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Challenges and prospects of concentrated solar power deployment in Algeria

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ABSTRACT

The global community is targeting to triple the renewables capacity by 2030. Middle East and North Africa Region can play a key role in this process. Algeria is one of these countries not far from Europe and is expected to be a big exporter of renewable energy. The decision-makers in Algeria have planned to deploy solar photovoltaic and concentrated solar power (CSP) as main renewable energy systems. This study aims to shed some light on the barriers that hindered deployment of the CSP in Algeria though the high potential in terms of solar energy. In this study, data were collected from various sources and the literature. The data are examined, analyzed, and discussed to highlight the barriers of CSP deployment in Algeria. The study showed that cost, energy prices in the Algerian market and water consumption are the main causes for the low deployment of CSP in the country. However, exporting clean electricity to Europe would renew the interest of Algeria in CSP in the future.

Keywords: concentrated solar power, water consumption, energy exportation, renewables deployment

INTRODUCTION

Algeria has used renewable energy (RE) since its independence in 1962 with small hydropower plants implemented with several dams and wind power plants for pumping water in the high plataux. The government renewed interest in renewables energy sourses in the 1980's by launching research and experiments on photovoltaics (PV) in the Center for Development of Renewable Energy. A pilot solar PV was installed later in 2010 in the Sahara (Ghardaia). It consisted of a small PV power plant of 1.1 MW. This project aimed to train engineers and test developed technologies before their large-scale deployment. Further, a wind power plant of 10.2 MW installed capacity was also commissioned in the same year 2010 in Adrar. In 2011, the operation of a hybrid concentrated solar-natural gas plant in Laghouat, known as solar power plant 1 (SPP1) was commissioned. The solar field uses parabolic through collectors (PTC), the most common among concentrated solar power (CSP) technologies with 91 plants over the world against only 34 solar tower plants and a few using Fresnel and Dish technology (Alami et al., 2023). More solar PV plants have been built around the country with individual installed capacity up to 60 MW.

Algeria is deploying RE sources to strengthen its electricity network and diversify its energy matrix, which is the prime priority for the government. It is also aimed through this RE sources deployment to limit the carbon footprint, in line with the global efforts and Paris 2015 agreement. RE also enables saving of natural gas, which can be exported to increase the country's exportation capacity which depends mainly on gas and oil exports.

Algeria is located in North Africa; it has a strategic geographic location for future clean energy exports. On a hand, it is in the sun belt area known for its high solar energy potential. The average sunshine duration is higher than 2,500 hours per year, and the average energy yield is higher than 3,000 kWh/m^2/year (CEREFE, 2023). On the other hand, it is not far from Europe, which is expected to be a big importer of RE in the near future. Algeria has an advantage of a more than 1,200 km long coastline in front of the south European coastline and has plans to export clean electricity to Europe via Italy. The Algerian Sahara can power entire Europe and more due to the large surface area, more than 130,000 km^2, and the high solar energy potential.

The Algerian program for deploying RE sets a target of 22,000 MW by 2035, which will cover 27% of electricity generation (CEREFE, 2023). The CSP received less attention, with an installed capacity of 25 MW generated by the power plant SPP1 in the country. Other CSP plants were planned (SPP2, SPP3, and SPP4) to be operational in 2018 but they have never been constructed. Nevertheless, the CSP global installed power capacity has increased five times in the last decade 2010-2020. At the end of the decade, the CSP installed power capacity can approach 7 GW (IRENA, 2023).

High solar energy potential, financial support, policy, and technology maturity are the main drivers of CSP deployment (Kiefer & del Río, 2020). Nevertheless, in some regions such as North Africa and namely in Algeria, CSP has received less attention in terms of deployment though being in a region of high solar energy potential. Only one CSP plant was operated since 2011 in Algeria. This paper is aimed to discuss the reasons behind this low deployment of CSP technology in Algeria alongside their potential perspectives. Available field and published data are examined aiming to highlight the barriers to find solutions and pave the way for an adequate deployment of CSP in Algeria.

CONCENTRATED SOLAR POWER GENERATION

Current Status and Development of Concentrated Solar Power

Solar power generation is receiving continuous development and worldwide deployment. PV- and PTC-based CSP are the main types of solar power being developed. Unlike PV systems, CSP has the advantage to make use of a storage system which enables power generation in cloudy conditions. CSP plants are based on concentrating mirrors to focus the solar radiation energy to heat the transfer fluid and generate steam for the turbine to generate electricity. This technology has been developed and its deployment increased five times in the last decade, 2010-2020 (IRENA, 2023). In 2020, the installed CSP power in the world achieved 7 GW (IRENA, 2023). In this period, the levelized cost of electricity (LCOE) of CSP declined by 68% making it more competitive compared to other renewable sources. In 2021, the LCOE of commissioned CSP plants was USD 0.114/kWh in average (IRENA, 2023).

