African Journal of Advanced Pure and Applied Sciences (AJAPAS)
Online ISSN: 2957-644X
Volume 3, Issue 5, 2024
Page No: 30-40
Website: https://aaasjournals.com/index.php/ajapas/index
ISI 2024: 0.877 **SJIFactor 2024: 6.752** **معامل التأثير العربي: 1.62**
Special issue: First International Conference on Technical Science (FICTS-2024), Sabha, Libya

Investment in Renewable Energy: A Case Study of North Africa

Okba mekhnane [1 *], Lazhari Zouaouid [2]
[1] Faculty of Economics, Commerce, and Management Sciences, Laboratory of Applied Studies in Financial and Accounting Sciences (EASFC), University of Ghardaia, Zone Scientifique, Ghardaïa, Algeria.
[2] Faculty of Economics, Commerce, and Management Sciences, University of Ghardaia, Zone Scientifique, P.O. Box 455 Ghardaïa, 47000, Algeria

الاستثمار في الطاقة المتجددة: دراسة حالة شمال أفريقيا

عقبة مخنان [1*]، زواويد لزهاري[2]
[1] كلية الاقتصاد والتجارة وعلوم التسيير، مختبر الدراسات التطبيقية في العلوم المالية والمحاسبية، جامعة غرداية، المنطقة العلمية، غرداية، الجزائر
[2] كلية الاقتصاد والتجارة وعلوم التسيير، جامعة غرداية، المنطقة العلمية، غرداية، الجزائر

[*]Corresponding author: mekhnane.okba@univ-ghardaia.dz

Received: May 01, 2024	Accepted: October 08, 2024	Published: November 12, 2024

Abstract:
This research paper aims to shed light on the reality of investment in renewable energies in North African countries, exploring their fields and investment prospects. The study concluded that the region has an ideal potential to create an integrated system that will produce renewable energy, liberate vast quantities of water, air condition living and working spaces, and create jobs without adding to the burden on Mother Earth. Large areas of North Africa with high levels of sunshine and high-quality solar radiation are potential sites to exploit the sun's lending of energy free of charge.

Keywords: North Africa; renewable energy; Solar Energy; Wind Energy.

الملخص
تهدف هذه الورقة البحثية الى ابراز واقع الاستثمار في الطاقات المتجددة بمنطقة شمال افريقيا، واستكشاف مجالاتها وآفاق الاستثمار فيها .وتوصلت الدراسة إلى أن المنطقة تمتلك إمكانيات مثالية لإنشاء نظام متكامل سيقوم بإنتاج الطاقة المتجددة، وتحرير كميات كبيرة من المياه، وتكييف المساحات المعيشية والعمل، وخلق وظائف دون إضافة عبء على كوكب الأرض. تعتبر المناطق الواسعة في شمال إفريقيا التي تتمتع بمستويات عالية من إشعاع الشمس وجودة عالية من الإشعاع الشمسي مواقع محتملة لاستغلال الطاقة الشمسية المجانية.

الكلمات المفتاحية: شمال إفريقيا، طاقة متجددة الطاقة شمسية، طاقة الرياح.

Introduction

The paper provides an overview of investment in renewable energy and the state of receipt of foreign investments in North Africa. The paper consists of eight main parts. The first part of this paper presents the introduction. The second introduces the renewable energy course in North Africa. The third section presents the types of foreign direct investments and the mechanisms of operation. The fourth section presents a comprehensive review of investment in renewable energy, especially solar and wind investment, and subcontracts in world trade. The fifth section underlines the importance and the potential facilitation for the promotion of investment in renewable energy. Section 5 presents the case study of Tunisia which has favored just and liberal subsidies to promote

investment in solar and wind energy and section 6 of the case study of Egypt, which has chosen the policy of feed-in tariffs for emerging wind energy contra regulations non payees. Section 8 presents official attitudes regarding foreign investment. The last section summarises the main conclusions and recommendations for investment in renewable energy in North Africa. [1]

1.1. Background and Rationale

North African countries are among the most ambitious in terms of targets for renewable energy development. The evolution of the willingness of North African countries to cautiously consider and then prioritize the development of renewable energy sources has proven that the environment and security can be constituent elements of national strategies. After a decade of negotiations and planning, the Desertic announced the successful conclusion of the feasibility phase in December 2012. Its initial plans for utility-scale renewable energy projects in Morocco and Tunisia have been realized on time and on budget. [2]

Investment in renewable energy in the Middle East and North Africa (MENA) region has been at the center of global attention in the recent past due to various factors. Historically, the MENA region, and especially North Africa, is rich in renewable energy resources, including solar, wind, geothermal, and bioenergy, which have never been sufficiently exploited. Economic and socio-political factors have also prompted investment in renewable energy sources within the region. First, significant energy import dependency is an essential aspect of North African economies. In this context, increasing the share of renewable energies is perceived as a strategy to reduce the cost of energy and the vulnerability of the electricity sector in North African countries. Second, investing in renewable energy sources also fuels economic development and meets growing energy demand across the region. This approach is all the more relevant because 50% of the population in North African countries is rural, and more than 30% still lives in extreme poverty. As a result, investing in energy, especially renewables, could be a catalyst for the growth of micro- and small- and medium-scale enterprises in the fields of agriculture, agro-industry, and micro-processing, thus providing gainful rural employment. [3]

