Financial or Socio-Economic Feasibility? Potential Assessment of Renewable Energy Investment in Algeria

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Abstract

This study examines the objectives behind the Algerian government's investment in renewable energy—whether the investment decision is for financial or socio-economic feasibility. The study applies the Net Present Value (NPV) method to provide an answer. The findings show that socio-economic feasibility, rather than financial feasibility, is sought from the investment in renewable energy. The latter remains an inappropriate criterion for assessing a project's success or failure. The findings are helpful for future studies to build on and will likely attract the attention of policymakers in Algeria.

Keywords: renewable energy, financial feasibility, socio-economic feasibility, sustainability

1. Introduction

In response to the decline in hydrocarbon revenues, the rising domestic electricity demand, the depletion of oil and gas reserves, and greenhouse gas emissions, the Algerian government decided to develop renewable energy resources as a measure to help alleviate the implications that could result to the economy, the citizens and the environment. In 2011, the Algerian government adopted a national energy mix plan to generate 22 GW of power electricity from renewable energy by the year 2030 with a growth rate of 1000 MW per year. In addition to meeting the increasing domestic demand for electricity, the government planned to open a market to export electricity surpluses to generate income to feed the state treasury with foreign currency and contribute to economic development. Of this electricity power generation, 12000 MW will be devoted to the national market and 10000 MW to exports. The production of this amount of renewable energy implies that more than 300 billion m^3 of natural gas will be saved, and around 348 Mt equivalents of CO2 emission will be reduced [1]. This development plan has been updated many times to settle finally at 27% renewable energy in total electricity production by 2030. As shown in Table 1, the electricity production plan from different sources (photovoltaic, concentrated solar power, geothermal, wind, biomass, and co-generation) is to be achieved in two periods (2015-2020 and 2021-2030).

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Table 1: *Renewable energy targets for electricity production [1]*

Electric Power						
1st Period (2015-2020)			2nd Period (2021-2030)			
Energy source	MW	%	MW	%	Total (MW)	%
Photovolatics	3000	66.3	10575	60.52	13575	61.7
Wind power	1010	23.32	4000	22.89	5010	22.77
Concentrated solar power			2000	11.44	2000	9.09
Biomass	360	7.95	640	3.66	1000	4.55
Co-generation	150	3.31	250	1.43	400	1.82
Geothermal	5	0.11	10	0.06	15	0.07
Total	4525		17475		22000	

However, while the Algerian government recognizes the development of renewable energy as a source of sustainable development, the investment in renewable energy is not without costs. The implementation cost of the first phase, 3000 MW of renewable energy, is estimated to be 120 billion USD [2]. As such, it is necessary to ensure that the investment in such projects will be as efficient as possible to drive down their costs and attract investors to access the renewable energy market. In this direction, the Algerian government has set up several financing mechanisms, including power purchase agreements (PPAs) and feed-in-tariffs (FiT) for solar energy, wind energy, and cogeneration (Executive Decree No.13-218, the Arrêtés of 2014). According to the PPAs, power producers (national and international investors) offer their lower prices in exchange for a long-term contract to sell power for 20 years. The PPAs are intended to help drive down the price of power and secure project financing. The FiT for solar energy, wind energy, and cogeneration is based on the number of operating hours. Following an initial five-year phase during which the base tariffs will apply according to the potential operating hours of the power plant, the applicable FiT will be revised for each project based on its effective operating hours during the initial five-year phase. The feed-in tariff applicable to facilities with a low production time will be increased up to 15 percent. In comparison, the feed-in tariff applicable to facilities with a high production time will be reduced up to 15 percent following regulatory reevaluation rates.

