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Renewable Energy Resources in Iraq: A Review

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Abstract

Depending on fossil fuels such as crude oil is becoming a big environmental and economic dilemma. Fossil fuels release carbon oxides which hurt the environment by forming greenhouse effect which leads to the global warming and climate change. Moreover, countries over the world and especially Iraq use the crude oil and natural gas daily which makes this fuel expensive and threatened to be stopped one day. In this study, a simple review focuses on renewable energy as a clean and cheap energy that they could be recommended to use safely in Iraq. In conclusion, the renewable energies are the optimal solution to avoid the increased cost of the crude oil and reducing the risk of the environment pollution.

Key words: Renewable Energy, Iraq Resources, Bioenergy

1. Introduction

Fossil fuels emissions represent the most dangerous effect on the environment globally because it forms the greenhouse effect which is the main reason of the climate change and/or the global warming [1, 2]. Therefore, this study will focus on Iraq as one of the growing countries over the world and because of its depending on fossil fuels in providing the energy. Table 1 shows percentages of the various types of fuel with respect to the total fuel usage in Iraq [3, 4].

Table 1: Iraqi fuel consumption with respect to the total usage

Year	Oil (%)	Natural Gas (%)	Hydro-electric (%)	Renewable Energies (%)	reference
1980	9	1	0.1	0	[5]
2010	32	6	0.4	0	[5]
2017	75.58	23.36	1.062	0	[4]
2018	71.51	27.37	1.304	0.19	[3]
2019	66.8	31.8	0.91	0.46	[4]
2020	75	37	0.5	0.1	[5]
2035	92	66	1.2	0.4	[5]

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In this table, it is shown that the use of crude oil is increasing rapidly except the period between 2018 and 2019 where the depending on natural gas increases. It displays also the natural gas increased because the governmental roles of using the excess natural gas instead of rid of it.

Before 1990, there were 32 thermal and hydropower stations have been operated to generate about 10.2 GW which exceeding the country demand [6]. In reality, the wars destroyed about 90% of the ability of power production [7]. The period from 1990 to 2003, 24% of the total demand in Iraq of the electricity has been produced by using hydropower source [8]. After 2003, the electric power crisis started when the demand increased rapidly and the production decreased because the war and the unsteady life situations [9]. To overcome this problem, Iraq started importing the electricity from its neighbors [10]. Table 1 also showed a slight contribution of the renewable energy resources compared to the fossil fuel in the power production.

Iraq has sunny weather most of the year and mostly windy especially during winter and autumn. Also, it has offshore and wide planted regions for biomass energies. The present study is an attempt to review the possibility of applying each type of renewable energies in Iraq by displaying the advantages and the disadvantages of each type. Therefore, this review aims to increase the understanding of the renewable energies as efficient and sustainable energy resources. Therefore, it will receive more attention. Understanding the importance of the renewable energies is a good path to reduce the dependency on fossil fuel and reduce the possibility of environment damage.

2. Importance of using the renewable energy in Iraq

1. Iraq is one of rich country in term of renewable energy choices. Iraq has solar weather most the time, wide areas are perfect to be considered as wind turbine fields, two long rivers with mountains are perfect for hydropower, good areas with forests which are good to be used as Bioenergy.

2. Iraq depends on fossil fuels currently but this energy resource is threatened to be stopped one a day. With increasing of electricity demand, the republic of Iraq is expected to produce the electricity from the renewable energy about 222 GW.

3. Renewable energies are contributing in preserving the environment by reducing the pollution because the renewable energy is easy to use and clean.

4. Most countries which incorporate in OPEC plus union are turned to renewable energy production because it sustainable and long term supporting to their economy more than the fossil fuels.

3. Renewable Energy Resources

The ministry of electricity in Iraq, Renewable Energy Center has been established to focus on solar and wind energy as the main resource of power in Iraq.

Kazem and Chaichan [11] reviewed and discussed the current and future exploitation of renewable resources in Iraq. They showed that the solar, wind and biomass energies are not being used sufficiently in Iraq currently. Moreover, offshore wind energy at the southern part of Iraq at the Arabian Gulf is not investigated well.

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In the next section, up to date types of the renewable energies will be reviewed. The principle of operation, advantages and disadvantages of each type will be outlined here to increase the people awareness about the renewable energies and understand its cheapness and sustainability.