1.2. Scope and Objectives

Objectives: (1) Reveal the actual scope of the inflow of investment in renewable energy technologies, on the one hand in terms of the amounts invested and, on the other hand, in terms of what these investments are actually for, in practice, at the level of the niche markets and renewable energy policies, projects, and programs of these three North African countries in question. (2) Go beyond the "macro" perceptions of the "relevant" stakeholders and of the professional investors, financiers, policymakers, and public authorities in their role as members of the one-planet fragmented elite. The two case studies do not simply review the profile of the renewable investors from Western and East European countries. They explore the question "who is importing capital into North African renewable energy (NARE) projects?" as champions of decarbonisation. (3) Unveiling, interpreting, defining, and interacting with the main stakeholders that are operating in these same markets in the field of renewable energies, those pragmatically constituted by the socio-political and environmental movements at national, transnational, regional, and local level who are seeking to influence and try to control their development and their outcomes, and those actors who are on the receiving end (either as victims or who are opposing what threatens to become the new occupying force) of the impacts of foreign investments in their countries. [4]

Scope of the study: The study covers an important interrelated yet underdeveloped topic at the heart of contemporary global debates and discussions about decarbonisation, energy security, geopolitics, and sustainable development. It uncovers and analyses the constraints and disincentives to investment in renewable energy located in the current energy systems, policy frameworks, and global value chains in North Africa. The research provides detailed analysis and new empirical evidence on the legislative and regulatory framework and official discourse, the investment inflows, global and regional trade, and the markets for renewable energy technologies—solar and wind turbines—in Algeria, Egypt, Morocco, and Tunisia. [5]

2. Renewable Energy Landscape in North Africa

Renewable energy potential in North African countries has added in the last decades further attempts to the list of the measurable goals of sustainable socio-economic development including diminishing unemployment and expanding job opportunities, especially for young people, reducing desertification, enhancing security on water supply in hybrid infrastructure designs, mitigating climate change and controlling global warming impacts. Indeed, sub-regional and international attempts have been based on the surrounding circumstances of the implementation of big new projects in these countries. The initiatives related to client-oriented service improvements to make direct use of local renewable energy resources in new socially acceptable disperse power generation systems also have been substantial to curb energy starvation. [6]

Given the abundant energy resources and the continuous increase in energy demand, the North African region offers a promising piece of land in the context of a switch to more sustainable energy generation. Renewable energy options in the North African region mainly are solar, wind, bioenergy, geothermal, and ocean energy. The

region experiences the highest solar radiation amounts worldwide besides a very promising windswept extending along the two shores of the Mediterranean Sea and the northern Sudanese region. Detailed solar radiation measurements suggest values over 7 kWh/m2/day in the western and central side of the basin and winds in vast areas are strong enough to support large-scale energy conversion systems. Biomass in the North African countries also extends healthily to poorly characterized potential into serious cost-effective options in the Northern West African countries. [7]

2.1. Overview of Renewable Energy Sources

- Renewable Energy Sources in North Africa The countries in North Africa have abundant sources of renewable energy, particularly solar and wind energy. As for its distribution, Algeria, Egypt, Libya, Morocco, and Tunisia have renewable energy technical potential. These North African countries also have endowments to biomass and hydro sources of renewable energy. In this paper, biomass is not covered for in-depth technical assessment because of the renewable-generated electricity at the national or regional level and being supplied from investment projects initiated from national development financial institutions such as Koch group and Prosperity Group, and from the African Development Bank (AfDB) to these countries for off-grid and on-grid rural electrification, supplementing, and energy supply. In addition, renewable energy resources are utilized in some of the islands in the region for local energy requirements. [8]

- Renewable Energy Resources Renewable energy resources can be utilized through different types of energy, viz., solar, wind, wave and tidal, biomass, geothermal, and hydro sources. Different geographical locations can have one or more renewable energy resources that can be used for sustainable development. [9]

2.2. Current Policies and Initiatives

In Tunisia, Morocco, and Algeria, the policy for renewable energy aims to adjust domestic energy consumption by using environmentally friendly technologies. Despite that, the support systems concentrating on FITs are relatively limited but are subject to further increase over the upcoming years. Favorable investment opportunities in the projects are offered in Morocco, and in Egypt with regard to SHP. Tunisia and Algeria offer moderate-level investment opportunities. National and regional governments in Morocco, Tunisia, Algeria, and Egypt are endeavoring to succeed, particularly in implementing renewable energy plans, and emphasize the development of the tourism industry. The Comprehensive Framework Study undertaken by the PrC in 2004 clearly demonstrates how a dramatic shift in the development of renewable energy projects is taking place. Governments are enhancing their responsibility for the projects, and therefore the future involvement of private partners must be integrated as early as possible in the scheme to foster the design and allow a greater sharing of risks. [10]

Focusing on current policies and initiatives, various measures, policies, and initiatives are considered at the local, regional, and international levels to increase the share of renewable energy in the energy mix. This paper looks at these efforts on the local level (in the countries hosting and cultivating the potential for renewable energy projects). In this respect, we discuss the regulatory framework with regard to renewable energy and the government efforts undertaken to promote and regulate renewable energy projects. [11]

