

Renewable Energy and its Environmental and Economic Impact

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Abstract:- In order to preserve the environment and reduce the use of very expensive natural resources and in order to reduce the amount of the electricity bill, it is very important to turn to the use of renewable energy to produce electricity.

I. INTRODUCTION

Renewable energy is classified according to the sources from which it is taken. One of the advantages of renewable energy is that it is available in all parts of the earth in one form or another naturally and without research and exploration. It is energy derived from natural sources that can be renewed within a period of time not exceeding a human lifespan, and without causing a depletion of the planet's resources or causing an imbalance in nature. However, there are drawbacks to renewable energy, and types of renewable energy include sunlight, wind, rain, tides, waves, biomass, and thermal energy stored in the Earth's crust, which makes it an inexhaustible source of energy, not to mention that its climate damage or... The environment is almost non-existent. It is constantly renewed. Renewable energy comes from natural sources or renewable natural processes, and its availability may depend on time or climate. Although it is referred to as a modern technological innovation, humans have long been dependent on energy sources. Natural for heating, transportation, lighting, etc. The wind has always been a source of energy for ships and mills. The sun also provided warmth during the daylight hours and helped ignite fires that last until the evening, as solar energy is one of the most important sources of renewable energy.

Energy is at the heart of the climate challenge – and it is the key to the solution.

A large portion of the greenhouse gases that cover the Earth and trap the sun's heat are generated through power production in power plants, by burning fossil fuels to generate electricity and heat.

Fossil fuels, such as coal, oil and gas, are by far the largest contributor to global climate change, accounting for more than 75 percent of global greenhouse gas emissions and about 90 percent of all carbon dioxide emissions, the main cause of global warming.

To avoid the worst effects of climate change, emissions must be reduced by approximately half and gradually in all areas that play a role in environmental pollution, including power generation stations and factories, by 2030, and reaching net zero by 2050.

To achieve this goal, we must end our dependence on fossil fuels and move towards stopping the production of electricity through stations that operate on fuel, including oil derivatives, and invest in clean alternative energy sources and establish stations that generate electricity based on renewable energy, which can be accessed. , affordable, sustainable, and reliable.

Renewable energy sources - available all around us, provided by the sun, wind, water, waste and heat coming from the Earth - are inherently renewable and emit little greenhouse gases or pollutants into the air. They may be expensive to start with, but after construction the difference becomes clear in terms of operation and Effects on climate. Fossil fuels still represent more than 80% of global energy production, but clean energy sources are gaining ground and many countries and companies are turning to renewable energy. About 29 percent of electricity currently comes from renewable sources.

II. RENEWABLE ENERGY SOURCES

➤ Solar Energy

Solar energy is the most abundant energy source and can be harnessed even in cloudy weather. It can provide cooling, heating, and natural lighting, in addition to generating electricity and heat. Sunlight can be converted into electrical energy through mirrors that focus solar radiation or photovoltaic panels. fig 1.

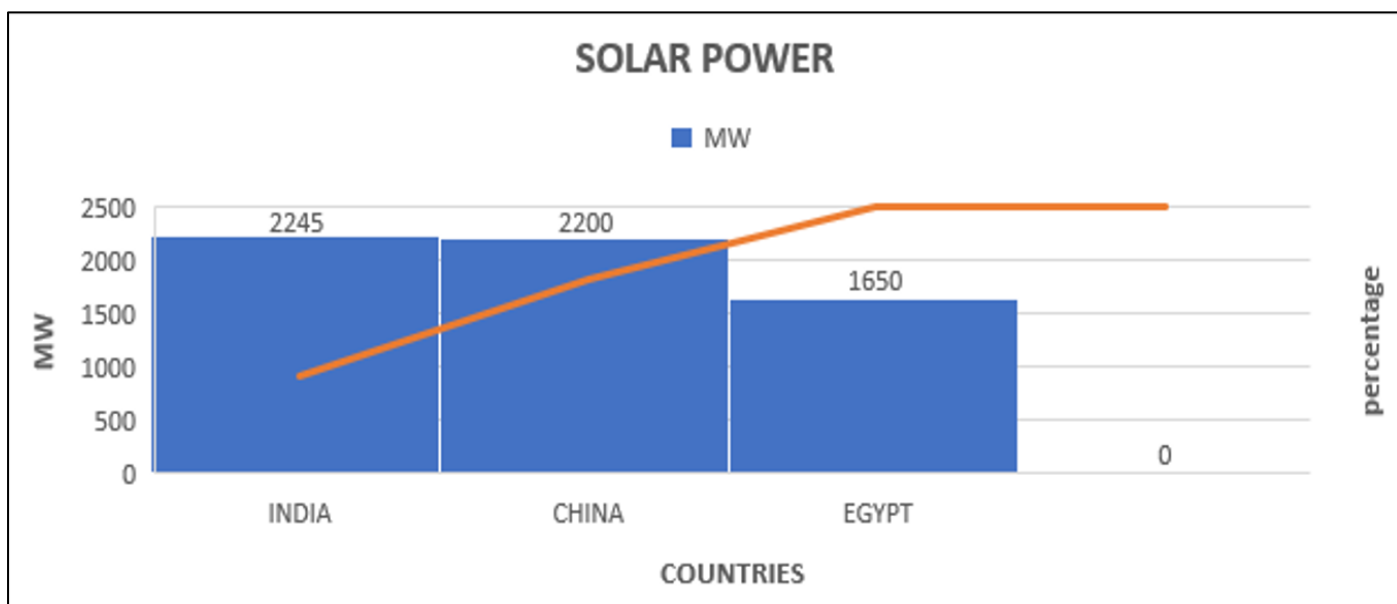


Fig 1 Largest Solar Plants

➤ *Regarding Solar Energy, there are Several Types in Terms of use and Connection:*

- **On Grid**

It is used for the purpose of supporting the national grid, where electricity is produced and synchronized.

