GLOBAL ENERGY DEMAND FOR DIFFERENT ENERGY SOURCES: CURRENT STATUS AND FUTURE PROSPECTS

Mr. Balasaheb Popat Kale, Prof. Belkar Janardhan Ambadas, Mr.Sharad Bhaskar Dighe,

balasaheb.kale@pravara.in.

jbelkar22@gmail.com

sharaddighe1992@gmail.com

Arts, Science and commerces College, Kolhar, Maharashtra

Agriculture College, Loni, Maharashtra

ABSTRACT. *Future expectations indicate a significant increase in the rates of fossil energy use over the coming decades in light of many factors (population growth and high rates of global economic growth). However, despite a shift at the worldwide level of the diversification of energy supplies, this diversification still constitutes a small percentage of energy production globally. In light of this, three long- term scenarios have been proposed that analyze this sector's potential and future possibilities within the outlook of the global energy landscape.*

Keywords: Global energy, energy market, energy demand, energy supply

Introduction

Energy is the key to contemporary development and the economic axis necessary for this development, as it constitutes today one of the ruling elements of economic growth due to the link between it and this growth. With the increase in the latter rates, the need for it increases. As it became known that traditional energy sources such as oil, coal, and gas have a limited life and are close to running out, and thus it is necessary to search for alternative sources of traditional sources that are renewable and available in abundance, and continuously without running out, and this is what has become the focus of attention in many countries of the world, especially those Which seeks to sustain its growth, and achieve self-sufficiency in energy supply at low cost from an economic and environmental point of view. The research gains importance because it seeks to identify the global energy market with its two sides (demand and supply). The significance of the research comes from studying and foreseeing the future, as including the end gives it additional importance by monitoring the changes taking place in the energy market at present and in the future. The problem contained in the research lies in knowing the possible effects and results of the impact of future changes on the depleted energy sources and the extent to which these sources can meet the growing energy needs of the global economy (H. K. Kadhim & Abdulzahra, 2021). The research aims to identify the future of current energy and the extent of its continuity in light of many variables (renewable energy), which have become a pressure tool on the importance and role of depleted energy sources (fossil energy). Depleted energy sources will continue to dominate global production and consumption

in the energy market in the coming years, and renewable energy sources will continue to play their role as complementary and alternative energy in the future.

1. The Historical trends of energy supply and demand

The growing global demand for energy in all its forms, especially the depleted sources of fossil fuels (crude oil, natural gas, and coal), is putting pressure on the major oil companies for natural gas. While maintaining these two ratios means incurring high costs in exploration and exploration, new energy sources, such as heavy oil and oil sands, are being developed to produce industrial oil that can extend the supply of conventional crude oil. In addition to the availability of coal in large quantities, its reserve/production ratio is currently estimated at

200 years (Matsuo, Yanagisawa, & Yamashita, 2013).

Global energy use has increased nearly 20 times since 1850, tenfold since 1900, and more than four times since 1950. The various energy sources witnessed a significant transformation during this historical development during the past century. In the nineteenth century, vital resources such as wood, charcoal, and agricultural residues were used today as traditional energy sources (Gokcol, Dursun, Alboyaci, & Sunan, 2009). The steam engine kept pace with the industrial revolution. It provided means of converting thermal energy into mechanical energy, and wood was the primary source of energy to finance steam in those engines. Coal eventually replaced wood, and the second half of the nineteenth century witnessed a significant rise in coal production, which became the dominant fuel in world consumption during 1890-1965 (A. H. Almagtome, Al-Yasiri, Ali, Kadhim, & Heider, 2020). This extensive use of coal has brought about profound changes in the industry, especially in developed countries.

