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Renewable Energy Sources in International Energy Markets: Reality and Prospects

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Energy sources are a requirement of our daily actions as a means of improving human progress, which contributes to further development and productivity. Renewable energy will help to mitigate climate change effectively, but this use should be sustainable to meet the needs of future generations of energy. In particular, there is still limited knowledge of the interrelationship between renewables and the size of global energy demand. This study aims to explore the reality and future of renewable energy sources in the world and how shifting from traditional fossil-fuel energy sources to renewable energy sources can reduce the impact of climate change. The study uses a qualitative research approach by reviewing papers in the scope of the study, as well as reports and statistics from international and regional energy production organisations. The results, based on reports by the International Energy Agency and OPEC, show that dependence on renewable energy sources will increase globally over the next two decades, making it a major source of energy in the global energy markets. All types of renewable energy sources are non-emissions that will help to reduce greenhouse gas emissions in the future. However, expenses, price levels, policies and market conditions have become barriers that prevent developing and least-developed countries from fully exploiting renewable energy production technologies. There is, therefore, a real need to establish a state of global cooperation to support developing countries, including Arab countries, to ensure access to renewable energy sources and clean energy technologies.

Key words: *Renewable energy, energy market, clean energy, renewable energy prospects, energy storage.*

Introduction

The planet is increasingly being a multicultural society due to the growing daily energy demand of the population of the world, while the planet cannot shift in its shape. There is a growing need for power and related costs to meet human economic and social growth, health and education. Going back to renewable resources to help reduce carbon emissions is an esxcellent approach that requires to be feasible to meet future generations ' energy demand (Owusu & Asumadu-Sarkodie, 2016). Traditional energy sources have been transmitting a great deal of security in meeting global energy needs for a long time (Schaefer & Caine, 2012). However, in recent times, suspicion has begun to revolve around the adequacy of these sources to meet the energy needs of the world today and in the future. This is due to the natural depletion of its reserves and its continuous increase in consumption, with a growing global population and many other changing factors. In addition, the world has begun to take an interest in climate change, with pollutant emissions from the environment resulting from the final use of traditional energy sources, as well as environmental pollution in general. In this regard, the depletion of traditional energy sources and their environmental impacts necessitated the search for and continuation of other sources of energy to secure supplies (Kaminski, Marszalek, & Ciolkowska, 2008). The renewable energy sources have therefore emerged as being inexhaustible and widely available on land, and the energy they generate is clean. The importance of renewable energy sources is the inevitable result of major developments in oil and natural gas technology from unconventional sources, as well as the increase in its vast and technically recoverable reserves. As a result, these sources, together with renewable sources in the global energy supply mix, are starting to play an active role in the structure of the global energy balance. In the light of global economic and population growth, fossil energy sources have become a matter of doubt, because they are unable to continue to ensure the security of supply globally, as they are energy sources that are exhausted (Altvater, 2006).

Moreover, the lack of clarity in the future of renewable energy sources will lead to pressures to increase demand for fossil energy sources, which will require further changes in the diversification of non-conventional and renewable energy sources in order to ensure the security of supply. It is, therefore, necessary to study unconventional and renewable energy sources and their role in the global market for energy. In this context, many studies are dealing with the prospects of global energy sources, renewable energy sources and shortages in the global energy market (Dyatlov, Putkina, Lobanov, Schugoreva, & Minakov, 2019; Kabir, Kumar, Kumar, Adelodun, & Kim, 2018; Lan, Malik, Lenzen, McBain, & Kanemoto, 2016; Owusu & Asumadu-Sarkodie, 2016; Sarmiento, Burandt, Löffler, & Oei, 2019; Stecuła & Brodny, 2017). The aim of the paper is to identify the reality and future of energy shortages and non-conventional and renewable energy sources, as well as to identify the level of development and progress in energy sources. In addition, the study aims to determine the capacity of unconventional and renewable energy resources to meet the world's energy needs and its role in

preserving the environment and achieving a sustainable equilibrium. The qualitative analysis has been used to review studies in the field of research, as well as to review the statistics on energy sources issued by international and local institutions. The potential impact of study emerges in determining the extent of diversity and development in the generation of energy sources, in particular non-traditional energy sources and renewable energy sources, both at present and in the future.

