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Introduction:

Developing countries need to use energy that benefits the primary population, and there are a variety of advantages that characterize it, the world's trend towards oil towards energy sources and their disuse, in order to supply the superior populations of energy on the other hand, and an exit from the fatal spectre of all fossil energy resources Non-increasing oil and gas resources from the other side.

Moreover, friendly energy sources like sun power, biomass, wind power and hydroelectric energy are inexhaustible sources used to produce power. For example, wind power is energy that's sourced from the energy of the wind with using turbines to produce electricity with being considered for generating electromechanical energy, as well as, wind power as an energy source is one of the best sorts of renewable and clean energy in Libya whose use has spread as an alternative to fossil fuels. Abundant and renewable energy is found in most developed countries, but its availability varies from one region to another. In addition, clean renewable energy does not produce emissions such as greenhouse gases during operation, and requires varying spaces depending on the size of the station and the type of towers. Furthermore, precisely mentioning wind energy because in ancient history, it was also used in the form of windmills for tasks such as grinding grain and pumping water. Today, advanced wind machines known as wind turbines are used in many places worldwide to change wind power to generate electricity for industrial and public services use. However, in recent years there was huge demand followed by rapid improvement for solar technology from the public and private sectors to provide electricity on commercial facilities and homes levels and that was nearly all over the place. Hence, solar power is clean, endless and eco-friendly supply of electricity and specialized manufacturers worked hard to ease the solar panel fitting process but it is still a complicated lengthy process with different factors to be taken into account. As well as, it's important to mention that Libya was the first Arab country to put the solar system in use in the early seventies in the last century placing and side from significantly reducing consumers' electricity bills, there are certainly many advantages to installing solar panels at homes, work buildings and state offices, like carbon reduction footprint, preparing people while working or when they are home for grid interruptions with improving the value of having a healthy life with protecting the nearby environment (K El-Arroudi, 2013).

Study Problem : The problem of the study is summed up in answering the following two questions:

1- Does Libya has geographical capabilities to generate renewable energy from natural resources available throughout the country?

2- Would the available clean energy resources be managed to achieve sustainable development?

Study Hypotheses : The hypotheses of this research are:

1- Libya has natural resources to generate renewable energy.

2- Libya has one of the biggest Sahara deserts to generate solar energy.

3- Libya was the first Arab country to implement projects to utilize solar energy to generate electricity in the 1970s of the last century.

Study Objectives : As previously mentioned, this study is aiming to know the renewable energy sources for better investing them in various state departments to carry out the needed sustainable development goals in Libya because energy is the main pillar of economic development in the country with focusing on the following objectives:

1- Detecting renewable energy sources in the three provinces in Libya.

2- In what areas can the clean resources of energy be utilized in Libya?

Study Methodology : Literally, this study is looked at as qualitative rather than being a quantitative research based (M Dzikus, 2019) and the author carried out this scientific research on the principles of consistency where several approaches were used. As well as, the study relied on the analytical approach to data that were obtained from the Central Agency for Statistics and Information Technology in Libya, in addition to reviewing the literature of other state departments related to the subject of the study published in books, theses, dissertations, scientific journals, and others.

Research Area : Libya is located in North Africa between latitudes 19° and 34° N, and longitudes 9° and 26° E. From the northern, side on the Mediterranean Sea Libya's coast is longest in North Africa with 1950 km, the Republic Arab of Egypt is on the eastern border, from the southeast there is the Republic of Sudan, to the south on the Libyan border we find Chad and Niger and finally on the western border of Libya are located the republics of Algeria and Tunisia. To the west. With

an area of approximately 1.8 million square kilometres, and by dividing Sudan Libya now is the third largest country in Africa, and the 16th largest country located right in the centre of the world as shown in the below map 1:

Map N°01 : The location of Libya right in the centre of the world map



Source: [https:// %D9%81: Libya \(Libya centered; orthographic\)](https:// %D9%81: Libya (Libya centered; orthographic))

The objective limits were represented by studying the most important sources of renewable energy from the continuous and recurring flows of energy that occur in the natural environment from multiple resources, namely solar energy, wind energy and biomass. The research structure included the following:

- 1- The concept of renewable energy.
- 2- The geographical distribution of the most important sources of clean energy in Libya and their importance.
- 3- Clarifying the institutional framework for the use of renewable energy in Libya.

The Importance of the Study : Previous studies indicated in many textbooks and scientific journals that renewable energy is the energy that is derived from natural limitless sources. Proper utilization of energy resources is a hot debate recently going all over the world and it is very essential to choose which source of energy must be used and why. Majority of factors like cleanliness, cost, stability, efficiency and less environmental effects are giving renewable energy much stronger

reasons to be used. Actually, there many industries around the world are still dependent on fossil fuels for electricity generation. No doubt, these fuels are very effective as far as power production quality is concerned, but in the end, they are not advantageous. Either in Libya or in North African region, fossil fuels will deplete one day or the industries must turn to renewable sources as soon as possible. Moreover, these fossil fuels pose a huge threat to environmental balance and are a cause of many ecological hazards. Therefore, this study is very important not only for the state of Libya but also for all countries in the region as previously mentioned.