- **Off Grid**

It is used for the purpose of producing electricity in cases of power outages due to malfunctions or reduction schedules. It is also used to reduce dependence on national electricity and reduce the electricity bill.

- **Hybrid**

This type includes connecting the first and second so that the power grid is supported and part of it is used in cases of a national power outage.

- **Wind Energy**

Wind energy uses kinetic energy to move air through large turbines located on land, at sea, or in fresh water. Innovations in technology have resulted in better electricity production from wind turbines over the past few years fig2.

Wind energy can power some homes, although its effectiveness depends on several factors, according to Mother Earth News. You may need to combine a wind turbine with another source of renewable energy (such as solar panels) to fully power your home. Here are some other factors to consider.

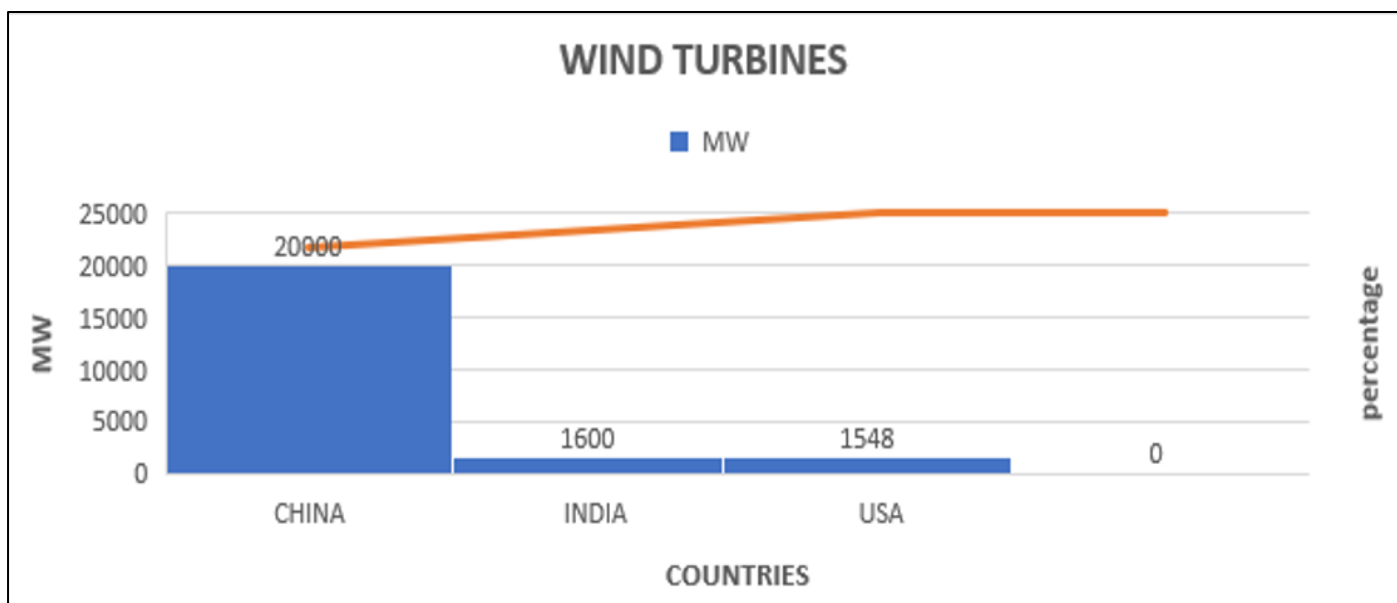


Fig 2 Largest Wind Turbine Plants

➤ *Geothermal Energy*

Geothermal energy uses thermal energy coming from within the Earth. Many underground aquifers are often large sources of geothermal energy.

➤ *Hydropower*

Hydropower harnesses the energy of water moving from high elevations to lower elevations, thus generating energy from reservoirs and rivers. It is currently the largest source of renewable energy in the electricity sector.

III. ADVANTAGES OF CLEAN ENERGY

➤ *Renewable Energy Sources are all Around us*

About 80% of the world's population lives in countries that are net importers of fossil fuels - that is, about 6 billion people depend on fossil fuels from other countries, which makes them vulnerable to geopolitical shocks and crises in addition to the high costs that fall on the consumer.

In contrast, renewable energy sources are available in all countries, and their potential has not yet been fully exploited. Estimates from the International Renewable Energy Agency (IRENA) indicate that 90% of the world's electricity can and should come from renewable energy by 2050 to save the world from the energy crisis.

Renewable energy sources provide a way out of dependence on imports, allowing countries to diversify their economies and protect them from unpredictable fossil fuel price fluctuations, while driving inclusive economic growth, new jobs, and poverty alleviation.

➤ *Renewable Energy is Cheaper*

Renewable energy is actually the cheapest energy option in most parts of the world today. Prices for renewable energy technologies are falling rapidly. The cost of electricity generated from solar energy fell by 85 percent between 2010 and 2020. The costs of onshore and offshore wind energy decreased by 56 percent and 48 percent, respectively, as a result of companies engaging in the process of competing and producing the required quantities according to marketing demand.

