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The Role of Renewable Energy in the Protection of the Iraqi Environment

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Abstract:
In this article, the types of renewable energies and the environmental effects of consuming these energies are studied. Energy is one of the things necessary for economic and social development and improving the quality of life, and the presence of continuous and sustainable economic energy is essential for any economic development and growth. Humankind has been aware of renewable energies such as biomass and geothermal energy for a long time and has used these energies as heat sources for shelter. With the beginning of the extraction of fossil fuels such as oil and coal and unlimited access to these products, the use of renewable energy sources, except in remote places and forest areas, has become limited and forgotten. Currently in Iraq, fossil fuels such as oil and gas are the most consumed sources of energy, and due to the limited fossil energy resources in addition to the problems caused by the consumption of these types of fuels, one must look for a place to use renewable energy and new energies for future generations. Iraq has many opportunities related to the use of rich sources of renewable and new energy such as wind energy, geothermal energy, hydroelectric energy, and solar energy. The use of these renewable energy sources not only reduces the use of limited fossil fuel resources but also prevents the harmful effects of greenhouse gases in the atmosphere and global warming. In this article, renewable and new energies such as solar energy, wind energy, geothermal energy, biomass, biogas, hydropower, and hydrogen are introduced. The technology used to harness renewable and new energies were discussed in addition to its environmental impacts, Iraq's talents, and the possibility of using these energy sources. A review of renewable and new energies shows that the development and use of renewable energies are very suitable alternatives to fossil fuels and the use of some renewable energy sources such as the sun and wind can help maintain the health of the environment.

Keywords: Energy crisis, renewable energy, environmental impacts, fossil fuels.

Introduction

In all societies, energy has always been recognized as the main driving force, and with the advancement of countries in industrialization, the importance of energy and its impact on human life has increased. Today's world has faced many problems and obstacles in the field of providing cheap energy and pollution caused by fuel consumption. Considering the high consumption of fossil fuels and the high production of greenhouse gases due to the consumption of these fuels in the atmosphere, research has been undertaken to solve these problems (Fergi et al., 2012). The growth of the economic activities of countries in the world has made the governments of countries have more accurate forecasts of energy consumption and control of the amount of energy supply and demand with proper planning in fuel and energy consumption (Limoei et al., 2013). With the increasing demand for energy consumption of fossil fuels such as oil, gas, and coal on the world on the one hand and limited energy resources on the other hand, the world has faced the problem of energy crisis. Given the finite and expensive fossil fuels as well as their devastating effects on the environment, researchers are looking to replace fossil fuels with new and renewable energy sources (Zastempowski, 2023).

Unlimited new and renewable energy sources would be a good alternative to fossil fuels, and the technology needed to produce these energies should be cheap and convenient. On the other hand, the production of renewable and new energies, in addition to ensuring the needs of countries in providing electric energy, thermal energy, and other energy consumption, must be compatible with environmental standards and not harm the environment (Holechek et al., 2022).

Energy, unlike fossil fuels, the consumption of which pollutes the air and the environment, is environmentally friendly and does not pollute the environment. Another advantage of using renewable energy is to help reduce fuel imports. In this paper, we will introduce new and renewable energy such as nuclear energy, wind energy, hydroelectric energy, geothermal energy, biomass, biogas, hydrogen energy, and solar energy. We will also discuss the problems and obstacles to using these energies.

Renewable and new energies

Limited fossil fuels and corn pollution transmitted around the world by these fuels have prompted researchers to consider suitable alternatives to these fuels. Meanwhile, renewable energy sources such as wind, biomass, geothermal energy, etc. have been introduced as suitable energy sources to produce the energy needed by the world. In the following, we will examine these renewable energy sources.

First: wind energy

Wind is one of the largest sources of renewable energy for energy production (Kaplan, 2015), so it can be said that all the winds on the planet can provide all the energy consumed in the world. Wind power has grown significantly in recent years. Wind energy is currently one of the cleanest and cheapest renewable energy sources in the world (Abdelkareem et al., 2018). Wind energy production can reduce energy costs for consumers. Wind power generation technology has reached an acceptable stage by optimizing the size of turbines as well as optimizing wind farms, and the production efficiency of this renewable and clean energy is constantly increasing. One of the advantages and attractiveness of wind energy is that the turbines that are installed in agricultural

lands or pastures do not create obstacles and do not interfere with the use of agricultural lands and livestock breeders. In fact, farmers can make dual use of wind (Chu et al., 2017).