Firstly. The Concept of Renewal/ Green Energy

It is globally known that renewable or green energy is the stream of energy that can obtained from inexhaustible natural resources available in nature in a limited or unlimited manner, but it is constantly renewable, and no pollution results from its use. It is clean and environmentally friendly energy and thus renewable energy is one of the effective tools in preserving energy. The environment, in reducing climate change, and in securing the supply of sustainable energy in all sectors of electrical, thermal, and mechanical energy. Furthermore, previous studies described renewable energy as the energy derived from natural resources that are renewable and cannot be exhausted. It includes the energy released from the sun, water, wind, waves, and tidal movement. It differs from fossil fuels because its waste does not contain environmental pollutants. Commercial use of some renewable energy technologies has spread while, to varying degrees, others are still in the research and development phase. What increases the importance of spreading the use of renewable energy is its suitability for urban and rural areas, especially since the percentage of the world's population is in renewable energy. On the other hand, alternative energy in Libya represents supportive and cost-effective investment options in the medium and long term because its importance lies in achieving sustainable development according to the following:

1- The shift towards clean energy technology will lead to meeting the rapid shortage for electricity in Libya and achieve the required sustainable development.

2- Clean energy technologies are friendly to the environment, and the application is at the core of sound management of natural resources.

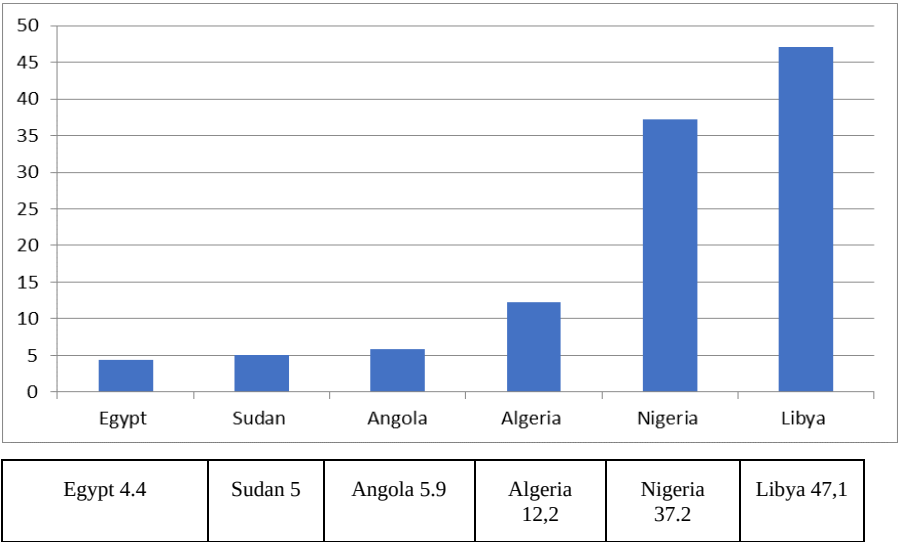
3- Renewable energy reduces gas emissions and is considered a sustainable source of energy to mitigate the negative effects on health and the environment, global warming and climate change.

4- The use of renewable energy is an important factor that contributes to increasing economic growth, reducing financial restrictions, and employing the workforce to reduce the phenomenon of unemployment, and thus it contributes to achieving economic and social development (A Khalil, 2015).

Secondly. Current energy Sources in Libya

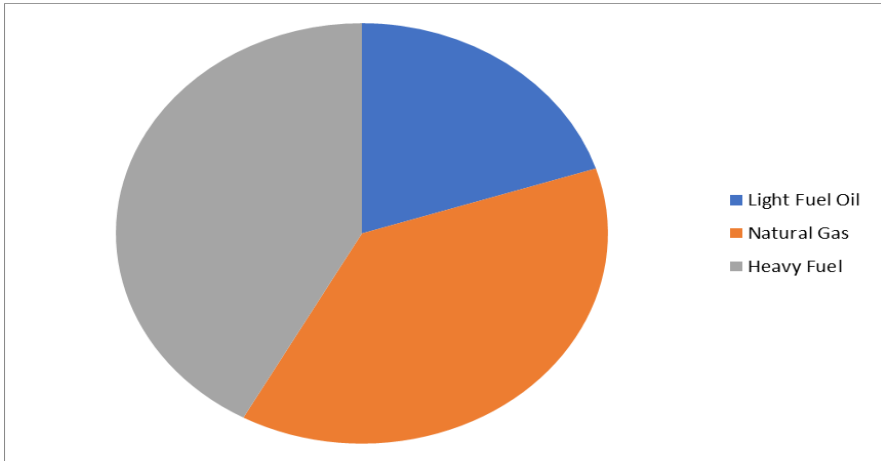
As an economic fact, the main resources of power or energy in Libya are based on natural gas and oil with an oil reserve of 47.1 billion barrels by 2012 and 54TCF natural gas, so Libya is really an important strategic energy supplier to many EU countries especially Germany and the southern European side. In addition, the oil of Libya is primarily the largest supply with a share of 66% by the year 2000 after being decreased to 62% representing 42% of light fuel oil and 20% of heavy fuel oil with 38% share of gas as shown in the below Figure (1):

Figure 1: Libya proved oil reserve 2012



source: Omar A Mohamed & S H Masood (2018).

