

The Future of Renewable Energy in the Iraqi Economy under Fossil Energy: Forward-Looking Study

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Abstract

It is critical to address whether or not renewable energy projects in Iraq are economically feasible and realistic and to account for the significant challenges that investment in renewable energy in Iraq will face in the future. We then attempt to look forward to three scenarios, which assume that the current situation will continue to have its problems and apparent manifestations. This is the most likely of the three.

Keywords

Renewable Energy, Economic Growth, Fossil Energy.

Introduction

Whether they are energy exporters or importers, many nations have established a national strategic energy strategy, making it one of the most significant economic and strategic commodities in the world today (Vivoda 2009). These nations have made substantial expenditures in R&D to ensure the availability of low-cost, high-efficiency, and environmentally friendly energy sources to fulfill the growing domestic demand. To keep pace with the world's changing energy landscape by expanding the country's energy mix and providing safe and sustainable power, Iraq has to invest in renewable sources. Economic growth and a favorable climate for renewable energy are essential to Iraq's future (Almagtome et al. 2020). In addition to the 40 billion dollars in losses attributed to a chronic lack of electricity supply, the country's environment has been damaged by global warming and air pollution due to the excessive use of fossil fuels. It would have generated high revenues if exported and invested in the country's infrastructure. Still, there are many obstacles to overcome, both in terms of funding and technical expertise. A

further factor to consider is Iraq's reliance on competing fossil fuels as an energy source, making it difficult to attract foreign investment in renewable energy initiatives (Vakulchuk, Overland, and Scholten 2020). As a result of this research, we may learn more about how to diversify our energy sources and reduce our reliance on fossil fuels, damaging our natural resources and threatening future generations' rights. Iraq's inability to deal with electricity shortages is due to its dependence on oil and fossil fuel revenues and challenges related to using renewable energy sources to diversify its energy sources and solve the problem of electricity production deficits. Iraq's energy future will be examined in light of significant worldwide developments and the growing trend toward renewable and alternative energy, and the problems Iraq has in diversifying its energy sources and reducing its dependency on fossil fuels as part of this research. We examine the notion that depleted energy would continue to be Iraq's primary energy source, especially about gas, and that oil derivatives may be dispensed with as fuel for power plants. The research suggests that renewable energy will play a complementary role to gas in the foreseeable future.

The Research Methodology

Descriptive and forward-looking methods were used in the research. The descriptive method was used to analyze the most critical challenges faced by renewable energy deployment and use. The forward-looking method was used to formulate the prospects for future developments through development scenarios of the Iraqi economy.

Future Necessities for Investing in Renewable Energy Projects

Since the nature of renewable natural energy sources and their role in reducing energy consumption and saving money necessitates tying their importance to a vision of sustainable development. Developing a framework model with three pillars is necessary: the economy, the environment, and social implications. To measure the strength or weakness of sustainable development, can renewable energy be used to protect natural capital so long as the use of renewable energy does not detract from the ability to gather future harvests? Sustainable development depends on a country-by-country approach to renewable energy. Identifying economic and environmental requirements for renewable energy projects is a complex process that considers global, regional, and local issues (Gielen et al. 2019). In addition to "low-cost/local jobs," climate change mitigation is one of the most critical factors driving the growing usage of renewable energy worldwide. It is clear that Iraq needs all of these goals, from minimizing the consequences of climate change and pollution to achieving energy security, "he stated. Energy services, both

renewable and non-renewable, are closely linked to sustainable development initiatives in developing nations like Iraq. The seventh sustainable development objective focuses on ensuring that everyone has modern, dependable, sustainable, and cheap energy. Three goals must be met to achieve these aims: universal access to energy services, a more significant proportion of renewable energy sources in the energy mix, and energy efficiency. One of the top tasks for implementing the seventh Sustainable Development Goal is to improve international collaboration, boost investment, increase infrastructure, and modernize technology in developing nations (Sasmaz et al. 2020). Modern energy usage is critical to any Millennium Development Goals, including measures like final energy consumption per capita and the classification of power use into rural and urban categories. The sort of energy resources utilized is also essential. As a result of a lack of energy, losses in the tens of billions of dollars might have been avoided if industries and telecoms had been used for tourists. When it comes to the stability of an energy supply, the concept of energy security is critical. This includes current or future systems' ability to provide energy, supply, and distribute resources. Fluctuations in supply and reliability and indicators provide information on the energy security standard about sustainable development. Aside from these other factors that make the nation unique, Iraq enjoys privacy about the future of energy because it is an oil-producing country. Renewable energy use is increasing despite Iraq's abundant fossil fuel resources. Considering the current energy sector condition and a comprehensive study that considers all economic factors and environmental impacts related to a country's inability to satisfy its own energy needs. After the war, the electrical establishment had to deal with sabotage and outdated infrastructure, as well as the challenges of financing and reliance on oil revenues, as well as the lack of legislation and investment laws that encourage and guarantee investments of the private and foreign sector as well as accompanying external efficiency.