The use of local wind power can help the rural community because the income from wind power is in the hands of the local people. In countries such as Denmark, Germany and the Netherlands, farmers invest individually or in organized groups in the field of wind turbines and sell the electrical energy obtained to local electricity service companies; On the other hand, they increase farmers' share of income from wind power (Huesca-Pérez et al., 2016).

According to the International Energy Agency (IEA), Iraq is aiming to increase its renewable energy capacity by 10% by 2030 , The government of Iraq is aiming to attract new foreign investors for the creation of 3 large-scale solar energy projects and a wind energy project. Renewable energy, including wind energy, has become a vital part of reducing air pollution and improving its quality through the use of small wind turbines to generate electricity in Iraqi weather conditions. Optimal use of wind turbines for highway lighting is possible. The maximum efficiency of wind turbines depends on an advanced design and the wind speed recorded in the Iraqi winter is relatively acceptable to generate this energy at least (Mahdy et al., 2017).

Second: biomass energy

Biomass energy includes products derived from the process of photosynthesis, this process is the chemical storage of solar energy and represents a renewable store of carbon in the environment. Biomass energy is distributed all over the world and is available in some form in all countries. Biomass is characterized by degradable components generated from agricultural residues and wastes such as plant and animal materials, forestry, and related industries, as well as biodegradable industrial and urban wastes (Sánchez et al., 2019).

Biomass obtained from agricultural and forest wastes is more suitable for use in electric and thermal power plants. Other sources of biomass that are limited but used in energy production are seaweed, algae, and animal waste. Other biomasses can be mentioned such as wood fuel, fuel from grass plants, sewage sludge in urban and industrial areas, and waste from industries for energy production. One advantage of producing energy from biomass is that, unlike other renewable energy sources such as wind and solar, which are produced intermittently, their production will continue within 24 hours (Lozano & Lozano, 2018). The energy produced from biomass is carbon neutral, meaning that the carbon dioxide released during the energy production process is recovered from biomass in the growth stage. Different biomass has their energy production technologies. Some specimens do not have much value for energy production because they are very expensive to collect and transport and are only used for other purposes such as fertilizer. The environmental impacts of using bioenergy to produce fuel from biomass require the application of processes with complex organic compounds, which leads to the production of some solid, liquid, or gaseous waste during the process or after the end of the process. As mentioned earlier, biomass production processes may cause many environmental pollutants or they may cause one type of pollution to turn into a completely different pollution problem. Another problem with biomass is the replacement of natural forests such as forests in the tropics or forests in more temperate regions. Low-yield forest plans that may endanger biodiversity. Swamps, marshes, wildlife habitats, and ecologically important areas may also be threatened and endangered (Qasim & Csaplovics, 2023).

Nowadays, Iraq generates a great quantity of biomass every year. Unfortunately, instead of contributing to the energy industry and economic progress, these wastes are burned directly, potentially causing a slew of environmental issues. Based on earlier studies, the theoretical energy potential of Iraq agricultural wastes is assessed. 10 million tons of dry agricultural leftovers can create 115 PJ of energy per year. On the other hand, bioenergy potential is heavily reliant on the geographical distribution, availability, and accessibility of real waste. Wasit, Qadisiyah, and Mosul are the most feasible locations for this agricultural waste potential. This might lead to the development of a long-term economic plan for the successful and sustainable utilization of important accessible waste for bioenergy generation (Alhassany et al., 2022).

Third: geothermal energy

Geothermal energy contained in the solid crust of the Earth is called geothermal energy. The center of the Earth is an enormous source of thermal energy, which is directed to its surface in various forms, including volcanic eruptions, hot water, or due to its conductive property (Limberger et al., 2018).

In general, the regions of land that have the following three important features (Fig.1) could have good potential for geothermal energy utilization.