As a result of industrial transformations, especially after the Second World War, the relative importance of oil among the energy sources consumed in the world has increased, as the increase in oil consumption outweighs the increase in the consumption of other energy sources and its transformation from the primary dependence on coal to the central reliance on hydrocarbons (oil and gas), In 1929, oil did not contribute more than 16% of the total consumption of energy sources in the world, while coal contributed about 79% of its total in the same period. However, the relative importance of oil has tripled after the industrial transformations. The relative importance of oil and gas has become about 58 % of global energy consumption in 1965, while this percentage became 65.4% in 2000, then this percentage decreased to about 52.9% in 2014. As for coal, it constituted 39.6% of the total global energy consumption in 1965, and its share shrank to 24.5% in 2000, until it reached 2014 about 28.4%. On the other hand, nuclear energy contributes only 0.2% of the total energy. In comparison, hydroelectric power received only 2.1% of the total energy sources in 1965, while these percentages became 7.5% and 2.6 % for nuclear and hydroelectric energy in 2000. Then both energies decreased in 2014 to 4.8% for nuclear energy and 2.4 for hydropower (Wachtmeister, Henke, & Höök, 2018).

2. OPEC forecast

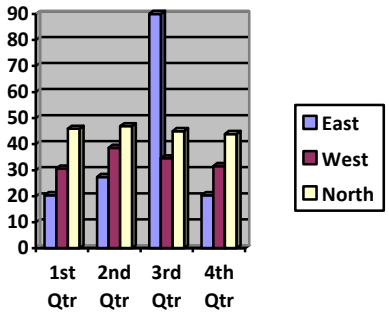
All organizations and companies specializing in the field of energy predict a significant increase in global demand for energy during the coming decades as a result of the expectation of high rates of economic and population growth, high standards of living, and an increase in individual consumption in the world, and that most of that increase in energy will be met by fossil fuels (Oil, gas, and coal), which are expected to contribute between (75% – 80%) of the anticipated increase in global energy consumption, as OPEC estimates it at about (299.0)

million barrels per day (2020), bringing demand to about (336.0) and (370.7) million barrels per day (2030) and (2040) respectively, compared to (273.9) million barrels per day in (2014), i.e., an expected annual growth rate of (1.2%). However, the expected growth rate is slower than It was in the past three decades, reaching a growth of about (2%) annually.

With regard to various energy sources, OPEC sees the continued dominance of oil over energy sources during the first part of the forecasts until the year (2020), as) in (In addition, the demand for coal and gas will decrease for the same period until the share of coal in the total primary energy reaches (24.7%) in (2030) and (22.1%) in (2040) compared to crude oil, either gas demand levels Naturally, it will be almost identical with coal during the forecast period, despite its rapid growth compared to other forms of energy, and the main reason for the decline in demand for crude oil from the total primary energy during the forecast period is the natural depletion of oil, as well as the adoption of strict policies on changes Climatic, and with regard to other energy sources, it is expected to maintain stable levels, especially hydroelectricity, with the exception of biomass energy, which grows at a faster rate until it reaches about (10.7%) in the total primary energy supply in the year (2040), as distributed in the following table.

Table 1. OPEC forecasts global initial energy demand (2014-2040)

	Global energy supplies				Growth rate	% of total energy			
source	2014	2020	2030	2040	2014-2040%	2014	2020	2030	2040
Oil	85.1	90.7	95.6	96.2	0.5	31.1	30.3	28.5	25.9
Coal	77.7	81.9	82.9	81.8	0.2	28.4	27.4	24.7	22.1
Gas	59.6	66.7	82.0	96.6	1.8	21.8	22. 3	24.4	25.9
Nuclear Power	13.2	15.6	19.8	25. 5	2.6	4.8	5.2	5.9	6.9
Hydropower	6.6	7.6	8.9	10.2	1.7	2.4	2.5	2.6	2.8
biofuels	28.2	30.8	35. 0	39. 8	1.3	10. 3	10.3	10.4	10.7
Renewable energy	3.4	5.8	11.8	21.3	7.3	1.3	1.9	3.5	5. 7
Total energy	273.9	299.0	336. 0	370. 7	1.2	100	100	100	100



Source: *own compilation*

3. Scenes of global development

The future analysis supposes the formulation of development scenarios that link the phenomenon's possible horizons to various extents, showing the possible and potential changes in the horizon of the future to be foreseen. Perhaps when we talk about scenes of future development in the field of renewable and depleted energy, the following timeline of development can be placed in the framework of three scenes:

3.1. Continuation of the current situation (benchmark projections)

This scene is based on the following assumptions:

1. Non-restriction of energy supplies and the continuation of the supply of energy without significant shocks that lead to disruption of the global energy market. The absence of a radical change in energy prices, especially oil, means that various energy sources will maintain the exact relationship between marginal costs and price.
2. Continuing demand for fossil fuels according to what is expected in light of its current levels.
3. The rise in conventional and unconventional oil reserves gives confidence in the possibility of continued dependence on them to secure global energy needs.
4. To take timid measures regarding environmental legislation that does not threaten the oil market regarding the demand of large consumers from developed countries.
5. The continuation of renewable energy production technologies at their current levels and the absence of revolutionary technologies pave the way for a significant future change in the energy market.