The Global Market of Renewable Energy

Renewable energy sources have played an important role in the global energy markets (Dreidy, Mokhlis, & Mekhilef, 2017). Lately, the use of renewable energies has become the best option for obtaining clean energy at a competitive price complementing traditional energy sources. It is important to note that more than 170 countries have adopted renewable energy targets and some 150 countries have implemented energy policies to stimulate investment in their renewable energy technology (Heath-Brown, 2015). Each renewable energy source is responsible for its own developments on the global energy market. The following is a discussion of the most prominent renewable energy sources expected to be an important part of the global energy market.

- **Global Solar and Wind Energy Market**

Continuous advances in the technology and techniques for using the energy that can be generated from the sun have added a great deal of efficiency in the use of solar energy, especially in the supply of electricity. In general, the world has witnessed the growth of all solar energy technologies, and solar cell technology has emerged among them, as well as wind energy, as it is continually evolving. Solar and wind energy are a natural source of energy and play an important role in mitigating environmental pollution. Advances can be seen in the global production of solar photovoltaics and wind energy, as shown in the following table:

Table 1: Global Production of Renewable Energy (2005-2017)

years	Global production of solar PV Giga watts	Solar Additive Giga watts	World production of wind energy Giga watts	Wind power added Giga watts
2005	5	1+	59	12
2006	6	1+	74	15
2007	8	2+	94	20
2008	15	7+	121	27
2009	23	8+	159	38
2010	40	17+	198	39
2011	70	30+	238	40
2012	100	30+	283	45
2013	137	37+	319	36
2014	177	40+	370	51
2015	228	51+	433	63
2016	303	75+	487	54
2017	402	99+	539	52

Source: (Growth, 2018)

Table (1) shows that the global production of solar PV reached 5 GW in 2005 and increased to 40 GW in 2010 and the volume of production is defined as slowly increasing between 2005 and 2010 and the amount of energy added during the period was relatively small. Table 1 also shows that the global production of solar photovoltaic energy is rising rapidly after 2010 to hit 402 GW in 2017 by adding significant energy compared to previous years. Recent advances in the production of solar energy have made it an important part of the global energy markets (De Jager et al., 2011). With regard to wind energy, Table (1) shows that the global production of wind energy and the amount of energy added has significantly changed over the period (2005-2017) as the world's wind power generation surpassed 59 GW in 2005 and increased to 539 GW in 2017. There is also an increase in the amount of wind energy added in the world, and the biggest increase in wind energy was added in 2015 and is highlighted, and this substantial increase in 2015 is the result of the growth of wind power generation in China. It should be noted that the solar energy markets and the added quantity of solar PV are concentrated in China, the United States, Japan, Germany, Italy, India, the United Kingdom, France, Australia and Spain, respectively, which are the ten most important countries in the production of this type of energy (Blazquez, Fuentes-Bracamontes, Bollino, & Nezamuddin, 2018).

At the beginning of 2017, there was a growing interest in setting up solar energy projects in many Arab countries, including the State of Kuwait, the Emirate of Dubai, Egypt, Saudi Arabia and Morocco. The Nour 4 solar power plant project in Morocco, which is expected to run this station by the end of 2018, is at the forefront of these projects. This initiative is one of the most critical solar energy generation projects in the world. In terms of wind energy markets, it is concentrated in China, which is the largest producer of wind energy, followed by the United States of America, Germany and India. Generally, wind turbine production is concentrated in China, the European Union, India and the USA. On the Arab side, Morocco is at the forefront of wind power generation, followed by Egypt, Tunisia, Jordan, Algeria, Bahrain, Syria, Kuwait and finally Lebanon. Many Arab countries are planning to improve the development of wind power in order to reduce the use of traditional energy sources that pollute the environment (Macmillan, 2016).

- **Global Hydropower Market**

Hydroelectric power is one of the most reliable sources of electrical energy supply in the world. China, Brazil, the United States, Russia and Canada are the largest countries in terms of water energy generation, followed by India, Norway, Japan, France and Turkey. It is noted that some countries produce more than half of their electricity from hydropower, including Brazil, Iceland, Nepal and Mozambique (El-Khoury, 2015). Due to its high efficiency and sustainability, the hydroelectric industry is experiencing significant growth in the world and is expanding in Asia, Europe, North and South America and Africa. The capacity generated in the world of hydroelectric power has risen from 723 GW in 2001 to 857 GW in 2007 (Alnaser & Alnaser, 2019). In addition, for the period from 2008 to the present, energy production from water sources is increasing, as shown in the following table.