A: heat source, B: liquid medium, C: porous medium

In some areas of the earth's crust that have favorable conditions, high temperatures can be reached and this energy can be used. According to estimates made in the earth's crust to a depth of 3000 meters, it is 431024 joules. 85% of this energy is at a temperature below 100 degrees (genuine et al., 2018).

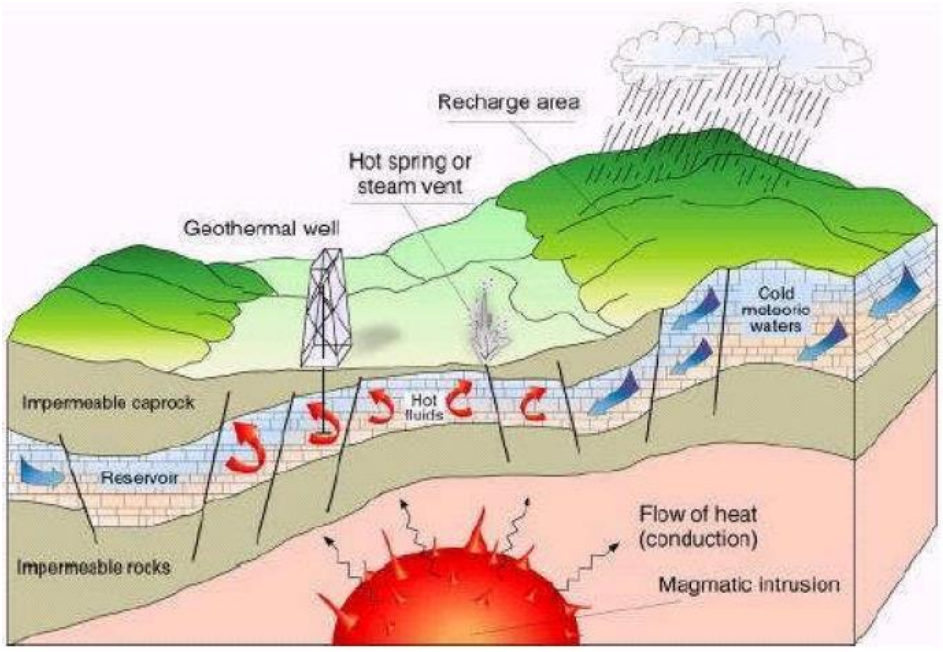

Figure 1: A simple diagram of an ideal geothermal system (Syukri et al., 2018).

The use of this type of geothermal energy, like other renewable and new energies, is possible in both the methods of power generation plants and other power stations, and it is more important

compared to other cases of energy production by the geothermal method.(Figure 2)shows the percentage of use of geothermal energy in the world in 2015. The history of the use of geothermal energy in Iraq goes back to very distant years when people traditionally used baths and swimming pools. In past years, the use of energy from fossil sources such as oil and gas has reduced interest in this type of renewable energy. In recent years, with the increase in environmental pollution caused by fossil fuel consumption, fossil fuel resources and the possibility of using geothermal energy have been limited in many countries of the world. In 2007, researchers selected potential geothermal regions using a Geographic Information System (Elbarbary et al., 2022).

