

¹Jameel Al-NAFFAKH, ²Mohammed R. Al-QASSAB

DATASET THE ANNUAL GROWTH GENERATED OF RENEWABLE ENERGY BETWEEN TURKEY, IRAN AND IRAQ

^{1,2}Mechanical power Department, AL-Furat Al-Awsat Technical University, Najaf Technical engineering college, Najaf, IRAQ

Abstract: The consumption of fossil fuels has risen to be the main source of energy generation in most countries since the start of the industrial revolution around the world. The greenhouse gases generated from this use produce significant negative effects on the environment and human health. As a result of these disadvantages, the world needs to search for alternative energy sources that are low in carbon. The article focused on the amount of renewable energy generation in Turkey, Iran and Iraq from the collection of statistical data for the period from 2010-2020. Turkey occupied the clear progress to benefit from renewable energy sources, followed by Iran and Iraq. Where the percentage of annual growth of power generation based on hydropower in Turkey, Iran and Iraq (71.4%, 28.5% and 0.1%) respectively. With regard to other sources of renewable energy, Turkey had the largest share in generating energy from wind and solar energy, with an annual growth rate of (88.03%, 98.22%), respectively. Finally, renewable energy can be considered as a promising source of energy for future generations when correct planning policies are determined by countries.

Keywords: renewable energy, solar energy, wind energy, hydropower energy

INTRODUCTION

Fossil fuels have become dominant in energy production after the start of the Great Industrial Revolution in most countries of the world, which led to significant negative effects on human health and the global climate as a result of the emission of greenhouse gases resulting from burning fossil fuels. In order to reduce the emissions of pollutants resulting from burning fossil fuels, the world needs to switch to using renewable energy sources that are low in carbon and environmentally friendly. The International Renewable Energy Agency indicated in its report that 66% of the total energy should be from renewable energy by 2050, through the promotion, development and use of internationally concerted efforts [1]. The use of various renewable energy sources is widely considered beneficial, such as wind energy, solar energy, geothermal energy, hydropower in the face of crises from the use of fossil energy, and they are considered as clean energy sources[2], [3]. Clean energy has led to an increase in global awareness to reach a climate free from the problems of global warming and environmental pollution, which can cover the needs of local energy requirements, part of which is the traditional dependence on fossil fuels [4]. The great demand for energy has led to a global trend to exploit remote and mountainous areas to implement international commitments and agreements to use renewable energy sources as an alternative to traditional energy sources[5]. There are many challenges facing future generations in exploring and promoting the use of renewable energy sources, through setting policies and increasing public opinion education towards a clean climate. Where it can be used to direct increasing global awareness by focusing on various global social networking sites, and reaching useful insights into the advantages of using renewable energy technology as an alternative future energy plan[6]. China is the main player in the field of renewable energy globally, accounting for half of the global production of solar and wind energy, with a growth of nearly 800 gigawatts, which

is equivalent to an average annual increase of 18% between the period 2015-2020. A plan has also been drawn up to increase the percentage of wind and solar energy use in China at an annual rate of 14% and 18%, respectively, over the next ten years. The indicator is that China is on the right track in using renewable energy resources[7]. Turkey is one of the poor countries in the production of fossil fuels, as nearly 80% of the total energy requirements are imported from other countries. Where the amount of energy consumption was 230 thousand kilotons of oil, while the average energy production was 35 thousand kilotons of oil for the year 2016. This leads to the fact that Turkey relied on renewable energy sources to meet the requirements and reduce the expenditures required to import fossil energy types from abroad[8], [9]. Oil was discovered in Iran in 1908, thus becoming one of the countries with oil production in the Middle East. Reliance on fossil fuels, especially oil, represents a major source of income for Iran. Then, the share of crude oil consumption in energy sources decreased from 91% to 43% from 1980-2018[10]. In contrast, the rate of natural gas extraction increased from 7% to 56% between 1980-2018, to be a major source of energy in Iran[10]. This country has not given great importance to the use of renewable energy sources to provide alternative sources, although it has a diverse resource environment to diversify its energy mix due to various economic and technical constraints. Therefore, various techniques and policies must be applied to exploit the natural sources of renewable energy in Iran[11]. Iraq is characterized as one of the countries with high oil productivity and is one of the members of the Organization of Petroleum Exporting Countries, so it depends on fossil fuels for domestic consumption for energy production[12]. Also, the geographical location gives it the privilege to benefit from solar radiation (one of the renewable energy sources), which reaches 1899 kilowatts/m², especially in central and southern Iraq. Despite that, there are no serious attempts to adopt

