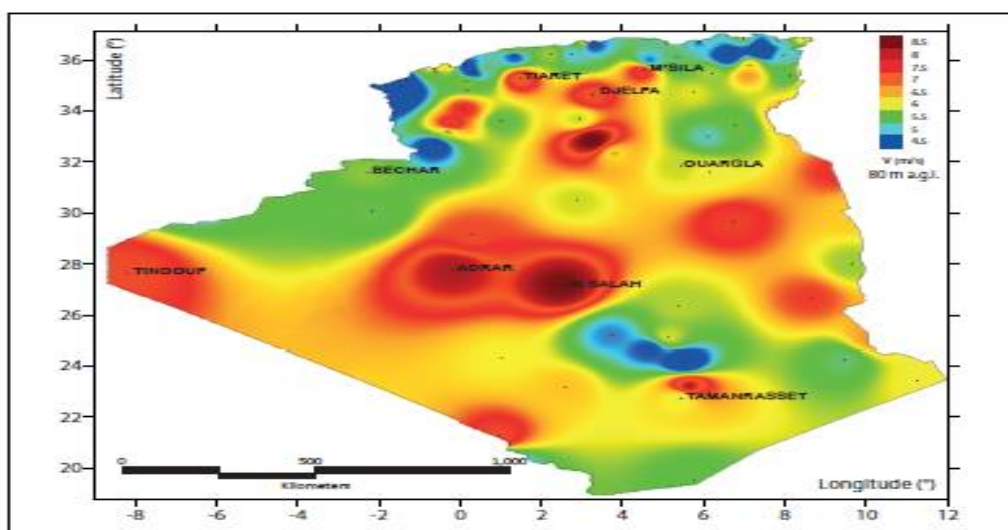
Tab 7. highlights the lion's share of the China International Water & Electric Corporation (CWE) and China Nuclear Industry Huaxing Construction (HXCC), which started building five solar energy projects with a combined capacity of 780 MW in September 2024. Those consist of a 220 MW facility in Batna, a 200 MW plant in Guellet Sidi Saad, an additional 200 MW installation in Douar El Maa, and two smaller 80 MW plants located in Abadla and Ouled Djellal Wilaya. In April 2024, PowerChina broke ground on two key components of "Solar 2,000 MW" program, which are the 220 MW Bir Naam and the 150 MW Khenguët Sidi Nadji photovoltaic power plants (Biskra wilayate). These projects are expected to be completed within 16 months.

On the other hand, and as part of the Solar 1,000 MW initiative, the Turkish company Özgün İnşaat began constructing the 362 MW Hassi Delaa (Laghouat wilayate) Solar Power Plant in March 2024. On its side, The Chinese Construction Engineering Corporation (CSCEC) started in March 2024 work on a 300 MW solar power plant in El-Oued wilayate, with aiming to finish by late 2025 or early 2026. In parallel, CSCEC also broke ground on a 200 MW solar power plant in El M'Ghair. COSIDER Canalisations, a division of the COSIDER Group, started in March 2024, building a 300 MW solar power plant in Ouargla wilayate. Simultaneously, the company initiated work on two more project solar facilities anticipated to be finished in 12 to 14 months: a 150 MW plant in Touggourt and a 250 MW plant in Béchar. Lastly, In April 2024, PowerChina company, broke ground on the 220 MW Bir Naam, and 150 MW Khenguët Sidi Sadjì photovoltaic power plants (Biskra Province). This project is a key component of Algeria's Solar 2,000 MW initiative and are expected to be finalized within 16 months.

2. Wind Energy:

Wind capacity in Algeria, is quite relatively moderate, with speeds ranging between 2 and 9 m/s (Fig 8).

Fig 8: The wind speed potential in Algeria



Source: Sabih, Kheder Haddouche; Hafida Daaou Nedjari, & authors, "Wind energy", in: Centre de Développement des Energies Renouvelables (CDER), "Algerian Renewable Energy Resource Atlas", 1st Edition, Alger, 2019, p. 22, (<https://www.cder.dz/download/ATLAS%20final.pdf>). Retrieved on 02/23/2025.

Fig 8 unveils the significant variations of wind patterns throughout the extent of the country. Light to moderate winds encountered in the northern regions, save for the Mediterranean coastline and mountainous highlands, where speeds range from 6 to 7m/s. In the Grand Sahara, however, wind speeds can exceed 7m/s particularly in the South-East regions (Béchar, Tindouf, Adrar), whereas in Amguel (Tamanrasset wilayate), it can even surpass the value of 8m/s. Those Saharan locations are strongly viable for wind energy development.