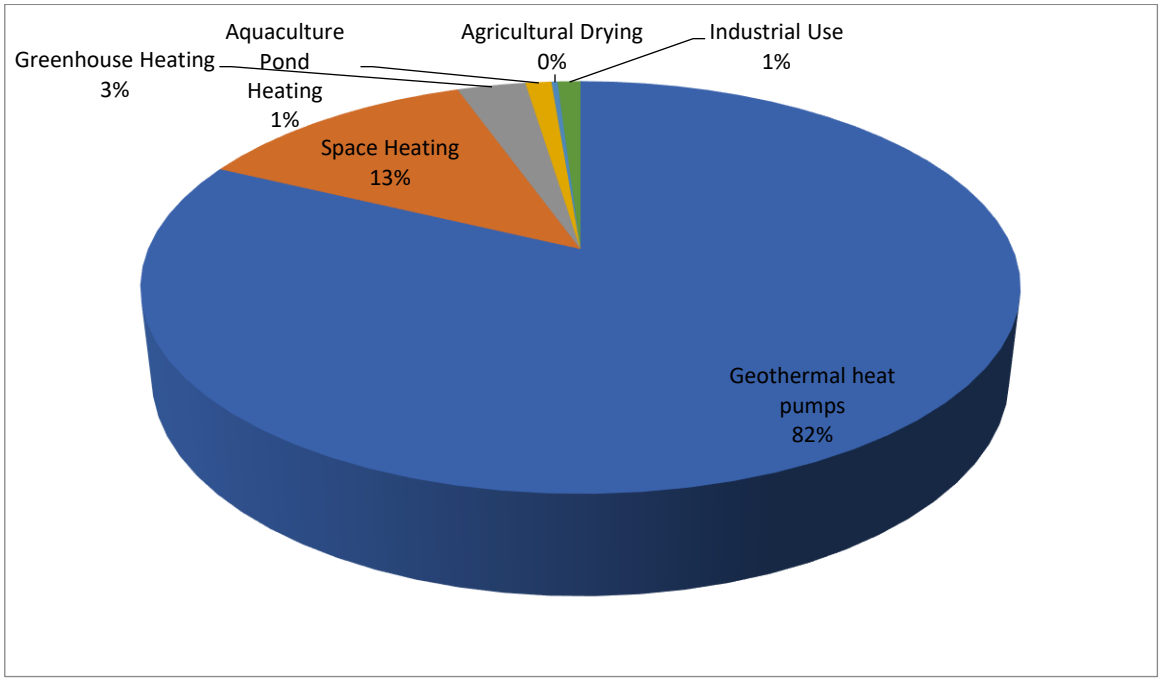

Figure 2: Summary of different categories of direct use of geothermal energy worldwide for this period (Zhu et al., 2015)

The planet's geothermal renewable energy potential is almost equal to the total global energy demand. The first geothermal power plant was built in 1904 in Larderello, Italy, and in 2012, 24 countries in the world were using renewable geothermal energy. Geothermal growth in 2012 was less than 3%. Currently, geothermal energy is concentrated in regions such as West America, Indonesia, the Philippines, New Zealand, Iceland, and East Africa, which are active and geographically suitable. Although many efforts have been made to commercially produce geothermal energy in the world, these efforts to commercialize this energy have not been fruitful (Perez & Perez, 2022).

Fourth: the energy of the oceans and seas:

Energy can be used in the oceans and seas in three forms:

Wave energy, tidal energy, and ocean thermal energy conversion. The phenomenon of tides in the seas and oceans is caused by the gravitational influence of the moon on the Earth. This effect causes the rise and fall of water levels in the seas and oceans on the coasts during the day and night. With the help of tidal power plants, the energy of this movement can be taken and used. Tidal power plants can be set up in deltas, the place where rivers enter the sea or the coast, and

studies show that tidal energy can be more easily controlled where a river enters the sea(Herrera et al., 2021). Therefore, the best place to set up tidal power plants is the one with the most tidal access. Dams constructed for this purpose can be very strong protection against the intrusion of high waves caused by coastal flooding; This measure prevents the destruction of the coastal environment. Hydroelectric power plants are used at desired hours, but tidal power plants can only produce electricity at certain times of the day and night. The cost of tidal power plants depends on environmental characteristics and geography (Langodan et al., 2016) According to studies, the high costs and the long time spent building power plants prevent the establishment and operation of these projects. The initial costs of building a tidal power plant are higher compared to other types of hydroelectric power stations, but after the construction of these power stations, the operation and maintenance costs are low and no additional fuel is required for these power stations. One of the advantages of tidal power plants is that the production of electrical energy from these stations provides the possibility of transportation over the inlets of rivers to the sea, thus reducing greenhouse gases by replacing clean energy with polluting fossil fuels. the environment. Even though the energy of the oceans and seas has a high potential to produce the energy that the world consumes and is the same as the current energy needs of the world, the technology required to exploit this type of renewable energy has not yet reached an acceptable level and the cost of producing this type of renewable energy is very high and it is high, which It caused a lack of interest in this clean and renewable energy (Abbasi et al., 2022).

Fifth: hydrogen energy

Hydrogen is not readily available on Earth in elemental form. However, it can be produced from compounds found in natural or synthetic sources. Hydrogen is the most abundant element in the universe, making up approximately 75% of all matter (Baykara, 2018).

