Available online at www.dergipark.gov.tr

INTERNATIONAL ADVANCED RESEARCHES
and
ENGINEERING JOURNAL

Journal homepage: www.dergipark.gov.tr/iarej

e-ISSN: 2618-575X

International
Open Access

Volume 02
Issue 01

April, 2018

Review Article

Investigation of usage potentials of global energy systems

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ARTICLE INFO

Article history:
Received 24 February 2018
Revised 20 March 2018
Accepted 21 March 2018

Keywords:
Energy demand
Energy systems
Fossil energy
Renewable energy

ABSTRACT

Throughout history, mankind has made progress in social and technical areas by finding many energy sources and developing energy systems. For this reason, energy is a necessary and indispensable issue. Today, due to the increasing demands, the energy requirement has increased even more than in the past. In order to increase this energy capacity, researches and studies have been carried out on the use of energy systems more efficiently. They will be also carried out in the future. In the new global world, great progress has been made in the energy systems technology and very different systems have been found. It is clear that these systems provide high benefits in many sectors, especially in the industrial and transportation sectors. In order to use the energy for their internal consumption, and also export it, the developed countries have power plants with large production capacity. For this reason, the developed countries are competing with each other in energy issues. Producing mechanical and electrical energy, using underground energy sources and alternative energy sources are the major factor which keeping pace with the changing world. In this study, it has been tried to give technical and statistical information about the use of natural energy, natural gas, coal and nuclear energy sources and renewable energy systems such as wind, solar, hydro and biomass. We emphasized which energy system the world head toward for certain years. In addition, the advantages and disadvantages of these systems have been demonstrated.

1. Introduction

Energy experts say that very soon, the major emphasis will be on the running out of fuel resources in the world. Petroleum, coal and natural gas have been taken out from the earth for million years. It is estimated that petroleum will be used up within 100 years and coal will run out approximately within 500 years. Ignoring the minor issues, today's researchers examine the future supply-demand changes related to energy systems in detail. (Debates and polemics about energy do not affect) The mechanical power is arisen from our energy reserves. The world loses its energy capital, and this situation does not raise enough concern in the society [1].

Planning energy systems depends on economical, environmental, constraints, and other factors. These factors are important challenge around the world. Natural energy resources are not infinitive and nowadays many countries need a lot of energy. To get expressive and much more energy, many experts have found new energy systems and developed new energy policies [2]. In the economic system of global energy market, first and last suppliers chain includes countries and companies generating energy and also countries and companies consuming it. Fiscal and income surveys are important for intermediate production and final consumption. In addition, these surveys are interdependent with certain agreements in using of the direct and indirect energy that involved in commercial activities in the economic system [3]. Depending on the energy system, the technology and the energy source, the economic factors of energy production vary. Energy resources have certain characteristics. There are definite statistical distributions. Depending on wells, minefields, river beds and mountains areas etc., these distributions may change.

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Because of this change, productivity and economic factors are modified. Assessment of energy is elaborated for all (country and industrial) economies. [4, 5].

Environmental policies direct the designing of energy systems. For example, the global warming and climate changing are two of the most important environmental problems. They usually result because of the greenhouse gas (GHG). GHG is the most important factor affecting the amount of energy generation from different energy systems. According to the research conducted in the last two decades, energy production from the fossil sources has had negative impact on the environment. However, it can be thought that this issue may open the way for policies leading clean energy production. Energy experts emphasize that new technologies should be developed to fix the negative impacts of climate change, GHG and carbon emissions on the energy economy. Some researchers say that new energy presentation programs need to be developed for clean and efficient energy planning [6, 7].

Energy organizations and investors ought to get new or improved energy systems for efficient energy and in order to decrease environmental problems. In these studies, a new global energy system management may be found out. By using qualitative performance of the energy system, quantitative and qualitative assessments on the demand and production values can be achieved. In order to investigate structure of global energy systems, regional activities (economic and technical) and investment affair can be analyzed. They have key roles. Rebound effect can be thought in energy system issues. It can cause increasing of energy efficiency and diminishing GHG. So that, by using energy, the economic growth can be enhanced [8, 9, 10].

