

## BARRIERS FACING THE PROSPECT OF ALTERNATIVE ENERGY IMPLEMENTATION IN HOUSING AREAS IN TRIPOLI, LIBYA QUALITATIVE METHODOLOGY

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### الملخص

مع زيادة الطلب على الكهرباء والكهرباء في ليبيا بسبب الزيادة السكانية والنمو الديموغرافي السريع، والتقدم الاقتصادي والتحسينات في سلوك استهلاك الطاقة إلى جانب حاجة الحكومة إلى الحفاظ على النفط والغاز كمصدر رئيسي للدخل القومي. كل هذه العوامل يمكن أن تشير إلى أن الطاقة المتجددة هي الحل لمشكلة زيادة الطلب على الطاقة خاصة وأن ليبيا لديها أكثر من واحدة من الطاقات المتجددة. على الرغم من كل هذه الطاقة المتجددة لا تزال تواجه تحديات في التنفيذ. ترتبط التحديات بالحوافز السياسية، والحوافز التكنولوجية، والحوافز الاجتماعية، والتي يعمل العديد منها كحوافز في وجه تنفيذ واستخدام الطاقة المتجددة. ومن هنا يهدف هذا البحث إلى التعرف على التحديات والعوائق التي تواجه تنفيذ مصادر الطاقة المتجددة في منطقة طرابلس في ليبيا من خلال استخدام تصميم بحث نوعي باستخدام مقابلات مع ستة من المسؤولين في وزارة الكهرباء والطاقة المتجددة في ليبيا، من خلال اجتماعات عبر الإنترنت باستخدام مقابلات شبه منظمة. تم تحليل المقابلات على أساس التحليل الموضوعي حيث أضاف المشاركون تحليلاً متعمقاً للعوائق التي تؤثر على تنفيذ الطاقة المتجددة في ليبيا. على الرغم من التحولات السياسية الأخيرة في ليبيا، فمن الواضح أن الطاقة المتجددة لا تزال ذات أهمية استراتيجية حاسمة. في ظل انخفاض أسعار الوقود الأحفوري الذي تدعمه الحكومة الليبية، أصبح واضحاً من تحليل البيانات أن أكبر عائق يمنع الشعب الليبي من التحول إلى الطاقة النظيفة هو العامل السياسي لعد وجود لوائح وقوانين تحمي المستثمر

## ABSTRACT

As the increased power and electricity demand increase in Libya due to increase population and rapid demographic growth, economic progress and improvements in energy consumption behaviour coupled with the need from the government to keep the oil and gas as a major source of national income. All these factors could indicate that the Renewable energy is the solution of the increased energy demand problem especially as Libya have more than one of the renewable energies. Despite all of this Renewable energy is still facing challenges in implementation. The challenges are related to Political Barriers, technology Barriers, Social Barriers, which many acts as barriers in the face of implementation and use of renewable energy. Hence, this research aims to investigate the challenges and barriers facing the implementation of renewable energy sources in the Tripoli area in Libya through the use of qualitative research design using interviews with the six of the officials in the Ministry of Electricity and Renewable Energies in Libya, through online meetings using semi-structured interviews. INTERVIEWS were analysed based on thematic analysis where the respondents added in depth analysis of barriers affecting implementation of renewable energy in Libya. Despite the recent political shifts in Libya, it is obvious that renewable energy is still of critical strategic significance. Given the low prices of fossil fuels subsidized by the Libyan government, data analysis revealed that the biggest barrier preventing the Libyan people from switching to clean energy is the political factor, as there are no regulations or laws protecting investors.