Furthermore, regarding the Electricity generation by fuel type, the below Figure (2) shows the exact details.

Figure 2: Electricity generation by fuel type in Libya 2012

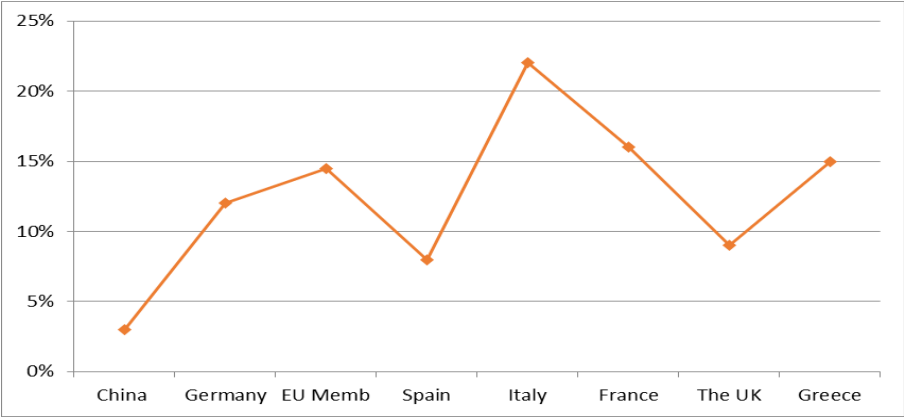
source: Omar A Mohamed & S Masood (2018).

In the near future, electricity private and public demand will normally increase with the rapid use in agriculture and industry. Having said that, the main exports revenues for Libya are significantly relying on gas and oil with 90% of its entire revenue. Notably, in 2010, the majority of Libyan gas and oil has been sold to southern Mediterranean European countries (M Jefferson, 2013). Hence, European state members get 85% or more of the Libyan crude oil exports as follows:

- 1- Italy gets 376,000 barrels per day with 22%.
- 2- France 205,000 barrels per day with 16%.
- 3- United Kingdom 95,000 barrels per day with 9%.
- 4- Greece 63,000 barrels per day with 15%.
- 5- Germany 144,000 barrels per day with 12%.
- 6- Spain 136,000 barrels per day with 8%.

7- Others with 14.5%. and the rest of 3% goes to China import 3% as shown in Figure (3) and the USA imports an average of 95,000 barrels of Libya's oil per day. Therefore, Libya's oil and gas supply are the main source of income for the country.

Figure 3: Libya's crude exports to the EU and rest of the world



source: Bauer R (2015)

Supplying energy keeps increasing with an annual estimated growth of 5% as oil having being the highest consumption share in the gas and oil industry. Furthermore, Electrical power covers an average of 99% is currently in use to provide electricity for about 2000 homes in various areas, as well as, Libya's economy has a speciality in Africa continent while other countries in north Africa like Algeria, Morocco, Tunisia and Egypt have started to establish different industrial bases with agricultural potentials so they have a diversity of economic resources but with big numbers of populations in each country, also it's only Libya that's enjoying this advantage a result of having a small nation and huge gas & oil-driven economy proving that Libya is having a similar economy with that of oil-exporting nations in the Arab Gulf comparing to countries in North Africa.

Few years ago, Libya has witnessed a continues need in energy demand as in the mid-summer of 2004, Libya was has experienced blackouts since power station were not able of keeping up with the high demand an a lot of the existing power plants in Libya were converted to natural gas so new power plants had been built to run on gas so the volume of oil for export can be increased (R Zhai, 2016).

Thirdly. Geographic Clean Energy Sources Distribution in Libya

1. Libya and solar Energy

Libya without a doubt is one of the leading countries in solar energy production in the North African region and the Arab world as it started using solar energy projects started in the early seventies from the last century. Libya is characterized by bright sunshine throughout the year

and a favourable geographical place for solar power. Libya's solar energy potentially considered to be at 2,000-3,000 hours of solar radiation per year. Libya has a number of large projects to benefit from solar energy, including a solar plant in the city of Ghat with a capacity of 1.2 MW and other projects in the city of Sabha and the city of Misurata. The solar energy sector in Libya is considered a strategic sector for the country and promotes energy self-reliance and sustainable development.