The usage policies of energy systems lead to global energy scenarios. Most of these scenarios include focusing on renewable energy (RE). But, scope of energy sanctions is not definite and based on investigation in the present research. In addition, many energy scenarios usually do not reflect the real current demand and production values because economic factors and the amount of the demand change over the time [11, 12]. This situation relies on development of the world.

Energy is used by different economic entities in global supply chains, including the exploiter, producer, consumer, intermediate trader and final trader. The chains of energy systems can be evaluated by many factors. The systems of input-output analysis method is adopted to trace the direct and indirect energy use associated with both intermediate production and final consumption activities in the economic system. In the world economy, 15% of the energy use embodied in trade turns out to be induced by final consumption, and 85% is attributed to intermediate production [3].

Global energy expenditure has been swiftly increased in last 50 years, and it will be going on to expand over the next half century. Using of fossil fuels stimulated the increasing of industrialization in North America, Europe and Japan for cheap energy in the past. In addition to these countries, energy consumptions of the other countries also continue to increase. Thus, this consumption is going to effect the industrialization and energy planning of next 50 years. Technologies of China and India have improved rapidly due to the energy usage because they represent approximately a third of the world's human population. The depletion of oil resources in the near future is an expected situation. The advantage factors of the RE technologies of wind biofuels, solar thermal, and photovoltaics (PV) have finally showed maturity and the ultimate promise of cost competitiveness [1].

According to International Energy Agency (IEA), total primary energy usage in North America and Europe has come down, and the increase in the global average energy use has arisen about 2.8 % during the last decades [13,14,15,16].

Even, with a 2% increase in energy usage per year, the primary energy demand of 12,271 MTOE in 2008 would double by 2043 and triple by 2063. Of course, the global energy usage cannot continue to increase at the same rate forever. It is estimated that the global energy usage will increase at an average annual rate of 1.2 until 2035. It may be even optimistically estimated that the growth rate will be 1.2 %. Reaching a value of 16.934 MTOE/year, the global energy usage will increase by 38% until 2035 [13, 16]. World energy demand values are shown in Figure 1 and Table 1.

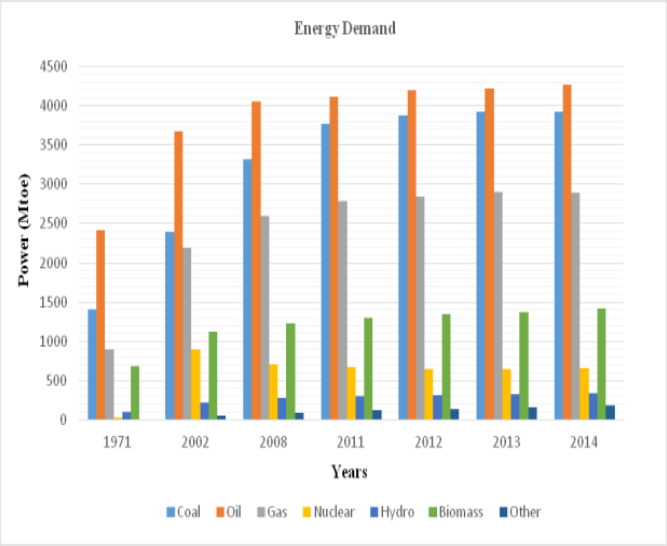

Figure1. Changing in world energy demand for the last decades [17, 18, 19, 13, 14, 15, 16]

Table 1. Energy demand of the last decades in the world [17, 18, 19, 13, 14, 15, 16]

Energy Production (Mtoe)							
Year	Coal	Oil	Gas	Nuclear	Hydro	Bio	Other
1971	1407	2413	892	29	104	687	4
2002	2389	3676	2190	892	224	1119	55
2008	3315	4059	2596	712	276	1225	89
2011	3773	4108	2787	674	300	1300	127
2012	3879	4194	2844	642	316	1344	142
2013	3929	4219	2901	646	326	1376	161
2014	3926	4266	2893	662	335	1421	181

In this paper, the production quantities of the world's energy systems over the years and the change in demand figures have been shown. In recent years, it has been attempted to explain to which energy systems the world give importance and why. They have been given up step by step. Energy production and demand distributions within the last ten years in major energy production regions around the world were examined in comparison with the numerical values for each energy system, and the energy systems selected by these regions.