Hydrogen gas plays an important role in industrial processes, mostly as a feedstock. Nowadays, fossil fuels constitute the main sources of hydrogen production. Chemical hydrogen is possible by the electrolysis of water. Approximately 95% of the hydrogen produced is used in households. As the use of hydrogen increases as a fuel and as the global temperature continues to rise, it will be necessary to produce it on a larger scale using diminishing amounts of fossil resources. Several detailed reviews are available on the comprehensive evaluation of hydrogen production methods (Dincer & Acar, 2015).

Hydrogen can also be produced from biomass via pyrolysis/gasification using a process similar to coal gasification. However, since biomass has a lower calorific value than coal, larger plants are required. Thermal methods are well suited for hydrogen production from bio-oil, biogas, and biomass derivatives. Electrochemical and processes based on the photolysis of organic matter are being developed, to produce electricity and hydrogen from organic waste. Various methods are available to produce hydrogen from water including electrolysis, direct pyrolysis or pyrolysis, thermochemical processes, and photolysis (Wang et al., 2014).

Potential of Hydrogen production from Natural gas in Iraq One of the important feedstocks for the production of hydrogen is natural gas which mainly consist of 98% methane. In Iraq, there have been increase in the production of crude oil which often co-produced with associated gas. However, the associated gases are under-utilized and continuously flared. Based on world energy report, there is a large proven natural gas reserves in Iraq . As at 2016, the natural gas production

in Iraq was estimated to be 900 ktoe and proven research of 3158 bcm. Rather than consuming the large amount of the natural gas produced for electricity generation, hydrogen production could also be included into the energy mix using natural gas as feed stock (Alsaffar et al., 2020).

Sixth: hydroelectric power

Hydropower has been the main source of renewable energy worldwide, accounting for up to 71% of that supply as of 2016. This capacity was built in North America and Europe between 1920 and 1970 when thousands of dams were built. The construction of large dams has stalled in developed countries because the best dam sites have already been developed and environmental and social concerns have made the costs unacceptable. At present, more dams are being removed in North America and Europe than they are being built. The hydropower industry has moved into dam construction in the developing world and, since the 1970s, has begun building larger hydropower dams along the Mekong River Basin, Amazon River Basin, and Congo River Basin (Moran et al., 2018).

In more than 150 countries around the world, hydroelectric power is currently used, including 11,000 plants with 27,000 generating units. Europe has the highest installed capacity around 260 GW, followed by East Asia, led by China, and then South America, led by Brazil. In the past few years, China has commissioned significant hydropower, and now surpasses the United States as the country with the highest total installed capacity (Pilesjo & Al-Juboori, 2016).The geography of Iraq is characterized by two large rivers, the Tigris and the Euphrates, which constitute the country's primary water resources. Several dams have been built, making it possible to establish hydroelectric power plants in these areas (Aziz et al., 2019).

Electricity is supplied by 9.22%, 80.49%, and 10.29% from hydropower, fossil fuel power plants, and imported electricity, respectively. About 24,400 MW of new capacity will be added by 2017, including 7,000 MW of thermal power, 13,000 MW of gas, and 400 MW of renewable energy. According to the country's energy master plan, another 4,000 megawatts will be added by converting simple cycle power plants to combined cycle technology. Since the country is currently interested in developing power stations in a short period to get more energy quickly, oil and gas-fired stations are currently the preferred option. Although hydroelectric development is part of the long-term strategy, there is more focus on developing large dams for flood protection and irrigation. Wind and solar fields are also required. The full hydroelectric potential can be estimated at up to 80,000 GWh per year (Pilesjo & Al-Juboori, 2016).

Approximately, 13% of electricity generation comes from hydroelectric power in Iraq. In 2012, 1864 MW of power was installed from hydroelectric stations, whilst the generated power approached just 855 MW. In Iraq, the Hydro-Power stations are divided into two categories. First, the hydropower stations have storage tanks, and the second category is those that have tanks with limited storage. By 2035, Iraq is willing to enlarge the use of hydropower to reach approximately 14 Twh of installed power(Merza, 2022).