The subsidized feed-in tariffs will be financed through a National Fund for Renewable Energies and Cogeneration (Fonds National pour les Energies Renouvelables et la Cogénération), by a 1 percent tax levy on the state's oil revenues, and through other resources or contributions, including a premium paid by end-users [3]. In this sense, tariffs will range from 12.75 Algerian dinars per kilowatt hour (DZD/kWh) to 15.94 DZD/kWh (0.12-0.15 USD/kWh based on prevailing exchange rates) for solar photovoltaic projects. For wind power projects, the base tariff will range from 10.48 DZD/kWh to 13.10 DZD/kWh (0.10 USD to 0.12 USD based on prevailing exchange rates) depending on whether the installed capacity of the production facility is over 5 MW or comprises between 1 MW and 5 MW [4]. CSP projects are not included in the FiT scheme [5].

While there have been abundant studies that related the investment project in renewable energy in Algeria to technical potential, measures and regulations, and socio-economic issues, there is, however, no study that relates the investment project of renewable energy to financial issues. For example, the study by Stambouli [6] has given an appraisal of renewable energy from a production potential point of view and argued that these could be powerful energy source alternatives to fossil fuels. The study by Hochberg [7] has analyzed the actual development and use of renewable energy in Algeria and reported that despite the considerable abundance of renewable energy, issues related to energy subsidies, renewable tender rules, and the financial and operational

health of the state-owned utility company "Sonelgaz" the counterparty in renewable tenders, present barriers for its development and use. The study by Sibel and Terrapon [7] has analyzed renewable energy from a social and economic point of view and revealed that the transition towards renewable energy presents an opportunity for social and economic development. The studies by Bouznit et al. [1] and Zahraoui et al. [8] have discussed the policy measures and programs set by the Algerian government to promote renewable energy generation. These studies discussed the legislative framework, financial incentives, the feed-in tariff system, and the tender and auctions undertook. All these studies have pointed out that Algeria's high renewable energy potential could be exploited as a means of sustainable development.

The purpose of this study is to analyze the investment project in renewable energy from its financial aspect. Its particular concern is with the financial assessment of the project as regards its contribution to the financial growth of the state-owned utility Sonelgaz in charge of buying electricity from the producers and selling and distributing it to the Algerian residential and industries. The remainder of this study is structured as follows. After the research methodology, the study provides an overview of the availability and the potential of renewable energy in Algeria; it then discusses the role of energy production in the economic growth of Algeria. Following is an attempt to assess the project's financial feasibility from the perspective of Sonelgaz. A discussion of the interaction of financial and socio-economic benefits of renewable energy and their implications on project sustainability is provided before the conclusion and recommendations for future studies.

The study uses a quantitative method with a cost-benefit analysis approach to answering the main research question related to the financial feasibility of the project investment in renewable energy in Algeria. Among the different cost-benefit analysis methods, this study applies the financial method of the Net Present Value (NPV) to provide an assessment indicator of the cash flow impact. When the NPV is greater than zero, the project is considered financially feasible. Otherwise, the project is considered not to be financially feasible. Data were collected from official documents, newspapers, articles, and the internet.

2. Availability and potential of renewable energy in Algeria

Algeria is a country that possesses one of the highest potentials for the use of solar energy in the world, which is estimated at 13.9 TWh per year. The country receives an annual equivalent sum of 2500 kWh/m². The solar energy capacity is 7.26 kWh/m² in the south and 4.66kwh/m² in the north of Algeria. The solar sunshine duration exceeds 2000 hours annually on the entire national territory and reaches 3900 hours in the high plateau and the desert. If fully exploited, it would enable Algeria to produce more than 169,400 terawatts per hour, equivalent to 5,000 times the annual national electricity consumption [2]. As such, the 2011 development plan for renewable energy primarily focused on solar. The plan aims to reach 15,000 megawatts (MW) of electricity generation capacity based on renewable resources by 2035, with a growth rate of 1000 MW/year. Furthermore, around 1000 MW of off-grid renewable energy installations are expected to be ready by 2030. Besides contributing to the local electricity supply, this plan is expected to contribute to new job creation, agricultural development, municipal water supplies, and a low-carbon environment [8].