2. Global Energy Resource

In order to meet the basic energy demands perfectly in next 40 years, besides identifying the targets, perfectly use of traditional energy sources (such as fossil and uranium) is also important. The restriction fixed them for the reasons of environmental policies [1].

2.1 Natural Gas Energy

Natural gas is a one of the fossil energy resource that can be found in nature reserves. Although it occurs in a similar way with oil, it differs from oil. This energy resource is supposed to play an important role in the progression of a cleaner and more flexible fossil energy system [20]. Natural gas chemical composition is a mixture of light hydrocarbons, generally alkanes, which are normally gaseous at room temperature. It is the cleanest and the least carbon-intensive natural energy resource. Methane (CH_4) is the most abundant gas, accounting for more than 85% of the natural gas. In addition to the other components of natural gas, they are light alkanes and hydrocarbon compounds such as ethane, propane, butane and others. Natural gas attracts the interest of many area (such as energy and environment). It contains a lot of methane that has been considered as an input in the production of other high value products (such as syngas and high purity hydrogen). Considering the environmental protection trend in the world, the usage of naturel gas is emphasized as a clean and sustainable energy generation. So, it can be said that the interest of researchers on natural gas will increase importantly in near future [21, 20]. In the last about 20 years, GHG emissions have been rising continuously. These emissions value have been steady about 32 billion tons of carbon dioxide (CO_2) equivalent and resulted due to fuel combustion ($GtCO_2$-eq) since 2014. Because combination of mix natural gas and renewable energy intensity and changing are low ratio, separate energy generation should be assessed. Decreasing in energy intensity equaling to 77 % of the impact on world emissions has been caused by global domestic product improvements since 2014. And, remaining ratio (23 %) is offset by changing fuel mix. As it can be understood from this, energy efficiency has a key role for steadying and reducing emissions [22]. For these reasons, not only positive environmental impact of natural gas has been considered but also the annual production of natural gas has been increased in some regions (Table 2).

Table 2. World natural gas production [17, 18, 19, 13, 14, 15, 16]

Some Years of Energy Production (BCM)							
Region	2000	2002	2008	2011	2012	2013	2014
North America	788	759	815	869	901	924	941
Europa	482	491	555	525	507	512	462
Asia Oceania	122	130	170	202	218	221	221
Eurasia	609	635	701	703	692	691	657
Asia	136	209	341	410	433	461	484
Middle East	201	219	335	399	404	420	441
Africa	53	69	100	111	120	119	131
Latin America	105	102	131	149	156	159	165
World	2527	2622	3149	3370	3432	3507	3502

2.2 Coal Energy

The usage of the coal utilized as a heating fuel for thousands of years has been increased after invention of steam machines in the 19th century. Even though environmental policies have been adopted in the energy sector today, it has become an indispensable energy source in many countries. Coal is one of the solid natural energy resource which is kind of fossil fuels. It has variety organic (Carbon) and inorganic (such as hydrogen and oxygen) materials in its structure [23, 24]. During geological ages, coal was formed like sedimentary rocks. And, quality of the coal was determined by geological activities, different chemical reactions and environmental conditions during those ages. In other words, these factors are very important for the heat generation capacity (energy) of coal [25, 23, 26]. Regarding these factors, two different kinds of coals emerge underground. First hard coal (Anthracite and Bituminous) which has high calorific value. Second, Brown coal (Sub-bituminous coal and Lignite) that has lower calorific value than hard coal [26].