Table 2: Global Production of Hydroelectric Energy (2008-2017)

years	World production Giga watts	Power added Giga watts
2008	874	_____
2009	900	26+
2010	936	36+
2011	970	34+
2012	990	20+
2013	1000	10+
2014	1055	55+
2015	1064	9+
2016	1096	32+
2017	1114	18+

Source: (Kabir et al., 2018)

Table (2) indicates that the global production of hydroelectric power reached about 874 GW as in 2008. Despite the fluctuations in the amount of added energy between global increase and decrease, global hydroelectricity production has evolved to reach 1114 GW in 2017. It should be noted that the production of energy from water sources is directly related to the quantity of water available (abundance of water, water scarcity) in the countries producing this energy. Hydropower is produced in many Arab countries, including Algeria, Egypt, Tunisia, Iraq, Syria, Morocco, Sudan, Lebanon and Jordan, and production is minimal compared to the rest of the world. The total amount of hydropower generated in the Arab countries in 2016 is 12079 MW / year, representing 1% of the total global hydropower output for the same year (OAPEC, 20115).

- **Global Market of Geothermal Energy**

Geothermal energy is rising modestly relative to the growth of other renewable energy sources, and its markets are stable. Despite its slow growth, the cumulative installed underground energy in the world has risen from 10.3 GW in 2008 to 14.1 GW in 2017. The energy derived from geothermal energy in 2017 is the largest contribution to the duration (2008-2017) as shown in Table (3).

Table 3: Global Production of Geothermal Energy (2008-2017)

years	World production Giga watts	Power added Giga watts
2008	10.3	0.3
2009	10.7	0.4
2010	10.9	0.2
2011	11.0	0.1
2012	11.3	0.3
2013	11.9	0.6
2014	12.5	0.6
2015	12.8	0.3
2016	13.4	0.6
2017	14.1	0.7

Source: prepared by authors based on (OAPEC, 2018)

Geothermal energy use and markets are concentrated in the United States, the Philippines, Indonesia, New Zealand, Italy, Mexico, Iceland, Kenya, Japan, and Turkey. Such countries stand out from the rest of the world by exporting geothermal energy, and the United States of America comes first. Some countries also rely heavily on geothermal energy, such as Kenya, which has around 27 percent of the energy mix in geothermal energy (OAPEC, 2018). As far as Arab countries are concerned, the exploration of geothermal energy is still in its infancy, and some Arab countries are focusing on the development and implementation of projects to produce geothermal energy.

- **Global Market of Biomass Energy**

Biomass energy is differentiated from the rest of renewable energy sources, used for cooking and heating in homes, for producing energy in factories and for producing electrical energy. It turns biomass into a fuel that is of great importance in the mix of global energy balances. The electric energy produced from biomass in the world in 2016 amounted to about 112 gigawatts, which represents about 504 terawatt-hours. The United States of America is the world leader in the generation of electrical energy from biomass, followed by China, Germany, Japan and India. In addition, biomass energy is produced in some Arab countries and Qatar comes first, followed by Jordan, Lebanon and the United Arab Emirates (OAPEC, 2017). Biomass capacity in 2017 rose y only 1 terawatt-hour per year from 2016 to 555 terawatt-hours in 2017 (REN21, 2018). Concerning, biofuels, global production grew from 19651 thousand tons of oil equivalent in 2005 to 84121 thousand tons of oil equivalent in 2017, with annual growth levels fluctuating between increase and decrease. Such volatility is due to competition from other

fuels, as well as to the costs, prices and conditions that biofuels need to generate economically feasible amounts. These facts and developments in global biofuel production for the period 2005-2017 are shown in Table 4 below.

Table 4: Global Production of Geothermal Energy (2008-2017)

Years	**Biofuels** **Thousand tons of oil equivalent**	**Annual growth rate**
2005	19651	_____
2006	25666	30.6
2007	37429	45.8
2008	50109	33.8
2009	55894	11.5
2010	63906	14.3
2011	65680	2.7
2012	66848	1.7
2013	72415	8.3
2014	80009	10.4
2015	79866	-0.1
2016	81483	2.0
2017	84121	3.2

Source: prepared by authors based on (BP Statistical Review of world energy, 2018)