In Libya, solar energy depends on solar radiation, which is an important climate element, and which emits large amounts of energy in the form of waves whose length ranges from very short, such as gamma and x-rays, to long radio waves, and radiates in all directions. Solar energy can be defined as the light and heat derived from the sun, which humans invest using modern technological techniques through the phenomenon of photovoltaics using Maria, which is in the form of large groups called farms. Energy in open areas is different from cells, to take advantage of solar radiation to generate solar electrical energy that is placed on the roofs of buildings for use in heating water and heating, where the Maria reflects light on tanks filled with water for the purpose of heating it and generating steam through which turbines are driven to generate electrical energy. Despite that, Libya was the first Arab state to use solar energy but now the country has to undertake the required changes including making new Electricity legislation for providing a clear systematic framework to encourage the use and investment of clean energy for making alternative energy more popular and even more competitive. Therefore, Libya has to rebuild its electric power tariff system. Precisely, it has to redirect the subsidies for gas and oil generated electricity to alternative clean energy that's friendly to the environment, and for improving savings, energy effective laws have to be in use including introducing an energy reading meters. The related government body also has to monitor and protect consumers' rights. These values are important to build confidence to local and foreign investors to attract more participation in clean and alternative energy projects. Hence, Libya has to be ready for the needed energy transition like the UAE government that is taking a step forward to position itself for the coming transition and it's now the time for the state of Libya to make a decision about the best future for its nation (B.Fortin, 2019).

2. The Plans of Solar Energy in Libya

Libya has strategic plans to develop solar energy in the country. These plans aim to enhance the use of solar energy as a main source of electricity generation and reduce dependence on fossil fuels. Plans

include constructing more large solar plants and improving solar infrastructure. The Libyan government also aims to increase investments in the solar energy sector and enhance cooperation with international companies and institutions to develop solar energy projects in the country. In addition, the plans also aim to enhance awareness of the benefits of solar energy and encourage sustainable use of energy in various sectors such as housing and industry. It is expected that these plans will contribute to providing new job opportunities and strengthening the local economy in Libya (N Taylor, 2019).

3. Main Advantages of Using Solar Energy

Looking at previous studies and academic literature, there are several advantages to consuming solar energy like:

1. Stability: Solar friendly power is endless and unlimited so it is not based on the use of limited natural resources such as oil and natural gas.

2. Cost Savings: Although it may require a large initial investment to install solar energy systems, it helps save energy costs in the end. Solar energy is free and does not require paying increasing electricity bills.

3. Reducing harmful emissions: Using solar energy does not cause harmful emissions to the environment such as greenhouse gases and air pollution, reducing the greenhouse effect and keeping the air clean.

4. Independence from the electrical grid: Thanks to autonomous solar energy systems, users can rely on solar energy to supply them with electricity independently, making them not dependent on the central electrical grid.

5. Reducing the electricity bill: Using solar energy can help reduce electricity costs, especially in homes and commercial companies that need a lot of electricity.

6. Promoting green employment: The solar energy industry provides job opportunities in various sectors, including design, installation, maintenance, marketing, and research and development.

7. Energy diversity: Relying on solar energy contributes to diversifying energy sources and reducing dependence on fossil fuels.

8. Taking advantage of unused solar spaces: Solar energy systems can be installed on flat roofs and unused lands, which helps make the most of the available spaces.

9- Solar energy can be used to combat desertification in Libya by:

A- Installing solar energy systems to operate irrigation devices and supply arid areas with water.

B- Solar energy can also be used to operate water desalination systems to convert salt water into water suitable for drinking and agriculture.

3- It can limit environmental degradation and enhance agriculture and irrigation in the desert and arid areas of Libya.

4. Using Solar Fabric over Traditional Energy

Solar panels and similar solar-sourced objects, which have often been very limited in what, they can achieve. From merely sitting on building roofs all day long, that can only get any user so far in the power department when compared to what they need these days; the demand outweighs the supply here. They might be suitable for powering a few extra items at home like a slow cooker or a tumble dryer, in the end, the future of solar-power might come in the form of wearables. Moreover, what has made this possible? The answer is solar cell fabric, and in Libya, it is coming to a store near homeowners sooner than they might think (J de Celis, 2014).

4.1. Advantages of Using Solar Fabric over Traditional Energy

Solar fabric has many advantages over traditional solar panels and here are some of them accordingly:

1. Flexibility: Solar fabric can be installed on curved surfaces, such as the roof of a building or tent, making it more versatile than traditional solar panels.

2. Lightweight: Solar fabric is much lighter than traditional solar panels, making it easy to install and transport.

3. Aesthetic appearance: Solar fabric is available in different colours and patterns, making it possible to integrate solar energy into buildings and structures without compromising their aesthetic appeal.

4. Waterproof: Solar fabric is waterproof, which means it can be used in places where traditional solar panels may be damaged by water.

5. Low maintenance: The solar fabric requires very little maintenance, as there are no moving parts or mechanical components that need to be replaced or repaired.

6. ECO-FRIENDLY: The solar cloth is made from recycled materials, making it an eco-friendly option for those who want to reduce

their carbon footprint. In short, solar fabric is a flexible, lightweight and versatile alternative to traditional solar panels, making it an attractive option for those who want to generate clean, renewable energy in a variety of settings (R Moryn, 2018).