**KEY WORDS:** barriers and challenges, Implementation of renewable energy, transition to Alternative Energy.

## INTRODUCTION

Libya is an oil-exporting nation in North Africa that covers an area of approximately 1,750,000 Km<sup>2</sup> with a 2000 Km long coast. Recently Libya becomes a significant supplier for energy sources such as natural gas and oil[1]. The shift of the conventional energy prices affected Libya as well as many countries around the world. The search for a cleaner, environment-friendly, cheaper, and a more available source of energy becomes the quest for many countries in order to be able to replace oil as the primary energy source. Oil is considered as the major income source for Libya [2]. In terms of renewable energy, Libya has a high potential, especially wind energy and solar energy. Renewable can offer additional benefits such as creating local jobs, driving local economies, and reducing carbon pollution[3]. Thus the country aims to adopt a new strategy is to reduce the dependence on oil through the improvement of another source of income along with the search for other energy sources that is able to cope up with the increasing demand for energy[4]. This can be done through the use of other renewable energy such as wind energy, and solar energy will help Libya reduce its dependence on oil. In this study, we aim to investigate the challenges and barriers facing the implementation of renewable energy sources in Libya, especially in the Tripoli area, through the use of a qualitative approach that aims to offer a broader vision of the problem.

Tripoli is the capital of Libya, and the city witnessed rapid development during the last decade, a vast infrastructure transformation has occurred within the area. It includes several extensive facilities, besides many new residential projects. Tripoli, as a modern city, is considered a fertile ground to evaluate its societal trends toward implementing the concept of RE[5]. Libya is predominantly an oil-producing nation and has many policies and regulations that favour this trade. This is considered a major obstacle against the implementation of renewable energy sources. The current national policies in Libya are angled towards the conventional energy sources, which has been given major motivations[5]. The promotion of renewable energy use requires evaluation of the current laws, regulations, and police to provide a more favourable condition for its use. The new regulation will enhance the market penetration of alternative energy sources—the need for other cheaper energy sources to overcome the high production cost of oil. However, the technology required for this type of energy still requires a lot of development; this explains the existence of the myriad technical challenges. Additionally, the costs of changing infrastructure and the uncertainty of the new source of power is a source of repulsion to entrepreneurs[6][7]. This problem can be overcome through the implementation of policies that require the institution to utilize renewable energy and creating awareness among the public on the need to switch to renewable energy.



Figure1: LIBYA MAP

## LITERATURE REVIEW

The development of renewable energy over the past decade has exceeded all anticipations. International established capacity and manufacturing from all renewable technologies have enlarged considerably and maintaining master plans have proceeded to extend to more countries all over the globe. In the early 2000s, the improvements demonstrated rising trends in global renewable energy investment, capability, and association via all segments. Yet, most conventional predictions did not forecast the exceptional enlargement of renewable that was to open out over the decade forward[8]. The last decade has also brought a series of institutional

changes. REN21—the Renewable Energy Policy Network for the 21<sup>st</sup> Century was created as an outcome of the renewable 2004 conference in Bonn, Germany. The organization was established as the multi-stakeholder “coalition of the willing,” bringing together key actors from both the private and public sectors to facilitate a rapid global transition to renewable energy. REN21 was the first international organization to begin tracking renewable energy development after its founding in 2004, and it has continued to provide the most comprehensive global outlook on the state of renewable each year. Results from this tracking are presented annually in the REN21 Renewable Global Status Report (GSR), a report that has become increasingly comprehensive over the past decade as the landscape of renewable energy has become more diverse and complex [9]. Five years on, the International Renewable Energy Agency (IRENA) was created and, by mid-2014, already counted 135 member countries as its members, demonstrating the high level of global interest in advancing renewable energy. IRENA supports countries in their transition to a sustainable energy future[10]. The intergovernmental organization encourages governments to adopt enabling policies for renewable energy investments, provides practical tools and policy advice to accelerate renewable energy deployment, and facilitates knowledge sharing and technology transfer to provide clean, sustainable energy for the world’s growing population. In parallel, the International Energy Agency has considerably scaled-up its analytical work on renewable energy. While founded in response to the 1973/4 oil crisis to help member countries co-ordinate a collective response to major disruptions in oil supply, its expansion into renewable demonstrates the role of renewable play in ensuring reliable, affordable, and clean energy [5] .

There are critical challenges facing the use of renewable energy, such as Social Barriers, the availability, and complexity of technology, and the policies and regulation enforced by the country.