Future Environmental and Social Necessities for Renewable Energy

Renewable energy exploitation is crucial in the push for renewable energy exploitation and investment to combat climate change and lower local air pollution. The main reason for investing in and promoting renewable energy in industrialized and developed countries is to reduce carbon emissions to mitigate the impact of climate change. It improves energy security and promotes economic structural change effectively so that new jobs related to renewable energy are can be created. Even if carbon capture and storage technology are utilized, the power generation cycle assessments indicate that greenhouse gas emissions from renewable energy technologies are much lower than those associated with fossil fuel sources. Kilowatt-hours excluding emissions from land-use change (Edenhofer et al. 2011). For example, kilowatt-hours, like other members of the

Paris Agreement on Climate Change, has announced what it plans to do to combat climate change and the goals Iraq is seeking to reduce greenhouse gas emissions by 155 percent. It is lower than required by 2035—a decrease of an estimated 90 million tons (total emissions in THEM.M. 2014 are estimated at 155.5 million tons) (MILLS 2020). People in Iraq's southern oil-producing areas are particularly vulnerable to the effects of pollution from oil extraction, which is the primary source of hazardous gases in the atmosphere. Carbon dioxide emissions in Iraq have tripled since 1908 and now exceed 150 million tons per year, according to a study published by the Australian Institute of Public Policy on Carbon Dioxide emissions due to fuel use in Iraq. In terms of greenhouse gas emissions, Iraq is ranked eighth globally (Hashim et al. 2020).

As a result of the preceding, the government will need renewable energy to create power to lower CO₂ emissions generated by future usage of conventional energy. The effects of global warming are visible in Iraq's air pollution and unprecedented rise in temperatures, which leads to an increased demand for electric power. In turn, high greenhouse gas ratios result from increased fuel volumes and lower rainfall levels, which affect the ecological diversity of nature and water scarcity that has led to fluctuating amounts of water. We must develop new ways to produce food while improving irrigation and water, and land management to successfully transition to a changing climate in the agricultural sector. To achieve the essential determinants of human development such as health, education, and gender equality, as well as clean air and water, people must have access to affordable and dependable energy. In nations with a high Human Development Index, the quantity of energy used per capita from non-conventional energy sources must meet specific minimal requirements to provide a better standard of living. Power production, transportation fuels, and industry are among the most targeted sectors in greenhouse gas emissions. In addition to the material consequences already mentioned, it is necessary to address the psychological effects of the social dimension suffered and suffered by Iraqi society. The lack of energy supplies and the unprecedented rise in temperatures have impacted stability and psychological calm, i.e., the citizen suffers from deteriorating economic conditions, unemployment, and the apparent shortage. As a result of the high number of divorces, murders, robberies, and other criminal acts, new societal norms emerge that threaten family and community harmony.

Future Economic Imperatives for Investing in Renewable Energy Projects

A wide range of factors has been taken into consideration, including economic imperatives, cost analysis, energy markets, jobs, and energy safety, as well as environmental needs and natural protection. A review of the energy situation in Iraq is

needed to see if there is a financial benefit to adopting renewable or sustainable energy sources rather than fossil fuels (Edalati et al. 2017). They are available at low rates, with government backing to deliver electricity locally. Thus, the emphasis will be shifted nearly totally to electric power, which will be used for everything from home heating and cooling to transportation. As part of Iraq's long-term energy plan, the country has established long-term goals for the renewable energy regulatory framework, which should be at the center of the country's overall long-term energy strategy.

- Supporting environmentally sustainable technologies.
- Achieving energy safety by increasing quail production in Iraq using renewable energy sources such as (solar, water, and wind).

International treaties have called for lowering pollution and tackling global warming, which necessitates an increase in electrical supply for the afflicted nations, such as Iraq, which has a high level of air pollution and rising temperatures. A (sudden) interruption in the collection of energy will have less of an impact on the energy system if it is protected from disruption by diversifying its energy sources. The second objective was to address Iraq's long-term problem of insufficient energy supply, and Iraq's electrical issue is that supply is not keeping up with demand over time. Due to population and economic growth, as well as rising temperatures and more significant usage of air conditioners, peak demand was anticipated at 26 G.W. in 2019 and is expected to rise to 37 G.W. in the following five years due to population and economic growth as well as shifting demographics (Laine et al. 2019). Insufficient production of free and associated gas and high investment costs in gas, all of which depend on the amount of oil extracted and restricted in production under OPEC agreements. I will impact the amount of oil exported and, consequently, on the country's federal budget's oil revenues. It is the main point of the strategy. A sustainable energy source for achieving these two ends does not mean that renewable energy's goals and other motivating factors are irrelevant. Aside from climate change and providing safe electricity, certain renewable technologies have reduced prices due to advances.

Regarding cell s manufacturing and installation, Messia, we have made significant advancements in Tor design. Pena advancements in thermal energy storage coupled with wind CSP due to its low cost and capacity to compete with fossil fuels. Value and local jobs are created and increased revenue, improved trade balances, and contributions to industry growth and job creation. Stressed countries tend to be less successful internationally. The government's goal is to establish a stable renewable energy market that maximizes the domestic value of this industry. It was capped by the name change of

the Ministry of Electricity to the Ministry of Electricity and Energy Renewable, which signifies the government's shift toward renewable energy deployment and utilization.