As the first of its kind in the country, a 10 MW wind farm was built and has been operational since 2014 in the Kabertene region of Adrar wilayate, as part of the renewable energy scheme strategy. It consists of 12 wind turbines, each with a power capacity of 850 kW, covering an area of 30 hectares (Ouahiba, 2015, p. 6).

Despite the intermediate potential of wind energy in Algeria, it has not been adequately harnessed, that illuminates its modest allocation within the 2023 renewables capacity (1.69%) (Fig 6). In addition to the 2030-2035 renewable energy initiative, which aims to achieve a capacity of 400 MW, the Algerian Energy Minister stated during a press conference in December 2024 that, in collaboration with the World Bank, Algeria is currently exploring the launch of a project to produce 1,000 megawatts of wind energy across 10 promising sites.

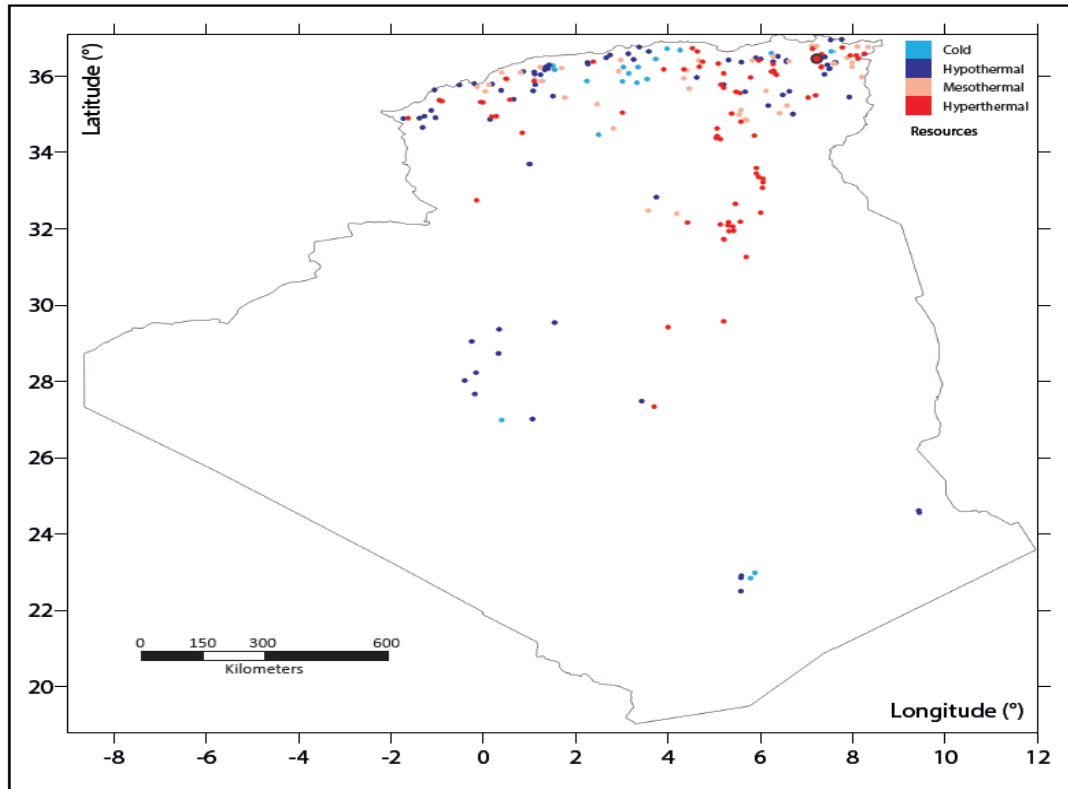
3. Biomass (Bioenergy):

Various biomass sources exist, including lignocellulosic materials, agricultural and food waste, sludge from wastewater treatment plants, municipal waste, and more. Through four primary methods -thermal, thermochemical, chemical, and biochemical processes-biomass or waste can be transformed into usable forms of energy, known as bioenergy, such as heat, electricity, or fuel. The potential for waste recovery in Algeria is estimated at more than 500,000 toe (tonnes of oil equivalent), which could generate over 1,900 GWh of electric capacity (Amine Akbi, 2019, pp. 41, 43). The development of bioenergy is still at the experimental stage in research laboratories (Aziza, 2016, p. 4).

4. Geothermal Energy:

Algeria possesses a high potential of geothermal energy with over 240 thermal springs across the country. At present balneotherapy remains practically the only direct use of this energy. The famous Hammam Debagh hot spring (Ex-Hammam Meskhoutine) is listed among the hottest hot springs in the world, with a water temperature of 98°C: (Salima OUALI, 2019, p. 38).