In order to attract local and foreign investments in renewable energy, Algeria has set several regulations and incentive measures related to the distribution of electricity and gas to ensure the purchase of renewable energy (Law No 02-01), the goals and funds of the project (Law No 09-09 of 2009), incentives to increase the generation of renewable energy (Executive Decree No 13-218 of 2013), the distribution of the renewable energy project through tenders and auctions (Executive

Decree No 17-98 and No 17-204), the promotion of renewable energy for sustainable development (Law No 04-09) and the passing of legislation by the Algerian parliament allowing foreign entities to own a majority stake. In the second half of 2021, a call for investors for its first megaproject of 1000 MW solar photovoltaic power plants was launched. The project is divided into lots of 50 to 200 MW each. The goal is to attract independent power producers to develop renewable energy resources, the most abundant of which is solar [10]. Some 60 solar photovoltaic plants, concentrated solar power plants, wind farms, and hybrid power plants are to be installed by the year 2030 [9]. Because of its location in the Sahara Desert, Algeria's solar potential is enormous, estimated to be as high as 14 TWh per year. It is important to note that Algeria's Sonatrach Oil Company and Italian's Eni Oil and Gas Company jointly built a 10 MW solar plant in 2017. Sonatrach's 2030 Vision calls for installing 1.3 GW of solar generation capacity at the company's oil and gas sites, mainly to cover electricity needs on production sites. It is expected that some 30-40 percent of the electricity produced for domestic consumption will be from solar energy by 2030. [10]. Furthermore, one of the world's first hybrid power stations is located at Hassi R'Mel, which combines a concentrated solar power array covering over 180,000 m² with a gas turbine and steam cycle plant, using natural gas and solar-generated steam. The plant started electricity production in June 2011.

Algeria also has 13 hydropower plants, and they represent its third-largest energy resource after natural gas and oil. Most of Algeria's hydropower plants are located in the northern parts of the country that benefit from high levels of rainfall.

Algeria has tremendous wind energy and geothermal potential as well. Its wind potential is forecast to be about 35 TWh/year. It built its first wind farm at Adrar, with an installed capacity of 10 MW and funding from the state-utility Sonelgaz. Moreover, a series of thermal springs in north central Algeria in locations such as Ouarsenis, Biban, and Kabylie hold promise for geothermal plants.

3. Economic growth and energy production in Algeria

In Algeria, hydrocarbons (oil and natural gas) resources are considered the engine of economic development. Revenues from hydrocarbons export have constituted the primary financial source for economic activities. These revenues from hydrocarbon export have allowed Algeria to make advances in economic and human development. The country nearly cleared its multilateral debt in 2008, invested in infrastructure projects supporting economic growth, and introduced redistributive social policies that alleviated poverty and resulted in significant improvements in Human Development Indicators. Oil and gas continue to contribute to financing national economic development in 2019, including 20% of GDP, 41% of fiscal revenues, and 94% of export earnings [11]. However, the fall in oil prices and the decline in export volumes caused a steep fall in hydrocarbon export revenues. The overall budget deficit is estimated to have widened to 16.4% of GDP in 2020, while the current account deficit is expected to have increased to 14.4% of GDP. With international reserves falling to 46.9 billion USD at the end of 2020, poverty is expected to have risen in 2020 due to falling growth and employment. Such factors have caused a slowdown in GDP growth during 2015-2019 [12].

The fall in hydrocarbon export revenues, increasing domestic electricity demand, and environmental impacts have let Algeria recognize that the country's future is no longer in hydrocarbons and that sustainable development is to be achieved through the diversification of its energy resources. The energy mix in Algeria is currently composed of 35% oil and 65% natural gas. One of the challenges of energy security in Algeria is the energy mix diversification, with an electricity penetration rate of 99% and a distributed natural gas penetration rate of 60% [13]. In Algeria,