3.1. Solar Energy

The climate variety of Iraq is characterized by a hot weather through summer months (June, July and August) where the temperature differs from 43 to 50 ^{o}C while the weather during winter months (January, February and March) is moderated with temperature rounded by 1 to 8 ^{o}C [12, 13]. The irradiation rate is measured as 6.5 to 7 kW-hr/m^2. Moreover, the brightness of sun is ranging from 2800 to 3300 hr/year. These features of weather in Iraq give the country an excellent qualification to exploit solar energy [14].

Solar energy represents one of the best and great sources of energy over the world. It is green and renewable energy because of the massive amount of the energy that transfer from the sun to the earth daily. It can be harvested through photo-voltage panels or directly by the solar power plants [15]. Iraq represents a good sunny country compare to other regions because of the large deserts which covers about 30% of the total lands of Iraq. Figure (1) shows the sunny regions distribution in Iraq.

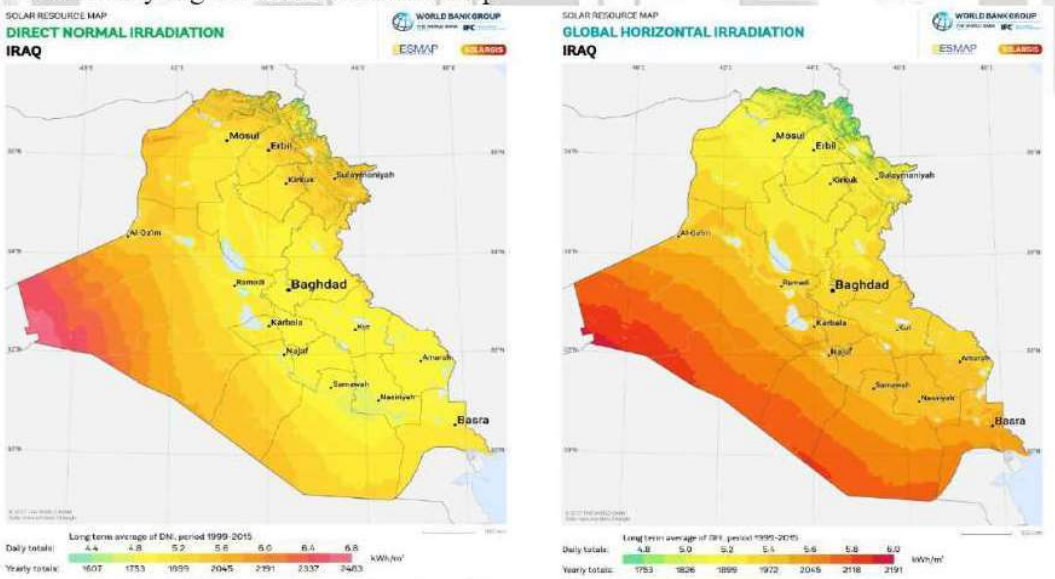

Figure (1): Solar irradiance distribution in Iraq [16]

Iraq can collect more than three thousands hours of solar energy. The radiance varies from 416 W/m^2.hr in January to 833 W/m^2.hr in June [17] compare to the average global horizontal irradiance (170 W/m^2. hr). In spite of this large amount of energy, harvesting of waste heat through solar resource did not get efficient attention and needs more interesting to utilize it.

Currently, numerous reports talk about using solar energy widely in Iraq and some scientists say that the Iraqi people have the enough knowledge about this type of resource to be ready to avoid depending on fossil fuels [18]. Moreover, the ministry of electricity of Iraq took the first step about establish solar power plants in many of Iraq to provide about 755 MW by the end of 2020 and invited the solar power companies to take part with this trend

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[19]. Solar energy can be used in many applications including the cooling and electricity production indirectly through the panel collector or reflectors fields as shown in figure (2a) or directly as in the using of solar panels in figure (2b)

(a) (b)

Figure (2): Using of solar energy a) solar collectors b) solar panels

It is easy to lustrate the using of solar energy relates to its application as in the figure (3).