Renewable Energy in the Iraqi Economy under Fossil Energy

There has been a push to invest in renewable energy technologies and serious thinking since the early 1970s when the energy crisis first emerged (Verbong and Geels 2007). This is because of price fluctuations and supply disruptions due to political, economic, and natural impacts, as well as studies that show there is a potential for future depletion of fossil fuels. The adoption of sustainable development that meets current needs without jeopardizing the ability of future generations to meet theirs is something he has emphasized since the U.N. Conference on Human Environment in Stockholm in 1972 and the World Commission on Environment and Development in 1987 until the Earth Summit in Rio de Janeiro in 1992 on environment and development. The Earth Summit was reconvened in Rio de Janeiro in 2012, known as Rio +20, to emphasize the activation of the role of the United Nations Environmental Program as an authority, following the 1997 Special General Assembly session dedicated to the environment, known as the Earth+5 Summit (Giese 2017). This was followed by the World Summit on Sustainable Development in Johannesburg in 2002 + (10). The world's leading environmental organization. Since the Stockholm Accord, several key conferences have focused on the need to combat environmental deterioration. The worldwide program is Agenda 21, and the Rio Declaration on Environment and Development was adopted under the Rio principles. While Rio21 stresses a shift in consumption and production patterns to achieve sustainable development globally (changing patterns of unsustainable consumption and production). It also calls for a greater share of total energy sources to come from renewable energy sources, which can be achieved by developing and deploying alternative energy production technologies. Cleaner fossil fuel technologies and the sustainable use of traditional energy resources are essential to achieving sustainable development. Additional objectives include improving energy efficiency, promoting regional networks between centers for energy technology research and development for sustainable development, supporting improved performance, transparency, and information on energy markets about supply and demand aspects of stability, efficiency, and other important measures. However, despite Iraq's abundance of fossil fuels, it does not mean that the country cannot keep pace with the global trend toward a sustainable energy future and the international commitment to environmental protection, which Iraq must be a part of. Iraq must also be part of this movement and this international orientation. The United Nations environment and development have resulted in international commitments on stabilizing the concentration of greenhouse gases in the

atmosphere at a level that prevents serious human interference in the climate system. Even though Iraq has not signed this agreement, it does not mean the future expectation of the imposition of international obligations. It was shown in Iraq's signing of the Paris Agreement in 2015, which was ratified, has been eliminated. Because global warming is driven by greenhouse gas emissions from the burning of fossil fuels, it is necessary to agree to keep global warming below 2 degrees Celsius and aim for 1.5 degrees Celsius with climate aid to developing nations. This adds to Iraq's budget imbalance, which has already been exacerbated by the OPEC-imposed lowering of the price and the subsidized domestic consumption of a significant portion of the production. Although the United States has a long history of participating in international meetings and conventions. On the subject of climate change, Both efficiency and cost-effectiveness of renewable energy technology will continue to increase over time. In addition to the reasons already outlined, the Iraqi government is encouraged to consider all possibilities. The financing Accessible to the public As a result of increased investment in renewable energy sources and the prospect of alleviating domestic energy shortages, In addition to gas-powered electric power. Investing in renewable energy is a viable option in light of the fluctuation in world oil prices. In the event of rising oil prices, oil revenues increase, resulting in increased funds allocated to investments in energy, including renewables. This diversification of energy sources is necessary to ensure the safety of our energy supply. When oil prices fall, we have to look for alternatives to ensure that we do not halt the global trend toward clean and environmentally friendly energy. Still, in the case of Iraq, which relies on oil revenues that fall in the event of low oil prices, we have to look for alternatives to ensure that we do not halt the global trend toward clean and environmentally friendly energy. Setting ambitious goals and carefully planned programs to meet the expected growth in energy demand with ambitious goals and carefully considered programs. They provide the opportunity to build large domestic markets for renewable energy and international cooperation between governments and financial institutions that are essential to take advantage of the opportunity, which are opportunities for local investors. Reducing dependence on oil is one of the many reasons why renewable energy sources are being bolstered. The government's goal is to provide enough local supplies while avoiding price swings in oil, which is why renewable energy sources are being bolstered. Government subsidies on fossil fuels used in energy production, their influence on the balance of finance for renewable energy, and the degradation of its competitiveness must be addressed to counteract the impact of shifting oil prices on investment in renewable energy deployment and consumption. Despite some overlap, fossil fuels' effect on renewable energy production may be broken down into four primary categories. In the first place, fossil fuel subsidies reduce the cost of fossil fuel-based alternatives, weakening

the relative competitiveness of renewable energy. For one thing, fossil fuel subsidies tend to bolster existing generating methods, making it more difficult for new technologies to enter the market. Renewable energy technology development for immigrants. Third, fossil fuel subsidies, which appear to make fossil fuel technologies more appealing than renewable energy, hinder the role of a bigger investment in renewable energy in the electrical grid.

Future Challenges to Investing in Renewable Energy Sources

There are many obstacles to investment in renewable energy sources, including legislative, financial, technical/infrastructure, and awareness/social acceptance barriers. However, most of these obstacles can be overcome, especially when facing challenges that do not necessitate financial resources, such as awareness and social acceptance. When it comes to the challenges of financial resources that have been greatly affected by the decline in oil prices, governments have started providing financial allocations for a series of solar projects in several provinces with production capacities of 30 to 225 MW for the plant and several areas. To meet Iraq's goal of 10 GIGA watts or 20% of the electricity mix by 2030, a total of 755 MW of solar power will be installed in the next several years (1). Furthermore, as part of foreign investment in developing oil and gas production and associated gas, the government has recently signed new contracts with Chinese companies and French company Total. It will contribute to the supply of gas to the gas plants and the production of electricity from solar energy, which will contribute at the very least to the dispensation of imported gas and imported electric power, in addition to the new contracts in the second half of 2021. For example, integrating renewable energy into electric power systems, both at a technical level, considers the introduction of Iraq's electricity grid system and its technical nature. It necessitates significant development and is one of the most important obstacles to deploying and using renewable energy in the future.