Fig 9: The wind speed potential in Algeria



Source: Salima, Ouali; Khedidja, Bouzidi; & authers, "Geothermal energy", in: Centre de Développement des Energies Renouvelables (CDER), "Algerian Renewable Energy Resource Atlas", 1st Edition, Alger, 2019, p. 38, (<https://www.cder.dz/download/ATLAS%20final.pdf>). Retrieved on 02/23/2025.

Fig 9 illustares the geothermal springs scattered across Algeria, categorized according to their temperatures, ranging from cold to hyper-thermal.

5. Hydraulic Energy:

Hydraulic Energy refers to the energy produced by harnessing the kinetic energy of flowing or falling water, generally through the construction of dams on rivers and the use of movements of tides and water levels in oceans and seas. The water is collected in a huge reservoir and released at a constant rate, driving turbines that convert the kinetic energy of the water into mechanical energy, transformed then into electrical energy. Surface Hydraulic resources in Algeria are estimated at 65 billion cubic meters, and they decrease schematically from north to south, with a low number of rainy days (Amina Mekhelfi, 2022, p. 6).

IV. Challenges and Prospects :

Although Algeria's potential in renewable energy is undeniable, the challenges faced in this sector do not stem from the resources themselves, but rather from the way those resources are being exploited and the commitment to achieving actual sustainable development. Algeria actually has an immense renewable energy potential, especially in solar energy, due to its

geographical advantages. However, the real challenges lie in effective resource management, strategic planning, and strong commitment. Also, the national economy is still heavily dependent on oil and gas exports, which could hinder the transition toward renewable energy, given the reliance on current infrastructure and economic priorities may not align with the transition. Despite Algeria is still far from achieving its goals under its ambitious 2030-2035 renewable energy program, it is making steady progress toward shifting to clean energy. In terms of total energy capacity, it is ranked 22nd in Africa, with 590 MW total capacity in 2023, whereas in solar energy it holds the 12th position, with 451 MW capacity the same year. South Africa however, is taking the lead with 10,623 MW total renewable energy capacity including 6,164 MW solar energy capacity (IRENA, 2024, pp. 2, 21).

Additionally, Algeria lacks advanced technology and expertise in renewable energy systems, which can be acquired via many channels. The prices of solar panels have declined substantially since the 2020 COVID-19 pandemic, reflecting a persistent trend of cost reductions in the solar energy field (OECD, January 2025, p. 9). This reduction paves the way for more affordable and accessible solar energy. However, the energy storage systems such as batteries, remain relatively expensive, which can limit the utmost capacity of solar energy, let alone the fact that infrastructure enhancements and funding are called for the integration of large-scale solar energy into current electricity grids. According to estimates from the Commission for Renewable Energies and Energy Efficiency (CEREFEE), Algeria is on track to reach a production capacity of approximately 4 GW by the beginning of 2025. While presenting the sector's budget included in the 2025 Finance Bill before the Finance and Budget Committee in Parliament, the Minister of Energy and Mines indicated that 2.02 billion DZD (~14.95 million USD) is allocated to the energy control program and renewable energy projects connected to the electricity grid (Assemblée Populaire Nationale (APN), 2024).

In this context, it is worthy saying that some decision-makers, who are unfamiliar with the renewable energy sector, have long assumed that the country's energy security is solely tied to electricity, despite electricity accounting for only 20% of total energy consumption. They have failed to fully understand the intermittent nature of solar and wind energy, leading to an underestimation of their role in shaping energy consumption patterns. Looking ahead, the strategic vision for economic development, highlights the growing need of a new type of human resources essential for driving progress (Tawfiq, Radwan, & Nazim, 2021, p. 12).

1. Challenges and Obstacles :

These indicate difficulties that can be coped with through striving, often carrying a more positive or motivational tone. They also represent more tangible barriers or concrete hindrances that might be harder to address or overcome.

- **Dependence on Fossil Fuels:** the heavy reliance on oil and gas might slow down the transition to renewables due to existing infrastructure and economic priorities.
- **Financial constraints:** limited funding and financial mechanisms can hinder progress, as developing renewable energy infrastructure needs substantial investment.