Researchers are striving to improve the performance of CSP and reduce its LCOE to make it more competitive. Development is focused on the solar collector field, heat transfer fluid (HTF), and the storage system to reduce the capital cost of CSP plants.

The solar field is composed mainly of PTC collectors which have been developed in shape and size over time since 1984 (Aseri et al., 2021). Optical characteristics and thermal performance have been improved. The aperture area significantly increased up to 1,048 m^2. Since 2016, no significant change is obssrved in the design and size of commercial PTC (Aseri et al., 2021).

Thermal oils are used as HTFs in CSP. They have been used in pioneer CSP installations in USA back since the 1980's (Aseri et al., 2021). Thermal oils include mineral oils, silicone, and synthetic oils (Benoit et al., 2016). Owing to their thermal characteristics, thermal oils are the common HTF in a great number of CSP plants worldwide mainly in Spain. They are thermally stable through cycling in the heat transfer loop, but their cost remains a demerit when compared to other alternatives such as molten salts. Another disadvanatage of thermal oils consists of the relatively low operating temperature which limits the efficiency of the CSP installation (Cabaleiro et al., 2012). In addition, thermal oils are not safe; they are explosive at high temperature (Aseri et al., 2021).

Regarding the efficiency of CSP plants, three generations were developed (Alami et al., 2023). The first generation delivered power based on Rankine cycle with an efficiency of about 38%. The second CSP generation showed an efficiency increase of about 45%. Development of new materials and their optical performance led to a third generation of CSP plants in addition to integrating thermal energy storage (TES) for energy autonomy. This technology advancement contributed to significantly reducing the LCOE of newly commissioned CSP power plants.

Further, the overall efficiency of CSP power plant is continousely subject of research. Higher performance contributes to decreasing the cost and increase thereby deployment of CSP. Optimization tools are necessary for optimal design and performance (Xu et al., 2024). Reseach and development could achieve up to 40% in cost reduction by 2030 (Khan et al., 2024).

In the past decade, TES has shown a significant progress in CSP. Long storage duration and low cost of TES as well as power dispatchability has increased the interest in TES for CSP installed worldwide (Bonk et al., 2018). Molten salt and thermal oil are the most common storage materials used in commertial CSP. Owing to its low cost, molten salt seems to dominate the TES for CSP in the current decade (Khan et al., 2022). Molten salt has other attractive features including high thermal conductivity, thermal stabilility, low viscosity. Aditionallly, they are non-toxic and non-flammable (Aseri et al., 2021). Other storage materials with much less commercial deployment include water and concrete while phase change material (PCM) is still being investigated. The latter offers high density and will play a significant role when it achieves utility scale and technology maturity. Thermochemical storage materials are also being tested at lab-scale.

The storage capacity and backup duration are the key parameters in storage systems for CSP. PCM can significantly contribute to meet this challenge due the high energy density (Ismail et al., 2022) that can offer. Another advantage PCM has is the nearly constant temperature during heat delivery unlike sensible heat storage (Teggar et al., 2023). It should be noted that research focused mainly on low temperature storage when investigating PCM. These category showed potential but also limitations that research is addressing (Khan et al., 2023a) including long stability over loading/unloading, corrosion, low thermal conductivity, subcooling, expansion, etc. Solutions to these drawbacks are proposed but still in lab-scale which need to prove their reliability in the field. Among solutions investigated, one can cite nucleating agents for reducing the

Figure 1. Solar power plant 1 in Laghouat, Algeria (ABENGOA, 2023)

subcooling effect (Teggar et al., 2022) and thickening agents to limit the effect of segregation as well as passive heat transfer enhancement of PCM (Bouzama et al., 2023) using nanoparticles (Nedjem et al., 2020), fins (Boulaktout et al., 2021), porous media (Nedjem et al., 2021), heat pipes (Bouadila et al., 2022), and hybrid enhancement techniques (Nedjem et al., 2022). For the next step, PCM of high melting temperature should be the field of research for next years as most of studies made on PCM were on medium and low temperature due to easy experimentations at this temperature level at low cost.

Research advancement in solar collectors, HTFs, and storage materials will lead to high performant and cost-effective CSP which increases its deployement in future. Optimization of the performance of the different componenets of the CSP plant is also important to reduce the LCOE (Boukelia et al., 2015). Moreover, research is underway to provide viable and cost-effective HTFs of high thermal characteristics and storage materials of high energy density. Moreover, hyprid renewable sources (PV/wind/CSP) are promising in terms of lowering the LCOE (Kennedy et al., 2022; Sumayli et al., 2023).