as in other countries, the diversification of the energy mix is expected to strengthen prospects of economic development, alleviate poverty, and improve citizens' living standards. The energy mix diversification impacts economic growth and development as a consequence of the export of additional gas. Augmenting the amount of natural gas for international export could also equip Algeria with commercial relationships and geopolitical influence [7]. The Algerian government expects this investment in renewable energy to respond to economic and social challenges, generate more revenues, create new job opportunities, offset the shortcoming of fossil fuels, and provide a higher standard of living. Revenues and taxes from export will positively affect economic growth. Investment in renewable energy is likely to speed up GDP growth due to selling the energy savings from the decrease in natural gas consumption and consequently generating more export revenues of at least 100 million USD [14]. In addition, the project is intended to encourage and promote the development of the local industry in the solar photovoltaic sector. The project stresses the need to embody an energy transition adapted to national specificities to support the national manufacturers and finance institutions. This is done by ensuring the optimal operation of the solar power plant throughout the electricity purchase and sale contract over 20 years [15]. This renewable energy investment project will help develop new skills and employment opportunities. Algeria also has a clear incentive to develop its renewable energy resources regarding fiscal health, local economic development, and international influence [15]. It is considered that the project presents an opportunity and a lever for economic and social development, mainly through the establishment of industries that create wealth and jobs.

4. Potential socio-economic benefits of renewable energy

Renewable energy generation plays a significant role in the economy by providing various socio-economic benefits. The potential socio-economic benefits generated by renewable energy for Algeria are understood as follows:

Cost saving and revenue generation from low dependency on fossil fuels: Renewable energy permits the replacement and diversification of energy sources and, as a result, a low dependency on fossil fuels (oil and gas). This low dependency on fossil fuels permits to free up of considerable volumes of natural gas, currently used for domestic electricity generation, for additional exports to international markets. According to some information sources, Algeria's renewable energy project will preserve more than 550 million cubic meters of gas per year in its first phase, saving at least $100 million annually [15].

Job creation: The production of renewable energy sources will likely lift job prospects in the country. The production plan for renewable energy expects the generation of 100,000 jobs for national renewable energy production and 100,000 jobs for renewable energy export [16]. The planned large solar power projects with up to 4 GW generation capacity are expected to create job opportunities for 56000 people during the construction phase and 2000 more jobs during operation [17].

Reducing environmental risk: The CO2 emissions in the country are greatly caused by the power generation from oil and gas. The Environmental Performance Index (EPI) puts Algeria 86th of 132 countries [18]. Algeria committed to the Intended Nationally Determined Contribution (INDC) and agreed to reduce greenhouse gas emissions by 7% by 2030 [8]. According to officials, the project would avoid 1.3 million tons of carbon dioxide emissions per year, which would represent, in terms of financial valuation, a gain of $70 million [15].

Penetration to the international market: The renewable energy project is expected to allow Algeria to position itself on the international market via the export of electricity at a competitive price and the export know-how. Sonelgaz estimated that 34,411 km of transmission lines are to be

implemented from 2017 to 2027. Currently, 9,930 Km of transmission lines are under development, with another planned 24,511 Km, including national and international interconnections. As a result, the export of renewable energy through the development of new cross-border transmissions could permit commercial and political influence on importers.

Energy and production input: The production of renewable energy at subsidized prices will make power energy abundantly available, hence, uninterrupted and regular energy supply, particularly in the southern and rural parts of Algeria. Subsidies in the form of low electricity prices can be seen as a socio-economic advantage. In the situation where energy is supplied in a sufficient amount, both citizens' and companies' production capacities increase as a result; the economic development will be positively affected [8].

Cost-effectiveness: Renewable energy development is an enormous challenge facing the Algerian government because of the high investment costs. The cost of this development project is estimated at 120 billion USD [2]. However, renewable energy will become more cost competitive as increasing production technologies are implemented, and their costs are expected to decline further.

Developing local manufacturing and financial capacity: The tender rules require local manufacturing of solar components, including modules, racks, cables, and other equipment. The tender rules furthermore require financing from national institutions, ensuring appropriate levels of technology transfer, local participation in projects, and gaining more knowledge to take on further development in renewable energy.

Renewable energy education: The importance given to renewable energy by the Algerian government is reflected in its plans to establish educational institutes to train professionals in the field of renewable energy and sustainable development [19].