Lower prices make renewable energy more attractive everywhere – including low- and middle-income countries, where most of the additional demand for new electricity will come. As costs fall, there is a real chance that a significant portion of new energy supply over the coming years will come from low-carbon sources.

Cheap electricity from renewable sources could provide 65% of the world's total electricity supply by 2030. It could lead to the decarbonization of 90% of the energy sector by 2050, significantly reducing carbon emissions and helping to mitigate climate change. It is now a source of global concern, and its consequences include environmental disasters, drought, blackouts, and impacts on health

Although solar and wind costs are expected to remain higher in 2022 and 2023 compared to pre-pandemic levels due to a general rise in commodity and freight prices, their competitiveness is actually improving due to steeper increases in gas and coal prices, the agency says. International Energy (International Energy Agency)

➤ *Renewable Energy is Healthier*

According to reports and statistics provided by the World Health Organization, about 99 percent of people in the world breathe air that exceeds air quality limits and threatens their health, and more than 13 million deaths around the world annually are due to environmental causes that can be avoided, including air. The diseases that are now spreading catastrophically are the results of environmental pollution.

Unhealthy levels of fine particulate matter and nitrogen dioxide arise mainly from burning fossil fuels. In 2018, air pollution caused by fossil fuels caused health and economic costs worth \$2.9 trillion, or about \$8 billion per day.

Therefore, switching to clean energy sources, such as wind and solar energy, not only helps in tackling climate change, but also in tackling air pollution and health.

➤ *Renewable Energy Create Jobs*

Investing in renewable energy sources creates three times more jobs than those in the fossil fuel industry. The shift towards net zero emissions will lead to an overall increase in energy sector jobs, while about 5 million jobs could be lost in fossil fuel production with steps towards relying on renewable energy by 2030. However, the most important thing is that an estimated 14 million jobs will be created. One million new jobs in clean energy. This means a net gain of 9 million new jobs provided by businesses that need investments in the field of renewable energy.

In addition, energy-related industries will need an additional 16 million workers, for example, to take on new roles in manufacturing electric vehicles and highly efficient appliances or in innovative technologies such as hydrogen. This means that more than 30 million jobs could be created in clean energy, efficiency and low-emission technologies by 2030.

➤ *Renewable Energy Makes Economic Sense*

In 2022, about \$7 trillion was spent supporting the fossil fuel industry, including through explicit subsidies, tax breaks, and health and environmental damages that are not priced into the cost of fossil fuels.

By comparison, we need to invest about \$4.5 trillion annually in renewable energy until 2030 – including investments in technology and infrastructure – to allow us to reach net-zero emissions by 2050.

The initial cost is clearly daunting for many countries with limited resources, and many will need financial and technical support to achieve the transition. But investments in renewable energy will quickly pay off. Reducing pollution and

climate impacts alone could save the world up to \$4.2 trillion annually by 2030.

Furthermore, efficient and reliable renewable energy technologies can create a system less vulnerable to market shocks and improve resilience and energy security by diversifying energy supply options.

Both basic types of solar energy are made by capturing energy from sunlight. Solar PV is the most common type and is produced when photons in sunlight strike a silicon solar panel. The other type of solar energy is called solar thermal energy, which is produced by using the sun's heat to heat water.

Once sunlight hits the solar panel in solar PV, the photons then excite the silicon molecules, causing them to move, generating electricity. The electricity generated by solar PV panels is then transmitted directly to the electrical grid or stored in a battery until needed.

Solar thermal energy can be used to provide hot water for homes and swimming pools; There are a number of solar thermal power plants around the world. Solar thermal power plants use an array of mirrors to focus the sun's heat onto a container of liquid. When the liquid boils, it releases steam, which is then used to run a conventional steam generator such as those found in coal power plants.

Although many people use solar photovoltaic panels to generate power for their homes, they can also be used to create large-scale power plants as well. However, solar PV plants require a much larger area than CSP plants, which can generate more energy in a much smaller space.

➤ *Hydro Power*

The world now depends on water energy as one of the most important renewable energy sources, more than wind or solar energy. In 2021, the power of hydroelectric energy in the world recorded an unprecedented level of 1,308 gigawatts.

Utilities around the world rely on hydropower to generate electricity, due to its low cost, ease of storage and distribution, and the fact that it is produced without combustion of fuel, which means that it does not release carbon dioxide or pollutants as happens with power plants that burn fossil fuels such as coal or natural gas. .

The question is: Is it possible to generate clean, renewable energy from rivers, while at the same time restoring wildlife and the environment in general?

Engineers are changing the future of hydropower with fish-safe turbines. California-based Natal Energy has partnered with Breakthrough Energy Ventures, an investment firm owned by Microsoft founder Bill Gates, to create a swept-edge turbine that improves fish survival. In addition to saving the fish, the Natel turbine aims to create climate-resilient hydropower that can withstand the fluctuations of unpredictable rainfall.

The traditional approach to hydropower generation is not compatible with modern conditions, because the weather and rainfall patterns themselves are changing.

At a time when floods or severe droughts threaten regions around the world and climate change leads to unusual weather patterns, hydropower, as envisioned by Natel, could make watersheds more adaptable to the environment.

“Climate change is water change,” Gia explains. “We saw an opportunity to rethink hydropower facilities and equipment based on civil and environmental engineering techniques, using fish-safe turbines based on machine learning techniques and satellite images.”