renewable energy sources to be a parallel line to the production of fossil energy in the country. Where Iraq suffers from a severe shortage of energy as a result of the rapid growth in energy consumption, especially electric power plants as a result of the destruction of various wars from 1980 until now. Therefore, the Iraqi government must rely on tangible programs and policies to build renewable energy plants to fill the shortage. Research centers in Iraqi universities discussed presenting plans to exploit renewable energy of various kinds, such as solar distillation of non-potable water or the use of solar cells to generate electricity and increase its efficiency[13], [14]. In this statistical article, data on renewable energy technologies and the rate of consumption and production in Iraq, Iran and Turkey are considered. These countries have a variety of renewable energy resources that can be used in addition to fossil fuel energy, with the extent of the change in the share of renewable energy for the period from 2010-2020.

MAIN RENEWABLE ENERGY SOURCES

- **Solar Energy:** Solar energy is one of the most, cheapest and cleanest renewable energy sources that can be directly accessed. The amount of solar radiation received varies according to several factors, including geographical location, the degree of clarity of the atmosphere, and others. Where the intensity of the incident solar radiation ranges from 50 to 1500 W/m². Several techniques have been developed to take advantage of this large source to obtain energy that can be exploited in different fields (converting solar energy to thermal or photovoltaic)[15].
- **Wind Energy:** One of the fastest growing types of renewable energy as an alternative to fossil fuels, it is abundant and renewable. It is classified as a type of electromechanical energy, and the production capacity to benefit from wind energy has increased at a growth rate of 25% annually, from 8.25 GW in 2000 to 570 GW in 2020, according to the statistics of the International Renewable Energy Agency. Wind energy systems can be used in open areas, and it is not preferable to use them in the center of cities because of the obstacles that prevent the benefit from wind speed, which is the basis in the generation process[16].
- **Hydropower:** Energy generated from the movement of flowing water at dams or reservoirs to move turbine blades to generate hydroelectric power. Many countries have taken advantage of this technology in building hydroelectric power stations, as Norway relies on this technology to generate 99% of the coverage of the need for electricity. China has also built the largest hydroelectric power station with a generation rate of 80-100 TW.h/year. The benefits of hydropower lie as an environmentally friendly fuel source, as well as associated benefits such as flood control, irrigation methods, water supply, and drought reduction[17].

DATASETS RENEWABLE ENERGY

A study of the share of consumption of renewable energy of all kinds (solar energy, wind energy, hydro energy and

others) in Iraq, Iran and Turkey. Turkey took the lead in benefiting from the use of renewable energy, with a rate of more than 12%, compared with Iraq and Iran, with small percentages that did not exceed 3%, as shown in Figure 1[18].