The Acting Factors: Several factors will shape this scene's movement. Perhaps the most prominent of them are:

First: Energy consumers

Energy consumers play an essential role in shaping this scene, as the ultimate goal of production is to meet the growing consumption needs, whether in developed or developing countries. Most of the addition to global energy consumption will come from developing countries and new industrial countries, as the growth of large cities will increase The future needs of developing countries. The growth of large cities has become remarkable, prompting analysts to formulate the term megacities, which refers to the state of the most massive cities. In 2008, 20-39 million people lived in the ten largest cities in terms of population. Population: Tokyo comes at the forefront (39 million people), followed by Delhi (33 million people) in India, Shanghai in China (28 million

people), and Mumbai in India also (27 million people). According to the United Nations Human Settlements Program (Habitat) report for the year 2009, a global transformation that has emerged during the past two years is that, for the first time in history, more than half of the world's population lives in cities. The number of city dwellers reached about 3.3 billion in 2008, expected to rise to more than 5 billion in 2030 (Huo et al., 2012). This will entail several results, perhaps related to the energy sector. First, the construction sector's energy consumption will grow faster than the consumption of the industrial and transportation industries. It is expected that the construction sector's energy consumption will increase between 2010 and 2030 by about 5.85 British thermal units, knowing that each unit is equivalent to 1000 megawatts. In contrast, energy consumption will grow by about 4.01 British thermal units in the industrial sector and 3.15 British thermal units in the transportation sector (Yu, Jin, & Jia, 2020). On the other hand, cities represent two-thirds of the world's energy use, which poses a special challenge in the face of reliance on renewable energy due to the limited space available.

Second: Energy Policies

The energy issue has become a geostrategic issue for industrialized countries. Even for the major developing countries that have become among the significant consumers of oil and gas, their governments and national companies have begun to develop foreign energy policies. For example, China will face complex and diverse issues. On the horizon of 2020, its imports will be two or three times higher than domestic production, and 90% of them will come from the Arab Gulf. Therefore, it must adopt policies to secure the flow of these supplies, and it must indulge more in political affairs. The region may have to adjust its policies towards Kazakhstan and Russia and recalculate its investments in Orimolic oil, which produces fuel made from bitumen in Venezuela, of which it plans to own 70%, in addition to increasing its investments in Mexico and increasing its imports of African oil.

Similarly, China invested in Gulf oil, especially in Saudi Arabia, Iran, and Iraq. Sinopec obtained a natural gas exploration and production contract in Saudi Arabia in 2002, and the same company tried to invest in Iranian gas fields in 2004. China Petro China Limited, a state oil company, won. Established and existing under the laws of the People's Republic of China for the Development Contract of Halfaya Field in Amara 2010.

It is noteworthy that the state oil companies of consuming countries, especially developing ones, have begun to adopt policies that differ and contradict those of government companies of producing countries. For example, India's Petroleum and China's ONGC, to secure markets in promising regions rather than venture into primary production operations overseas, rely on sound business thinking and the strength of political connections and sympathy they gain in those regions. Therefore, it has tended to intensify its investments in Africa, especially in Sudan, Gabon, and others (Zafar, 2007).

Third: Producers of fossil energy

According to the assumptions of this scene, fossil energy producers will continue to play a significant role in the global energy market, and OPEC will provide about 75% of global oil production in the fields of conventional and unconventional oil, as well as natural gas until 2030 (Aleklett et al., 2010). This is because the oil reserves in the OPEC countries - especially the Arab ones - will be sufficient to maintain conventional oil production in those regions at current levels until 2030 and beyond.