For uninterrupted energy supply, many appropriations are needed for grid and distribution system development and the formulation of schedules and planning to deal with this issue and save money for it. A balance between supply and demand ensures that electricity demand fluctuates according to the time of day, week, and season. Maintaining frequency and keeping voltages within a predetermined range are two of the system's primary functions. This process is regulated with great precision and controls supply and demand minute by minute through automatic management of creation through organization and follow-up of pregnancy. In contrast, transmission and the formulation of generation plan control changes across more extended periods, ranging from hours to days (operation or suspension known as the unit's commitment). It is necessary to determine what generators

should be used and how they should be distributed. Controlling and managing the supply and demand balance is also essential.

Transmission and distribution networks with limited capacity are required to move energy between generators and consumers in electric power systems. This necessitates the availability of generation capacity and networks capable and adequate for plans. Electric power systems with particular qualities require consideration of renewable energy's properties to incorporate them into present energy systems (Al-Yasiri et al. 2020). Due to the volatility of some renewable energy sources and predictability, the capacity balance is low if there is no correlation between generation and peak demand. The burden of distributable age or other resources to ensure a balance between supply and demand is partly due to the increased responsibility of distributable generation or other resources. In addition to the expansion of existing networks and the building of new networks for renewable energy, extended distances may be required to transport power generated from renewable sources. In addition, there has been an improvement in operational procedures, markets, and planning. When it comes to the growth of renewable energy, one of the most significant difficulties and problems is the lack of infrastructure in Iraq, where the wealth of natural resources makes solar power outages a severe problem for operators. As a result of Iraq's electricity grid's numerous issues since the 1990s, including AT & C losses of more than 50% and more than 67% of electricity lost before a bill could be issued, the country's central electrical system was initially designed for significant support with marginal reserves or without recycling reserves (1). A lack of progress in the grid's development has resulted in many energy transformers, nutrients, and distribution transformers operating excessively or below capacity, resulting in technical failures and network failures, especially during peak times in the summer when electricity demand is at its highest.

Scenarios for the Future Development of Renewable Energy under Fossil Fuels

While the first scenario assumes that the current situation will continue in 2020-2030, the second scenario assumes a further deterioration in the deployment and use of renewable energy sources and a decline in the government and private sector's ability to provide the required funding. Projects for the production of renewable energy and the corresponding infrastructure.

Scene 1: Directional Scene: Continuation of the Current Reality 2020-2030

Financing renewable energy projects based on oil revenues:

Scene assumptions:

1. The dependence on oil rents remains in the process of financing development and public spending in Iraq. The lack of new sources of financing because oil prices remain at current levels, in light of the continuing restrictions on production and exports.
2. Continued austerity in allocating investment spending and not attracting foreign investment or activating the private sector.
3. Government commitment to reach and achieve the 2030 Sustainable Development Goals.
4. Continued legislative delay by passing a law on renewable energy and developing strategic plans according to applicable technical and economic studies.
5. Continued weak government performance in achieving the required reforms and combating financial and administrative corruption.
6. Continued reliance on fossil fuels from local and imported oil and gas derivatives to operate power plants.
7. Continuing the modest investment approach in financing and constructing solar power plants with modest capacities without developing the electricity management and distribution system and expanding and developing the electrical grid.
8. Increased domestic consumption rapidly under the pressure of population growth and the growth of cities and the industrial sector.

There are several factors in looking ahead to the trends of this scene, perhaps the most prominent of which are:

- **Oil Revenues**

Based on international energy organizations' and institutions' expectations on future oil prices, we will adopt new expectations that take into account the impact of the pandemic on the global economy and the closure, which has been reflected mainly in demand and, therefore on price expectations (Bekheet 2020b). As of the beginning of this quarter, Iraq's reliance on oil income to pay operating and investment costs has been explored in-depth, placing Iraq in an embarrassing situation to finance new energy investment projects and even maintenance of power plants and fuel support for the operation (Bekheet 2020a). If oil prices climb beyond \$50 a barrel, it is predicted that the state's operational demands can be met. But even if oil prices rise to 70 dollars a barrel in the fourth quarter of 2021, this will not address the problem by giving additional cash for investment, including electricity and the volume of subsidies for this sector. It is estimated to be one of the highest rates in the region in absolute terms equivalent to 7.86 percent of the total federal budget if the budget of the Ministry of Electricity in 2019 exceeded government subsidies

for the electricity sector. Since 2008, the Ministry of Electricity's capital balance has begun to decline to the theoretical value of \$32 billion (1). An estimated \$8.76 billion in sub-subsidized fuel and \$4.73 billion in subsidized fuel comprise 87.3 percent of financial assistance for 2018, respectively, according to the Iraqi Ministry of Electricity. Several obstacles must be overcome in harnessing energy resources and implementing reasonable energy policies, including lowering oil prices, political and economic instability, the expansion of Corona, and the massive government budget deficit.