5. Purchase and sale of solar electricity by Sonelgaz

As it is indicated in Executive Decree No. 13-218 of 2013, the Algerian government has taken incentive measures to boost the production of renewable electricity generation. According to this executive decree, the government commits itself to grant bonuses for the costs of diversification of electricity production from renewable energy sources to buy all renewable electricity produced by both public and private enterprises at a price above the production cost. The electricity generated by the renewable energy plants will be sold through PPAs to a state-owned utility formerly named Sonelgaz for a maximum period of 20 years. Sonelgaz is therefore the sole utility company responsible for the marketing of electricity in Algeria, i.e., buys and distributes all the electricity produced from the renewable energy project. As provided in the tender, Algeria adopted a purchase price for electricity generated from renewable energy sources for periods. The purchase prices depend on power and the period of exploitation (the first 5 years and the remaining 15 years). The base tariffs range from 0.12 USD/kWh to 0.15 USD/kWh for solar PV projects. The electricity power generated from the project is to be sold to the distributor (Sonelgaz) at a guaranteed fixed price for 20 years (fixed price contract). This FiT incentive is supposed to be attractive to all investors inside and outside Algeria. The feed-in tariff for solar energy is summarized in Table 2.

As of June 2021, the price of electricity generated from natural gas (including all taxes and fees) among Algerian households was 5.34 Algerian dinars per kilowatt hour, corresponding to around 0.038 U.S. dollars per kilowatt hour. Businesses instead paid 4.58 Algerian dinars, or 0.033 U.S. dollars for a kilowatt hour of electricity. In contrast, the average electricity price in the world is 0.14 USD/kWh for households and 0.12 USD/kWh for businesses. Electricity purchase prices of solar energy by Sonelgaz from the producers are therefore very high compared to the selling electricity

Table 2: *Feed-in tariff for solar energy*

Source	FiT (USD/kWh)	
Solar PV	First phase (2015-2021)	Second phase (2021-2030)
Contribution	3000 MW	10575 MW
< 5MW	0.12	0.089-0.15
> 5W	0.096	0.071-0.12

prices from natural gas paid by the households to Sonelgaz by 0.158 USD (0.191–0.033 USD). It suggests that despite the financial losses incurred by Sonelgaz as a result of the subsidized price policy, the policy aims to achieve a myriad of social goals including poverty alleviation, social care, social justice and social security, which are the most important factors influencing economic development in Algeria.

6. Project investment assessment: Cost-benefit analysis

The cost of producing solar energy and its financing sources are the main challenging factors for the acceleration of the project. Since this type of investment requires large expenditures, the Algerian government must consider the project's financial feasibility (cost-benefit analysis). Thus, the renewable energy project must be evaluated from its lifetime cash inflows and outflows to determine its financial feasibility, which is the project's potential return generation compared to its costs. A variety of financial evaluation methods have been identified in financial literature to examine the financial feasibility of projects, including payback period, return on investment, and internal rate of return methods. The cost-benefit analysis is performed here in terms of Net Present Value (NPV), which account for all cash inflows over a given time period and the initial investment costs. Using this technique requires a discount rate to compare future values (cash inflow and outflows). If the sum of discounted cash inflows exceeds the initial costs, the project is considered financially viable. Financial feasibility considers financial returns from the perspective of the investor (Sonelgaz) as the counterparty in renewable tenders, i.e., as guarantor of the electricity purchase contract. Therefore, what is of concern is the price (cash outflows) by which Sonelgaz purchases electricity from the producer, while on the benefit side (cash inflows) concerns the selling price of electricity by which Sonelgaz sells electricity to consumers. The solar energy production cost is excluded from the calculation of the NPV.

6.1. Cash inflows and outflows

The investment project in this study is considered as the producer-buyer-consumer relationship between the companies producing the solar energy (project company), the buyer (Sonelgaz) and the consumers. From Sonelgaz's perspective, the project cash outflows are considered in terms of prices paid to the producers (0.12-0.15 USD/kWh). According to the targets, a total of 22,000 MW is expected to be produced by year 2030 with 12,000 MW devoted to the national market, and 10,000 MW to exports.