Fourthly. Solar Energy Situation in Libya

Libya's main energy sources are not sustainable, also to a large extent some studies say that the current oil and gas reserves are expected to serve Libya for the next thirty or forty years, but this prediction or statistics have not yet been verified, and if true, Libya You will need to find alternative sources of energy before the next 30 or 40 years are up. In general, Libya is known for being the main source of fuel in terms of natural gas and crude oil. Nevertheless, this study has proven that Libya possesses huge reserves and potential of resources that can be used to generate sustainable energy that will be sufficient for domestic use and export to the outside world. Unfortunately, now not many renewable energy sources are being used. The Libyan state uses 42% of heavy fuels, 20% of light fuels, 38% of gas and 0% of alternative energy. Furthermore, the main alternative energy source of clean to be considered is solar power/ energy, simply because Libya is a country that receives an abundant amount and for very long hours, especially in the summer and fall seasons, as well as good proportions of solar source of power/ energy for all the year. On the other hand, the State of Libya would definitely gain huge benefits from the solar alternative energy for use in health, education, agriculture, industry, lighting, and other areas of life, and this can also be practiced at the near, medium, and distant levels.

It is possible to benefit from wind power, as it was recorded that the wind speed in Libya, which was studied in 2004, was ranging between 12-14 miles per hour at an height of 40 meters which is maybe lower than the speed of wind in some other neighbouring countries that are generating power from wind. As another option, the Libyan government can think of using tides to generate even a small amount of electricity, and with the regional and global conflicts and energy crisis with fears of running out of oil and natural gas, the State of Libya has also begun to explore ways in which it can obtain energy from alternative and friendly to the environmentally sources.

The Renewable Energy Authority in Libya (REAOL) has put in place measures to increase the use of renewable or green energy sources by 2020 to 10%, which is currently less than 1%. The same body is currently aiming for to developing different wind farms and alternative

energy plants for generating power with enabling this strategic plan to achieve its goals. It was previously reported that renewable energy sources in Libya are not sufficiently exploited during the current period and constitute less than 1% of the country energy usage. However, Libya has previously used alternative energy sourced in the form of solar thermal power, biomass, wind power and. In addition, Photovoltaic energy is seemingly appearing to be the most common alternative energy to used in Libya since 1976. There are currently more than 100 photovoltaic plants across the country (J Gradziuk, 2020).

Fifthly .Wind Energy in Libya and worldwide

According to various academic references, Professor James Blyth of Anderson College in Glasgow had built the first windmill that was used to produce electricity in Scotland in July 1887. He installed the turbine at a height of 10 meters in the garden of his holiday home in Marykerke, and it being used for charging batteries that were developed by Frenchman C A Faure, simply for powering the lighting in his hut to be the first house worldwide to be using electricity supplied by wind power. Another Scientist called Blythe had previously offered surplus electricity to the local community of Marykirk to light the main streets, but they rejected the offer because they believed that electricity was "Black magic or the work of the devil." Although, at a later stage many wind turbines were established for necessarily providing emergency power in local asylum situations and to serve clinics and dispensaries; however, this invention did not work widely, especially since it was economically expensive at that time. Moreover, in different parts of the world such as Cleveland, Ohio, USA, a much larger machine was designed, engineered and it was established between 1887-1888 by Charles Brush, that was established by a home engineering firm and started operating between the years of 1886 and 1900. The rotating wind turbine was 17 meters (56 ft) in diameter and mounted on a tower 18 meters (60 ft) high. Although large by today's standards, it only produced 12 kilowatts. An associated dynamo has been used either to direct power to batteries or to operate up to 100 incandescent lamps, three arc lamps, and various engines in the same firm. Hence, wind power is the energy that is extracted from the kinetic power of the wind throughout the rotation of wind turbines to generate electricity, and known as a sort of electromechanical power. Wind power is a sort of alternative energy that's widely used instead of fossil fuels. It is abundant and renewable energy, and notably its availability varies from one location to another (Budzianowski, 2017).