On the other hand, the export rate prevailing in Russia is acceptable, as natural gas and hydroelectric and nuclear energy provide the primary energy resources, making oil use relatively stable. Still, the Gulf countries and others can lead to high population growth to increase the demand for energy To satisfy the growing need of it locally, as well as its lack of renewable energy sources and its dependence on fossil energy (Foster et al., 2017). According to the assumptions of this scene, unconventional oil producers will not be able to play a significant role, as their contribution will remain between 2-3% of the total global oil production, which is close to its current levels. The continuation of the decline in oil prices to below $80 could constitute their continued survival as marginal producers, which hinders the possibility of increasing their production as well as enhancing

their ability to spend on research and development and reduce production costs over time (A. Almagtome, Khaghaany, & Önce, 2020). On the other hand, one of the future scenarios is the withdrawal of several small oil producers from OPEC and among the candidate countries: Indonesia, Algeria, and Nigeria, from membership in the organization. However, increasing the production capacities of its significant producers could contribute to compensating for these countries' crude oil production. On the other hand, the possession of these countries with large reserves of natural gas can work on the continuation of the weight of these countries as producers of fossil energy. These developments may pave the way for the emergence of a new OPEC with the most significant importance in the Gulf region, which means an increase in the Gulf's influence in the organization and a decline in the Venezuelan influence, which has lost its loud voice since the departure of Hugo Chavez.

Fourth: Renewable Energy Producers

It is expected that the demand for renewable energy in this scene will increase, except for non-hydro-renewable sources. Developing countries will be responsible for providing 18% of nuclear energy production in the world in 2030 (Ağbulut, 2019). Projections indicate that non-renewable energy sources will continue to dominate until 2080, and alternatives to carbon fuels will hardly exceed 25% of the total energy supply until close to the 1970s, and even by the end of the century, it will rise to about 40%. Renewable energy sources will provide even cumulatively during the current century about 30% of the total energy used, and about 60% of it will be available in the last three decades (Holmberg, Andersson, & Erdemir, 2012). Solar energy will be the fastest growing among renewable sources, as it will form about (12.7%) in 2035, then wind energy will be followed by about (7.8%) for the same year, while hydroelectric energy will be the least growing among renewable energy sources because it is old used energy and that most The areas suitable for the construction of dams are already exploited. Regarding the volume of electrical energy production, hydropower will occupy the first place, followed by wind and solar energy (Montoya, Aguilera, & Manzano-Agugliaro, 2014).

Fifth: The state of the global economy

The state of the global economy and its growth rates play an important role in shaping the future energy scenes in the world, as stagnation or depression will lead to negative results that affect the energy demand, especially from oil. In addition, the economic recovery and boom contribute to improving and increasing this demand. For example, the 2008 crisis led to a decline in global demand for oil, the first in nearly a quarter of a century, by about half a million barrels per day in 2009 (AL-Jawahry, Mahdi, Al-Fatlawi, & Almagtome, 2022). In addition, it led to a slowdown in the growth of crude oil supplies from outside OPEC countries, which led to the emergence of An imbalance in the balance of supply and demand due to the collapse of demand in the Organization for Economic Cooperation and Development by more than 1.5 million barrels per day, which caused a significant increase in the commercial oil stocks of its member states (Difiglio, 2014). Furthermore, this crisis has produced new crises, as the European debt crisis arose, which struck the Eurozone and affected its medium and small economies. Its repercussions could lead to a global economic slowdown.

3.2. Discover and develop renewable energy sources

According to this scene, renewable resources represent an increasing share of more energy in the future, and this share will grow so that it will play a key role in more global energy, as the discovery of new technologies can accelerate the transformation process in the worldwide energy market, especially in the electricity sector. This scenario is based on the following assumptions:

1. Rising energy prices globally
2. International efforts support the development of renewable energy within the framework of a collaborative effort between governments, manufacturers, oil producers, and renewable energy.
3. The development of the technological level of renewable energy is a result of increased investments in it.
4. Implement stricter environmental policies
5. The success of developed Western countries in developing technologies that reduce oil consumption in the transportation sector, such as developing electric vehicles and biofuels.