The wide variation in climate from year to year, and the unpredictable rainfall, are among the things that will make finding creative solutions even more urgent.

If these solutions are developed in a sustainable manner, hydropower can serve as an environmentally friendly fuel source, with attendant benefits such as flood control, irrigation methods, water supply, and drought reduction.

The Natel turbine is equipped with satellite technology that allows hydroelectric power plant operators to monitor changing watershed conditions, such as melting snow, and predict water flow in a more accurate way.

IV. WEAK POINTS IN RENEWABLE ENERGY

➤ *High Development Cost*

The development of renewable energy plants requires a large cost, whether in research or manufacturing the components necessary to complete the process successfully, in terms of materials and space required for the development and expansion process, especially in solar power plants, while the process of extracting fossil fuels is less expensive because all the manufacturing tools are already present at the site.

➤ *Weather Fluctuations*

In general, almost all renewable energy sources are exposed to weather fluctuations and are affected by climate changes, which affects their production. For example, heavy rain or slow winds may reduce the production of this energy, and the expected climate change in some places may make it difficult to produce renewable energy and make it impossible to install some types of renewable sources to produce energy.

➤ *Inability to Produce in Large Quantities*

Coal-fired power plants can produce large amounts of energy, but renewable sources cannot produce large amounts of energy in one place and in a short time, which makes it necessary to reduce energy consumption or create new facilities that can produce energy at a faster rate.

➤ *It is Not Available in all Places*

The intensity of solar, hydro and wind energy required to install power plants is not available in all regions of the world, which requires the establishment of more energy transmission

infrastructure facilities that may not be better than what already exists.

➤ Large Areas

Producing a large amount of renewable energy requires installing a lot of solar panels and wind farms. Large areas of land are needed to produce large amounts of renewable energy.

The availability of suitable land represents a source of concern for designers of electrical energy projects of various types and sources, because the area of land, its location, and its availability are essential to the project, such that it may delay the start of work on the project. Concern may be growing regarding the selection and use of land for energy production for two reasons: one is whether the available land is sufficient for electric power production stations, and the other is concern about the space that these stations can occupy at the expense of natural landscapes, vegetation, and environmental components. The production and generation of electricity is the process of converting various forms of energy into electricity, so that it can be used to supply and feed homes, companies, factories and all facilities therein. There are several ways to generate electricity, each of which has its own requirements, advantages and disadvantages in terms of land area. But there is a question that is frequently asked in scientific circles: What is the energy source that uses the largest area of land?

Wind power plants require 99 square meters per megawatt, and what is meant here is wind plants that are built directly on the ground, while solar photovoltaic power plants require 19 square meters per megawatt hour per month. On the other hand, we see that fossil power plants are better off than renewable energy, except for plants with carbon capture and storage technology, which requires 21 square meters per megawatt hour per month. If the plant uses natural gas with carbon capture and storage technology, it would require less than 1.3 square meters per megawatt hour per month. We come to the energy source that requires the least land area per megawatt, which is nuclear energy, as it requires only 0.3 square meters per megawatt. This means that it is the most efficient source and the least demanding of land use. Each unit of electricity (megawatt) of nuclear energy requires 70 times less land area than coal, and 63 times less than land-based solar photovoltaic energy. This number will increase to 330 times if the space need of nuclear power plants is compared with wind power plants. Therefore, we can conclude that the requirements of renewable energy on land area in general are higher than those of fossil energy, with the exception of coal, but nuclear energy is considered the most effective of all sources of electrical energy.

Countries with small areas have tended to take this point into account, exploiting the rooftop areas of homes and stores to install solar photovoltaic panels, in addition to exploiting the seas and oceans to use offshore wind energy turbines, but their capital and operational costs are higher than those that use wind energy. Ground or ground-mounted solar PV plants. In conclusion, land area remains merely a factor taken into account in order to plan the electrical power system, and it

may be influential in countries with small areas, islands, or provinces densely populated with residential neighborhoods, commercial centers, and industrial complexes.

➤ Connect to the Electric Grid

Connecting the wind energy system to the national electrical grid has advantages and disadvantages. When the turbine or panels don't produce enough energy to power your home, the grid provides the power you need to keep your home running. You also have the opportunity to sell excess energy to the electric power company.

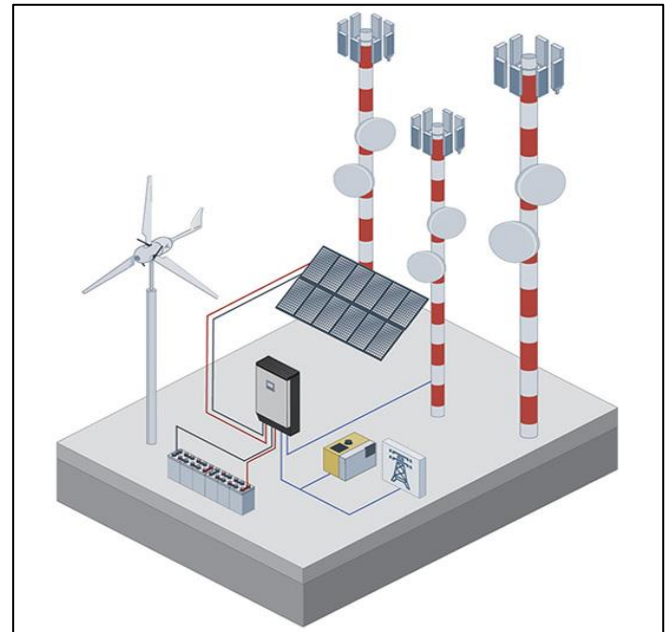


Fig 3 Renewable Energy Plant

➤ Solar use :