3. Investment Opportunities in North Africa

Renewable energy projects: These projects offer robust returns and benefits of brownfield development projects in the sense that site planning, grid connection pathways are significantly lower risk given the increased scarcity value and desirability of the transmission rights to the European interconnector. Given new advances in PV technology, Concentrated Solar Power (CSP) becomes potentially economic in the deserts of Libya, a major breakthrough in the North African market given prevailing efficiencies on thermal platforms. Thus, CSP facilities have reduced risk though they are in need of significant subsidies support from the RPPE. Initial development time frame also forms an incentive for aggressive entry; a number of potential deals are only six months behind RPPE developments (SIG). Additionally, now there are a number of alternative deals and partnerships available to investors. The one deal "New Dawn energy sources" on the table is for 4 projects in Libya, three Concentrated Solar Power (CSP) projects, and one wind project. The solar portion comes to a total capacity of 1710 MW. The deal is with a foreign energy corporation and is for $13 billion US and is valid for 20 years. SIG is negotiating with a number of different companies and special purpose vehicles – that have similar interest in Libyan renewable energy as a source of expansion and improvement for their technological and human capabilities. The projects concerned are only those that SIG found suitable for the interests and requirements of the Republic of Libya and the general tenders. The key deal that SIG will be negotiating on behalf of the Republic is an agreement to establish a new project company to conduct the projects through. This new JV will have the corporation and allotment structure similar to the other 5 RPPE JVs. Up to 80% of this company is intended to be allocated to the MAC and a Libyan Company, and up to 20% for the hopeful Bidders/technology provider. [12]

With a population of over 200 million inhabitants, the North Africa region has tremendous market potential for investors. The aggressive economic development of countries in the region is leading to significant power capacity

shortfalls. This potential presents numerous opportunities for foreign as well as local stakeholders, government stakeholders, and others interested in participating in the development of North Africa. Renewable energy projects, particularly those including interconnection with the EU, market rivals in wholesale and generation projects, and present the possibility of vast absentee retail power sales markets situated in the northern hemisphere. [13]

3.1. Solar Energy Projects

This coincides with the peak solar income and can provide energy exports to grid partners located north of the Mediterranean Sea, i.e., to Europe. The combination of a cheap cost, high response time, low emissions, as well as the cost risk of roughly 80% of the installed equipment being imported with a high and highly volatile exchange rate, and a social and psychological, rather than economical value, can substantially enhance the investment risks and subsequently the value of 'home-grown' alternatives. Thereby, summer peak load coincides exquisitely with the peak insolation income. Furthermore, the nice touristy white sand beaches are uncomfortably hot during the summer, providing a much-needed niche for air conditioning activities dominated by electric power use, specifically during the day. The associated Nebelung activity mitigates power lines expansion, reducing hassle, while providing additional night load when little sunlight is available. Moreover, the development of photovoltaic skills will facilitate the development of RDT, a currently distant but rewarding issue. [14]

The continent of North Africa receives abundant sunlight throughout the year, making the region ideal for solar energy development. The solar energy projects that may be developed and promoted in the region comprise solar power generation (CSP) and solar home systems or other micro-generation options. According to some estimates, the region depends on the import of 70% of its energy. Biomass exploitation is close to maturity but spatially limited. Coastal wind power is facing load factors around 30% and the wind resource is limited so far. Offshore wind power is available but faces slow development. There is an increasing demand for electricity in the region, and substantial spare capacity is needed in summer. [15]

3.2. Wind Energy Projects

According to the report, Egypt is the leading country in terms of wind energy projects, with North Africa due to boast some 326 MW of installed wind power capacity in 2009; 50 MW will come from Libya. The EIB report is the most comprehensive in terms of gauging future wind projects in North Africa. It outlines the four wind projects under development in Egypt, which are sited along the Gulf of Suez beside the Zafarana wind farm. Host to an array of governmental and private sector-backed wind schemes, Egypt is expected to install over 400 MW in new capacity by 2010. Meanwhile, Libya and Morocco are both looking to develop four wind farms over the next three years. In Tunisia, a country with significant renewable energy potential that has yet to be developed, Tunisian Energy Developer has recently penned a deal with the Albania Investment Corporation to develop 3 x 5 MW wind farms north of Bizerte in the Cap Blanc peninsula. [16]

Wind energy today in North Africa. The European Investment Bank (2006), in its recent report on the electricity sector in the Middle East and North Africa, provides an intimate understanding of the potential for wind energy investment in North Africa based on current investment activity, as well as the pipeline of future investments and expected electricity output. Thus, North Africa, notably Morocco and Egypt, are the fulcrums of wind energy activity in the MENA region at present. These have invested in 147 MW (in 4 projects) and 95 MW (2 projects), respectively. The EIB (2006) earmarks future investment potential of an additional 515 MW in Egypt and 340 MW in Morocco, which are at an advanced stage, as they are in an advanced stage of development. The total installed wind power in North Africa is 669 MW, a very modest amount given the total wind energy potential in the region. Nevertheless, work is underway in Libya and Tunisia to develop larger wind power sites. [17]

1) 3.3. Hydroelectric Projects

The area of North Africa is considered to have good prospects for the generation of hydroelectric energy, particularly because of some of the river basins involved that are the target of several schemes for the construction of dams—the most common method used for the generation of hydroelectric power. The various schemes also involve the use of the water after it has passed through the reservoir and the dam, often in association with an irrigation development, which is also likely to involve water storage. Some of the river flows have also been identified as likely sources of hydroelectric energy largely because of the cost advantages offered by ground drops at appropriate sites. It is suggested that several such sites could be developed to generate a combined total of more than 2,000MW. [18]

The area of North Africa has several basins, some of which are interesting options for investment in hydroelectric projects. The job involves the collection and comparison of technical and economic data from several sources to piece together as accurate a picture as possible of the potential for hydroelectric generation in the North African region. The data is crucial to inform a discussion of the potential for investment in hydroelectric projects in the area, particularly focusing on the countries of Algeria, Egypt, Libya, Morocco, and Tunisia. The sector of

hydroelectric energy presents good investment prospects, and country by country differences do not seem to affect the general evaluation, as all of the countries in the region receive the same market score. [19]