Solar Power Plant 1

In an attempt to integrate solar thermal energy, Algeria began in 2007 the construction of a hybrid gas-fired-solar plant (**Figure 1**) known as SPP1 based on combined cycle (CC) and concentrated solar thermal energy. The plant is in Laghouat province (**Figure 2**) 100 km south of Laghouat City. This site was selected due to the high solar energy potential, proximity to the gas field of Hassi R'mel as well as the high voltage transmission line of Tilghemet. The area has a solar potential with direct normal irradiation higher than 950 W/m^2 during summertime and more than 3,000 sunshine hours per year. The area is flat, and land is available which is adequate for the project. Other selection considerations include the availability of water sources of Sonatrach (oil company) and an airport nearby. The site (33°07' N, 3°21' E) is 700 m above sea level. The temperature in the site ranges between -10 to 50°C throughout the year. The average relative humidity is 24%, with rainfall less than 100 ml/year and an average wind velocity less than 5 m/s (Ikhlef & Larbi, 2018).

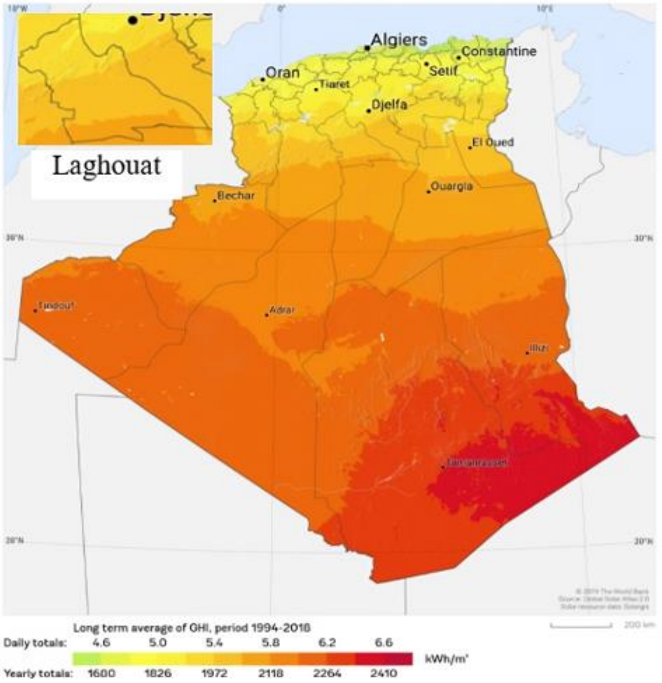

Figure 2. Laghouat Province in Algeria and solar map (Source: Authors' own elaboration)

The solar energy concentration concept is popular mainly in Spain and USA. In 2019, about half of the CSP units were built in Spain; 42 plants amongst 98 worldwide (Aqachmar et al., 2019). The Algerian CSP plant has been constructed by a Spanish company that obtained the tender for construction of the plant, bringing this technology to Algeria combining CSP and CC gas turbine plant. The power plant works partly on solar energy; when the sun is not shining, the plant is fed with natural gas to generate electricity. The CSP in SPP1 uses PTC consisting of mirrors that focus sun rays on a tubular linear receiver containing thermal oil as HTF. The hybrid plant is composed of a solar field of CSP, with 250 PTC of 150 m long and 5 m diameter installed on two main zones, as depicted in the satellite view (**Figure 3**). The PTC is equipped with a sun tracker and CC power block composed of gas and steam turbines. The CC is based on two 45 MW gas turbines and an 80 MW steam turbine for electricity generation (Ikhlef & Larbi, 2018). Also, there is a steam line, an air-based condenser, an auxiliary cooling system, water treatment unit, heat exchangers gas recovery unit, water circuits, pumps, and an electric transformer. The plant was built on a surface area of 130 ha, of which 90 ha for the solar field. The SPP1 plant has a power capacity of 130 MW gas-fired and solar power of 25 MW. For the first three years following its inauguration, the yield was 193.23, 192.54, and 196.83 GWh for 2012, 2013, and 2014, respectively. **Figure 4** shows annual electricity yield of SPP1 since 2015. The power output is in the range of 1,000-1,200 kWh/year. Irregular output is caused mainly by some technical issues consisting of common maintenance problems such as:

- Repair and replacement of damaged mechanical components in the power field and water loop.
- Maintenance routines including lubrication and mechanical repairs.