Table 1 Oil demand and supply forecasts for 2019-2030 (1 million barrels per day)

General	2019	2020	2025	2030
Oil demand	97.9		99.9	103.2
Oil supply	97.8		99.9	103.2
The gap between supply and demand	-0.1		0	0
Oil price (\$)	63		71	76
Gas/million feet 2 standard		1.300	4	
Population (population)		40.150.174	45.520.500	51.211.700

Source: Oil Demand and Supply Data: IEA Global Oil Markets Outlook for 2020

- **Gas Supply**

OPEC's curbs on oil output have decreased oil production in Iraq, resulting in a record 300 million cubic feet of gas being produced. However, this is less than the 300 million cubic feet of gas expected to be delivered this year due to lower oil production. Irrigation of 4 million cubic feet of gas per day in Iraq's goal for 2025, when it will no longer need to import gas from other countries. Iran's associated gas prices have risen, and the current Brent crude price is estimated at 5.1 dollars per British thermal unit (MMBtu). So, Iraq was forced to import Iranian gas at an average of 4-5 billion cubic meters a day to meet peak demand. Even though the contract price for dry gas from Basra Gas Company was set at \$4.50 per million British thermal units (MMBtu) (GCB), on the other hand, the current Brent crude oil price of about \$1.7 per British thermal unit is less expensive than utilizing 200,000 barrels of fuel consisting of a mixture of gas oil, oil, and heavy fuel oil to run power plants. Iraq's gas-to-energy strategy necessitates an investment of more than \$44 billion over the next five years. It has been projected that the country needs 24,000 megawatts of power and approaches 30,000 during peak times in the summer, but Iraq now generates just 16,000 megawatts.

- **Population Growth**

To slow Iraq's population growth to 51.211.500 people in 2030, the Central Bureau of Statistics should revise its population growth projections downward (Ersoy and Terrapon-

Pfaff 2021). In addition, energy sector investments are required to meet the demand for 55.000 Mw of power by the year 2030, which is regarded as a high proportion worldwide and requires large expenditures, both for export and for electricity generation, which is predicted to rise to 55.000 Mw by the year 2012 2030.

- **Energy Policies**

Iraq has pledged to meet the 2030 goals for sustainable development. As part of the 2013-2030 Strategic Energy National Committee Integrated, the announcement was made. Additional strategies were then put into action. In 2020, 750 MW will be available. Under the Ministry of Energy's objectives for Inta Electric power and 1000-500 MegaWatts from renewable sources to comprise 20% of the energy-generating mix by 2012 to 2030. According to Iraq's dedication to energy safety, diversifying its sources, lowering greenhouse gas emissions, and meeting the rising lack of electricity supply, this tendency is becoming more commonplace (Musawia and Maan Abood Alib). However, as a result of low oil prices and production limits, these little steps may not appear promising in light of the population increase and predicted demand for power from renewable sources from 2010 to 2030, as a result of the lack of a law on the regulation of renewable energy, political instability, and delays in the necessary changes. The declaration of hopeful and promising policies is not enough to fulfill the aim. The electrical grid's growth and extension and the private sector's promotion are among the essential components of the power industry. The tense security environment Confidence in Iraq's failing economy harms international investors' confidence.

Furthermore, a year ago, successive administrations had poor management and regulation in place. 2005 Due to antiquated rules, deep-rooted corruption, and bureaucracy, investment in renewable energy has been delayed. Nevertheless, the worldwide renewable energy industry is rushing.

Scene Results

An enormous amount of money and effort is needed to solve chronic power supply shortfalls and reduce pollution in Iraq. Moving towards sustainable energy and diversifying its sources, There is now a deficit of between 7000 and 10000 Mw in prime time output. In addition to importing Iranian gas to create more than 3000 MW, Turkey also imports electricity between 2000 and 1200 MW. One hundred megawatts is a lot of power. The distribution of food supplies is the most critical. Wood for plants and the improvement of the power grid Renewable energy projects cannot fill this gap in demand

because of a lack of funding. Instead, they need to focus on achieving self-sufficiency, providing fuel from oil derivatives, operating all gas plants, and increasing efficiency.

Scene 2: The Pessimistic Scene: 2020-2030, Insufficient Funding for these New Energy Projects: (Continued Reliance on Fossil Fuels)

Scene assumptions:

1. Fossil fuel prices are falling due to slowly growing demand after the global closure due to the Corona 19 pandemic and the government's declining ability to finance investment.
2. Growing mindless domestic consumption of fossil energy and its reliance on it to operate power plants.
3. Building solar energy technologies only in Iraq, with limited investment projects and not overcoming the challenges ahead.
4. There are no real investments in renewable technology, both at the manufacturing and assembly levels.
5. Not relying on a realistic policy commensurate with the goal of renewable energy in Iraq and not legislating laws on supporting renewable energy.
6. Population growth continues at historical rates.
7. The government's commitment to achieving the 2030 Sustainable Development Goals has declined.
8. Economic reform processes in the country have stalled, and financial and administrative corruption is rampant.
9. High government subsidies for fossil fuels.

• Increased Gas Supplies

World oil prices play a significant role in Iraq's financial resources and, as a result, impact the volume of investment. According to the scenario of global sustainable development (1), if oil prices fall below 60 dollars per barrel, Iraq will direct limited investment in the energy sector, even with minor production increase due to OPEC restrictions, which is limited to large global companies I.J. To achieve the government's goal of resolving the problem of inadequate electricity supplies in light of population growth and high continued demand, which is expected to grow at an alarming rate by 2030, the emphasis will be on investing in gas projects and their infrastructure. Several factors are pushing for increased investment in gas, including:

- a) All types of power plants in Iraq operate with gas and high efficiency.