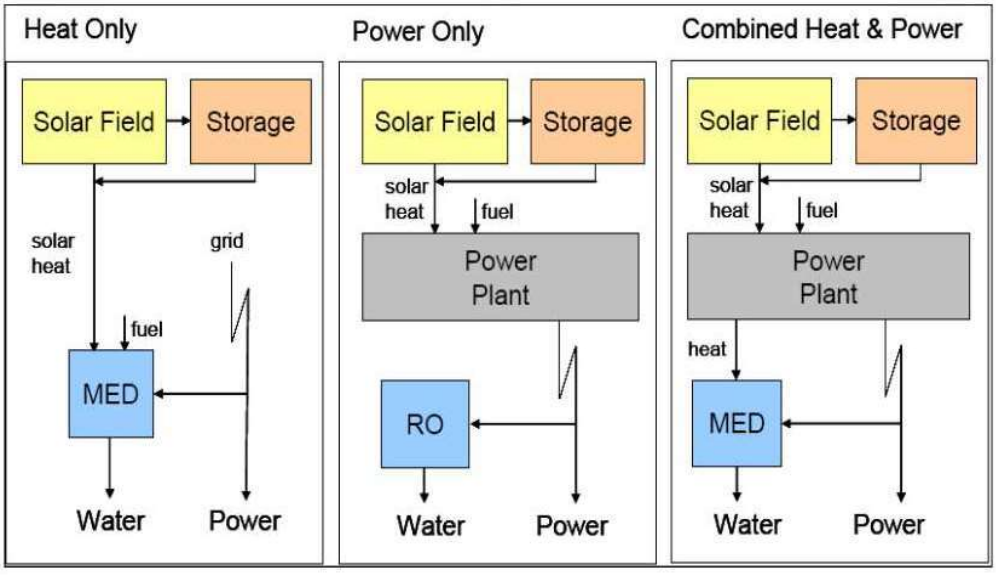

Figure (3): The various applications to the solar energy [20]

New strategic agreement with the Iraqi government to develop the solar energy projects to generate at least 2 GW by 2030 [21, 22] is promoted by an international company called International renewable energy and sustainability in 2022. Through this agreement, Iraqi

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government intended to increase and enhance the clean energy production in central and southern parts of Iraq.

Maan [23] reviewed the applications of solar energy in Baghdad which is the capital governorate of Iraq. The review focused on the possibility of using several applications, such as domestic heating water to reduce the electricity consumption in winter, thermal storage, solar ponds, concentrated solar power and photovoltaic panels.

There are many advantages about using solar energy in Iraq which are given below [24]:
1. It has not emissions so solar energy will be perfect technology to stop increasing the global warming and avoid the climate change.
2. It could be used in whole days of the year including cloudy times where lower amount of energy can be produced.
3. It can be return back to the company in case of there is an excessive amount.
4. There are no limitations about the locations in which they are installed.
5. Solar energy efficiency can be improved more than the other conventional methods to produce the energy.

However, the solar energy has many disadvantages, such as:
1. High initial cost for the materials and the installation
2. High power requests need to use wide panels or collectors since the efficiency is not high. In fact, it is only 13% now.
3. Needs for large capacity batteries to store the lightly time to be used at night.
4. With the advantage in point (4) above, it still depends on the geographic location of the installation.
5. Low production of the power in winter session.

In conclusion, the solar energy as free and sustainable source, still good choice in spite of the many disadvantages. Many researchers worked on the design of the solar collector [25, 26, 27, 28, 29], it could be referred for more information.

3.2. Wind Energy

It represents the most important energy resource as renewable and clean energy. The wind turbine is the main part of the wind energy station because the turbine is the responsible of converting the kinetic energy of the flowing air (the winds) to mechanical energy and then to electricity via an armature as shown in figure (3).

a b

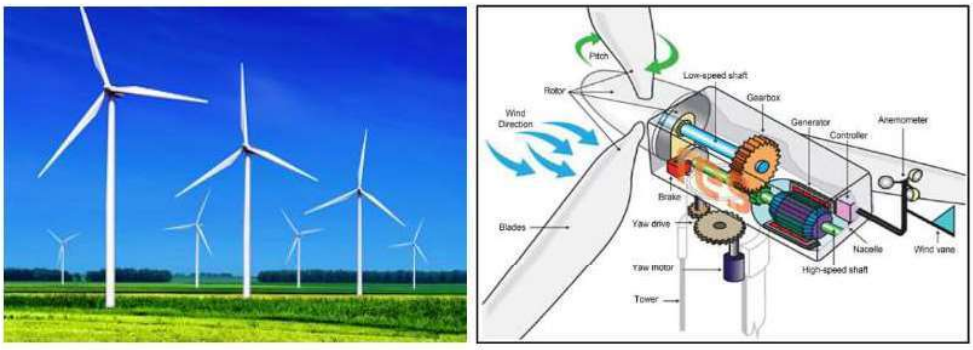

Figure (3): Wind turbines a) farm [30] b) schematic construction [31]