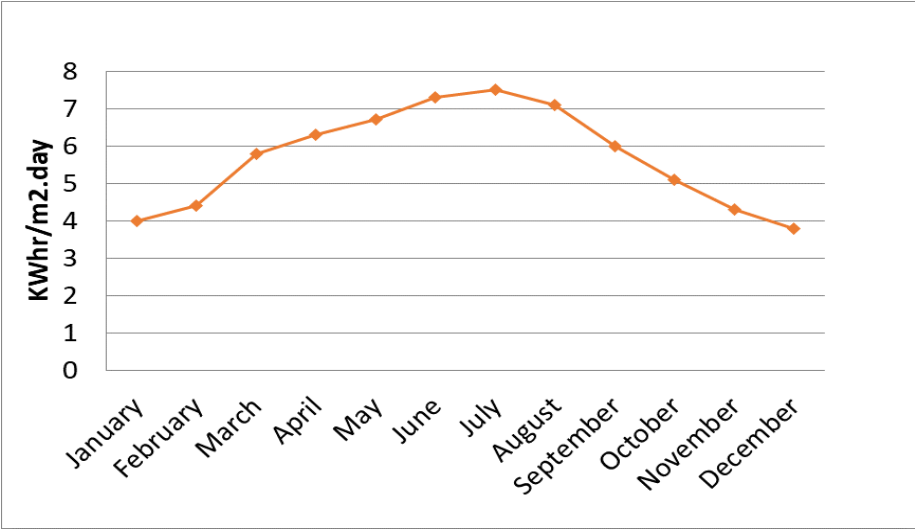
It is clean, renewable energy that does not produce emissions such as greenhouse gases (greenhouse gases) during operation, and it requires varying areas depending on the size of the station and the type of towers used. It is not recommended to place wind turbines in urban areas due to obstructions that prevent taking advantage of good wind speeds. However, it is feasible in rural areas due to the large areas and small buildings. Its impact on the environment is usually less problematic than other energy sources. Despite its abundant production in areas with high wind speeds, one of its drawbacks on the utility scale is that its peak production does not usually coincide with peak consumption, which does not contribute to reducing the burden on traditional electricity production plants during peak consumption (W Choon, 2015).

As for homes, their biggest drawback is that the production from wind turbines is not sustainable, and to avoid this, the production can be benefited by connecting them directly to the public electricity grid or installing batteries to store that energy and benefit from it throughout the day. Usually in off-grid electrical systems. In addition, It is commonly known that large wind farms consist of hundreds of individual wind turbines that are connected to a grid to transmit electrical energy. Onshore wind energy is an inexpensive and competitive source; It is cheaper than coal, gas, or fossil fuel plants, while offshore wind is more stable and stronger than onshore winds. However, offshore wind farms have very high construction and maintenance costs than regular farms on land, whether on the coast, desert, or mountain highlands, as well as, small onshore wind farms can provides electricity to isolated locations outside the scope of the electrical grid. For this reason, wind energy is developed according to what is required or we know is correct, due to the need for more savings in a timely manner and targeting what was previously established. Libya relies more on fossil fuels and knowledge of electricity like the rest of the third world countries, and this indicates that this country is not safe in the energy sector. Therefore, this is something that could affect the local economy with the possibility of facing some obstacles like the abuse of valuable natural gas and oil resources, bad impact on climatic conditions and detention of observers. In order to avoid this involvement, the facility decided to have various clean and other alternative energy sources. Hence, around 2000, The General Electricity Company of Libya, together with the Libyan Centre for Solar Energy Studies, started working on identifying the possibility of potential alternative energy resources that are friendly to the ecosystem in the form of wind power with building new wind farms to for providing electricity, furthermore, in 2004, the two forms conducted one

of the first wind speed surveys which indicated a high wind power potential in different areas in the state of Libya. Additionally, there is a great opportunity of production of wind power especially around Libyan coastal line and a contract has the approval of the Libyan government to be signed to install 25 Mega Watt as a start for this pilot project, with building several windmills and electricity from the wind power can be generated accordingly. As well as, during this project, technical and general knowledge would be transferred from the project experts directly to the selected candidates, who will be working in the field of wind power technology in the next coming projects, which means that the main emphasis of signing on this project is to help in building a wind farm with the benefit of having the best engineering experience supported with training to be given to the Libyan engineers during first project (A Asheibe ,15).

Moreover, the Libya government established similar projects to obtain the reliable wind and solar data throughout the country to allow the analysis and evaluation process effectively regarding the available wind and solar resources on the Libyan soil as all these projects are aiming to generate clean and alternative energy in Libya. For sure, using alternative energy source will allow the country to gain the required data and the needed information with having more knowledge about this new technology to develop the clean and favourable environment for alternative and clean energy production in Libya with building the right wind power towers throughout the country. Furthermore, one project has taken a place to gather the wind data from 16 different meteorological stations in the state of Libya at various height levels in the country's three regions Fezzan, Cyrenaica and Tripolitania with selecting the proper sites for wind power different projects while aiming to start building the first wind farm in the country and Figure (4) shows up the annually top 7 wind speed in Libya:

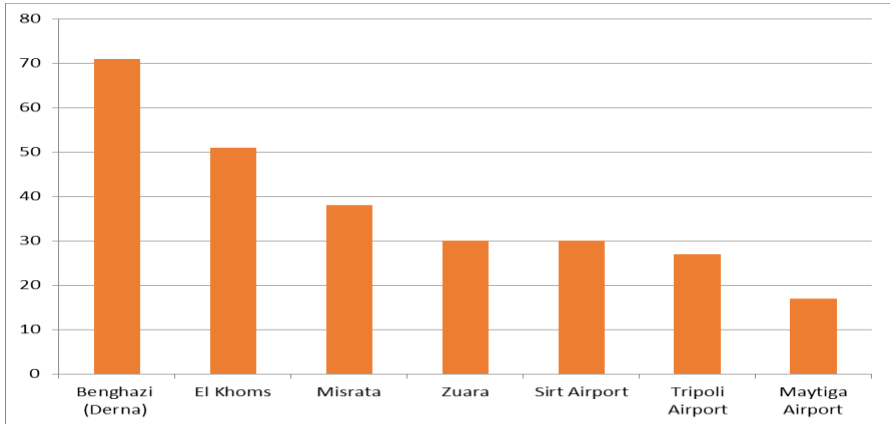
Figure 4: The annually top 7 wind speed in Libya