The shift to producing electrical energy through renewable energy sources is on the fast track. In 2022, the world installed 239 gigawatts of new solar capacity, eventually exceeding the TW metric. This means a 45% increase in solar energy capacity over the previous year. Positive market developments in the first months of 2023 promise another year of solar energy boom and this indicates that the complex is heading towards prosperity and further growth, and is expected to lead to 341 gigawatts of solar capacity newly added to the grid, by the end of the year - that is, This equates to a growth of 43%. This sunburst follows more modest progress in previous years, which were marked by pandemic-induced lockdowns, supply chain disruptions, and higher product prices. However, even in more difficult times, the solar industry has shown very strong resilience, with newly installed global capacities increasing by 19% in 2020 and 18% in 2021. This development includes large, medium and small plants for domestic or commercial use. Limited or in the field of agriculture and irrigation.

In the Kurdistan Regional Government, it is now focusing on renewable energy due to delegation problems and a shortage in power generation, as electricity production has reached 3,500 megawatts to provide electricity to 1.85 million customers. However, fuel shortages and water shortages mean

that supply is far from meeting demand, and the amount generated from clean sources has increased by 10 to 15 percent. It is noted that the demand for establishing renewable energy sources for homes is witnessing significant growth, which leads to reducing pressure on the national grid.

The resource-rich Region actually has the capacity to produce more than 7,000 MW of electricity but no enough fuel for those stations.

With actual production at only half the capacity, the demand is between 5,500 to 5,700 megawatts in summers.

As part of its green energy record, the KRG said it has worked to develop hydropower generation at Dukan and Darbandikhan dams, but both sites are struggling with low water levels

Dukan Dam, producing only 90 MW of electricity. The dam has the capacity to generate 400 MW.

The diminished generation means the national grid supplies only 12 to 13 hours of electricity daily, forcing people to pay for private generators or solar power. Residents often lament the poor electricity supply, especially in the brutally hot summer months when temperatures often surpass 50 degrees Celsius.

The fig 4 shows how small diesel generators provide consumers with electric when during power outages , thousands of generators located among houses that It will affect the environment and cause annoyance to citizens due to the noise of machines , also its cost citizens must be considered.

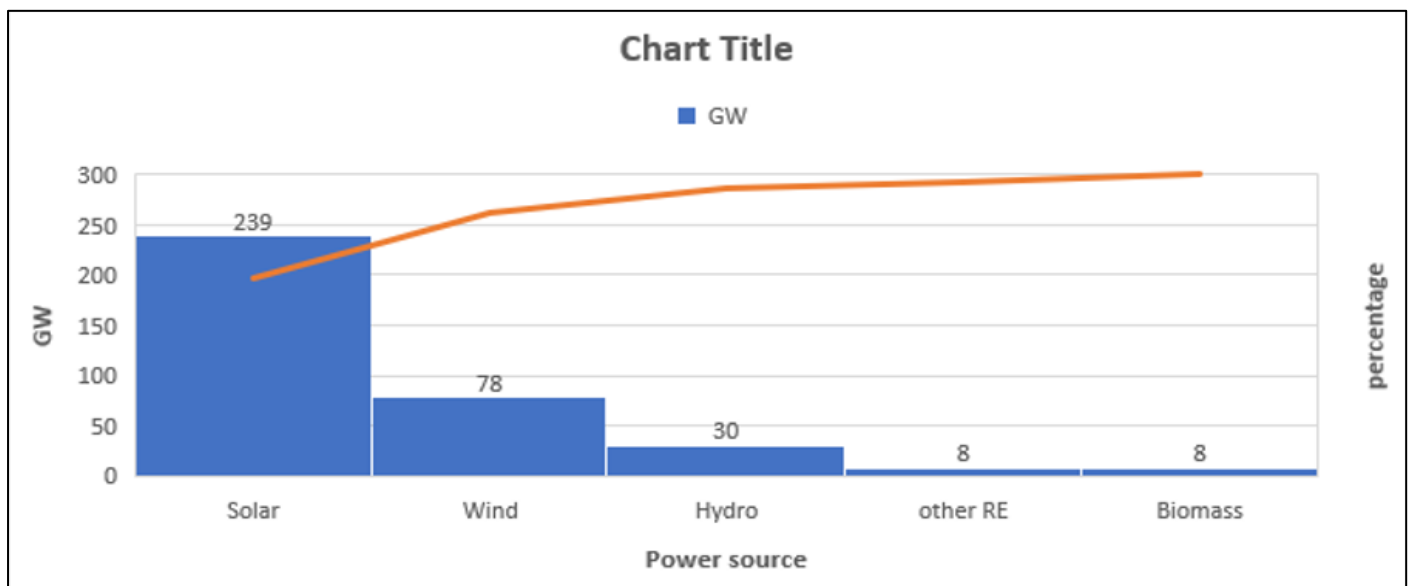


Fig 4 Growth in 2022 Power Plants

➤ Why Renewable Energy :