Coal is the most controversial fuel for good reasons. On the one hand, it provides almost 30% of global primary energy, and it is the world's most popular fuel for generating electricity, producing steel and making cement. It is also relatively affordable and widely available. On the other hand, coal use is responsible for 45 % of energy-related CO_2 emissions, as well as over 40 % of SO_2, around 15% of NO_x and emissions of fine particulate matter. As a result, analysis on coal too often tends to be one sided; highlighting either the negative environmental consequences or its positive contributions to economic growth. It is critical that in order to understand the

important role that coal plays in the global energy system, we should examine both sides of the coin. That is, while we are thinking about the implications of climate policies on the future of coal, we should also take in to account what coal is doing and will continue to do for energy security, economic growth and energy access in developing and emerging economies. In recent years, coal has been seen as a dying industry as a result of a greater awareness about climate change as well as growing competition of other energy sources like natural gas or renewables. In the last few years, global coal demand has stalled. However, there was a notable change showing a 4% annual growth from 2000 to 2013. Therefore, it is too early to say that coal is dead. Sluggish economic growth and energy efficiency improvements are restraining the power demand around the world [27].

Combined with the deployment of wind and solar photovoltaic (PV), these global forces squeezes conventional generation -- including coal. At the same time, carbon prices and other policies make the gas increasingly attractive, particularly in the United States. In this environment defined by the United States and Western Europe, new coal power plants are rare and the existing fleet steadily disappear. But there is another picture to consider, that of emerging economies with growing populations and prospects of robust economic growth. Some of them are dealing with frequent blackouts. Others are unable to provide electric power for everyone. For these countries, (most of them are in South and Southeast Asia) coal can provide affordable and secure electricity. For instance, although more than one quarter of the world's population are living in India, Indonesia, Pakistan and Bangladesh, , they have only 7 % of total global electric usage, and a large part of their population have no access to electricity. These four countries possess significant coal reserves. New coal power generation capacity could lock-in large amount of CO_2 emissions for the next decades. Yet it could also help in bringing modern energy services to millions of people. This is the contradiction of coal. And this is why we need to find ways to make the use of coal more environmentally sustainable by ensuring that all countries decide to use coal-fired power plants only to build the latest ultra-supercritical technologies and plan for carbon capture and storage in the future [27]. Coal burning processes can cause various environmental problems. For instance, as a result of coal burning, GHG occurs. SO_x in the burning coal gas reacts with water vapor in order to form acid rain [28]. Combustion of coal causes air pollutant particulate matter. Because of these environmental problems, many developed countries, such as England and France, have given up energy generated from coal. Because accepted environmental considering is formed by many countries, nowadays coal production and energy generation from coal are gradually diminished in comparison to the past years in the world (Table 3).

2.3 Geothermal Energy

Geothermal energy can be defined as boiling water stored underground in rocks and RE resource. It is a sustainable source of energy generation. Geothermal energy has been used for heating, cooking, bathing and other works for a long time in human history [29, 30]. First of all, geothermal was used for energy generation in 1904. And, this year was managed to start new geothermal energy epoch in the Lardarello area in Tuscany [31, 30]. Hence, geothermal energy took place in energy market.

Table 3. World coal production [17, 18, 19 13, 14 15, 16]

Some Years of Energy Production							
Region	2000 (Mtoe)	2002 (Mt)	2008 (Mtce)	2011 (Mtce)	2012 (Mtce)	2013 (Mtce)	2014 (Mtce)
North America	579	1051	883	826	767	745	757
Europa	319	822	258	248	246	294	225
Asia Oceania	184	364	337	323	348	382	412
Eurasia	213	469	401	429	461	435	423
Asia	1153	1864	2717	3377	3538	3623	3549
Middle East	7	15	2	1	1	1	1
Africa	91	174	208	209	218	218	224
Latin America	23	30	79	85	88	85	88
World	2355	4791	4880	5497	5667	5723	5680