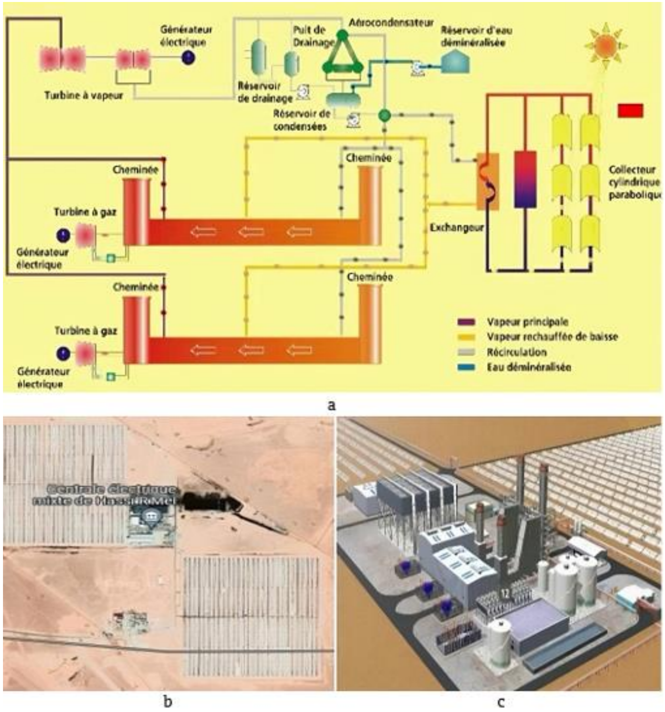

Figure 3. SPP1: (a) components; (b) satellite view; (c) 3D view (ABENGOA, 2023)

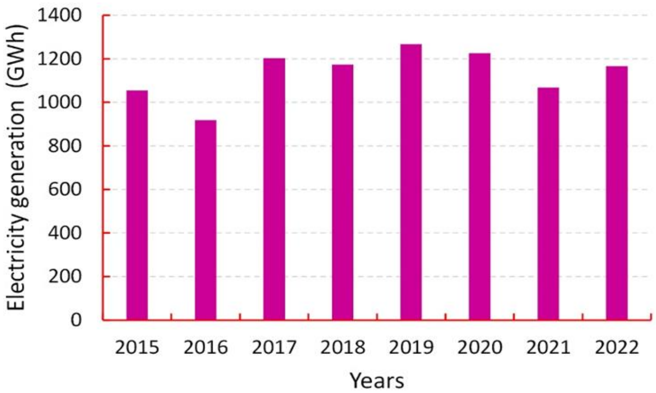

Figure 4. Annual electricity yield of SPP1 2015-2022 (Source: Authors' own elaboration)

For optimal performance and continuous satisfactory service of the power plant, an effective preventive maintenance is required.

POWER DEMAND AND GENERATION

In 2021, electric energy consumption increased by 11.5% compared to 2020 (Energy, 2023). Power demand has grown fast in the country. Peak power demand usually increases in summer due to heat waves and wildfires. The peak power demand increase shows consecutive records (**Figure 5**); a new record of 18,572 MW was observed on July 20, 2023.

To respond to the increasing power demand, more plants are installed. About 53% of power is generated by CC in Algeria and 40% by gas turbines (**Figure 6**), while only 5.4% is generated by steam turbine plants. Diesel-based electricity generation is still used for power generation mainly in remote areas and represents about 0.3% of the electricity generated in the country.

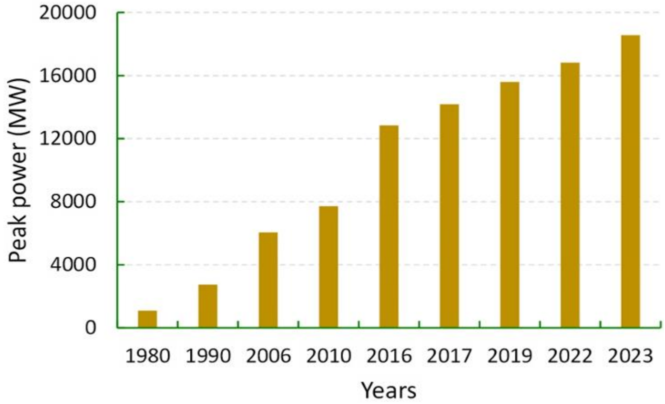

Figure 5. Peak power demand for 1980-2023 (Source: Authors' own elaboration)

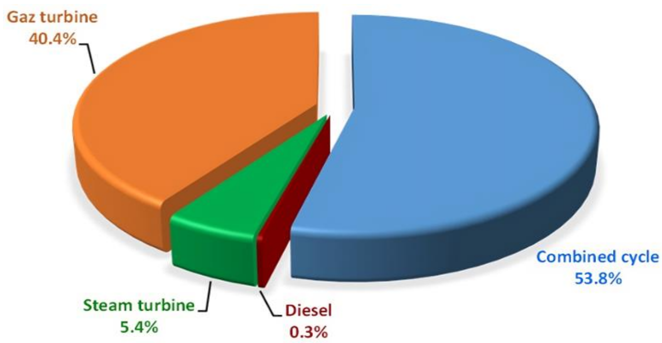

Figure 6. Power generation in Algeria (Source: Authors' own elaboration)