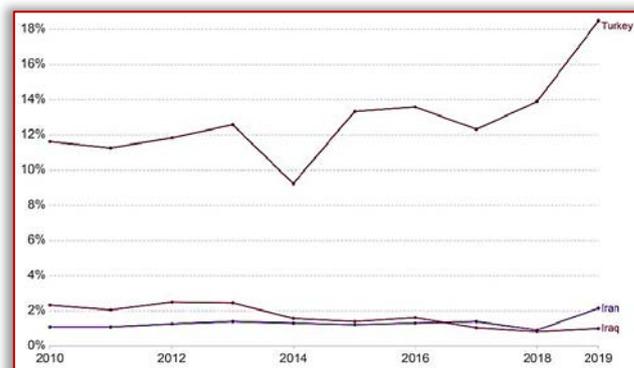


Figure 1. The share of primary energy from renewable sources

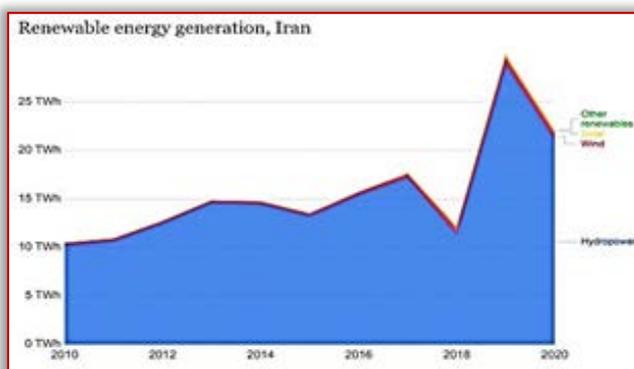
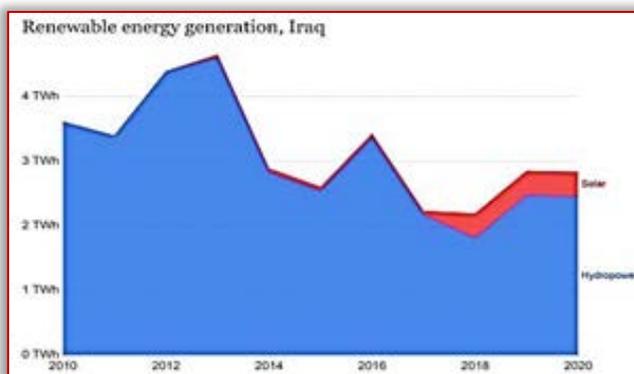
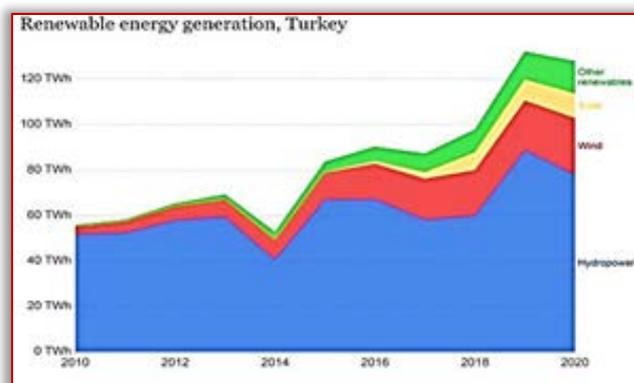


Figure 2. Renewables energy mix

Figure 2 showed a stacked areal chart of the mix of renewable energy technologies according to their types and the relative annual contribution of each. Where we note that

hydropower is the largest renewable source of energy generation in the study area, and Turkey's share of the largest benefit from the renewable energy mix, followed by Iran and finally Iraq[18].

Hydropower is the largest renewable energy source with low carbon and used globally. Figure 3 shows that 60% of renewable energy is generated from hydropower. The amount of hydroelectric energy varies clearly according to the contribution and exploitation of each country in the study area. Where the annual birth rate of Turkey, Iran and Iraq were (53.9TWh, 12.79 TWh and 1.52 TWh) respectively[18].

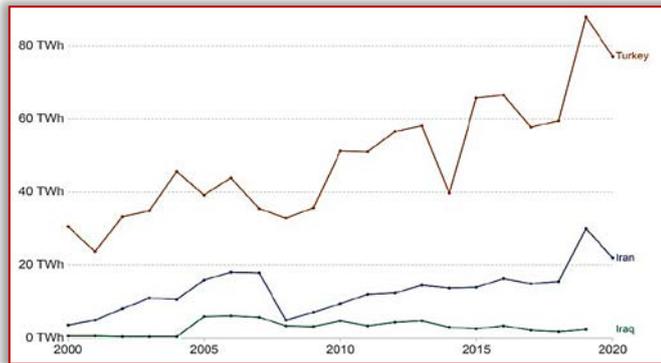


Figure 3. Annual hydropower generation is measured in terawatt-hours (TWh)

Wind power generation is one of the renewable energy technologies used in some countries of the world to generate the energy needed to meet their needs. Figure 4 shows Turkey's uniqueness in exploiting wind energy generated from onshore and offshore wind farms, with a large difference from Iraq and Iran. The growth rate during 10 years increased by 912 percent in Turkey, on the other hand, wind energy was not exploited in Iraq and Iran despite the availability of the appropriate environment for it[18].