Source: (Kurokaw, 2014)

Notably, the wind pattern in the city of Derna where the Daniel Flooding took place in September 2023 leaving behind the biggest flooding disaster in the Libyan history, has proven to be having the best level in the country indicating that the north-east coast is very much favourable for supportive wind power natural conditions taking into account that average wind power speed in different months in the city can generate different levels of wind power. Overall, the location of Derna is exceptional and is very promising for generating clean wind energy. The collected data have been used to analyse and describe wind speed distribution. In this, it can be said that alternative energy project can be concluded in the city of Derna for being a suitable place with high capability to generate clean energy from the wind power. It was also found that in the city of Derna, wind power conditions are excellent for producing wind energy. It was also found that in the city of Derna the wind speed average was recorded 9.8, 10.8 m/s at height of 50,100 meters respectively, and This wind speed record has been regarded as the best other among different geographic destinations in the country as in Derna the wind flows from the north east coast to south-west coast, with promising opportunity to construct a 61.75 Mega Watt wind farm at Alfatayh area, in the north east of the city. Furthermore, the state of Libya has also planned to begin some other wind power projects in various areas like south eastern and south western parts of the country due to having good windy conditions throughout the year and Figure 5 shows the top seven highest wind speed annually:

Figure 5: Yearly top Seven-wind speed all-time

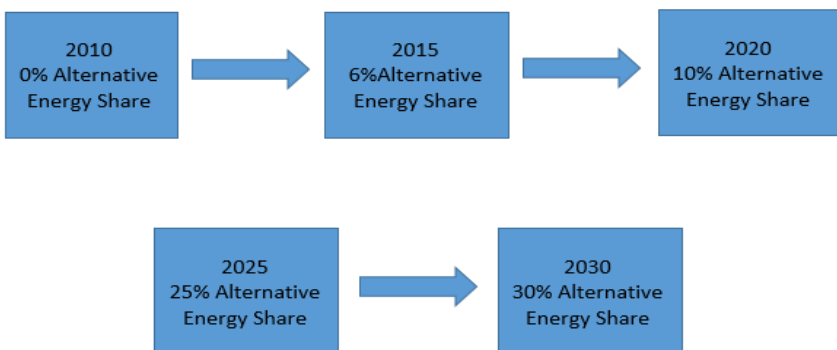


Source: Olsson G (2015)

Sixthly .Alternative energy plan of actions in Libya

Few years ago, the Renewable Energy Authority (REO) in Libya has aimed to promote using clean energy in Libya hoping to reach 10% of the energy supply that is provided by alternative energy supply by 2020 as it's shown in Figure (6). As well as, previous studies proved that Libya with its great potential could produce alternative energy from various sources regardless the fact of not doing enough for utilizing the alternative and clean energy formerly. Hence, as from 2006, the related Libyan authorities have planned to increase the production of clean energy from less than 1% to 6% in the next coming few years (Kurokawa, 2014).

Figure 6: Annual Alternative Energy supply in Libya



Source: Gazzo A, Kost C and Ragwitz M (2011).

Additionally, Libya also showed a great interest in increasing the availability of alternative energy by starting the national program for promoting using the solar heating technology in some areas that were selected carefully and there is strategic plan in 2020 in which the country would expand the alternative energy projects to increase the usage of clean energy from about 6% to the average of 10% showing that Libya is starting to promote for the culture of using alternative energy through different forms among the Libyan nation. Therefore, there were some serious plans to start utilizing the available alternative sources of natural energy to fully convert to using clean energy by 2050, which means that according to this strategic plan by 2050, the state of Libya will be completely relying on using clean energy instead of the permeable natural gas and oil. Moreover, Libya is very well known for supplying fuel to other countries with having the well for developing its alternative and clean energy for exportation to southern Europe neighbouring countries through undersea cables, Hence, a \$3 Billion deal was signed with UAE's Al Maskari Holdings in December 2010 and the project plans to incorporate alternative energy connecting Italy and Libya (K El-Arroudi,2013) .