- In order to realize the benefits of installing solar in households and any private sectors , let estimate that someone installed 5000w solar panels ,below calculation of effecting in electrical bills :

$$5000 \times 24 \times 30 = 3600 \text{ kwh/ month}$$

- According to Kwh Tariff in Kurdistan Regional Government /* Iraq :

$$450 \times 18 + 450 \times 24 + 600 \times 42 + 600 \times 72 + 900 \times 90 + 600 \times 181 = 276,900 \text{ ID deduct in electric bill per month .}$$

- According to Standards Gas Consumption is 0.21 kg/kwh , for above Solar Production :

$$0.21 \times 5 \text{ kwh} = 1.05 \text{ kg} \times 24 \times 30 = 756 \text{ kg per month .}$$

- If we compare the prices of generators that operate in neighborhoods in Iraq in general, we see that the price of kilowatts is much higher than the price of electricity. For example, in Erbil for the month of May, the price is one Amper was 11750 ID

$$\text{Power} = 1A \times 220V \times 30\text{DAY} \times 9.7\text{HOUR}$$

$$= 64,020 \text{ wh} = 64.020 \text{ kwh}$$

It mean that the price one kwh is $11,750 / 64.020 = 183.5$ ID or 0.12 USD , when kwh price for national grid for domestic consumers is 18 ID per kwh or 0.012 USD.

Its clear that installing private solar or wind turbines are cheaper in long terms than using electricity of commercial generators.

- If we Compare the Electricity Supply to the Electricity Grid and the Installation of new Energy Systems in Remote Areas, we see that there is little Difference with the following Characteristics Renewable Energy Oppression:

- ✓ Does not require maintenance
- ✓ Electricity will not be cut off due to weather conditions or power reduction schedules during production station problems
- ✓ No voltage drop problems
- ✓ The pressure on power plants will be reduced
- ✓ No monthly electricity bill



Fig 5 Small Generator Inside City

➤ Energy Resource Problems

• Fuel Shortage

Global energy consumption is increasing and we will face fuel shortages in general, whether liquid fuels, gas or coal, in the coming decades. Therefore, the availability of reserves is an important source of concern because there is an inverse relationship with an increase in energy consumption and a shortage of fuel

Producing or providing the fuel required to operate electricity production stations has become one of the

challenges at the global level as a result of the lack of sufficient fuel. Now, global reserves are decreasing day after day, and in return, the demand for electricity consumption is increasing rapidly. We now see how electricity is cut off for consumers in Egypt and Iraq due to Provides the required production of electrical energy

From the fig 6 we see the times of power outages in the city of Koya / Erbil in Iraq due to a lack of generation, despite the presence of sufficient production units in the generation stations, but the lack of sufficient fuel prevented the stopped units from operating or operating them for the benefit of film consumers.

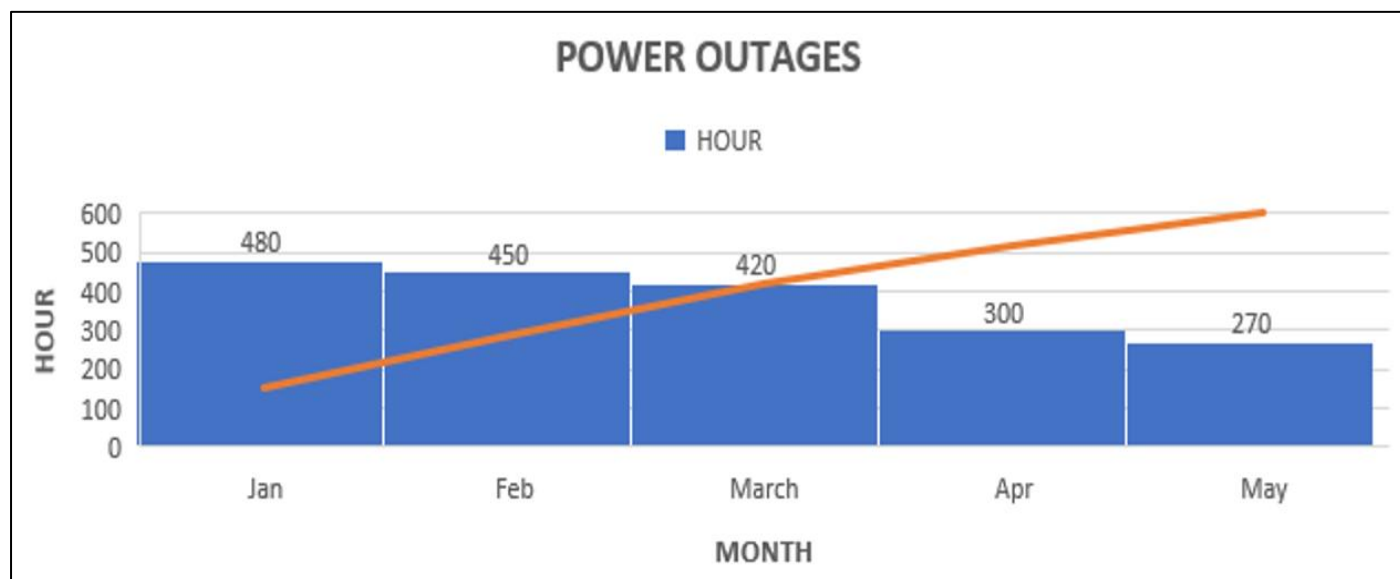


Fig 6 Power Outages

- **Excessive Consumption**

Our current consumption model is based almost entirely on using non-renewable energy sources to generate electricity such as oil, gas, coal and uranium.