Very hot flow resources of geothermal energy occur as mantle and core activities in the earth. These flows are taken upward and outward from deep subsurface. They may contain radioactive materials (uranium and thorium etc.). But when precautions are taken, they are harmless for the environment. Geothermal energy systems cannot be affected by weather and climate. Principle of geothermal energy is independent from sun and other conditions [32, 1]. Heat, permeability and water content features of geothermal resource are important factors in order to establish geothermal power plants generating energy by using geothermal systems. The most important of these properties is heat value. For the commercial energy generation purposes, heat value must be at least about 149 ^oC (300 ^oF). While the temperature increases, energy generation also increases. [1]. Energy generation may be significant for investors if geothermal resource heat is above 300 ^oC. Yet, Energy generation may be insignificant for investors if geothermal resource heat is below 150 ^oC. Reason of this is that energy generation (kW/h) increases in direct proportion to the increase in temperature [1, 33]. Whole Earth geothermal resource provides 50000 times more energy than all oil and gas resource do, and geothermal energy systems will increasingly continue to develop [34, 35]. Energy generation from geothermal systems has many benefits. For example, it contributes to reducing the impact of global warming, stopping GHG releasing to atmosphere, decreasing the public health risks and getting energy independently from fossil energy resources [36, 37]. RE technologies can ideally provide energy demand without any problems. But, sometimes energy investors see many barriers and risks discouraging them to get into the sector. Governments of countries had better ensure a positive policy and regulatory environment for research, development and innovation, and they should provide activities needed to support the sector (installers, service companies, etc.). Successfully policy development

provides not only the ability to assess which technologies have an important potential for the demanded energy, but also economic, sustainable energy and non-pollution. [19, 38, 32, 37, 39].

Nowadays, geothermal power technology has been continuing to improve; in 2015, its energy generation capacity reached to 12.7 gigawatts (GW) and the generated electric was 80.9 terawatt-hours (TWh) all over the world. Costs of energy generated by geothermal power plants vary between 1870 USD and 5050 USD per kilowatt. Likewise, costs of electric generation in geothermal power plant vary between 0.04 USD to 0.14 USD per kilowatt-hour. This situations contribute to benefits for economic issues [40]. Electric generation from geothermal power is shown in Table 4.

Table 4. World geothermal energy exploiting [18, 19, 13, 14, 15, 16]

Consumptions Value	
Years	Electricity generation (TWh)
1990	36
2002	57
2008	65
2011	69
2012	70
2013	72
2014	77

2.4 Oil Energy

Oil is a fossil energy resource which has been used since engine technology was invented in 19th century. Due to the development of engine technology and the advanced industrial activities (such as motor vehicle industry), importance of oil energy has boomed around the world. Depending on industrialization conditions, global oil companies have established and they have started to manage most of the energy market. Then, Complex oil transport systems have been established around the world for oil energy supply and oil companies and petroleum producing countries have gotten a great advantage for their economies [41]. Therefore, oil has taken part in the modern world. Oil has an important role in the modern world economy. It constitutes greatest energy trades of world. Approximately 33% of the world transportations depends on oil. Oil mainly provides cheap transportation goods and logistic to our world economies [41]. Oil demands have boomed three times in history. First, there was a great demand between 1859 and 1911; that period was called as Kerosene Era. Rapid industrialization and the need for raw materials caused an increase in demand in this period. Second period was named OPEC (Texas) Era (1973-2008). OPEC was established in 1960. And, the oil market grew more in this era. The global oil companies in central Texas wanted to erode price stability. In order to keep prices stable at high levels, oil regulators and global oil companies realized oil quotas, oil pooling arrangements, oil price formulas and market share agreements. Last era is called Bust Era (2009-). When OPEC members met in September 2008, they stated that the price of crude oil was dropped from $ 147 to $ 106 per barrel. But it has been never fulfilled. This incident caused disagreements among many OPEC members [42]. Primarily oil, coal and natural gas have been kept going as main energy resources. When fossil energy sources are compared to RE sources and nuclear energy resources, energy experts estimate that they will provide about 50 % of world energy source. Because of non-combusted transportation, oil demand rates have decreased step by step (Table 5). Yet, World oil demand continues to increase. And, world oil demand rating is not seen to be decline in the next years. [43, 16, 15, 14, 44, 45, 46, 47].