1. Alternative energy action plans in Libya

It can be said, that in any third world country like Libya, the relationship between renewable energy and sustainable development is highlighted through the continuous and permanent provision of energy at an affordable cost and in quantities commensurate with local and global demand, as development is based on the idea of protecting the environment and ensuring the optimal use and fair distribution of resources, and the role of renewable energy in development appears in ensuring the supply of the development system. Notably, with a reliable and sustainable source that can be relied upon to prolong the period of investment, the state of Libya sought to prolong the period of investment. Moreover, a national policy for renewable energy through coordination between the works of the state ministries related to the subject, and work to create a knowledge base for renewable energy that would facilitate the Libyan General Company of Electricity and established started, integrating renewable energy into future projects as previously mentioned and stated in different figures, renewable energies and the environment since the mid-seventies, and among the relevant legislation, which stipulates the support and encouragement of the uses of electricity regarding renewable energies in various fields and the localization of their industries. In addition, the Libyan government does not prevent not stop the private sector from investing in building stations

that operate on renewable energy. While providing the necessary incentives. It is widely well known that the energy system in Libya relies heavily on fossil fuel-based forms of energy, which occupied; nevertheless, the local authority has planned to increase the use of solar energy in various fields such as generating electricity, water pumping (B.Fortin, 2019).

These meters are connected to some special transformers, and the 1×1 system is connected to an insect trap with measurements inside which is a light source from neon. This system works at night, emitting neon, and neon produces light that attracts insects around it, and when it encounters the insect, it electrocutes them. Thus, insects can be combated and eliminated without using Pesticides are a source of pollution to the environment and fruits, in addition to eliminating the import of pesticides and saving currency. The use of renewable energy faces difficulty in developing the agricultural sector in other areas and investing in it in Libya. There are a number of challenges, including technological obstacles and others related to weak financing, as well as a significant lack of awareness of the importance of investment. Renewable energy (Polityke, 2018).

Conclusion :

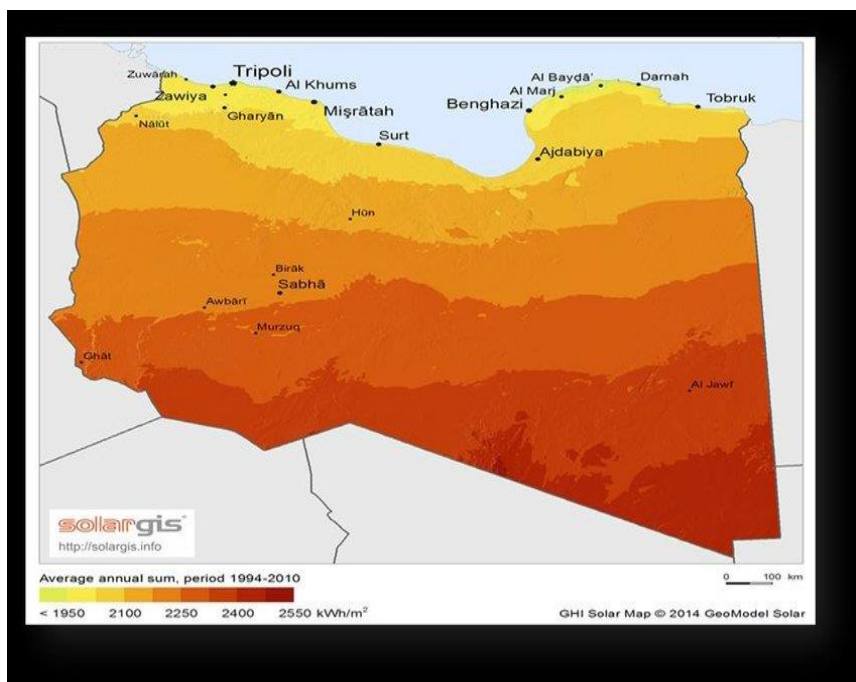
- Study Findings

1- Libya is planning to increase its share of renewable energy by 30%, in 2030 as the most important sources of which are hydroelectric, solar, wind and bioenergy.

2- There are different alternative energy sources that are available in Libya, such as hydroelectric energy, wind power and solar energy then energy from biomass.

3- The index of Libyan solar energy is increasing from north to south in the Libyan Desert, which produces medium energy density of with a capacity of 1.2 MW and solar irradiation across Libya, is shown in Figure (7) as follow:

Figure 7: solar irradiation across the state of Libya



Source: <https://www.sciencedirect.com/science/article/pii/S2666790>

- Study Recommendations

According to the results of this research, the authors strongly recommend that investing in renewable energy in Libya rely powered by a variety of alternative energy sources achieving environmental, economic and social stability in the energy sectors and the author's main recommendations are:

1- The use of solar energy can have a positive impact on the economy for achieving sustainable development and securing energy sources, in addition to the support it achieves in supporting competitiveness in productive sectors.

2- The use of alternative energy would help for ecological, economic and social stability in the energy sectors, in addition to its use granting future generations their right to the natural economic resources that the environment provides.

3- The amount of solar radiation and hours of solar brightness in the state of Libya can be used to also combat orchard insects in Libya by using sun power panels to generate electricity.

4- Solar energy can be converted into electrical energy stored in batteries and a light source is connected inside it, as this system works at night, emitting neon, and the neon light attracts insects around it.

5- Using green/ clean or renewable energy will ensure the future generation have the right to the natural economic resources that the environment provides.

6- The researcher emphasizes the keenness to spread environmental awareness to importance of using alternative energy.

7- The authors would take advantage to draw more attention to the serious need of further studies about this important subject.

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