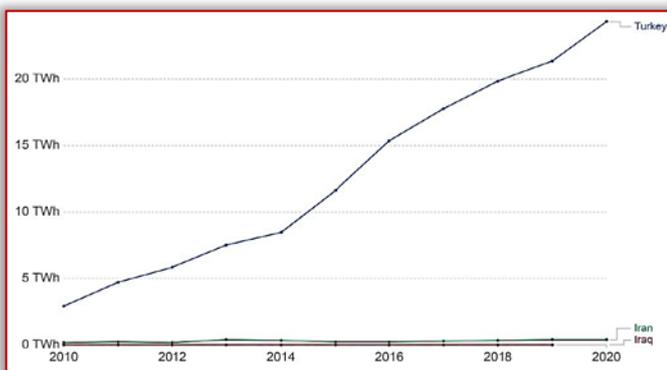


Figure 4. Annual wind power generation

The technologies for using solar energy are diverse, but it is worth noting that only a small part of the available solar energy has been used in our lives. Electrical energy is generated from solar energy by heat engines or photovoltaic converters. Among the applications that are made using solar energy are heating and cooling systems during architectural designs that depend on the exploitation of solar energy, potable water during distillation and disinfection, the exploitation of daylight, water heating, solar cooking, and high temperatures for industrial

purposes. Figure 5 shows the amount of energy generated from solar energy each year and the amount of accelerating growth in each country.

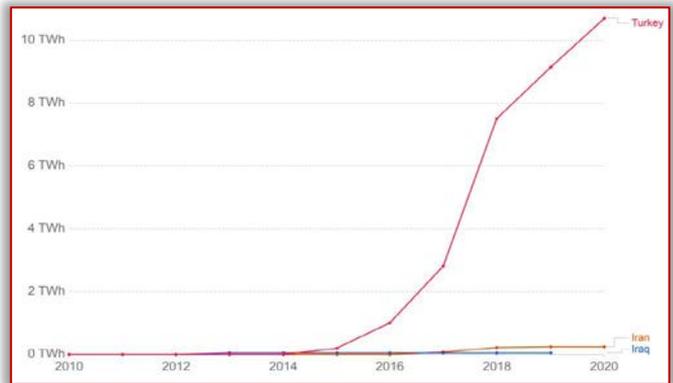


Figure 5. Annual solar energy generation

CONCLUSIONS

Renewable energy is the amount of energy generated from natural resources that are continuously renewed, such as wind, sun and water, and which do not produce greenhouse gases that are harmful to the climate. The world is heading towards benefiting from renewable energy to face environmental challenges and provide resources and economic returns that help in facing external shocks with regard to energy production and consumption. Some countries lacked real policies to spread and develop the use of renewable energy of various kinds, so in this paper, the rates of renewable energy generation in Turkey, Iran and Iraq for the past decade were concluded. The share of primary energy consumption resulting from alternative energy sources in Figure 1 showed Turkey's progress in the exploitation of alternative resources by 15.05% within 10 years, compared to the lowest decrease in 2014 by 9.22%. As for Iraq and Iran, there is no tangible economic policy in the field of renewable energy generation, as their percentage did not exceed 2% for the same period, due to their dependence on fossil fuels as a main source of energy production. It was found that despite the diversity of renewable energy sources with the availability of the appropriate environment for their exploitation, the share of hydropower acquired the largest share of the average amount of energy produced, as it reached in Turkey, Iran and Iraq (64.32, 15.69 and 3.58) TWh, respectively from 2010-2020, as shown in Figure 2. While the share of production from the rest of the renewable energy sources was very small and untapped in Iraq and Iran, unlike Turkey, where the production rate was 16.24 TWh. With regard to wind energy, noticed a linear and accelerated growth in Turkey, where its production in 2020 reached 24.32 TWh, as shown in Figure 4. The geographical location of the study area has an abundance of solar radiation to be utilized in generating energy, but Figure 5 shows that the policies of hard work have started recently, as Turkey achieved a great leap in the production rate from 0.19 TWh in 2010 to 10.71 TWh in 2020 with Iraq and Iran remaining below the acceptable level. Finally, this article revealed the lack of seriousness of relying on renewable energy sources in the study area compared to the global growth in the

development and use of clean energies with the availability of all climatic conditions and the abundance of natural resources. Rather, it relied on fossil fuels, despite the negatives that regional agreements on the environment and climate warned.