## METHODOLOGY

This research study explores the obstacles affecting the implementation of renewable energy in the city of Tripoli, Libya. The research uses the qualitative method to achieve the objectives of the research and to test the research hypotheses. The research follows a positivist model and a confirmatory research design. The research uses interview tools in data collection procedures. Data is collected through an online procedure. The study sample is six persons from the higher managements of the General Electricity Company and the Solar Energy Research Centre in Libya, where the six participants are denoted by P1 to P6. Objective analysis of qualitative data is used. This can be done through the use of other renewable energy sources such as wind energy, and solar energy will help Libya reduce its dependence on oil.

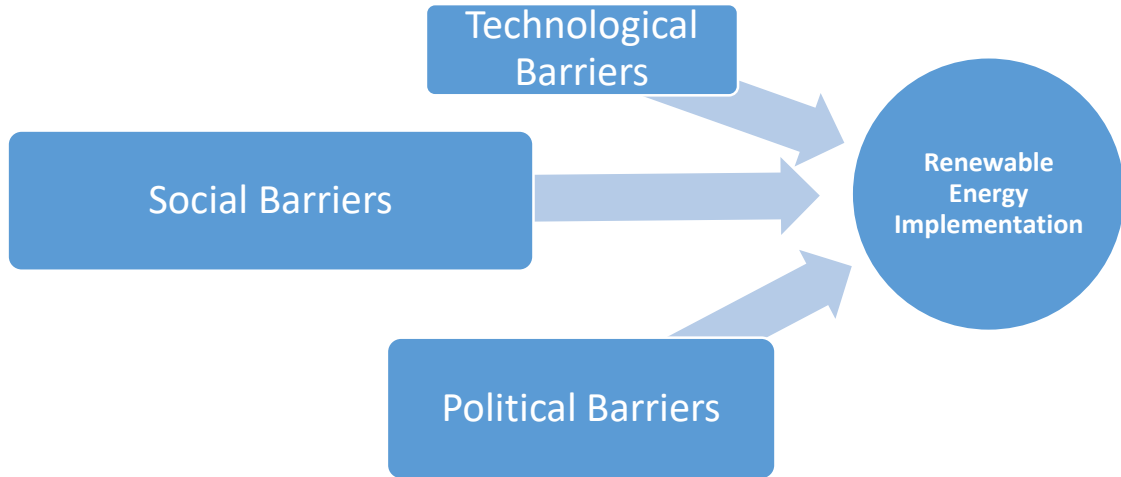


Figure2: Conceptual Framework

## DATA ANALYSIS AND DISCUSSION

### First theme: Technological Barriers to RE Development in Libya

The great majority of participants said that the pace of RE development in Libya was being slowed down by technical" concerns. Renewable energy (RE) intermittency (necessary backup and acceptable penetration levels) and energy storage (energy spillage) were some of the topics that developed in this area.

#### Intermittency in Renewable Energy: Backup, Penetration, and Storage.

Many responders pointed out that renewable energy (RE) is intermittent, which has both technical and economic drawbacks when employed as a source of power. As a result, if renewable energy (RE) is to be used on a big scale, a backup generating source or energy storage is needed. Extra generating sources or energy storage technologies "are additional costs that will impose complexity into the power system operation," says a Ministry of Energy participant.

In general, participants agreed that "RE cannot operate as a base load" and that it must be backed up by a dispatchable source, such as hydroelectric power production; hydro, coal, oil, and natural gas generation are all examples. Energy storage will be necessary for high levels of Renewable Energy (RE). Hydro reservoirs pumped hydro, hydrogen, and various kinds of batteries and fuel cells were all reviewed in the course of the presentation on energy storage. One of the most fundamental technological obstacles to the broad-scale use of RE is the inability to properly store vast quantities of energy.

Several participants voiced their worries about the reliability and development of RE technology. It's like any other technology that's never been deployed, according to P2, and P4 agrees: "There is a lot of ambiguity and scepticism with respect to RE technology."