active factors

First, technological development

Technological development is at the forefront of influencing changes in this scene. Improving energy efficiency can significantly affect the global oil demand, and using electric or biofuel-powered cars can increase the demand for these energy sources competing with oil. Some claim that the era in which "electric cars will spread must also witness a parallel shift towards the use of solar energy, wind energy, nuclear energy, and other renewable energy sources in generating electricity" (Lund, Lindgren, Mikkola, & Salpakari, 2015). Many observers believe that hybrid and electric cars will play a significant role in the future. For example, Deutsche Bank expects that hybrid and electric cars will represent about 25% of new vehicles in the United States in 2020, while China is expected to be two-thirds. Half of the lightvehicles' sales of high-quality and efficient new cars will be electric or hybrid in 2030 (Al- Yasiri, 2021a).

Second: Increasing the volume of investments in renewable energy

The International Energy Agency sees in its 2011 report that cumulative investments in energy supplies until 2035 will amount to about 37.9 trillion (in 2010 dollars), and the organization expects to invest about 6.4 trillion dollars over the next twenty-three years until 2035, of which 94% will be allocated to the electricity sector.

Third: The widening trend towards adopting renewable energy

The number of countries with targeted renewable energy policies has increased from 45 in 2005 to 164 in 2015 (Dornan & Shah, 2016). Accordingly, the relative importance of using renewable energy can significantly increase, as expectations indicate an increase from 18% in 2010 to about 36% in 2030 (Saygin, Kempener, Wagner, Ayuso, & Gielen, 2015). Furthermore, Europe has set itself an ambitious target in the use of renewable energy, which is to reach 20% of final energy by 2020, while Brazil aims to secure 75% of its energy needs from renewable sources by 2030, and China aims to achieve 15% by 2020 (Bekheet, 2021).

3.3. Reliance on depleting energy and decline of renewable energy

This scene is based on the following assumptions.

1. Continuing fossil energy consumption and achieving high economic growth rates.
2. Energy prices, especially oil and gas, do not rise in response to the growing demand for them.
3. The inability to overcome the challenges facing the development of renewable energy technologies.
4. Gradual abandonment of investment in new technologies
5. The occurrence of disturbances in the oil-producing areas.
6. The possibility of increasing energy production from non-conventional sources.

active factors

First: Prices - Costs

The decisions of other major oil and energy producers play a pivotal role in the global energy market, as major producers of conventional oil in OPEC and outside it will take into account the reactions and policies of other producers. Higher prices can encourage production in marginal and higher-cost producers, eroding the market share of lower-cost producers. Accordingly, there will always be a strong temptation to increase output to regain market share at a lower price, which will keep out existing and potential competitors (Al-Wattar, Almagtome, & Al-Shafeay, 2019). According to the expectations of the International Energy Agency, production capacities in the Middle East are likely not to develop significantly and rapidly, as expected by the reference scenario formulated in 2003, as low investment spending and high prices will increase the process of reducing demand (Sulieman, 2021). Therefore, the agency expects higher prices will not Compensate for the lower market share, and producers outside OPEC, especially in Africa and Russia, will reap the benefits.

Second: Abandoning nuclear energy:

Even though nuclear energy is not concerned with the problem of global warming, it is one of the most frightening and unstable types of energy, as its dangerous radioactive wastes can remain for an extended period with the difficulty of getting rid of them or destroying them without harming the environment and humans in the future.

Therefore, there are only a few people who could have predicted the actual effects on the global nuclear policy of the Fukushima nuclear reactor accident that occurred in Japan in 2011, as that accident led to Japan announcing its explicit

withdrawal from any future nuclear energy production operations by 2023. Other Western countries have indicated that they are reviewing their nuclear energy programs. In Germany, the government proposed phasing out nuclear energy until it is completely phased out by 2022 after recently relaxed legislation to allow Increasing the life span of their existing nuclear plants (Bruninx, Madzharov, Delarue, & D'haeseleer, 2013). While some countries have passed legislation that prevents the establishment of nuclear power plants in the future and requires their dismantling according to a timetable after a specific period has elapsed since their work, sometimes less than their life span, but rather dismantling them before operating them in some countries such as Austria and Italy (Jassim & Challoob, 2021). But once nuclear energy is entirely out of the scene, the gap will not be filled by renewable energy but by coal and gas.