- **Global Market of Hydrogen Energy**

Hydrogen energy is widely seen globally as a renewable energy factor in the future global energy balance mix. On the other hand, it is seen as an important part of the traditional global energy supply, but development in the use of hydrogen energy takes a long time. Despite the efforts of some countries, such as the United States of America, to expand the use of hydrogen energy in many areas, especially in transport, the use of hydrogen as a source of energy is still in its infancy. Many countries also believe that hydrogen will eventually become the primary source of energy in the transport sector (Hart, 2006). In general, the use of hydrogen as a source of energy requires a great deal of investment and technological development in addition to working on the construction of the hydrogen storage system. Focusing on protection in the use of high-level hydrogen safety is also one of the most important issues that concern hydrogen energy technology developers. All of these obstacles will lead to increased costs and create barriers to achieving the goal of generating hydrogen energy with economic benefits. After the success of many studies and the advancement of ways of using hydrogen as an energy source,

the market is hampered by the introduction of hydrogen-dependent products for energy generation, which are among the obstacles that need more time to overcome (Al-Shammari, 2009). In general, the increase in energy production from renewable sources will result in damage to traditional energy sources as it reduces the global demand for traditional energy sources and reduces its contribution to global energy supply. As a result, global demand for renewable energy will increase and its contribution to global energy supply will increase. Furthermore, the leading countries in the exploitation of renewable energy sources have achieved advantages in their energy sector, such as low environmental pollution and emissions that would change the climate and achieve a degree of security of supply.

Future Prospects of Energy Sources: Supply and Demand

The essence and trend of global energy consumption has undergone a dramatic change in the future energy forecast. This is due to changes in the nature of the structure of the global energy market, such as the emergence of modern production methods from unconventional sources and the growth of the use of renewable energy sources, as well as international calls to minimise environmental pollution from fossil fuels. In general, the global energy outlook varies from one international institution to another and also varies for the same organisation, depending on the scenarios adopted by the institution. There are many expectations from international and non-international organisations and some international energy companies that are involved in the degree of global energy consumption. Nevertheless, the predictions of the International Energy Agency and the Organization of Arab Petroleum Exporting Countries (OPEC) are the most relevant and most accurate forecasts in the field of energy. Forecasts for global demand and energy supply provided by the International Energy Agency and OPEC depend on several assumptions in their future vision are:

1. Growth in the economic activity measured by the gross domestic product.
2. Changes in the world's population.
3. Taking global energy costs into account.
4. Development of different energy source technologies.

The interest in a growing reliance on alternative sources of fossil fuels and environmental concerns plays a major role in the preparation of their projections (Al-Yasiri, 2016) as well as many of the variables and factors that are seen when preparing future forecasts. Overall, the forecasts of the International Energy Agency show that the global economy will continue to achieve a high average annual GDP growth rate and that the population will increase. The forecasts suggest that the rate of economic growth determined by GDP will exceed 3.7% over the period 2020-2030. The economic activity for the post-2030 years is expected to decline by a small percentage in order to achieve an average annual growth of 3.1 per cent over the 2030-2040 period. Emerging economies like China and India are expected to grow faster than the rest

of the world. With regard to the world's population, the International Energy Agency plans to hit more than 9 million people by 2040, while it currently stands at 7.5 million (IEA, 2016). Such an increase in the world's population as the global economy continues to expand is an important factor in shaping global energy demand and supply, as expressed in global energy markets.

- **Future Outlooks of Global Energy Demand**

The International Energy Agency (IEA) agrees with OPEC in its projections for global energy demand, both expecting a significant increase in global energy demand over the coming decades. These expectations stem from the assumption that the population will increase and that economic activity will continue to grow strongly, with an improvement in living standards that will increase individual energy consumption. It is also anticipated that there will be a significant increase in global energy supplies to meet energy needs. Furthermore, a large part of this increase in supply would come from new sources and renewable sources of energy, given the continued dominance of fossil fuels on both demand and supply sides. The following table displays the prediction of global energy demand according to the scenario of the International Energy Agency.

Table 5: Forecast of global energy production until 2040

Different energy sources	**New Policy Scenario**		**Current Policy Scenario (Reference)**		**Scenario 450**	
	2025	2040	2025	2040	2025	2040
Oil*	4577	4775	4751	5402	4169	3326
Natural gas*	3390	4313	3508	4718	3292	3301
Coal	3955	4140	4361	5327	3175	2000
Nuclear Energy	888	1181	865	1032	960	1590
Hydropower	420	536	414	515	429	593
Bioenergy	1633	1883	1619	1834	1733	2310
rest of renewable energy	478	1037	420	809	596	1759
total	15341	17865	15938	19637	14354	14879
Percentage of fossil fuels	77.9%	74%	79.1%	78.7%	74.2%	58.1%
Percentage of nuclear energy	5.7%	6.6%	5.5%	5.2%	6.6%	10.6%
Percentage of renewable energy	16.4%	19.4%	15.4%	16.1%	19.2%	31.3%