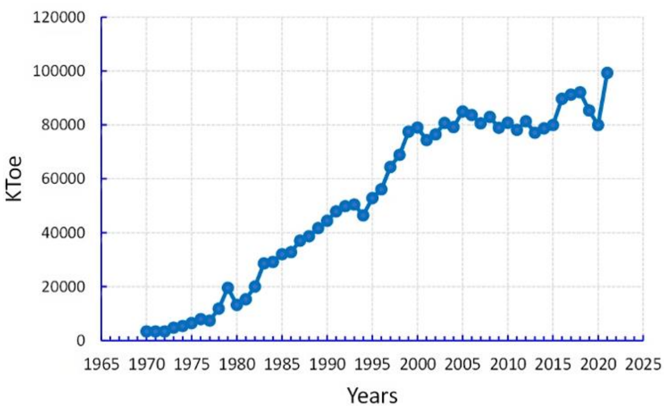

Figure 7. Natural gas production in Algeria since 1970 (Source: Authors' own elaboration)

Electricity generation in Algeria is mainly based on natural gas. Natural gas consumption was 7.8% higher in 2021 than 2020 (Energy, 2023). **Figure 7** shows the continuous increase in natural gas production driven by electricity generation and exports mainly to Europe. The electricity generation achieved 85,754 GWh in 2022 with an installed capacity of 25 180 MW (SONELGAZ, 2023).

Figure 8 shows the evolution of electricity production since 1970 (Energy, 2023). This increasing production is driven mainly by population growth and improvements in living standards but also due to the expansion of the electricity

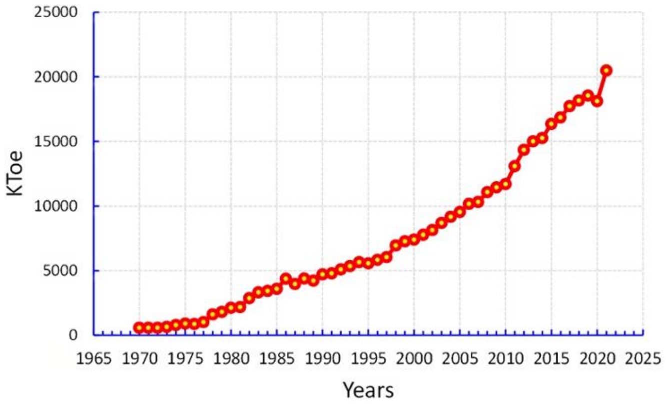

Figure 8. Electricity generation in Algeria since 1970 (Source: Authors' own elaboration)

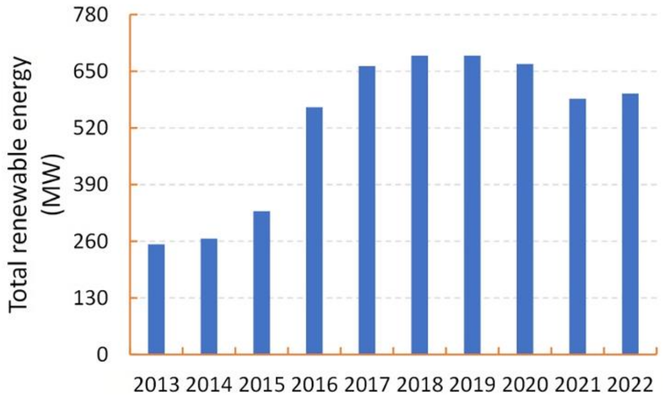

Figure 9. Renewables capacity in Algeria 2013-2022 (Source: Authors' own elaboration)

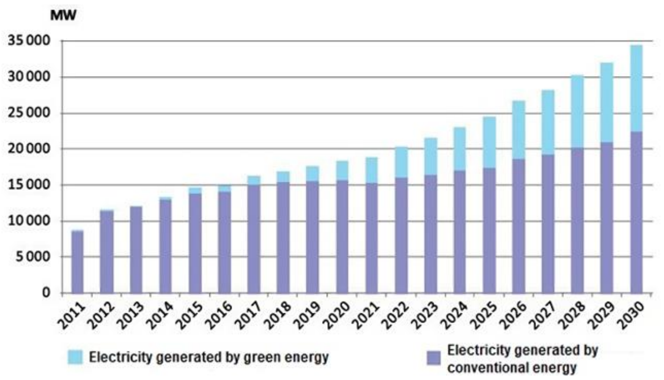

Figure 10. Electricity generation (green and conventional) in Algeria with 2030 prospects (CEREFE, 2023)

distribution network in sparse areas, where the country's land is more than 2,381,000 km^2 (MTA, 2023) for 45.4 million inhabitants (in 1/1/2022) (ONS, 2023). In 2022, 99% of the population had access to electricity.

RENEWABLES POWER GENERATION

Renewable power generation capacity in Algeria is not significant (**Figure 9**).