4. Challenges and Risks in Renewable Energy Investment

Undertaking a number of measures can help minimize these problems. Before discussing the possible solutions and approaches, as well as the risk management strategy of investing in North Africa, relevant stakeholders or experts working within the field must be carefully identified through conductive pre-studies matching our experience, to ensure that all potential risks are taken into account. Therefore, we are looking for "expert respondents," individuals who work in investment financing in the Middle East and North Africa. Suitable candidates would be expected to be one of the different people involved in the financing of project initiators, such as those who invest in large-scale renewable energy technologies in this region. Managers of private equity companies or investment funds specializing in the financing of renewable energy projects would be a perfect sample for us. [20]

Renewable energy projects are earning attention as potentially profitable investments. However, investing in the renewable energy sector could be risky, expensive, and complex for a number of reasons. A proposed plan of study will aim to identify the various challenges and risks that surface when investors seek to initiate renewable energy projects, particularly in North Africa. Our key interest is to see how potential investors view the huge window of opportunity found in North Africa, which has unique sunny and windy areas that qualify it as a region with enormous potential for generating electricity from renewable energies. This will also involve evaluating and understanding the different types of challenges or risks renewable energy investors face in North Africa and how they emerge. [15]

4.1. Political and Regulatory Risks

Investments in renewable energies across their various stages of development are heavily affected by regulations and government policies. In particular, investors often argue against significant investments in early-stage renewable technologies owing to the uncertainty surrounding future government policy and regulatory stance towards these technologies. Regulations and government policies can therefore present both regulatory and political risks to investors. Regulatory risk, according to Davis, describes "the risks based on unpredictable changes in legislative, judicial or bureaucratic decisions." Following this concept, political risk, not analyzed in this study, can be understood as the risk "arising from the actions of domestic or foreign governments which may affect either private property rights or the terms of international contract, or both" (Davis). [21]

While the development of renewable energy in countries which are consumers of energy, mainly the European countries, has been the subject of many studies, the emphasis here is on countries which are not the typical destinations for foreign direct investment (FDI). The results presented suggest that, apart from issues on the supply side of investment such as availability of capital, quality of infrastructure or incentives provided by the host government, many uncertainties exist on the regulatory and political environment side. This is of particular importance to the development of renewable energy markets because the implementation of a number of renewable energy technologies is to a considerable extent dependent on either direct financial incentives provided by the governments of the end-users, or, where such incentives do not exist, on the removal of a number of economic barriers later on. [11]

4.2. Technological Risks

Investors may confront other technological risks, such as the uncertainty of profitably using solar radiation to produce electricity with commercially available technology (an uncertainty compounded by competition with the rapidly falling price of photovoltaic generators), finding the necessary skilled labor for construction and operation, managing labor and productivity on a large scale in a remote area and under foreign jurisdiction, or public resistance to electricity pylons crossing Europe. These costs are heavily determined by energy policy. RE technologies have huge environmental uncertainties—often ones of local scale which make them concentration of the risk more dangerous. However, the main project-related risks remain effectively commercial, technical, and political, and so do the principal barriers. [22]

As a case study of long-term investment under uncertainty, we might discuss the investment in renewable energy (RE) for the production of electricity in North Africa. As we shall see, the actual technological risks are multiple. There could be public policy barriers to trade or regional cooperation. However, one way to reduce the risk is by engaging in public-private partnership. We can highlight the risks faced specifically by private investors, i.e. those of the demand side, in the deployment of Concentrated Solar Power (CSP) in Northern Africa. [23]

4.3. Financial Risks

Project Development, Technological, and Construction Risks: The assumption of the pricing situation played a critical role in the investor decision making, especially regarding the means of financing expectation. Attained

Inflation Nominal Risk Real Interest Rate Risk, the higher and longer the project construction period is, the greater the technological risk is. (exit from the transaction). Beside the technical risk, most renewable energy projects have their peculiar construction risk because of the unpredictable construction hazards for weather, transport, etc. [24]

Market and Regulatory Risks: In liberal energy markets, absent a long-term power purchase agreement with a utility, a project must be able to compete on the basis of price with other energy-producing technologies and with previous time of its own product sale. Regulatory hurdles also need to be addressed. However, unlike fossil fuels, renewable energy potential relies on significant government regulations and support to give it a "kick start" in every deregulated energy market. [25]

The financial risks in investment in renewable energy projects differ for every type of financial solution, including renewable energy projects without state support, renewable energy projects with market-based support schemes, or projects with fixed government support and projects with public-private partnership (PPP) solutions. In every one of these financial approaches, there are some financial risks and uncertainties that would affect the investment process and the profitable return on projects in the short or long run. Some of these risks and uncertainties can be mentioned as follows. [26]

5. Case Studies of Successful Renewable Energy Projects

Tunisia has ramped up the use of wind, solar, and geothermal energy for generating electricity, resulting in a higher proportion of the total national energy supply. In 2011/12, around 21,246,000 tons of oil equivalent was supplied, with 77% coming from fossil fuels. Changes in laws and rewards have been implemented to encourage the integration of renewable energy sources, especially in the electricity generation sector. Specific project categories have been granted special benefits, such as low-interest loans with a 45% guarantee, to make it easier to adopt renewable energy. The El Haouaria wind power plant, also known as Parc Eolien d'El Haouaria, has been in operation since December 2000 and is situated approximately 6km northeast of the El Haouaria seaport.