- b) Gas production is associated with increased oil production about associated gas. According to the Iraqi Oil Ministry, increasing gas supplies to generating plants provides large quantities of oil and its derivatives for export, with the electric power sector consuming 200,000 barrels per day.
- c) Gas production is associated with an investment in the oil sector through contract terms related to the processing and production of associated gas, which is feasible due to the dispensation of imported gas and electricity imported from neighboring countries.

- **Lack of Electricity**

Several factors have contributed to the ongoing electricity shortage in Iraq, including the Second Gulf War in 1991, the economic embargo, deterioration in infrastructure, and the introduction of the network, even after all the money spent on the electricity sector during 2003. Due to a lack of capacity to meet the growing demand, as well as a high volume of government support for both domestic and imported fuel supplies or maintenance costs for plants and distribution networks, and to address this growing gap in production, we must look for more practical and effective solutions that are less prone to financial and administrative corruption.

- **Challenges to Renewable Energy**

Iraq has a substantial and rising electricity production shortfall, which solar energy projects may fill as part of the National Energy Strategy if that is the intention. That which is missing from the rest of it has fled from the rest. It will be tough to finance an investment in a country with limited financial imports. Shortly, large and high capacity will create more than 10 thousand megawatts. To make up for the current lack. Increasing the amount of renewable energy produced to at least 31,000 MW over the years 2012–2030. Suppose there is not enough infrastructure in place to handle the additional power demands of this new form of energy. It will be complicated to implement the necessary modernizations and expansions of the distribution networks. In addition, there are additional fees. Investing in renewable energy projects early, as well as other legislative and technical hurdles, is essential. Reforms in the administration of the energy sector's social and administrative aspects Besides that, this one is too.

- **Solar Energy Policy in Iraq**

As a result of the recent Coronavirus outbreak and a drop in oil prices, the federal government's projected 2020 budget deficit is expected to be enormous (Connolly,

Hanson, and Bradshaw 2020). While this will likely lead to harsh austerity measures and a slowdown in developing renewable energy plans, it could also serve as an incentive for the government to diversify away from oil as a source of electricity. In addition, due to the government's integrated energy strategy, Iraq lacks a clear political renewable energy plan that is being updated and evaluated. Booz & Co.'s 2013-2030 Integrated National Energy Strategy report identifies the future vision of solar energy, which has been adopted as a suitable and viable source among other alternatives. It considers the possibility of generating renewable energy in the short term to supply remote demand outside the national grid while working to be connected to the grid in a medium-to-long period. However, renewable energy is expected to account for a small fraction of Iraq's total power output by 2030. According to the research, it is not enough to satisfy the goals established for renewable energy in light of Iraq's shortage of power and the growing trend toward sustainable and clean energy.

Scene Results

International Energy Agency projections show no deficit in production by 2030. Still, the world's current challenges and the pandemic's general closure and recovery period, as well as the global trend toward possible energy alternatives, most major fossil fuel consuming countries, have dwindled their dependence on fossil fuels in recent years. Consequently, most major oil consumers have reduced their reliance on fossil fuels in recent years. In light of these findings, the oil price is expected to settle at levels regarded low and unfavorable to producing nations, such as Iraq, which renders Iraq sensitive to the shock of low oil prices, resulting in a reduction in expenditure, particularly investment. In addition, investment hypocrisy in the energy sector will decrease Iraqi gas production due to low oil prices and OPEC restrictions on other natural gas projects. According to him, it leads to a dependence on oil derivatives and gas and special generators to operate power plants with low efficiency in terms of dependence on oil derivatives and increased pollution that exasperates the electricity. Therefore, the only way to solve Iraq's electrical issue is to cut financing.

Scene 3: Optimistic Scene: The Decline of The Funding Problem 2020-2030:

As a result of the increased use of renewable energy, If Iraq follows through on its Sustainable Development Plan for 2030, it will see an increase in the percentage of renewable energy in its future energy mix and a diversification of its sources. To solve the problem of energy shortages in the power sector by 20–30 percent by 2030, we need to diversify our energy sources and decrease our dependency on fossil fuels. This is a highly

optimistic scenario, however, because it necessitates a large amount of infrastructure investment and the resolution of several financial, political, and technological issues.

Scene Assumptions

1. Increasing the government's ability to finance investment in renewable energy projects and manufacturing technology due to several factors, perhaps the most important is the high price of crude oil or the country's increased production capacity.
2. The legislation supports renewable energy and amends the regulations and administrative regulations of the electricity sector.
3. Investing in the infrastructure of transport and distribution networks and modernizing electrical power management systems.
4. To benefit from leading countries in renewable energy through international cooperation with international energy agencies, institutions, and relevant organizations.
5. The government's continued commitment to achieving the 2030 Sustainable Development Goals.
6. Continuing technological development and improving the efficiency of renewable energy globally, and overcoming the technical challenges of using renewable energy in what suits Iraq.
7. Reducing government subsidies for fossil fuels in exchange for increased support for renewable energy.