- **Grid Integration:** refurbishments and modernization are required to incorporate renewable energy into existing power grids, which can be costly and time-intensive.
- **Shortcomings in technology and infrastructure:** the lack of advanced technology and expertise in renewable energy systems can stall integration and escalate expenditures.
- **Absence of a clear vision for the energy sector:** the absence of a clear vision for the energy sector has limited progress in renewable energy development.
- **Regulatory and Bureaucratic Hurdles:** convoluted policies and sluggish administrative procedures could pose obstacles for investors and developers.
- **Aligning priorities and responsibilities across key stakeholders:** Conflicting goals, unclear roles, and mismatched expectations among stakeholders (government, private sector, and civil society) could hinder the renewable energy program.
- **Public Awareness and Acceptance:** inadequate awareness among the public and stakeholders may impede the uptake of renewable energy.

2. Prospects :

These refer to the potential, opportunities, and positive future for growth, innovation, and development in renewable energy sector.

- **Abundant Renewable Resources:** Algeria is endowed with huge solar energy resources driven by high solar irradiance, mainly in the southern Saharan regions. Meaningful wind and geothermal energy potential is available.
- **Government Commitment:** the government has introduced a forward-looking target, namely generating 22 GW of electricity from renewable energy capacity by 2030, with an expected large-scale contribution of solar energy.
- **Regional and International Partnerships:** Algeria has been partnering with international organizations such as IRENA and UNDP, alongside countries like China, Germany and France to attract investment, enable technology transfer, and expand technical competence.
- **Economic Diversification:** switching to renewable energy sources could help Algeria diversify its economy, reduce its dependence on fossil fuel, and create new jobs. The gradual phase-out of fossil fuel subsidies in a socially acceptable manner supports the move in this direction.
- **Export opportunities:** the vast solar energy resources could potentially serve as a gateway to export growth, enabling the country to supply Europe and neighboring countries with renewable energy, thereby creating a new revenue stream.

- **Energy Security:** by enhancing the renewable energy sector, Algeria will strengthen its energy security and reduce its heavy reliance on finite fossil fuel resources.
- **Climate Change Mitigation:** renewable energy could reduce greenhouse gas emissions and help Algeria meet its goals aligning with global efforts on climate change.

V. Conclusion :

In this paper, we have taken an overlook on the status of renewable energy in Algeria. The government has launched a promising program initiative (2030-2035) aiming at providing 22 GW renewable energy capacity by 2030, with 12 GW allocated for domestic use and 10 GW for export. That capacity was to be divided between 62% of solar PV and 23% of wind, and including a target of 2 GW of Concentrated solar power (CSP). In terms of Installed capacity, Algeria is standing halfway to achieving those targets, ranking 22nd in Africa, with 590 MW total capacity in 2023. For solar Energy, significant progress has been made in 2023 (451 MW), holding the 12th position in Africa, with large-scale solar projects are underway to increase and harness solar capacity. On the other hand, wind power is also advancing despite the current limitations (10 MW in 2023), as the government is exploring the development of new wind farms in suitable expanses to capitalize on the country's wind potential. Within the same context, facilitation policies and Investment incentives have been introduced to promote Renewable Energy.

VI. References:

Books:

- George, Abraham, "**Sustainable Architecture, Alternative Concepts and Waste Reduction**", in: Saleem & Hashmi, Imtiaz Ahmed, " **Encyclopedia of Renewable and Sustainable Materials**", Oliver Walter, (Kidlington, Oxford, UK , 2020).
- Goyal G, Satyanarayan P, "**Renewable Energy: Accelerating the Energy Transition**", Springer, (Singapore , 2024) .
- Lachal Bernard, "**Energy Transition**", ISTE and John Wiley & Sons, (Great Britain and the United States , 2019)
- Smil, Vaclav, "**Energy and Civilization: A History**" , The MIT Press, (Cambridge, london , 2017).
- W . Jong, J. Ruud, "**Biomass as a Sustainable Energy Source for the Future: Fundamentals of Conversion Processes**", John Wiley & Sons, Inc, (Hoboken, new jersey, 2015).

Articles:

- Ahmed I. Osman, Lin Chen, & authors, " **Cost, environmental impact, and resilience of renewable energy under a changing climate: a review**", Environmental Chemistry Letters, Vol 21, 2023.

- Aziza Majda Amina, "**Le Développement de la Bioénergie en Algérie**", Bulletin des Energies Renouvelables, Number 38, 2016.
- Dolf Gielen, Francisco Boshell, & authes, " **The role of renewable energy in the global energy transformation**", Energy Strategy Reviews, vol 24, April 2019.
- Ebhota WS, " **Photovoltaic Solar Scheme in Sub-Saharan Africa: Socioeconomic Booster**", International Journal of Mechanical Engineering and Technology (IJMET), vol 10, Issue 10, October 2019.
- Ouahiba G, " **L'Energie éolienne en Algérie : Un bref aperçu**", Bulletin des Energies Renouvelables, Number 37, 2015.