At the current rate of consumption, oil will be the first fossil fuel to run out. According to expectations, there will be

between 40 and 60 years of proven reserves of conventional oil. Natural gas can be exploited for another 70 years. As for coal, there will be about two centuries of reserves. From the above, we conclude that energy sources are in great danger. We must move and find alternative sources of energy production, otherwise a catastrophe will occur in the field of energy.

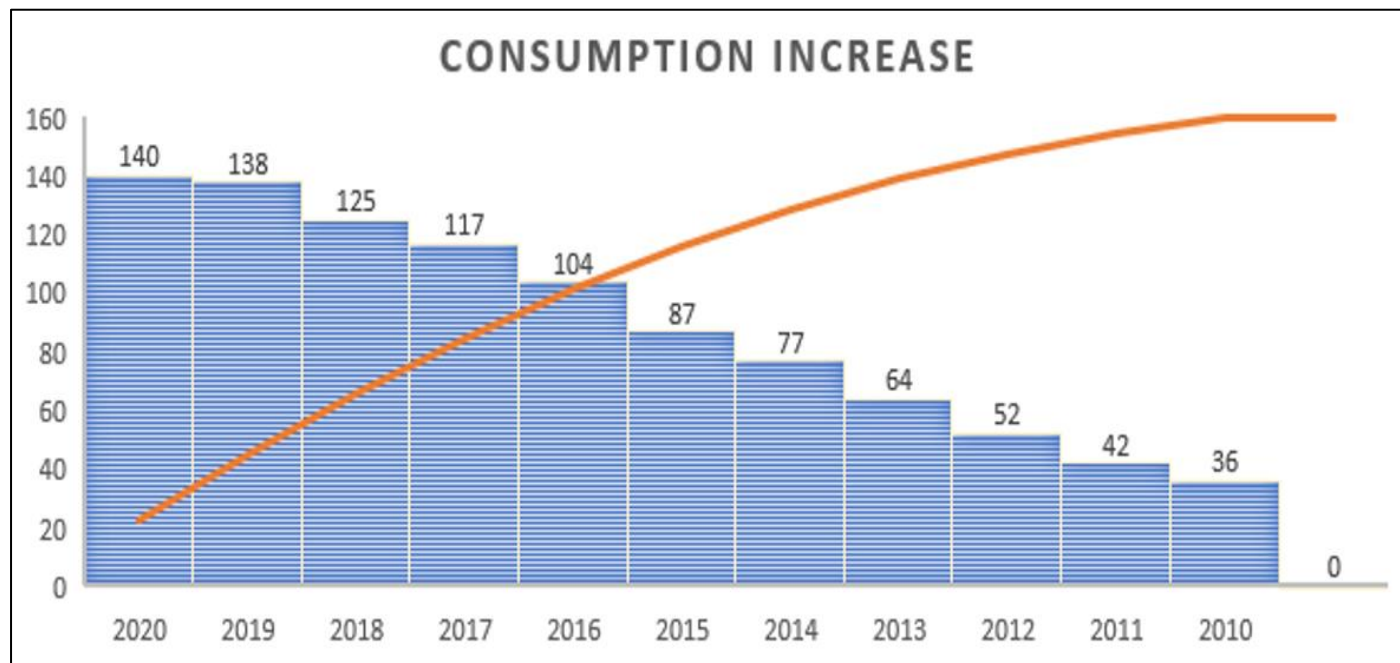


Fig 7 Electric Consumption Growth in Erbil / Koya

- **Overpopulation**

This data must be taken into account because it is based on current energy consumption without taking into account population and economic growth, and it is clear that it will rise significantly. Energy demand will be amplified by demographic factors – the global population is expected to

reach nearly 10 billion in 2050 – and the economic prosperity of growing regions. According to the International Energy Agency, global energy demand may rise by more than 50% by 2030 in the absence of public policies in this area and following short-term and long-term plans to prevent the collapse of energy sources. Fig 8