The following are essential factors in this area:

- **Increased Investment in Renewable Energy**

As non-OPEC output, notably from Russia, continues to drop and the U.S. LTO reaches modest levels, supply and demand are projected to move closer in a tight equilibrium in the second half of this decade. According to an Irina (International Renewable Energy Agency) report published in 2019, the average anticipated cost of solar energy is \$0.085/kWh produced by projects established in 2018 and is set to reduce to \$0.048 at the start of this decade and \$0.02 by 2030. Both gas turbines and solar P.V. have lower LCOEs than oil derivatives or private generators in residential areas, ranging from \$0.04 to \$0.11/kWh in the LCOE comparison analysis (2). As oil prices rise and Iraq's gas production increases in anticipation of self-sufficiency by 2025, energy technology, renewable energy, and solar costs continue to fall. The bilateral trend toward domestic gas

use in power plants and increased investment in renewable energy projects becomes more apparent. 2,000-megawatt solar power facilities will be built in Iraq by Chinese businesses under contracts signed by Iraq in 2021. 750 MW of capacity in the first phase and a strategic partnership with Abu Dhabi Future Energy Company to create solar P.V. projects with a total output capacity of up to 2000 MW. The Iraqi Ministry of Electricity estimates that 20-25 percent of the energy produced, or 10 to 12 gigawatts, may be financed under this scenario as part of the clean energy replacement strategy instead of fossil fuels.

- **The Role of International Oil Companies**

A balancing act is needed between Iraq's commitment to decreasing pollution in its oil and gas extraction activities and the multinational firms' commitment to the same thing in compliance with international obligations and agreements, as has been the case. They can play deRa as the president of these enterprises in delivering sustainable solutions to the absence of power under a contract with Total.

- **Adopting an Integrative Policy of Gas and Renewable Energy**

One of the most important goals of the Iraqi government's energy strategy is to increase Iraqi gas production to self-sufficiency. It helps to run power plants that are designed to run on gas fuel, with high efficiency and less pollution. It increases productivity, reduces costs, and provides crude oil for export if the daily consumption of Iraq's oil derivatives for thee is more significant than Iraq's domestic consumption of oil derivatives for thee. As a result, gas-fired electricity generation might top 24 gigawatts, and the government plans to add 10 to 12 gigawatts of renewable energy in the second half of the current decade, so Iraq could be on track to achieve (energy security) and diversity of sources here to reach sustainable energy in the future.

Scene Results

Although higher world oil prices are expected to benefit Iraq, the volume of exports under OPEC restrictions, particularly after the OPEC+ agreement, which reduced Iraqi exports by one million barrels per day, is critical. Assuming that Iraq's exports are restored to pre-OPEC levels and that the reality is 3.4 barrels per day, with the expectation of average prices in the optimistic scenario reaching 80 dollars per barrel, the country's monthly oil imports amount to mo. Although it was initially regarded as the worst-case scenario in the pre-Corna pandemic forecast, it has evolved into a very optimistic scenario. Given the significant global shift towards fossil energy alternatives over the next decade and the

expectation that demand will not see significant increases, OPEC's restrictions on production are expected to increase at reasonable prices by 70 dollars a barrel, and the volume of Iraq's revenues will be determined by OPEC's determination of its share of exports. Iraq can attract domestic and foreign investment in gas and renewable energy projects, as well as significant energy purchase agreements with investors under the boot model, but this will require greater political stability and seriousness on the part of the government in order to win the confidence of investors in the Iraqi economy. The fragile security situation is not the only factor influencing the government's plan to attract foreign investment, as mismanagement, regulation, laws, and omissions are also important factors in attracting foreign investment. Aside from the stifling bureaucracy and deep-seated corruption, keeping up with the quickly changing global renewable energy industry is tough.

Conclusions and Discussion

The government's inability to achieve financial sustainability as a result of increased operational expenditures, continued reliance on oil imports that are subject to market volatility, OPEC restrictions, and global turmoil reduces the government's ability to invest in renewable energy sources and access a safe energy mix, among other things. There is a serious global trend toward the replacement of fossil fuels with alternative sources of energy, placing Iraq in a difficult position in the event of the phase-out of fossil fuels, both in terms of importing alternative energy sources and in terms of diversifying the energy sources used domestically. Because of the significant expansion of renewable sources, particularly in the domestic power, transportation, and heating sectors, it is not projected that fossil fuels, notable oil, will continue to dominate the world's energy mix until 2030 and beyond. In addition to Iraq's international obligations under international environmental treaties and conventions, the country's continued environmental degradation is a result of the country's excessive use of fossil fuels. As a result, Iraq is one of the countries most affected by global warming, high temperatures, and air pollution. Iraq's electricity industry is suffering from the obsolescence of the electrical grid, and the electricity system has been established but is not appealing to investors. Without the growth of the electricity sector, it will be impossible to enhance the sector and add new producing capacity. The amount of energy lost during transportation and distribution is between 40 and 50 percent of the energy produced. Numerous challenges exist in the administration of the power industry in Iraq, including issues with the law, administrative procedures, the current tariff structure, and bureaucracy and management, amongst other things. The persistent power shortfall, with peak demand reaching 58 percent greater than