References

- [1] A. Jahid, M. S. Islam, M. S. Hossain, M. E. Hossain, M. K. H. Monju, and M. F. Hossain, "Toward energy efficiency aware renewable energy management in green cellular networks with joint coordination," *IEEE Access*, vol. 7, pp. 75782–75797, 2019.
- [2] A. Ashfaq and A. Ianakiev, "Features of fully integrated renewable energy atlas for Pakistan; wind, solar and cooling," *Renew. Sustain. Energy Rev.*, vol. 97, pp. 14–27, 2018.
- [3] D. C. Momete, "Analysis of the potential of clean energy deployment in the European Union," *IEEE Access*, vol. 6, pp. 54811–54822, 2018.
- [4] H. Lucas, S. Pinnington, and L. F. Cabeza, "Education and training gaps in the renewable energy sector," *Sol. Energy*, vol. 173, pp. 449–455, 2018.
- [5] M. R. Borovik and J. D. Albers, "Participation in the Illinois solar renewable energy market," *Electr. J.*, vol. 31, no. 2, pp. 33–39, 2018.
- [6] R. Thonig *et al.*, "Does ideology influence the ambition level of climate and renewable energy policy? Insights from four European countries," *Energy Sources, Part B Econ. Planning, Policy*, vol. 16, no. 1, pp. 4–22, 2021.
- [7] X. Xu, Z. Wei, Q. Ji, C. Wang, and G. Gao, "Global renewable energy development: Influencing factors, trend predictions and countermeasures," *Resour. Policy*, vol. 63, p. 101470, 2019.
- [8] K. Kaygusuz, "Hydropower as clean and renewable energy source for electricity generation," *J. Eng. Res. Appl. Sci.*, vol. 5, no. 1, pp. 359–369, 2016.
- [9] K. Kaygusuz, M. S. Guney, and O. Kaygusuz, "Renewable energy for rural development in Turkey," *J. Eng. Res. Appl. Sci.*, vol. 8, no. 1, pp. 1109–1118, 2019.
- [10] S. Solaymani, "A Review on Energy and Renewable Energy Policies in Iran," *Sustainability*, vol. 13, no. 13, p. 7328, 2021.
- [11] F. Atabi, "Renewable energy in Iran: Challenges and opportunities for sustainable development," *Int. J. Environ. Sci. Technol.*, vol. 1, no. 1, pp. 69–80, 2004.
- [12] J. Al-naffakh, M. R. Al-qassab, and Z. M. H. Al-makhzoomi, "Share of CO₂ emissions in Iraq, Saudi Arabia and Kuwait from the combustion of fossil fuels: A statistical study," vol. 2, no. 3, pp. 114–120, 2021.
- [13] M. R. Al-Qasab, Q. A. Abed, W. A. Abd Al-wahid, and J. T. Al-Naffakh, "Comparative Investigation for Solar Thermal Energy Technologies System," in *Journal of Physics: Conference Series*, 2019, vol. 1362, no. 1, p. 12116.
- [14] M. R. Alqasaab, Q. A. Abed, and W. A. Abd Al-wahid, "Enhancement the solar distiller water by using parabolic dish collector with single slope solar still," *J. Therm. Eng.*, vol. 7, no. 4, pp. 1000–1015, 2021.
- [15] S. R. G. Weliwaththage, "The Review of Innovation in Renewable Energy Sector in the World," vol. 1, no. 4, pp. 117–147, 2020.
- [16] F. Altuntas and M. Ş. Gök, "Technological evolution of wind energy with social network analysis," *Kybernetes*, 2020.
- [17] Y. Yao and Y. Xiuyuan, "A Summary of Research on Benefit Distribution in Coordinated Operation of Wind Power and

Hydropower," *Power Gener. Technol.*, vol. 39, no. 5, pp. 469–474, 2018.

- [18] B. Looney, "Statistical Review of World Energy globally consistent data on world energy markets . and authoritative publications in the field of energy," *Rev. World Energy data*, vol. 70, pp. 8–20, 2021.



ISSN: 2067-3809

copyright © University POLITEHNICA Timisoara,
Faculty of Engineering Hunedoara,
5, Revolutiei, 331128, Hunedoara, ROMANIA
<http://acta.fih.upt.ro>