Conference Papers:

- Amina Mekhelfi, hadda rebbouh, " **Développement de la production des énergies renouvelables en Algérie à travers le partenariat (Situation et perspectives)**", international conference on: The role of industrial areas in achieving participatory food safety in the light of the transition to the green economy, 11-12 may 2022, University of Bordj Bou Arreridj , Algeria.
- UNDP (United Nations Development Programme), "**Country programme document for Algeria (2023–2027)**", in first regular session Item 7 of the provisional agenda : Country programmes and related matters , 2023, New York.

Reports:

- Amine Akbi, sami bouchaib, & authes, " **Biomass Energy**", in: Nouredine Yassaa : said Diaf, & authes, " Algerian Renewable Energy Resource Atlas", Centre de Développement des Energies Renouvelables (CDER), éd. 1, Algérie, 2019.
- Direction Générale de la Recherche Scientifique et du Développement Technologique (DGRSDT), "**Programme national de recherche sur la sécurité énergétique**", Algérie, 2021.
- Egypt Energy, "**North Africa Energy Overview Report 2024**", Overview Report, 2024.
- IEA, "**World Energy Outlook 2024**", Paris, 2024.
- International Energy Agency (IEA), "**Renewables 2024: Analysis and forecast to 2030**", Paris, 2024.
- International Renewable Energy Agency (IRENA), " **Energy Profile: Algeria**", Abu Dhabi, 2024.
- International Renewable Energy Agency (IRENA), "**North Africa: Policies and Finance for Renewable Energy Deployment**", Abou Dhabi, 2023.
- IRENA, "**Renewable Energy Capacity Statistics 2024**", Abu Dhabi, 2024.
- Journal Officiel de la République Algérienne, N° 23, Algérie: IMPRIMERIE OFFICIELLE Les Vergers, Arrêté du 2 Rabie Ethani 1435 correspondant au 2 février 2014.
- KPMG International, "**Energy transition investment outlook: 2025 and beyond**", kpmg international entities, London, 2024.

- Ministère de l'Energie et des Mines et des Energies Renouvelables, "**Bilan énergétique National/2023**", Alger, 2024.
- Nora. A, Ines . J, "**Towards a Green H2 Economy: Algeria Country Report**", HYPAT Working Paper 11/2024, HYPAT : Berlin, 2024.
- OECD, "**Government Support in the Solar and Wind Value Chains**", OECD Trade Committee policy paper, N°288, Paris, January 2025
- Salima OUALI, Khedidja Bouzidi, & authers, "**Geothermal energy**". In: Nouredine Yassaa, said Diaf, & authes, " Algerian Renewable Energy Resource Atlas", Centre de Développement des Energies Renouvelables (CDER), éd. 1, Alger, 2019.

Websites:

- Assemblée Populaire Nationale (APN), (2024, octobre 23), <https://www.apn.dz/>, (Accessed February 23, 2025).
- International Energy Agency (IEA), (2023), "**Energy Mix (Africa)**", <https://www.iea.org/regions/africa/energy-mix> , (Accessed 15/2/ 2025.)
- Klein, A. L, (2025, January 01). "**Top 5 Solar Projects to Watch in Algeria**", Energy capital Power Éditeur, <https://energycapitalpower.com/top-5-solar-projects-to-watch-in-algeria/>, (Accessed February 19, 2025.)
- Ministère de l'énergie des mines et des énergies renouvelables , (2022), "**Programme de développement des énergies renouvelables**", Algérie. <https://www.energy.gov.dz/?article=programme-de-developpement-des-energies-renouvelables> , (accessed February 15, 2025).
- Tawfiq H, Radwan M, & Nazim Z, (2021, Janvier). "**Algérie 100% énergies renouvelables : recommandations pour une stratégie nationale des énergies renouvelables**" , <https://library.fes.de/pdf-files/bueros/algerien/17413.pdf>, (Accessed February 25, 2025.)
- The International Energy Agency (IEA), (2023), "**Algeria: Electricity**", <https://www.iea.org/countries/algeria/electricity> , (accessed February 15, 2025.)
- World Bank Group, (2023), Washington D.C, <https://www.worldbank.org>, (Accessed February 11, 2025)
- World Bank Group, (2024), "**World Bank country classifications by income level for 2024-2025**", <https://blogs.worldbank.org/en/opendata/world-bank-country-classifications-by-income-level-for-2024-2025> , (Accessed February 12, 2025)