producing capacity, is one of the world's most serious problems. Iraq's power generation frequently relies on natural gas, and the country currently faces a severe shortfall of natural gas supply to power plants, requiring the country to rely on imports of Iranian natural gas. Continued government assistance for fossil fuels, namely oil derivatives, delivered to the Ministry of Electricity in huge amounts, up to 200,000 barrels per day, has been granted to the ministry. In accordance with a global orientation and international treaties, the gravity of global warming and environmental degradation caused by the excessive use of fossil fuels and Iraq from ecologically impacted nations must be recognized. Changing the course of public expenditures by restructuring the general budget in favor of investment spending directed at expanding production capacities and infrastructure, particularly in the field of electric power, and diversifying its sources in order to achieve safe and sustainable energy and to halt economic losses caused by a lack of electricity in all sectors, is one way to achieve this goal. The oil industry is taking advantage of the enormous investments made by major corporations in the area, which includes contracts to develop power plants that use renewable energy sources. Understand that solving the electrical problem and increasing output will not be accomplished without substantial investment in the modernization, rehabilitation, and extension of the electricity distribution system and network. Particular emphasis should be paid to renewable energy through government assistance, as well as the procurement of productive energy and the localization of renewable energy technology, particularly in the field of investment in solar technology, which is one of the most suitable energy sources in Iraq. Boost the use of renewable energy across all sectors and in public and private buildings, and encourage its adoption through tax exemptions and other incentives, among other measures. It is necessary to adopt a strategic plan to address the problem of electricity generation that combines increasing gas production for electricity generation with increasing the contribution of renewable energy to electricity generation as part of an integrative process that contributes to solving the problem of rising current and future demand as a result of economic and population growth. When developing the Ministry of Electricity's strategic plan, the geographical position of the plants must be established in line with the intended location, by generation capacity, as well as whether or not they are connected to the national grid or are located outside the national grid (decentralized). In order to resolve the problem of connecting solar-generated energy to the grid in the near future, it is necessary to consider the construction of solar-generated energy plants in areas and districts, as well as their accessories, in rural areas that are not centrally off-grid because of the economic benefits and to reduce the migration of people from the countryside to urban areas because of the economic benefits.

References

- Al-Yasiri, A.J., Ali, M.A., Abed, H.A., & Bekheet, H.N. (2020). Equilibrium of the Global Energy Market between Conventional and Renewable Energy Sources: A Conceptual Analysis. *Journal of Talent Development and Excellence*, 12(2s), 3481-3496.
- Almagtome, A.H., Al-Yasiri, A.J., Ali, R.S., Kadhim, H.L., & Bekheet, H.N. (2020). Circular Economy Initiatives through Energy Accounting and Sustainable Energy Performance under Integrated Reporting Framework. *International Journal of Mathematical, Engineering and Management Sciences*, 5(6), 1032-1045.
- Bekheet, H. A. A. (2020). Implications of the Dual Crisis of Terrorism and Corruption on The Economic Development in Iraq: A Comparative Analysis. *International Journal of Psychosocial Rehabilitation*, 24(1).
- Bekheet, N. (2020). Developments of Oil Stocks and their Impact on Oil Prices in the Global Energy Markets. *International Journal of Psychosocial Rehabilitation*, 24(7), 8885-8893.
- Connolly, R., Hanson, P., & Bradshaw, M. (2020). It's déjà vu all over again: COVID-19, the global energy market, and the Russian economy. *Eurasian Geography and Economics*, 61(4-5), 511-531.
- Edalati, S., Ameri, M., Iranmanesh, M., & Sadeghi, Z. (2017). Solar photovoltaic power plants in five top oil-producing countries in Middle East: a case study in Iran. *Renewable and Sustainable Energy Reviews*, 69, 1271-1280.
- Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Seyboth, K., Kadner, S., Zwickel, T., & Matschoss, P. (Eds.). (2011). *Renewable energy sources and climate change mitigation: Special report of the intergovernmental panel on climate change*. Cambridge University Press.
- Ersoy, S.R., & Terrapon-Pfaff, J. (2021). 'Sustainable Transformation of Iraq's Energy System'.
- Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., & Gorini, R. (2019). The role of renewable energy in the global energy transformation. *Energy Strategy Reviews*, 24, 38-50.
- Giese, L.J. (2017). *The Role of NGOs in International Climate Governance: A Case Study of Indian NGOs*.
- Hashim, B.M., Sultan, M.A., Al Maliki, A., & Al-Ansari, N. (2020). Estimation of greenhouse gases emitted from energy industry (oil refining and electricity generation) in Iraq using IPCC methodology. *Atmosphere*, 11(6).
- Laine, H.S., Salpakari, J., Looney, E.E., Savin, H., Peters, I.M., & Buonassisi, T. (2019). Meeting global cooling demand with photovoltaics during the 21st century. *Energy & Environmental Science*, 12(9), 2706-2716.
- Mills, R. (2020). *Under a cloud: the future of Middle East gas demand*. Center on Global Energy Policy, Columbia University.
- Musawia, A.M.J.A., & Maan Abood Alib, A.J. (2020). Identifying Weaknesses and Possible Development Solutions for The Iraqi Economy. *International Journal of Innovation, Creativity and Change*, 13(1), 207- 224.

- Sasmaz, M.U., Sakar, E., Yayla, Y.E., & Akkucuk, U. (2020). The relationship between renewable energy and human development in OECD countries: A panel data analysis. *Sustainability, 12*(18).
- Vakulchuk, R., Overland, I., & Scholten, D. (2020). Renewable energy and geopolitics: A review. *Renewable and Sustainable Energy Reviews, 122*.
- Verbong, G., & Geels, F. (2007). The ongoing energy transition: lessons from a socio-technical, multi-level analysis of the Dutch electricity system (1960–2004). *Energy policy, 35*(2), 1025-1037.
- Vivoda, V. (2009). Diversification of oil import sources and energy security: A key strategy or an elusive objective? *Energy Policy, 37*(11), 4615-4623.