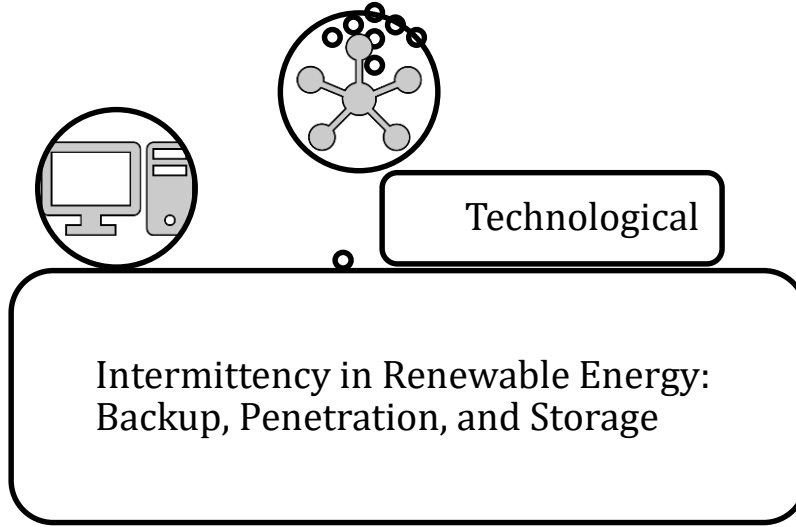


Figure3: Summary of the subthemes of technological barriers of RE implementation

### Second Theme: Social Barriers to RE Development in Libya

The significant majority of participants stated that "social" concerns were not hurting Libya's pace of renewable energy development (RE). The major subtheme related to social aspects are RE is socially acceptable, connectivity to the grid and environmental impact. The participants indicated that RE does not face any social or cultural opposition and it is considered as socially acceptable" as described by the majority of the participants. P4 indicated that it seems that people's views on renewable energy are heavily influenced by their knowledge of the aesthetic, environmental, and economic implications of these resources, particularly in the context of their own neighbourhood.

However, P1 raised another social concern which is connectivity to the grid. P1 indicated that "Many Libyan communities are disconnected from the Internet. 'Extending the grid to cover these places is deemed uneconomic and impossible.

P2 indicated another aspect of the social perception of RE which is the environmental impact as P2 stated that "Environmental pollution and economic development have been examined in a variety of ways' There will either be an improvement in environmental quality due to the absence of technical advancement and/or changes in the composition of production and

economic growth or an increase in pollution, which will have a negative impact on both the local, national, and global environment.”

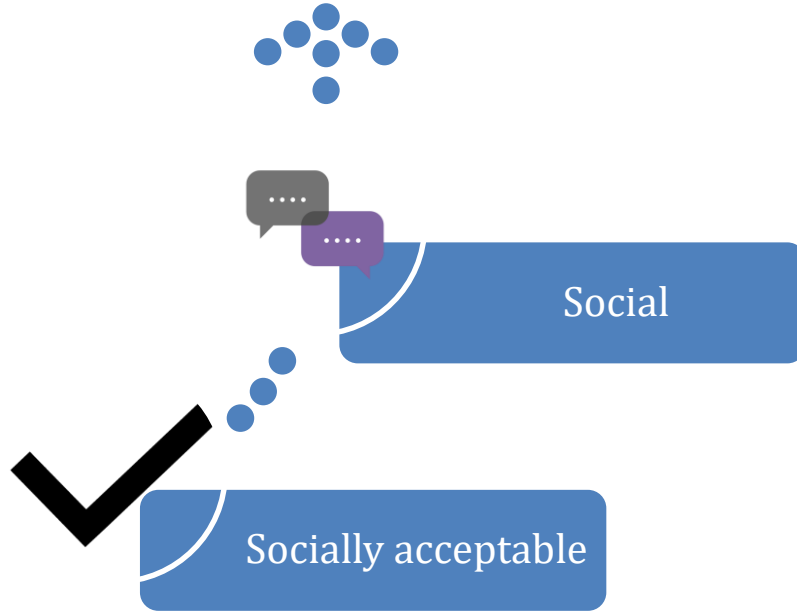


Figure 4: Summary of the subthemes of social barriers of RE implementation

### Third theme: Political Barriers to RE Development in Libya

All the participants indicated that "political" difficulties were impeding Libya's Renewable Energy development. The subthemes that arise from the content analysis of the political barriers including: institutional impediments, lack of government policy, objectives and political will, governmental focus only on oil & gas development, insufficient public participation over energy policy choices, and legal barriers.