Morocco’s Noor Project, which consists of three power plants, is a good example of a successful renewable energy project. The three power plants of the Noor project consist of Noor Ouarzazate I (160 MW), Noor Ouarzazate II (200 MW), and Noor Ouarzazate III (150 MW). I and II are solar parabolic, and III is a solar tower. The project covers a total of 3000 hectares, suffers an annual global horizontal irradiation rate of 2,000 kWh/m2, and will ultimately have a capacity of 510 MW. Recently, the African Development Bank provided almost 1 billion dollars in finance to build one of the power plants. When completed, "It will produce clean, renewable energy for 1.3 million Moroccans," the bank said. "The project will bring power to the people in hard-to-reach rural areas, reduce the cost of electricity for households, and boost economic development in the surrounding Maghreb and European Union neighbors. The Noor power plant in Ouarzazate will provide 24/7 access to reliable baseload electricity, both day and night, transforming the lives of people in its surrounding communities." [27]

algeria has been making significant investments in solar and wind energy projects. The country aims to reduce its reliance on fossil fuels and increase its energy security. The region has abundant solar and wind resources, making it an ideal location for renewable energy projects. In addition, the government has shown a strong commitment to developing renewable energy infrastructure. This is evident in the significant investment in solar and wind energy projects across the region. Additionally, North Africa has also seen a growing interest in geothermal and hydroelectric power.

5.1. Morocco's Noor Complex

The project's extraordinary potential has attracted interest from various academic and policy circles, who have translated their interest into a series of books and reports that study the case of Noor as part of an invaluable experimentation in the field of renewable energy policies. It is thus necessary to study an energy initiative that is often presented as the material embodiment of the energy turn that impacted the region in 2011. This initiative may be considered a relevant case study because it is of an extraordinary scope and represents a tool in the fight against energy poverty. The aim of the case study, however, is to place this investment project in the context of the historical dynamics of Morocco's development, which is structured in connection with Mediterranean energy transitions, taking into consideration both internal and regional aspects. [28]

Noor Complex, Morocco. Around fifteen years ago, Morocco's energy landscape was dominated by energy imports, while the country's own production was limited to a set of largely aging coal, diesel, and fuel oil-powered plants. Since then, Morocco has made a remarkable effort at diversifying its energy mix and in positioning itself at the vanguard of the renewable energy transition. The inauguration of the first phase of the Noor Complex is considered a key milestone in this ambition. In 2016, Noor I became fully operational. It was then the largest concentrated solar power (CSP) storage project in the world with a capacity of 160MW. [29]

5.2. Egypt's Benban Solar Park

Project Size and Financials Benban is expected to be the world's largest solar park once it reaches mid-stage construction, with up to 41 subprojects ultimately developing in the region by the end of 2019. The solar park currently stands at 1.8 GW of ground-mounted solar PV projects at a cost of $2 billion. An additional 0.8 GW of photovoltaic panels were installed on rooftops by companies developing utility-scale solar projects elsewhere in the country. All of the power generated in Benban is contracted with the Egyptian Electricity Transmission Company under a 25-year feed-in tariff. The tariff for the first round of Benban projects contracted ranged from 7.80¢/kWh to 8.43¢/kWh. Benban's second round, including seven solar developers awarded 180 MW of capacity, all secured contracts valued at 2.41¢/kWh. [30]

Introduction to Benban Solar Park The Benban Solar Park is located near Aswan, in Upper Egypt. It was developed as a public-private partnership between the International Finance Corporation and the Egyptian government, with the goal of increasing Egypt's renewable energy capacity. The $4 billion project was financed by a bevy of international financial institutions including the Overseas Private Investment Corporation and the Asian Infrastructure Investment Bank, among others. 32 companies from 14 countries have participated in the construction of the park, including EDF Renewables, SoftBank, and Alcazar (Egypt's El Sewedy Electric). The first stage of the construction for Benban started in 2015 with the plant being connected to Egypt's national grid in late 2017. [31]

---

6. Impact of Renewable Energy Investment in North Africa

Indeed, the development of renewable energies is taking place today in almost all countries. In the North African region, the development of electricity production from sustainable energies has become a serious option for economic, environmental, and social development. Renewable energies have created over 8 million jobs in the European Union alone. By comparison, renewables have created jobs in the hundreds. Notable news for North African countries: decreasing unemployment rates and poverty, and promoting economic development, as well as reducing climatic change. The use of renewable energies will help limit the degree of current environmental imbalance through the achievement of a 60% reduction of greenhouse gas emissions. Morocco and Saharan countries receive an average solar-energy exposure of 3,600 kWh/m²/year, with averages greater than 4,000 kWh/m²/year. These places can be "quoted" as best sights towards solar energies. [32]

6.1. Economic Benefits

Sustainable energy can stimulate sustainable growth as long as it is not carried out outside integrated growth and development policies. Growth strategies that integrate economic, energy, social, and environmental considerations are able to offer a variety of opportunities and synergies. The stimulus to growth can be immediate, relying on an established capacity to deliver profitability and employment but, equally importantly, are the positive longer-term contributions to efficient use of global resources, saving, climate protection, health, peace, and international justice. Sustainable energy investment programs absolve investments that are able to deliver simultaneous, objectively assessed value in all these policy arenas contributing to the host country's Vision 2040 as well as the international dimension. [33]