The selling price for which Sonelgaz will sell the electricity produced from the project had not been determined. In order to conduct a comparison between the cash inflows and cash outflows, it is presumed that the selling price will be the same or nearly the same as the selling price applied to electricity from natural gas. In Algeria, the price of electricity generated from natural gas and sold by Sonelgaz to households is 0.037 USD/kWh. Industrial users instead pay 0.033 USD/kWh.

These prices are less than the average world prices, which are 0.138 USD/kWh for residential consumers and 0.128 USD/kWh for industrial consumers.

6.2. Assumptions

- The discount rate of (3%) is assumed to be constant over the tender life period, which is 20 years.
- The anticipated electricity price from solar energy is hypothesized to be the same as that of the current price generated from natural gas.
- For calculation simplification, it is assumed that 1,000,000 kWh is the average annual consumption by households and businesses.
- The initial investment cost is assumed to be the total purchasing price paid by Sonelgaz at the beginning of the tender as a one-time lump-sum over 20 years. 0.191 USD is used as the average purchasing price of electricity payed by Solegaz to the producers for solar energy.
- The life period of the investment project is assumed to be the life period of the tender (n = 20 years).
- Cash inflows earned by Sonelgaz from electricity sales are calculated based on 1,000,000 kWh * USD every year. Hence, they are taken into account in the NPV calculation as constant annual cash receipt from the investment in the project.
- 0.038 USD is the selling price of electricity paid by households to Sonelgaz. The calculation is based on the residential consumer as the biggest energy consumer, representing 38.1% of the nationally consumed energy [20].
- Purchasing and selling prices are assumed to remain constant over the life period of the tender.

6.3. NPV calculation

The NPV of the investment is calculated to determine the present value of the cash inflows and to compare the present value of the cash inflows over 20 years to the initial investment.The calculation is shown in the equation below:

$$NPV = -Io + \frac{C_1}{(1+t)^1} + \frac{C_2}{(1+t)^2} + \frac{C_3}{(1+t)^3} + ... + \frac{C_n}{(1+t)^n} \quad (1)$$

Where NPV is the net present value; Io is the initial investment cost; n is the period investment in years; C is the annual cash flow; and t is the annual discount rate.

According to the tender, the purchase price paid by Sonelgaz is fixed for a 20-year period which has a significant impact on the NPV as the lower the discount rate, the higher the present value, particularly if the time period is extended. During the production of this study and at the moment of calculating the NPV of the investment, the discount rate was set by the Algerian central bank at 3% annually.

The result shows that the NPV is -3,254,655 USD. The negative NPV means that Sonelgaz pays (cash outflow) more than it receives (cash inflows) (15% of efficiency , i.e., the purchasing price of electricity costs five times more than the sale price). The low price subsidy system is the reason for this financial infeasibility. On the other hand, as Sonelgaz's financial capacity is not sufficient to support this negative financial effect, the payback period appraisal method could be an appropriate method to show how long it should take to recover the money laid out for the project. Despite the drawback of the payback method, in a situation like the case of Sonelgaz,

a short payback period can be more attractive than a longer-term investment with a higher net present value.

7. Discussion

In the accounting and finance literature, the cost-benefit appraisal methods justify a decision to implement or reject an investment project by identifying the project with the highest return. The cost-benefit method requires the availability of all benefits in monetary terms during all phases of the project. However, the socio-economic costs and benefits cannot be quantified in monetary terms and this makes the cost-benefit financial assessment method inappropriate. Alongside the cost-benefit analysis, consideration should be given to the socio-economic benefits and objectives from the project.