Academic and government respondents all believe that the Libyan government plans to minimise carbon emissions from the use of conventional fuel in electricity and water production stations, according to P1” In order to create power and minimise carbon emissions, the state has switched many of the electrical and water plants to incorporate gas” While P3 stated “Fossil-fuel-generated power is still more technically and financially viable than renewable-energy-generated electricity... Although it produces more carbon emissions than renewable power, it is a more reliable source of energy. and P4 stated “Renewable energy resources may help reduce carbon emissions and provide long-term electrical security; hence the government should promote their creation”.

According to the results of the analysis none of the participants indicated that the Libyan government had a clear policy on renewable energy. A few of the participants' statements are

a good reflection of this “There are no policies in place to support the implementation of projects in Libya, such as adequate safeguards for investors who want to allow both domestic and foreign private companies to participate in this plan's implementation, even though General Electricity Company of Libya, the renewable energy authority, and the Libyan government have collaborated on it. according to P1. Additionally, P2 stated that “No real actions were taken by new administrations following the political shift of 2011 to begin renewable projects to use Libya's renewable energy resources... But the formation of academic conferences, scientific symposia, and overseas positions has increased significantly.”

The respondents from the energy policy maker, generating and consumer groups thought that Libyan government officials needed to do feasibility studies for renewable energy projects , participants from the private sector indicated “There is no defined policy for renewable energy projects in Libya, according to the government. Another respondent agreed that Libya's renewable energy sector has to be studied in terms of technical, commercial, and environmental aspects before it can be implemented.

Failure to support Renewable Energy because of a lack of government policy, goals, and political will

There was widespread agreement among the participants – from all sectors (academics, government, and the business sector) – that Libya lacked government policy and political will to encourage the growth of RE. "RE is not a problem for government...no one is banging on our door regarding RE production," P3 a government participant noted. "In Libya, policy formulation and goal-setting surrounding RE is virtually non-existent," indicated P4. “In the lack of a defined policy on net-metering, many companies may have been reluctant to invest in Renewable Energy (RE).” as indicated P6 from the private sector.

Participants largely agreed that the government's current goals were too low. "In the first energy plan, they placed a limit of 80MW of RE," P1 as one academic participant said. "By 2020, the Plan seeks to attain a renewable energy contribution of 7% to the electric energy mix, and a 10% share by 2025. Wind, concentrated solar power, photovoltaic, and solar water heating will all contribute to this." the report said. ". It is surprising that, in light of the newly discovered possibility for further advancement, the goals for RE development remain the same.

“In other countries where RE has succeeded, the sector has been backed by different types of government policy and objectives” as indicated by P2. "You need to be regulated, enforceable objectives in terms of wind penetration – or renewable grid penetration, according to P2. Libya do not have net-metering policy small scale RE projects would can be seen as discouragement renewable energy growth. " As indicated by P2. On the other hand, a representative of the Ministry of energy said that "net metering will make no change whatsoever to power in Libya."

Several participants also felt that the government was too focused on oil and gas development to pay attention to other energy sources. Participants agreed with this viewpoint. offshore oil and gas development, according to P3 a ministry official: "seriously preoccupies the political



system." Another participant indicated "There has been no place for alternative renewables to be considered in that framework," P3 indicated. When all the money was going towards oil exploration, there was a "bit of a pull" away from renewable energy, according to one of the academics who took part in the discussion.