The impact of renewable energy investment: The study presents the economic benefits derived from investments in renewable energy projects in North Africa. In addition to its clear environmental advantages resulting from the reduction of harmful emissions, its major economic benefits also result from the future attraction of investors from developed and emerging economies should it come to the market, hence potentially increasing the overall economic revenues and the advantage of being the place for the transfer of a colossal number of technologies from the northern hemisphere. Moreover, such investments will modernize the countries' infrastructure and local service systems while reducing the trade deficit for fossil fuels. Renewables will also reduce the electricity generation-related unemployment rates in the region. This study demonstrates those country specificities and their contributions to future local and regional proper socio-economic development against climate change. [34]

6.2. Environmental Benefits

So what benefits does it bring to the region? Well, for one, it makes the environment not only safer and cleaner, but it becomes more readily available at all times. Renewable energy projects across the Arab world bring a huge positive externality that tends to be overlooked - brownie points for sustainability. Morocco has begun to establish itself as a hub for renewable energies. These investments can become sustainable income generators of the future. Not to overlook, of course, as discussed in the following subchapter, renewable energy reduces greenhouse gas emissions as opposed to the more popular and traditional fossil fuels, preventing China and the future emissions of North Africa from reaching Western levels. [35]

I recently worked on estimating renewable energy sources for the Exo-Energy Agency in North Africa. The main source of renewable energy in North Africa is solar power. On assessing the environmental impact of constructing a high voltage direct current (HVDC) transmission line, it was found that the power grid of North Africa is a serious hazard to migratory birds. However, HVDC transmission lines accepted the least number of bird kills and the lowest carbon footprint of the chosen major energy options. Popular renewable energy pools in North Africa are in Morocco, Algeria, and Egypt. [36]

7. Future Prospects and Recommendations

North African countries offer a real renewable energy potential and have elaborated diverse strategies and programs aiming at the development of these energies. They want to take advantage of the opportunity offered by their natural wealth. The programs in progress incorporated all activities: starting from the resources seeking to the electric and thermal energy production by way of mobilization of the interest groups, the technology development, the qualification of the specific manpower, the financing looking for and the support to all the activities to be developed in each host one of these countries. However, many obstacles remain. The biggest part of the states in the region has an unfortunate political, social and economic condition in addition to an energy one still mainly traditional. All these countries seek for a real evolution of their energy autochthony but from where? [37]

The exploratory richness of some of these countries in hydrocarbons can it be demonstrated, with strategic locations, a factor of strategic security for an energy supply dominated by the tedious transit by some possible waterways? The objectives of partners in the area and some efforts in a greater mobilization, efficient and thought to fight against the greenhouse effect to try to involve them gradually in the renewable energies support. The synergy between partners and the collective resolve to realize the next Declarative Summit create a favorable environment to widen the aids and the financial supports. This could be made under form of suitable measures in some forms of obligatory investment, in terms of trading credits drafting and encouragement of technology transfer of exportable knowhow and valued either by the markets of the North Africa or more. [38]

In this view, the regional financing can be amplified and shared in a way best adapted to support the specifics of the partner countries. Thus, when addressing these two questions, it will certainly have a simple and unrestrained speech and bold and generous action on the part of the community, that the weight of the dependent of energy positions of the North African countries can be softened appreciably and that a true win-win framework seems then to become possible before and after. The situation, of a rebound of the price of the crude oil is completely new and the impact that it can have on the plans of investment, and largely the North African economies, is difficult to locate. Is not the North Africa the true posed interrogative, because facing up these challenges could give the example to political-economic union to the world? [39]

7.1. Policy Recommendations

We recommend a combination of measures in order for North African countries to successfully transition from current energy mixes dominated by energy from a depleting non-renewable resource pool to reliance on green, renewable sources of power and heat. Indeed, combining measures could reduce North African countries' reliance on energy generated from non-renewable resources but avoid energy insecurity, ensuring that citizens have access to the energy needed for economic growth without increased vulnerability to shocks. [40]

Electrify public lighting. It has been a proven accelerator of economic growth in the Global South through reducing rates of poverty. Revenues from selling the energy for this purpose could cross-subsidize the electrification of the lighting of poorer areas. Governments could, in principle, transfer a portion of the cost of lighting public areas to bulk consumers of electricity – offering high-tariff options for farmers who want to irrigate their crops at night and industrial clients who wish to run night shifts. This solution has two benefits: it reduces demand for electricity during the day and offers households a relatively inexpensive and clean import-replacement solution. [41]

7.2. Technological Innovations

A transition to renewable sources of energy is a multidimensional, politically charged process involving ideology, conflicting economic interests, as well as environmental imperatives. Politics play an important role in the regulation of nuclear, coal, and fossil fuel plants, and industrial organization is frequently modified to encourage and later manage technological innovation, which has been widespread in the UK in energy-supply sectors. [42]

Renewable energy technologies do not have the learning curves of conventional technology. However, technological innovations are an integral component of the process of market penetration and are by no means straightforward. [43]

The main learning from the British experimental history of technological innovation in energy-supply sectors is that over-optimistic high-level technocratic interventions in energy-supply problems can have serious, even disastrous, consequences. Renewable projects can be accused after the fact, if technologies turn out to be little less than revolutionized, of warranting insufficient specification during planning. There seem to be two lessons to be learned from this: firstly, the way that the British government has managed the search for nuclear-waste disposal procedures "may indicate a path for the future diffusion of renewable-energy technologies policy", and secondly, a key role is performed by science-based third-party environmental activism or protest. [44]