The total capacity in 2022 was less than 650 MW, representing less than 3% of the total power capacity in

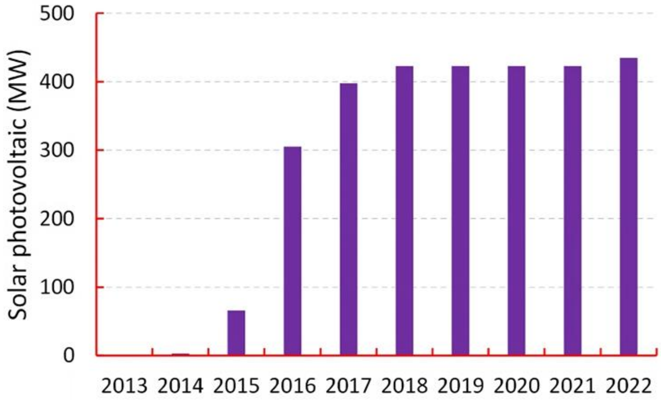

Figure 11. Installed solar PV capacity in Algeria 2014-2022 (Source: Authors' own elaboration)

Table 1. Grid-connected RES in Algeria

RES	Installed capacity (MW)	Operational year
CSP	25.0	2011
Wind power	10.1	2014
Solar photovoltaic	354.1	2018
Total	390.2	-

Algeria. The decrease shown between 2017-2022 is due mainly to the delay of solar PV projects, the increase of the fossil fuel installed capacity, and the decrease in the hydropower capacity driven by drought.

The government projections are to achieve 27% of clean electricity by 2030 (CEREFE, 2023) (**Figure 10**). Deploying RE plants enables, however, saving fossil fuel resources. Therefore, a program has been set to develop RES and limit consumption through energy efficiency.

Meanwhile, Algeria has set an energy efficiency program to limit energy consumption and emissions. The buildings sector is the main target of this program. Thermal insulation of building envelopes, low energy consumption lighting, solar water heaters, and rooftop solar PV were among the main measures recommended in this program. Public awareness and education are also considered as supporting measures. Moreover, subsidies and incentives are provided for energy users to encourage the deployment of clean energy and energy efficiency in buildings. This program also aligns with the Paris Agreement about climate change. In this framework, the International Energy Agency has a plan to double energy efficiency by 2030.

However, due to the relatively high LCOE compared to mainly solar PV on a hand and the low electricity prices in the local market on the other hand, investors cannot engage without support of the government. Thus, financial incentives and subsidies play a key role to attract investigators and improve CSP deployment.

Clean electric energy in Algeria is generated by solar PV, hydropower, CSP, and wind power. Solar PV yield is still minor in the national electricity production irrespective of the increasing interest of the policymakers in this promising technology. In 2021, the solar PV electricity yield was 642 GWh lower than that generated in 2020, where production was 665 GWh. This decline (3.5%) was due to technical issues in PV plants (IRENA, 2023). **Figure 11** shows the solar PV

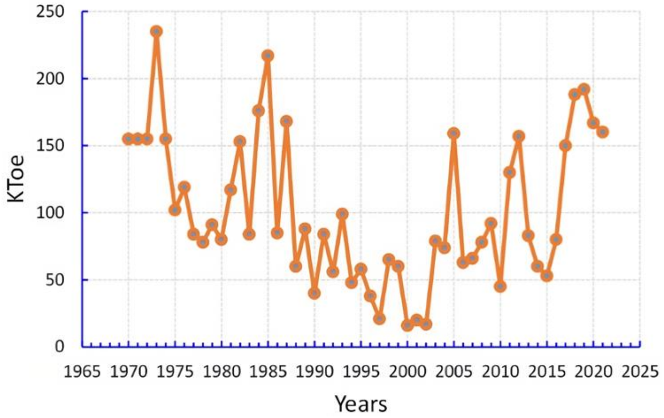

Figure 12. Hydropower generation in Algeria 1970-2021 (Source: Authors' own elaboration)

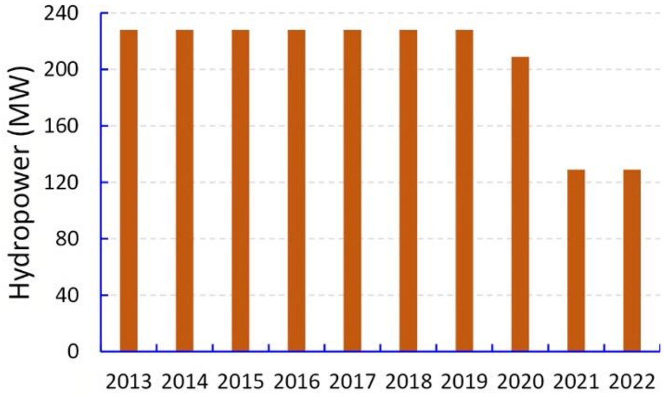

Figure 13. Hydropower capacity in Algeria 2013-2022 (Source: Authors' own elaboration)

deployment in Algeria over the years (IRENA, 2023). The total solar PV capacity (including off-grid) is still limited; less than 450 MW in 2022 (**Figure 11**). **Table 1** shows the on-grid RES capacity in Algeria.