Seventh: Nuclear energy

For decades, nuclear energy has been considered an important option for ensuring global energy security, and it has recently begun to be promoted as a solution to mitigate climate change. However, nuclear power remains highly controversial due to associated risks such as nuclear

accidents and problematic radioactive waste management. Economically, it is found that nuclear energy is still an important source of energy in many countries around the world. In climatic terms, nuclear energy is a low-carbon technology and thus could be a viable option for decarbonizing the world's major economies over the following decades, if combined with other large-scale strategies such as renewable energies. However, these benefits are outweighed by the radiological hazard associated with nuclear power plants (Mathew, 2022).

Nuclear energy is released from the nucleus, the nucleus of an atom, which is made up of protons and neutrons. Nuclear energy can be produced in two ways: nuclear fission - when a heavy nucleus of an atom splits into many parts, or nuclear fusion when two light nuclei of different atoms fuse. The nuclear energy that is being harnessed in the world today to produce electricity is through nuclear fission (Mathew, 2022).

Eighth: solar energy

The sun is a hot ball made of gas, with an internal temperature of 20 million degrees Kelvin due to nuclear fusion reactions resulting from the conversion of hydrogen into helium in the core of the sun. The inner core's radiation is strongly absorbed by a layer of hydrogen atoms near the sun's surface, which is why it cannot be seen. Heat is transmitted through this layer by convection. The sun uses its energy through nuclear thermogenesis, which converts about 650 million tons of hydrogen into helium per second, and this process will generate heat and electromagnetic radiation. Only a small part of the total solar radiation produced reaches the Earth's surface, and the radiation that reaches the Earth's surface is almost an indirect source of any type of energy used. Solar energy is the main factor for many natural motions, including wind, waves, heat, light, etc. (Hanasoge et al., 2012).

The sun's radiation reaches the earth with a maximum flux density of 0.1 kWh/m in the wavelength range of 0.30 to 2.5 μm. This short-wavelength radiation is present in the visible region and varies with location, time, and weather conditions. The sun's energy is more available than any other energy, depending on the expected future energy demand. The use of solar energy to produce electricity depends on the cost and benefit of productivity, and the efficiency of the technology, which is the continuous improvement and reduction of the cost per peak kilowatt(Lee, 2013).

The Sun's radiant flux can be used thermally, photochemically (photosynthesis), and photophysically (photosynthesis). The sun's energy is divided into direct and indirect types. Most of Earth's energy sources are indirect forms of the sun. In systems that directly use the sun's energy, the sun's energy can be captured through solar panels or mirrors to generate electricity (Alotaibi et al., 2020) (Hernandez et al., 2014). Despite the high speed of solar energy progress, there are obstacles in the way of developing this technology. Solar energy technology is complex, expensive, and requires advanced technology for setup and manufacturing. It is affected by many environmental factors, including the intensity of sunlight, clouds, and wind speed. Other applications of solar energy include heating and cooling systems, including hot water supply systems for heating and cooling buildings, fresh water supplies, transportation, and pumping systems, green space production systems, and greenhouses. and solar ovens, solar cooling, and drying systems (Moayeni & Manshadi, 2010) .

Solar energy in Iraq has a lot of potential future requirements and potential supply of solar energy. Where solar energy, being clean, unlimited and environmentally friendly, is presented as a

renewable energy source. Many problems such as carbon dioxide emissions, industry, human activities and electricity distribution networks attract a lot of attention due to the current situation of crude oil production and prices. Further, estimates of solar radiation levels and efficiency of photovoltaic cells, concentrated solar power (CSP), and solar stack towers. Those systems that combine different energy sources are called hybrid systems and have received a lot of attention in recent decades. Accordingly, Iraq, like the rest of the world, has its own solar energy stations, which are developing day after day (Abass & Pavlyuchenko, 2019).

Among the renewable energy sources, solar energy has attracted the attention of many countries of the world due to its low environmental pollution, easy access, and more during the day. The amount of energy that can be produced from daily sunlight in Iraq is more than double the country's annual energy consumption. The amount of energy radiation given off by the sun per square meter of the country's surface per year varies in different places. Currently, solar energy is used in different ways. It is possible to use solar thermal energy for domestic, industrial, and power station purposes. The electrical energy produced can replace the energy consumed by other fuels. Because sunlight cannot be used directly in place of fossil fuels, it is necessary to use devices to convert the radiant energy of the sun into the required energy, such as thermal energy, mechanical energy, and electrical energy. Since Becquerel discovered the photoelectric phenomenon in 1839, researchers have continued their research to convert solar energy into electrical energy (Mahdi et al., 2022).