Conclusion and Key Findings

Understanding better the particular opportunities in North Africa and European partnerships, it is incumbent to acknowledge the risks. First, more change is needed in electricity market regulations, since for the most part, regulations have aimed to crowd out ODA and MNC fossil fuel investment. Trade across regional networks and markets requires new models of investment in flexibility, including demand side management that is itself a new strategy and form of investment for residential, commercial and industrial users. Second, reliance for a significant share of local economies on European remittances will drive fears of intensifying underdevelopment within the Maghreb, a region already marked by unemployment and poverty. It is important to consider such hesitations and examine options for distribution sensitive policy. [45]

From this essay's analysis of renewable energy investment – with its historical emphasis on technology transfer from the global North to the global South through Official Development Assistance (ODA) projects, and large-scale energy infrastructure located and owned by Northern MNCs – some potentially important implications resonate. First, it is likely that more compelling cases for foreign investors can be made if power, transport fuels, and (in due course) heating feedstocks are designed for and sold to regional, rather than global, markets. Secondly, the joint investment in shared infrastructure, in and between different regions, has a window of opportunity distinct from foreign-owned, foreign-located, staple sector (agricultural, mineral and fossil energy) industries. [46]

The aim of the research presented in this essay was to explore the case for investment in renewable energy in North Africa, with a specific focus on the role of partnership between North African and European countries in driving low-carbon transitions in the region. The essay was prepared in the lead up to the 22nd UN Climate Change Conference of the Parties (COP22), which was hosted in Marrakesh, Morocco in 2016. While the successful outcome of the conference and the growing global momentum behind decarbonisation and efforts to address climate change give cause for cautious optimism about both the scale and nature of international climate cooperation, many hurdles remain. [47]

References

[1] R. M. Elavarasan, G. M. Shafiullah, S. Padmanaban et al., "A comprehensive review on renewable energy development, challenges, and policies of leading Indian states with an international perspective," in IEEE Access, 2020. ieee.org

[2] A. Aghahosseini, D. Bogdanov, and C. Breyer, "Towards sustainable development in the MENA region: Analysing the feasibility of a 100% renewable electricity system in 2030," Energy Strategy Reviews, 2020. sciencedirect.com

[3] F. Razi and I. Dincer, "Renewable energy development and hydrogen economy in MENA region: A review," Renewable and Sustainable Energy Reviews, 2022. [HTML]

[4] GS Sisodia, E Awad, H Alkhoja, "Strategic business risk evaluation for sustainable energy investment and stakeholder engagement: A proposal for energy policy development in the Middle East," Business strategy and ..., 2020, Wiley Online Library. nih.gov

[5] EM Mungai, SW Ndiritu, I Da Silva, "Unlocking climate finance potential and policy barriers—A case of renewable energy and energy efficiency in Sub-Saharan Africa," Resources, Environment and …, Elsevier, 2022. sciencedirect.com

[6] A. Bouraiou, A. Necaibia, N. Boutasseta, et al., "Status of renewable energy potential and utilization in Algeria," Journal of Cleaner Production, vol. 2020, Elsevier, 2020. [HTML]

[7] Y. Nassar, H. J. El-Khozondar, G. Ghaboun, et al., "Solar and wind atlas for Libya," Int. J. Electr. Eng. and Educ., vol. 2023. ijees.org, 2023. ijees.org

[8] A. Alsharif, A. Ahmed, M. Khaleel, H. Hebrisha, et al., "Applications of solar energy technologies in north Africa: Current practices and future prospects," Int. J. Electr. Eng. and Educ., 2023. ijees.org

[9] M. G. Gado and H. Hassan, "Potential of prospective plans in MENA countries for green hydrogen generation driven by solar and wind power sources," Solar Energy, 2023. [HTML]

[10] J. Kouton, "The impact of renewable energy consumption on inclusive growth: panel data analysis in 44 African countries," Economic Change and Restructuring, 2021. [HTML]

[11] S. A. Qadir, H. Al-Motairi, F. Tahir, and L. Al-Fagih, "Incentives and strategies for financing the renewable energy transition: A review," Energy Reports, 2021. sciencedirect.com

[12] S. Ehtiwesh, A. Gabbasa, I. Ehtiwesh, "The Potential of Using the Incorporation of Concentrated Solar Power and Gas Turbines in the South of Libya," International Journal of …, vol. 2023. dergipark.org.tr. dergipark.org.tr

[13] J. Schilling, E. Hertig, Y. Tramblay, J. Scheffran, "Climate change vulnerability, water resources and social implications in North Africa," Regional Environmental Change, vol. 2020. Springer, 2020. springer.com

[14] VZ Castillo, HS De Boer, RM Muñoz, DEHJ Gernaat, et al., "Future global electricity demand load curves," Energy, Elsevier, 2022. sciencedirect.com

[15] SA Khalil, UA Rahoma, "Verification of Solar Energy Measurements by (ERA-5) and Its Impact on Electricity Costs in North Africa," International Journal of Astronomy and …, 2022. scirp.org

[16] A. El-Bshah, F. N. Al-Wesabi, A. M. Al-Kustoban, "Resource assessment of wind energy potential of Mokha in Yemen with Weibull speed," energy, 2021, academia.edu. academia.edu

[17] R. Sedaoui, "Energy and the Economy in the Middle East and North Africa," in The Palgrave Handbook of International Energy …, 2022. oapen.org

[18] M. Bakkari, B. Bossoufi, I. El Kafazi, et al., "A review of wind energy potential in Morocco: New challenges and perspectives," Wind, vol. 2024, journals.sagepub.com. researchgate.net

[19] SA Alnaqbi, S Alasad, H Aljaghoub, AH Alami, et al., "Applicability of hydropower generation and pumped hydro energy storage in the Middle East and North Africa," Energies, 2022. mdpi.com