Source: International Energy Agency, World Energy Outlook 2016.
*Includes both traditional and non-traditional sources

Table (5) shows that there is a difference in the estimates of global demand for energy sources in the scenarios of the International Energy Agency because each scenario assumes specific policies that will be reflected in the number of expectations. One of the current policy scenarios is known as the IEA Reference Case scenario, which assumes the continuation of current policies and measures that have been firmly enshrined in international legislation to guide the energy sector. This scenario suggests that global energy demand will increase from 15,938 million tons of oil equivalent in 2025 to 19,637 million tons of oil equivalent in 2040 and that demand for oil will represent the highest percentage of energy demand compared to the rest of the sources. Global demand for oil in 2025 is forecast at 4751 million tons of oil equivalent and is projected to rise to 5402 million tons of oil equivalent. It is projected that coal would make up the largest share of demand for oil and then for natural gas. In general, fossil fuels will remain the dominant global demand, despite a decrease of 79.1% to 78.7% in their share of total energy demand for the period 2025-2040. As far as nuclear energy is concerned, this scenario assumes that the demand for it reached 865 million tons of oil equivalent in 2025,

representing 5.5% of the total demand for the same year. Nevertheless, due to its environmental problems and its warning against using it in a non-peaceful manner, as well as global disasters such as the Fukushima disaster in Japan, it is estimated that its share of energy demand in 2040 will decline to 5.2% of total global demand. This scenario assumes that demand for all kinds of renewable energy sources will continue to rise until 2040. The bulk of the increase in demand for renewable energy sources would come from demand for solar, wind, geothermal and hydrogen.

For the period 2025-2040, demand for these sources is expected to double from 420 million tons of oil equivalent to 809 million tons of oil equivalent. This increase in demand is the product of technological improvements and lower costs, especially for solar and wind power infrastructure. Whereas the demand for hydroelectric power will increase slightly during the study period and this decrease is due to the problem of water scarcity in most countries of the world. On the other hand, demand for bioenergy, projected at 1619 million tons of oil equivalent in 2025, will rise to 1834 million tons of oil equivalent in 2040. Typically, the market for renewable energy will constitute 16.1% of the total energy demand in 2040. Moreover, demand for alternative energy sources will grow as an important part of fossil fuels, as well as their importance in the economies of OECD countries, especially in the United States. The IEA also expects that the increase in global energy demand will mainly take place in countries outside the Organization for Economic Cooperation and Development. China and India are experiencing the world's most significant increase in demand, and the Middle East should make an important contribution to increasing energy growth. In OECD countries, the International Energy Agency expects a drop-in demand in its countries to streamline its pattern of energy consumption (IEA, 2016). Whereas the new policy scenario assumes the consequences of existing policies, taking into account the steps and initiatives implemented by various countries to mitigate environmental pollution generated by the consumption of fossil fuels. This scenario expects a decrease in the global demand for fossil fuels, which is estimated at 77.9% in 2025 to 74% in 2040. The decline is the result of the policies adopted by countries with a view to preserving the environmental balance by reducing environmental pollution. Such policies encourage innovation in alternative sources to improve their technologies and use them effectively to meet the world's energy needs. As a result, demand for alternative sources is expected to rise, as the nuclear energy ratio is expected to reach 6.6 per cent of global energy demand in 2040, and the proportion of all forms of renewable energy will reach around 19.4 percent of total energy demand in 2040. Scenario 450 assumes stronger and tighter policies to reduce pollution, with almost 50% of the likelihood of curbing the global rise in temperatures resulting from the ever-increasing consumption of fossil fuels.

It is therefore expected that in this scenario, dependence on oil, coal and natural gas will significantly decrease and demand for renewable energy will double, with increasing demand for nuclear energy as an alternative energy source. Global demand for fossil fuels is expected to

fall from 74.2% in 2025 to 58.1% in 2040 of the total demand for energy sources. Furthermore, it is expected that the global demand for nuclear energy will rise to 10.6% of total energy demand in 2040. Finally, it is estimated that the share of demand for all kinds of renewable energy will reach 31.3 per cent of the total global energy demand in 2040.