Figure 12 shows the country's yearly hydropower yield for the period 1970-2021. Hydropower is continuously declining due to drought caused by climate change. Hydroelectricity showed only 9 GWh in 2021 against 49.6 GWh in 2020, a decrease of 81% (IRENA, 2023). Therefore, many units have closed in recent years, and the installed capacity is increasingly declining (**Figure 13**).

The contributions of both solar thermal and wind power are smaller, knowing that Algeria has constructed only one plant for each, a wind power plant of 10.2 MW in Adrar and another CSP plant of 25 MW in Laghouat working in hybrid mode with natural gas (130 MW).

However, this RE program has not been realized as initially planned. For instance, 4 CSPs were planned in 2007, and only one has been built since then. Many projects have been delayed due to various reasons including the country's political stability and the COVID-19 pandemic besides the market electricity prices.

ELECTRICITY MARKET

The LCOE is a common measure to compare the cost of various forms of energy. The LCOE of RE has significantly fallen in the last decade 2010-2020. For instance, the LCOE of utility-scale solar PV fell by 88% and CSP by 68%. This significant fall in cost boosted the deployment of RE projects, mainly solar PV. In some markets solar PV is competing even with fossil fuel electricity. The LCOE of solar PV fell down to USD 0.048/kWh in 2021, while for CSP the LCOE was USD 0.114/kWh (IRENA, 2023). China is developing all clean power technologies, including CSP and making them cheaper as was done with solar PV. Construction cost of CSP plants in China is 40% less than in other locations in the world (Qaisrani et al., 2021).

In 2022, the most attractive renewable technologies were onshore wind power and solar PV. The LCOE of onshore wind plants was USD 0.033/kWh while for solar PV it was USD 0.049/kWh, thanks to efforts due to China to develop and deploy at large scale these technologies. For CSP technology, the LCOE is remarkably decreasing but still not competitive compared to solar PV for instance. Large deployement of CSP will contribute to further reducing the LCOE of CSP (Khan et al., 2023b).

Local Market

Algeria produced 99.26 MToe of natural gas in 2021 against 79.944 MToe in 2020, 19.5% higher due to the high demand mainly from Europe due to the Russia-Ukraine war. In 2021, 20.286 MToe was used in power plants for electricity generation. With oil and gas revenue, the government could invest in RES, including CSP, but less deployment was observed. This can be attributed to electricity pricing policies practiced in Algeria, mainly the for the residential and industrial sectors.

As an oil and gas exporter, electricity and fossil fuel prices in Algeria are independent of international prices. Fuel is sold up to three-fold lower than its production cost, the same for electric energy, which is natural gas-based production. One of the drawbacks of this subsidy policy is waste of energy. To cope with this, the residential electricity prices have been revised; 4 different prices have been adopted according to the amount of energy consumed, more consumption higher tariff. The industrial prices are also too low compared to those applied internationally. The kWh cost 0.12 2023 USD in 2019, and it is sold for domestic usage in the range 0.015-0.059 2023 USD/kWh, up to eight times lower than its cost due to a social policy aiming to provide affordable energy for the population. This low price of electricity destroys the competitive aspects of the energy market and eliminates the RES competition, including solar PV, which is 2022 the cheapest among renewable energies.

SPP1 sells electric energy generated to a local state-owned oil and gas company for 0.023-2023 USD/kWh in the framework of a policy of independent power producers and long-term guaranteed purchase. With this low price, the income of the plant for its whole estimated lifetime (30 years) cannot pay back the initial investment cost (more than 3 million-2011 USD).

Export Prospects

The Mediterranean power system was launched by the European Commission in 2010 under the PWMSP project

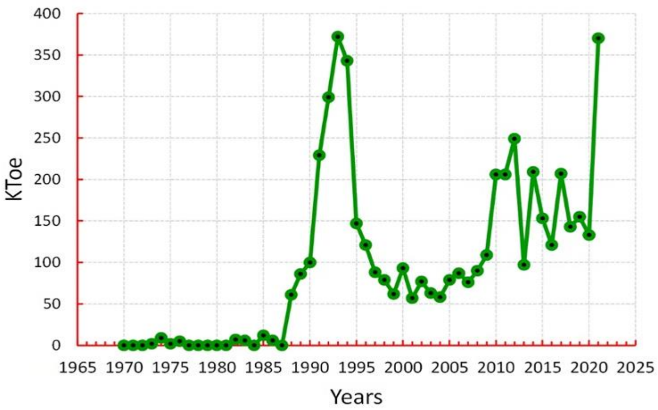

Figure 14. Electricity exports from Algeria 1970-2021 (Source: Authors' own elaboration)

(Paving the Way for the Mediterranean Solar Plan), aiming to promote electricity exchange in the Mediterranean basin (MED-TSO, 2023). Algeria and Italy are planning to connect their electricity grid as there is geographical as well as political proximity.