Third: Major increases in fossil energy production

To meet the increase in energy demand, OPEC member countries, especially Arab ones, will increase their oil production rapidly, relying on the vast oil resources and low production costs so that the total output will jump from 37% to 53% in 2030. But over the remaining years of The current decade, it is expected that non-OPEC countries will contribute to half of the increase in global production, and global oil production will not reach its peak before 2030. However, it will have begun to decline in some areas before this date (Al-Yasiri, 2021b). On the other hand, significant increases in natural gas production are expected in the transitional economies, and the Middle East, Africa, and Latin America will witness the fastest rates of this increase. China will consolidate its leading position in the forefront of coal-producing countries because it will account for about half of its global production during the scene, followed by the United States and India. At the same time, Europe will witness a decline in coal production due to reducing government subsidies and closing non-competitive mines.

Fourth: the effect of disturbances

The radical changes and turmoil in the Arab region could negatively affect the energy sector, as these events (ISIS expansion, Yemen war, ...) reinforce the global awareness of the potential or the dependence of energy-consuming countries on the volatile Middle East (Ali & Al-Yasiri, 2021). This type of conflict will likely develop within resource-rich nations because competing groups will compete with each other to win the largest share of wealth. This turmoil in countries with substantial oil reserves (H. L. Kadhim & Almusawi, 2021).

Fifth: Increasing the production of unconventional fossil sources:

In this context, unconventional fossil energy sources will likely witness an increase in production that could compete with traditional energy sources. For example, a significant increase in US shale gas production has helped reduce its dependence on imported liquefied natural gas. As a result, the United States is expected to become an LNG exporter by 2016. This increase has provided an excellent opportunity for Europe to address its supply security issues by importing more LNG and relying less on Russian gas.

The International Energy Agency believes that oil extracted from unconventional sources will constitute about 8% of global supplies by 2030, or about 9.3 million daily barrels. This recorded a significant increase from 2000 when production amounted to 1.1 million barrels per day. Most of it will come from Oil sands in Canada and petroleum tar in Venezuela (Ali & Al-Yasiri, 2021). However, it is also indicated that about 3000 billion barrels of unconventional oil reserves can be recovered. Nevertheless, it will take 80-90 years before it reaches its peak productivity, which appears slightly lower than conventional oil in 2030.

Conclusion

Whether for depleted or renewable energy, the global energy market is shrouded in many ambiguities and challenges. Depending on the future development of these crucial factors of economic and population growth, energy prices, and technological development, the path of global supply and demand may take different directions from the common ways. The dominance of fossil fuels worldwide, especially oil and gas, is expected to continue until 2030 and beyond, despite the growth in renewable energy sources. The oil-producing countries in the world will provide only about 100 million barrels per day in 2030, and the oil deficit may reach nearly 10 million barrels per day, which means the possibility of prices rising to a

level ranging between 150-170 dollars per barrel. Although it is difficult to accurately predict the political, economic, and strategic effects of this oil deficit, it could lead to a reduction in growth rates in developing and advanced economies alike, which may entail dire consequences for weak economies, and even adverse effects may affect China and India.

On the other hand, the growing global demand for fossil fuels and their rising prices will lead to the development of new energy resources such as non-conventional sources (shale oil) and renewable energy sources such as the sun, wind, and other sources. As a result, the world will reach its peak in oil production due to its mindless consumption. Then production will decline, not through producers reducing it, but a natural decline for this depleted resource, even though discoveries of reserves are made, but they are less than previous discoveries. Therefore Using fossil fuels in this way will speed up their run-out.

To guarantee energy availability, it is essential to broaden international conversation and collaboration between producers and users in depleting and renewable energy. The need for nations to establish links of cooperation and trade in the energy sphere by constructing extensive infrastructure in some countries in exchange for guaranteed access to oil is a demand that must be met. Work should be done to build an international system that governs energy management worldwide. This system should consist of various global energy bodies and institutions that, to be more effective, consider geopolitical and technological concerns. Implementing specific strategies and ways to rationalize and rationalize both sides of production and consumption would result in an extension of the reserve life by different years. Interest in the advancement of technology as well as sources of renewable energy.

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