For socio-economic objectives, the Algerian government decided to subsidize the price of electricity to achieve wider utilization by residential, commercial and industrial consumers. This will result in financial losses incurred by Sonelgaz. In Algeria, using public financing to protect citizens' purchasing power is a strong policy objective since its independence in 1962, particularly in terms of investment in basic services, education, healthcare, social care and social transfers, basic consumption goods, housing, and energy. In 2019, around 7.6% of Algeria's GDP went into subsidies: oil was subsidized 8.8 billion USD, gas 2.3 billion USD, and electricity 2 billion USD [3]. From an expenditure point of view, the socio-economic policies puts pressure on the government budget, and as a consequence, the Algerian government should take measures to minimize these expenditures to avoid social instability. This is especially true as Algeria is highly dependent on en¬ergy revenues where oil and gas currently represent more than 60% of the government revenues, and over 90% of export earnings. In this regard, the Minister in charge of prospective stated, "we must think about new business models, not necessarily the state budget, to finance the energy transition". The Minister further stated "the state budget is being put to the test today; there is a need to support this energy transition with an industrial strategy" [13]. On the issue of low hydrocarbon (gas and oil) prices and their implication on renewable energy investment, an official stated, "Sonatrach and Sonelgaz need to exit the low prices circle before any investment is considered" [22].

With the understanding that the raison d'être of renewable energy investment is associated with economic, social, and environmental objectives for sustainable development, these objectives become competing factors for the financial feasibility of the project. Hence, despite the project's financial losses, it should not be considered a failure as long as the investment project can be completed within its set of time, costs, and objectives. Studies consider failure to occur when the project does not achieve its objectives (e.g., [21, 22]). In the case of Algeria, the financial losses can be covered by the achievement of these socio-economic objectives. The low electricity prices adopted by the Algerian government to meet the national consumption demand of electricity can be seen as a factor likely to benefit socio-economic development. The study by Oyedepo [23] relates electricity consumption to economic growth and that the former is a causal factor to the latter. This means that electricity consumption has diverse impacts on a range of socio-economic activities and, consequentially, the living standard of citizens.

Therefore, regarding the socio-economic consequences of investments in Algeria, projects cannot be selected only on financial grounds. Both financial benefits and socio-economic benefits are to be considered at the same time. If we care only about financial benefits, then this will come at the expense of socio-economic benefits, and vice versa. Instead, an alternative policy based on both financial and socio-economic benefits should be followed. In this regard, Haddoum et al. [24] argued that it becomes necessary to promote renewable energy accompanied by energy efficiency

measures, for which price factor is necessary. Rising electricity consumption in Algeria makes it challenging to achieve the renewable targets set by the government, so more extraordinary efforts both in renewable promotion and energy efficiency will be needed if the proposed objectives are to be achieved. This is especially true for Algeria where the state budget is based on export revenues from hydrocarbon. The decline in hydrocarbon revenues suggests that public spending is no longer secured, and that policies designed to generate financial benefits from electricity distribution need to be complemented.

8. Conclusion and recommendations

In conclusion, this study has sought to provide an analysis of the financial feasibility of implementing renewable energy in Algeria. Given that the government subsidizes electricity prices, the decision by the government to invest in renewable energy is not because of financial objectives or gains but because of socio-economic objectives. As a consequence the cost benefit appraising methods are not appropriate. However, the study concludes that since the Algerian government favors projects that deliver socio-economic benefits, the project should be seen socially and economically feasible and its support by the Algerian government is justified. However, the subsidized price policy could be counterproductive long-term and become an obstacle to sustainable development. Thus, the need for financial considerations (financial/objectives gains) from the project to support these socio-economic spending requirements should be recognized.

This paper concludes with five recommendations for future studies. First, because the renewable energy project in Algeria is still in its launching process, the resulting lack of data on different costs could not allow a practical and realistic cost benefit analysis of the project. Therefore, data need to be broadened to include all cost elements: organizational costs, solar panel installation costs, and operating costs. Second, the cost-benefit analysis allows assessment of the project only from financial profitability. Hence, studies need to assess the project from an economic viability point of view to permit a comprehensive evaluation of the project. Third, it is important to highlight the need for future studies to compare the advantages and disadvantages of renewable and non-renewable energy (fossil fuels) from a finance perspective to draw a conclusion about the most competitive energy option for Algeria. Fourth, future studies need to analyze whether the path towards the socio-economic benefits of renewable energy in Algeria has been really achieved. Fifth, future studies need to confirm or disconfirm the findings of this paper as they are only hypothetical for the moment and are not established.

Declaration of interest: None

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