The Algerian power grid is currently connected to Morocco and Tunisia, through which power can be exchanged mainly from Algeria to the neighboring countries. The net transfer capacity between Algeria and Tunisia is 250 MW, while that with Morocco is 300 MW. Estimates indicate that the net transfer could achieve 1,000 MW by 2030. **Figure 14** shows the electricity exports from Algeria since 1970 (Energy, 2023). The exports are boosted again after an unstable situation in previous years; it will continue increasing with the high European demand.

There is an agreement between Algeria and Italy to interconnect the two shores via a 350 km high voltage direct current (HVDC) submarine cable between El Taref, Algeria, and Sardinia, Italy (**Figure 15**). This connection has a transmission capacity of 1,000 MW; the net exchange capacity of the country will increase to 2,250. Italy will be the gateway to the European electricity market. These electricity exports are expected to positively impact RE power generation in Algeria including CSP as the issue of low prices would be overcome and clean electricity would be economically viable.

EUMENA (i.e., Europe-MENA connection via HVDC electricity transmission) project was planned with a 2050 target aiming to supply 15% of the European electricity need by means of clean solar energy produced in the Middle East and North Africa (MENA) countries (Hori et al., 2017). The project planned to begin with 60 TWh/year solar concentrated electricity before 2025 to achieve 700 TWh/year by 2050 including 20 generation locations in the MENA region via GW-lines. CSP in North Africa could cover up to 15% of the global electricity need (Viebahn et al., 2011) which is regarded to play a key role in the future clean energy landscape. However, the political agreement is critical for export-import of clean energy between the two shores of the Mideteranean sea (Hess, 2018). Algeria and Italy are accelerating conceretization of the clean electricity export project. Thus, CSP would play a key role in these exports for the period 2030-50 (Boie et al., 2016).

Figure 15. Project of submarine HVDC cable Algeria-Italy (MED-TSO, 2023)

ENVIRONMENTAL IMPACT

Though CSP is considered one of the clean and sustainable energy systems, it has an impact on the environment (Ust et al., 2017). Life cycle assessment showed that wind power is recognized as the cleanest technology showing the least emissions. Not too far from that, we find other renewables including CSP, solar PV, PV, hydropower, and geothermal (Guidi et al., 2023). For instance, CSP plants integrating energy storage has the potential to mitigate emissions by up to 9 times compared to fuel fired power plants (Klein et al., 2013).

On the other hand, CSP plants need a huge amount of water, about 3,000 m^3/day. This water consumption of SPP1 is the daily need of almost 1,000 households for an average family of 4 persons, in other words, the average consumption of 3,750 inhabitants in Algeria, considering an average consumption of 80 l/inh/day average in Algeria (REPORTERS, 2023). Water consumed in the plant is used mainly for steam production. Water is scarce in this arid areas where the plant is built. Therefore, the water supply would be a challenge to install more CSPs in such regions in the country. There is a wastewater treatment nearby, but this unit cannot meet the quality and quantity needed. In order to be sufficient, expansion and implementation of post-treatment are required. Expansion is possible, knowing that the wastewater of Hassi R'mel is not fully treated due to the limited capacity of the treatment unit. Thus, further investment is required to solve this problem of water shortage in an environmentally friendly way. Also, the post treatment is possible but requires investment to meet the water quality required by the CSP plant. In addition, groundwater is available in the area but is of low quality for human use, which can be used without competing with human needs. The installed capacity is only 25 MW; more water is required for higher capacity, which is a challenge in such arid areas.

Installation of a CSP plant requires large land areas, and this may lead to an impact on the surrounding ecosystem, such as the loss of wildlife and biodiversity. Construction of CSP plants may affect natural sites and surrounding ecosystems, which can affect the populations, plants, animals, and birds living in the area. A change in the surrounding environment may occur due to changing land use, resulting in an impact on the biodiversity. To reduce CSP impact on the environment, the project must be carefully implemented, and measures should be taken to reduce water consumption, manage waste and maintain an ecological balance in the surrounding area

CONCLUSIONS

Algeria has constructed only one CSP plant since 2011 though being in a region of high solar energy potential and engaged policy to deploy renewables. The barriers of CSP deployment in Algeria are examined through data analysis. The main outcomes of the study are summarized, as follows:

1. Cost is the main cause that delayed the construction of many CSP plants in the country.
2. Low local electricity prices do not encourage private investors.
3. Water consumption is a challenge for CSP deployment.
4. Other barriers include availability and abundance of fossil fuel resources as well as the political and economical instability.
5. However, exports of clean electricity to Europe would renew the interest of Algeria in CSP in the future.
6. Furthermore, this analysis showed that the installation of CSP plants needs financial support and incentives as the generated power cost is still not competitive.
7. Research and development should be made to decrease the efficiency and ultimately the LCOE of CSP. Thus, optimization tools will play a key role to this aim.

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