One of the biggest advantages of solar energy is that it is freely accessible to the general public and available in abundant quantities compared to the price of various fossil fuels and oils in the past decade. Moreover, solar energy requires much less manpower expenditure than traditional energy production technology, and although solar energy is freely available everywhere, there is still initial expenditure on equipment needed to harvest this radiant energy through the development of cells and panels. and solar modules (Sharma et al., 2015). These small and small solar cells make no noise while they are working. On the other hand, large power pump devices produce unbearable sound pollution and are therefore very disturbing to the community. Nowadays, due to the decreasing amount of renewable energy resources, the cost per watt of solar energy devices has become more and more important in the past decade, and it will certainly become economical in the coming years and grow as a better cost-effective technology. and applications. Despite the many advantages, this energy also has a few limitations. First, solar energy does not radiate at night. Secondly, solar energy is not constant almost all the time. There must be plenty of sunlight available to generate electrical energy from the solar PV system(Bagher et al., 2015). Moreover, apart from daily fluctuations in the intensity of radiated energy, solar energy is impeded to reach the Earth during adverse weather conditions. For example, the amount of sunlight that reaches the earth's surface depends on the location, time as well as the weather as it falls during winter compared to summer and the sun's radiation is less intense. To overcome the drawbacks of this technology, solar energy must be stored elsewhere at night and highly efficient solar cells and modules must be developed (Srinivas et al., 2015).

Renewable Energies in Iraq

Iraq’s geographical location has largely determined the climatic conditions in most parts of the country with desert climate. It is very dry, cold in winter, and very hot in summer, with little rain falling in the winter season (Chaichan et al., 2018). The proximity of the location of Iraq from the

countries of the solar belt makes it receive high intensity of radiation sufficient to run solar plants to generate electricity in an excellent manner. Iraq also has a number of specifications that make it possible to use other types of renewable energies in variable regions of the country to produce electricity (Dodge & Mansour, 2021). In the coming paragraphs, we will briefly outline the renewable energies in Iraq and the possibilities of benefiting from them to produce electricity commercially (Chaichan et al., 2018).

The recent wars that Iraq went through had a great impact on destroying the infrastructure of power plants. Today, Iraq still suffers from an acute shortage of electricity treatment for citizens, noting that 90% of factories and government buildings are still idle. The demand for electricity in Iraq increased from 11,000 megawatts in 2007 to 16,000 megawatts in 2013, to 24,500 megawatts until the summer of 2018, and female students are still increasing due to the expansion of urbanization and projects and an increase in the population, and this is expected to increase demand will reach more than 30,000 MW in 2023 (Al-Waeli & Al-Asadi, 2018).

The Iraqi Ministry of Electricity has identified a deficit in electricity production of up to 6,000 megawatts, which increases during the summer due to the need to use air conditioners in this hot season of the year, which extends from May to the end of September (Abass & Pavlyuchenko, 2019). The bulk of the country's citizens depends on small or medium-sized generators (no more than one megawatt) to compensate for the lack of government treatment. These generators are powered by Iraqi gasoline and diesel, both of which are the worst fuels in the world because they contain large amounts of sulfur, which means more and more pollution. The operation of these generators causes loud noises in addition to emitting millions of tons of air pollutants and greenhouse gases. It is believed that the number of generators operating in Iraq exceeded two million generators of all sizes. The use of renewable energies in Iraq is still very late and does not exceed some dams producing hydroelectric power and some shy projects to use photovoltaic systems whose capacity does not exceed 10 kilowatts. The Iraqi government should use solar energy to produce electricity as one of its future goals as part of its focus on reducing environmental damage and pollution of the country's air, soil, and water, as well as working to find the best ways to use renewable energy in the country. Solar energy is clean energy that has the potential to meet a large percentage of the world's energy needs. It can be broadly categorized into two systems; a Photovoltaic (PV) system that converts solar energy into electrical energy, and a thermal energy system that converts solar energy into thermal energy. Photovoltaic is one of the technologies used to harness solar energy (Razali et al., 2019). The availability of local and renewable energy sources, in addition to being environmentally friendly, is one of the most important factors determining the selection of new energy sources. It can be said that solar energy in Iraq meets all these requirements. The level of solar energy intensity in this country is very high and among the internationally desirable rates, as it exceeds in some areas 2200 kWh / square meter/year. As it is free energy for all and renewable for a long time and does not harm the environment. The Iraqi government should invest in renewable energies through large revenues from oil sales and the exploitation of the great desert lands, which are considered among the best places in the world in terms of the number of sunrise hours estimated at 3300. The number of hours during the year and the amount of radiation on them. To cover the deficit in electric power production, which currently amounts to about 6,000 megawatts, we are preparing a plan that will take about 6 to 8 years. During these years, solar plants can be established to cover the current