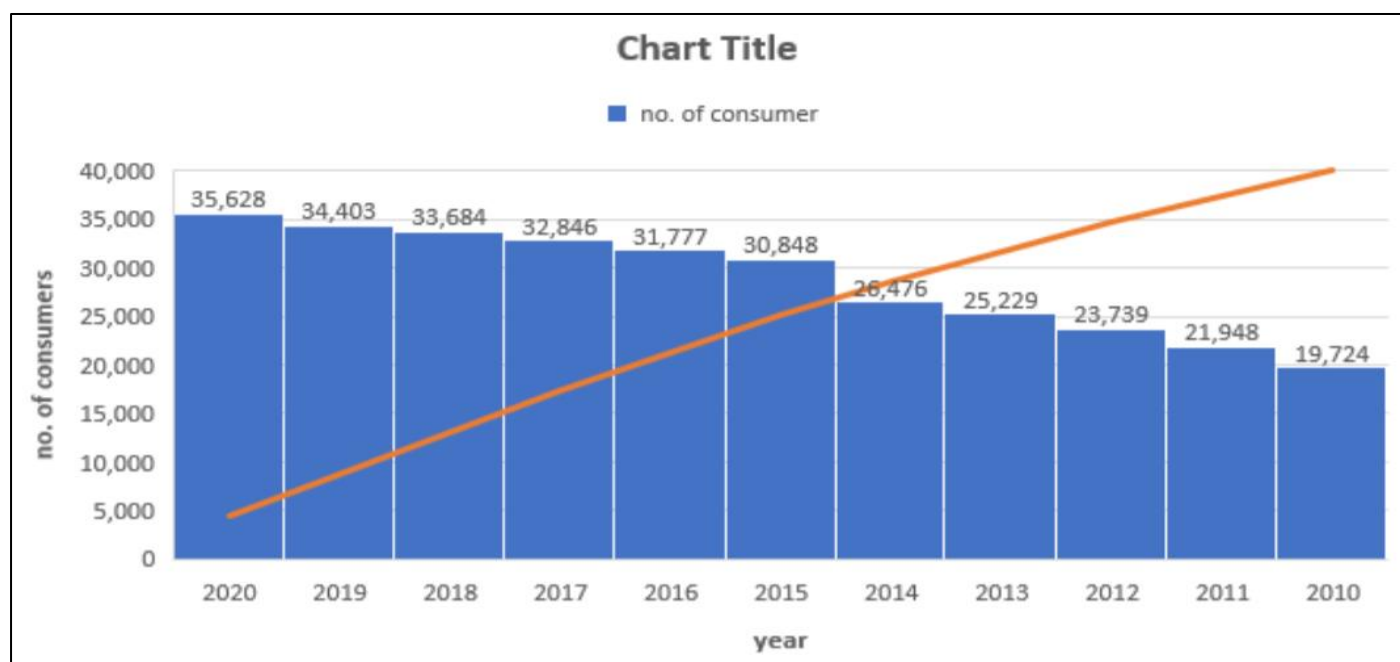


Fig 8 Electric Consumers Growth in Erbil / Koya

- *Old Infrastructure*

Another reason for energy shortages and scarcity is poor infrastructure of power generation equipment.

Most energy producing companies continue to use outdated equipment that limits energy production. The need to upgrade the infrastructure and establish a high level of performance is crucial in order to achieve the required efficiency of generation and operating equipment in all fields.

- *Wasting Energy*

Energy waste, which mainly comes from unnecessary use of energy resources, describes the waste of energy sources, especially fuel and electricity. Therefore, reducing waste is a tremendous source of energy saving, which requires taking action at the individual and collective levels through awareness in order to rationalize the use of energy, so it is possible to obtain the desired results.

➤ *Renewable Energy Component Manufacturing Forecasts*

The boom in renewable energy installations in 2023 and its optimistic outlook is reflected in the expansion of its manufacturing capabilities globally; The manufacturing capabilities of solar energy components have witnessed a tremendous boom over the past 7 years.

Polysilicon manufacturing capacity jumped from 98 gigawatts in 2015 to 439 gigawatts in 2022, with expectations that it will exceed 1 terawatt in 2024.

Chip manufacturing capacity also jumped from 63 gigawatts in 2015 to 553 gigawatts in 2022, and is expected to reach 870 gigawatts in 2024, according to estimates by the International Energy Agency.

As for solar energy cells; Its global manufacturing capacity has increased from 91 gigawatts in 2015 to 568 gigawatts in 2022, after which it will jump to 1.23 terawatts in 2024.

While the manufacturing capacity of solar modules jumped from 119 gigawatts in 2015 to 639 gigawatts in 2022, with expectations that it will reach 1.12 terawatts during 2024, according to the Energy Agency.

Despite the huge incentives announced by the United States to localize the solar energy industry in the country since August 2022; Research firms Wood Mackenzie still expect 80% or more of solar component manufacturing capacity to remain in China until 2026.

While the Solar Energy Industries Association of America (SEIA) expects America's solar component manufacturing capacity to multiply at least 17-fold by 2026, as a series of ambitious announcements come into effect.

The capacity of all announced projects to manufacture solar energy in America, since the issuance of the inflation reduction law until August 2023, reached approximately 155 gigawatts, distributed between 85 gigawatts for manufacturing modules, 43 gigawatts for manufacturing cells, 20 gigawatts

for alloys and silicon chips, and 7 gigawatts for manufacturing transformers, in addition to... A series of projects to manufacture electricity storage batteries with a capacity of 65 gigawatt-hours.

As for the manufacturing of the three main wind energy components globally: The manufacturing capacity of the windmill's outer structure reached approximately 126 gigawatts in 2022, and it is expected to increase to 140 gigawatts in 2025.

While the manufacturing capacity of turbine towers and blades reached about 106 and 117 gigawatts, respectively, in 2022, with expectations that this capacity will increase to 120 and 141 gigawatts in 2025, according to the International Energy Agency.

V. CONCLUSION

The availability of clean, affordable energy is crucial to avoiding the collapse of energy sources, preserving the global economy, and avoiding a devastating impact on public health. Using dirty fossil fuels to produce energy can have negative impacts on air quality and water resources, leading to a range of health issues such as respiratory problems and waterborne diseases. Working to provide renewable energy devices in the markets at a reasonable price will be extremely important to encourage consumers to switch to renewable energy sources.

On the other hand, clean energy sources can help improve air quality and protect water resources. Demand for energy is also likely to increase as the world's population grows, making it more important to switch to clean and sustainable sources. In addition, the impacts of climate change, such as sea level rise and poor housing quality, could disproportionately affect disadvantaged communities and exacerbate health inequalities.

It is necessary for all stakeholders, including governments, companies and individuals, to work together to promote the transition to clean energy and ensure its availability to all. Using clean energy on small levels, for example in homes or small factories and factories, will be a very important step because it contributes to reducing the use of The public network is the goal, and it is then possible to expand the process to include energy production greater than private needs to be a contribution to feeding the public network.

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