In the opinion of majority of the energy policymakers surveyed, the Renewable Energy Authority plan has had no noteworthy successes so far, the participants also indicated that Libya's proposal to share renewable energy isn't being executed properly. The results show that all groups feel that the strategy has not resulted in any notable successes. Even more importantly, according to the Ministry of Electricity respondents, they considered the interim Libyan government was the primary cause of failure in executing or continuing to execute the plan. One of the participants (P4), for example, indicated that the 2013 public budget of the state authorised by parliament included 12 million LD for renewable energy projects. However, no renewable energy projects were completed, and no results were achieved as a consequence, reads a statement from the state. P3 also indicated In spite of the fact that the country's current power plants are inadequate to meet its basic demands, the new Libyan administration has not undertaken any new projects. Most of the government's initiatives, particularly those involving energy, have been affected by the political turmoil. One of the academic professors (P1) indicated the fact that our strategy has made no headway so far must be reported. Robust infrastructure and increased security are necessary for the Authority to hire foreign investment experts and execute this strategy.

<b>Political</b>	Lack of government policy
	Lack of government objectives and political will
	Focus only on oil & gas development
	Insufficient public participation over energy policy choices
	Legal barriers

Figure 5: Summary of the subthemes of political barriers of RE implementation

## CONCLUSION

In the literature on the 'energy transition,' Libya is an important case study. A large amount of Libya's economic activity and government income, as well as a large portion of its power production, are still based on fossil fuels, despite the country's great supply of renewable energy resources.

An estimated 80% of Libya's GDP came from crude oil and natural gas production in 2010. For those who don't know much about the current state of affairs in Libya, it's crucial to have a sense of what's happening there. In order to maintain the same quality of living for future generations and minimise pollution and carbon emissions, Libya will need to find new sources of energy and revenue[5].

Due to the vastness of the country, energy delivery in Libya is prohibitively costly. Energy may be generated closer to demand centers, eliminating the need for lengthy transmission lines and minimizing power loss over those lines, which makes distributed systems more practical.

There is too much capital investment and fuel use in present fossil fuel facilities to produce electricity, according to a study comparing the costs and environmental impacts of alternative energy sources, including sunshine and wind.

In the Al-Fathia area, Libya is constructing a farm costing 184 million Libyan dinars (LD) that is predicted to generate 60 MW, is fuel-free, and doesn't need a lot of upkeep. Approximately 475,000 barrels of crude oil would be saved each year, which would cost about 25 million LD, and 120,000 tonnes of carbon dioxide will be sucked out of the atmosphere with a cost of 0.031 LD per kWh. In Libya, there are several sites where wind farms might be built, and it's crucial to stress this out.

The data demonstrate that Libya has a large desert region on a long coast with a great potential for both solar and wind energy, as mentioned in section 6.2, which highlights the importance of Libyan geography. Efforts to construct renewable energy projects in Libya by the Libyan government dating back to 1976. Significant advancements have been achieved over the last several years that make the usage of renewable energy alongside conventional energy sources a more viable option. Renewable energy sources such as solar radiation, wind, biomass, and geothermal play an important role in every nation.

The best technique to figure out how much renewable energy should be used is to look at the patterns of load fluctuation; that is, to see how well the local loads line up with the renewable energy production schedule. A high rate of power consumption is linked to the fact that Libya's months are generally hot, with a mean temperature of more than 35°C. Water pumps, electric fans, space heaters, and air conditioning make up the bulk of the demand during these months.

Furthermore, it has been discovered that Libya's energy consumption is rising and that a portion of this need might be met by renewable energy. Due to the abundance of oil in Libya, renewable energy has not received much attention. Renewable energy sources such as solar and wind power are widely accessible in Libya, although the country's reliance on oil and natural gas for energy and export earnings remains strong.

Several times a year, Libya gets battered by dry and scorching winds. From demonstration projects to full-scale commercial-scale wind farms, Libya's neighboring nations have shown that wind power is a viable option in that area.

There is an average of 3,200 hours of sunlight each year in Libya, according to the Libyan renewable energy authority, and the average solar radiation per square meter per day is 6 kWh. Libya's potential for solar energy has been calculated by the researcher, who found that each square kilometer receives solar energy equal to  $106 \times 1.5 = 4110$  barrels of oil each day.

There were no clear signs that Libyan authorities were actively sponsoring any educational or media-related programmer related to renewable energy, according to the findings of a questionnaire examining the country's position on renewable energy technology and the public's perceptions in each sector. The Libyan school system, on the other hand, does not include anything about renewable energy.

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