- **Future Outlooks of Global Energy Supplies**

The International Energy Agency estimates that fossil fuels will remain the most substantial proportion of the world's energy supply by more than 70% of the world's energy supply by 2040. The remaining portion is mostly renewable energy, in particular solar and wind energy. Nuclear energy is also expected to maintain its position in global energy supplies, particularly in Japan, which will rely heavily on nuclear energy to meet its energy needs. Shale gas and shale oil will also make a significant contribution to global energy supply, and the cost of alternative energy sources is expected to fall dramatically. This leads to the improvement of the economies of these countries and their position on the global energy market (IEA, 2016). On the other hand, OPEC predicts the growth of global energy supplies with the supremacy of fossil fuels over much of the market, as shown in the following table (6).

Table 6: Global Energy Supply 2020-2040

Different energy sources	**2020**	**2035**	**2040**
Oil	4496	4830	5043
Natural gas	3514	4435	5616
Coal	4425	5064	5631
Nuclear Energy	704	881	1175
Hydropower	375	445	507
rest of the renewable energies, including biomass	1691	2137	2797
Total	15205	17792	20769
Percentage of fossil fuels	81.7%	80.5%	78.4%
Percentage of nuclear energy	4.7%	5.0%	5.6%
Percentage of renewable energy	13.6%	14.5%	16.0%

Source: Organization of the Petroleum Exporting Countries (OPEC), world oil outlook, 2014

Table 6 shows that OPEC expects global energy production to rise from 15,205 million tons of oil equivalent in 2020 to about 20,769 million tons of oil in 2040. It also expects fossil fuels to contribute about 81.7% of global energy resources by 2020. In spite of its declining contribution to environmental and political considerations, it will remain the dominant share of

the largest share. It is expected to account for 78.4 per cent of global energy supplies by 2040, and OPEC expects nuclear energy to maintain 5 per cent of global energy supplies by 2040. On the other hand, Table (10) shows that the proportion of the contribution of renewable energy sources to global energy supplies increased from 13.6 per cent in 2020 to 16 per cent in 2040. It is apparent from the above that the expectations of OPEC are in line with the expectations of the International Energy Agency for global energy supply. Both organisations expect that fossil fuels will contribute the largest share of global energy supplies, with the increasing contribution of unconventional sources of oil and natural gas to supply. A significant change in nuclear energy is not predicted in the near future, and both organisations believe that the share of renewable energy supply will increase significantly and substantially.

Conclusions

The aim of the study is to analyse the current state of global production from renewable energy sources and the degree to which their use can be increased in the future. It also aims to discuss future prospects for the use of these sources in the global energy market as an alternative to conventional energy sources. The study uses the descriptive approach to achieve results by analysing previous studies dealing with energy sources and the determinants of their output at different levels. It also relied on statistics issued by regional and international organisations for the production and marketing of various energy sources, whether traditional or renewable. Fossil fuels represent the largest share of global energy demand, as well as production, as the most significant contributor to global energy supply. Although it is predicted that the proportion of this type of fuel will gradually decline, it will remain dominant in the energy market both now and in the near future. On the other hand, the natural depletion of fossil fuels and their environmental damage are important factors which have driven many countries to find inexhaustible energy alternatives and to meet human energy needs. As a result, unconventional and renewable energy sources have emerged as an integral source of fossil fuels today and in the near future.

The global reserves discovered from unconventional and economically extractable sources of energy are very high and surpass the proven reserves of traditional sources. This adds great importance to these sources and also complements and prolongs the life of conventional oil and natural gas reserves. Energy generation from renewable sources is the main source of clean energy which reduces environmental pollution. Electric energy production from renewable sources and methods of extraction are now being developed using highly efficient technologies, which have led to an increase in their significance in global energy markets. In addition, unconventional and renewable energy sources are important sources of energy today for the diversification of the global energy supply mix. It is expected to play an efficient and important role in providing the planet with energy in the future. It is, therefore, necessary to realise that fossil fuels are being exhausted, which means reducing reliance on them and take energy-

saving steps in the future. Scientific research in the area of non-traditional energy sources should also be extended in order to better understand its reserves and to accelerate study and development in this sector. In addition, efforts should be made to create markets for renewable energy technologies in a way that is easy to access and deploy. The unconventional oil and natural gas industry need to be developed in Arab countries because of the role of these sources in the global energy markets in the future. Finally, international cooperation in the field of scientific research and technology transfer concerning non-conventional and renewable energy sources is important. In addition, the creation of a private international organisation in the field of alternative sources should be set up to support efforts to improve the efficiency of production in these sources.

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