deficit and future increases. The Iraqi government owns a lot of empty lands that can be allocated or offered for investment in the construction of solar power plants. We know that the construction of solar fields does not take as long as other electric plants, a 500 MW plant can be built in one year, for example in China the largest solar photovoltaic power plant began in 2013 (Longyangxia Dam Solar Park was built with a nominal capacity of 320 megawatts (phase one), covering 9 square kilometers (3.5 square miles) (Abass & Pavlyuchenko, 2019).

Conclusion

The use of fossil fuels to provide the energy needed by the world will lead to many environmental problems, including Iraq, such as the emission of greenhouse gases into the atmosphere, the intensification of global warming, and the rise in water levels in the seas and oceans. On the other hand, these energy sources are limited and the best option to replace these types of fuels is renewable and new energy sources. Among renewable energy sources, solar energy is the cleanest and most reliable energy source in the world. Solar cells are devices that can convert the radiant energy of the sun into electrical energy using the photovoltaic phenomenon. During the electric energy production process, solar cells do not produce any environmental pollution. The production of energy from the solar energy source is cheaper and easier than other sources of new and renewable energies. Iraq focuses on available energy such as water and solar energy more than other energies, in addition to its recent reliance on fossil fuels and gases emitted from the ground and using them as electrical energy.

Iraq has recognized the significance of renewable energy as a sustainable and environmentally friendly alternative to fossil fuels. The country has set forth a future vision for renewable energy, aiming to diversify its energy sources and reduce its dependence on oil and gas. Through the foregoing and from the researcher's point of view, we can present the most important future plans for Iraq with regard to renewable energy:

National Renewable Energy Strategy: Iraq has formulated a National Renewable Energy Strategy, aiming to increase the share of renewable energy in its energy mix. The strategy sets specific targets for renewable energy capacity installation and outlines the policies and frameworks required to achieve those targets.

Solar Power: Solar energy is considered a key focus area for Iraq's renewable energy future. The country has abundant solar resources, and there are plans to develop large-scale solar power plants and encourage the adoption of solar panels for residential, commercial, and industrial applications.

Wind Power: Iraq also has considerable potential for wind energy, particularly in certain regions such as the southern part of the country. Plans are in place to harness this potential by constructing wind farms and utilizing wind turbines to generate electricity.

Geothermal Energy: Iraq has geothermal resources, primarily in the western and southwestern parts of the country. Geothermal energy is being explored as a viable renewable energy source, and there are plans to conduct studies to assess the feasibility of geothermal projects.

Hydropower: While Iraq is predominantly desert, it has some potential for small-scale hydropower generation through its rivers and water resources. There are ongoing efforts to identify suitable locations for small hydropower plants and promote their development.

Policy and Regulatory Framework: Iraq aims to establish a supportive policy and regulatory framework to attract investments and facilitate the development of renewable energy projects.

This includes providing incentives, streamlining permitting processes, and implementing feed-in tariffs or other mechanisms to encourage renewable energy deployment.

International Cooperation: Iraq seeks to collaborate with international partners, organizations, and investors to accelerate the development of renewable energy projects. This includes seeking financial assistance, technical expertise, and knowledge sharing to advance its renewable energy goals.

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