[20] M. K. Abdelrazik, S. E. Abdelaziz, M. F. Hassan, and T. M. Hatem, "Climate action: Prospects of solar energy in Africa," Energy Reports, 2022. sciencedirect.com

[21] F. Egli, "Renewable energy investment risk: An investigation of changes over time and the underlying drivers," Energy Policy, 2020. sciencedirect.com

[22] M. Jaxa-Rozen and E. Trutnevyte, "Sources of uncertainty in long-term global scenarios of solar photovoltaic technology," Nature Climate Change, 2021. uottawa.ca

[23] M. Amir and S. Z. Khan, "Assessment of renewable energy: Status, challenges, COVID-19 impacts, opportunities, and sustainable energy solutions in Africa," Energy and Built Environment, 2022. sciencedirect.com

[24] M. Wang, C. C. Wang, S. Sepasgozar, and S. Zlatanova, "A systematic review of digital technology adoption in off-site construction: Current status and future direction towards industry 4.0," Buildings, 2020. mdpi.com

[25] Y. Lu, Z. A. Khan, M. S. Alvarez-Alvarado, Y. Zhang, et al., "A critical review of sustainable energy policies for the promotion of renewable energy sources," Sustainability, 2020. mdpi.com

[26] C. Kul, L. Zhang, and Y. A. Solangi, "Assessing the renewable energy investment risk factors for sustainable development in Turkey," Journal of Cleaner Production, 2020. [HTML]

[27] S. R. Ersoy, J. Terrapon-Pfaff, and H. Agouzoul, "Sustainable transformation of Morocco's energy system: development of a phase model," 2024. wupperinst.org

[28] E. Okpanachi, T. Ambe-Uva, and A. Fassih, "Energy regime reconfiguration and just transitions in the Global South: Lessons for West Africa from Morocco's comparative experience," Futures, 2022. sciencedirect.com

[29] A. Laaroussi, O. Laaroussi, et al., "Environmental impact study of the NOOR 1 solar project on the Southern Region of Morocco," Renewable Energy and ..., vol. 2023. rees-journal.org. rees-journal.org

[30] M. Mostafa, F. El-Shahat, M. Riede, "Solar Energy in Africa-An Overview, with a Focus on Egypt," in Proc. Conference on Innovations, 2023, Springer. [HTML]

[31] M. Nabil Abdel Sadek El Sebai, "Impact of Solar Energy on Urban Design (Case Study, Benban´ s PV Solar Park)," Engineering Research Journal, 2023. ekb.eg

[32] J. Brodny, M. Tutak, and P. Bindzár, "Assessing the level of renewable energy development in the European Union member states. A 10-year perspective," Energies, 2021. mdpi.com

[33] G. Abu-Rumman, A. I. Khdair, and S. I. Khdair, "Current status and future investment potential in renewable energy in Jordan: An overview," Heliyon, 2020. cell.com

[34] B. Klagge and C. Nweke-Eze, "Financing large-scale renewable-energy projects in Kenya: investor types, international connections, and financialization," Geografiska Annaler: Series B, Human Geography, vol. 2020. Taylor & Francis, 2020. tandfonline.com

[35] A. Šimelytė, "Promotion of renewable energy in Morocco," Energy transformation towards sustainability, 2020. core.ac.uk

[36] A. Azouzoute, A. A. Merrouni, and S. Touili, "Overview of the integration of CSP as an alternative energy source in the MENA region," Energy Strategy Reviews, 2020. sciencedirect.com

[37] S. Nathaniel, O. Anyanwu, and M. Shah, "Renewable energy, urbanization, and ecological footprint in the Middle East and North Africa region," Environmental Science and Pollution Research, vol. 2020, Springer, 2020. academia.edu

[38] R. Vakulchuk, I. Overland, and D. Scholten, "Renewable energy and geopolitics: A review," Renewable and Sustainable Energy Reviews, vol. 122, Elsevier, 2020. sciencedirect.com

[39] K. Kingsly and K. Henri, "COVID-19 and oil prices," 2020. academia.edu

[40] S. Nathaniel, O. Anyanwu, and M. Shah, "Renewable energy, urbanization, and ecological footprint in the Middle East and North Africa region," Environmental Science and Pollution Research, vol. 2020, Springer, 2020. [HTML]

[41] M. Swilling, I. Nygaard, W. Kruger, H. Wlokas, et al., "Linking the energy transition and economic development: A framework for analysis of energy transitions in the global South," Energy Research & Social Science, vol. 2022, Elsevier, 2022. dtu.dk

[42] JQ Wilson, "The politics of regulation," in The Political Economy: Readings in the Politics and ..., Taylor and Francis, 2021. [HTML]

[43] Y. Yao, J. H. Xu, and D. Q. Sun, "Untangling global levelised cost of electricity based on multi-factor learning curve for renewable energy: Wind, solar, geothermal, hydropower and bioenergy," Journal of Cleaner Production, 2021. [HTML]

[44] S. BIALER, "12 Politics and Priorities," The Soviet Economy: Toward the Year 2000, 2023. [HTML]

[45] I. Bartolomei, "The water-related impacts of FDI in the renewables sector: between growth and sustainable development in developing countries," 2022. unive.it

[46] S. Weko and A. Goldthau, "Bridging the low-carbon technology gap? Assessing energy initiatives for the Global South," Energy policy, 2022. sciencedirect.com

[47] D. S. Olawuyi, "Can MENA extractive industries support the global energy transition? Current opportunities and future directions," The Extractive Industries and Society, 2021. [HTML]