Oil energy has notable debate and disagreement on the estimates of ultimate recoverable. In addition, it is appeared as a good compromise on the amount of oil reserves in the world energy sector. However, concerns on the issues, such as GHG, global warming, climate change, air quality, and other environmental factors, affects the demand and generation of oil negatively. Some expert said that environmental changing (climate, air and water) will be inevitable in the future. But, eco-friendly activities have been made (production electrical cars, hybrid energy systems development and trending green energy-such as solar and wind systems- etc.). These activities are partially successful. The exploiting of oil will have been continued about the next two decades [43, 41, 48, 49, 42, 50, 51].

Table 5. World oil energy source demand (mb/d) [52, 19, 14, 15, 16]

Region	1990	2000	2013	2014	2015
North America	19.4	23.1	21.9	21.9	21.8
Europa	12.6	13.9	12.7	12	11.5
Asia Oceania	6.9	8.0	7.0	7.7	7.3
Eurasia	9.3	4.1	4.6	4.9	4.9
Asia	6.3	11.4	16.3	19.7	20.8
Middle East	2.8	4.3	6.5	7.6	7.6
Africa	1.9	2.2	3.0	3.6	3.7
Latin America	3.1	4.2	5.3	5.7	5.9
World	66.1	76.7	84.0	90.1	90.6

2.5 Nuclear Energy

New energy era has been launched for nuclear energy systems due to arising the GHG emissions from the use of fossil energy systems, sustainable energy planning and the concern about the reduction of fossil energy resources [53, 54, 55]. Nuclear energy, which was first noticed in the 1930s and 1940s, is a sustainable system. In those times, it was demonstrated that a large amount of energy could be obtained from a little material. Energy emerges from the nuclear energy materials as a result of fission and fusion reactions. These reactions are endless in the atom. So, limited energy resources are not problem. Nuclear energy systems are based on atomic fusion process due to more available enormous energy [56, 57]. Nuclear energy policies contribute to economic growth and reducing the dependency to the foreign countries energy resources [58].

Nuclear energy has a major role in decreasing GHG emissions in energy sector. Resource investment and energy marginal production costs of nuclear energy systems are lower than other energy systems (natural gas and oil etc.). In addition, structure of nuclear energy cost is also stable. But Nuclear power plant investment cost is high. [54, 59, 60]. Nuclear energy systems may carry out some risks on environmental and public health. Almost all of the environment experts suggested that the possibility of a nuclear leak is high as a result of occurrence of an accident danger and malfunction or nuclear disaster under certain situations of production energy. Then, some amounts of radioactivity materials (Airborne radioactivity particle) and harmful radiation rays can release the environmental and public area. They may be carried by air movements far away. And then, they can cause a variety of chronic diseases on humans and devastation for nature [61, 56, 62]. Nuclear energy policies was greatly affected in 2011. The TEPCO Fukushima Daiichi nuclear power plant experienced a huge nuclear accident in March 2011. This accident was elaborated. Then, this event caused to modification of nuclear energy policies almost all over the world. [53, 54]. The idea of continuing electricity generation from green fossil energy was put forward. U.S.A. launched new nuclear programs which are safer and measured cautious. Germany shut down some nuclear plants and others brought new plan. As a result, electric/power generation from nuclear energy systems has been significantly changed after 2011. (Table 6) [63, 56].

Table 6. World nuclear energy demand [17, 18, 64, 65, 66, 19, 13, 14, 15, 16]

Years	Energy Demand Value (Mtoe)
1971	29
1990	526
2000	674
2002	692
2004	714
2007	709
2008	712
2011	674
2012	642
2013	646
2014	662

2.6 Hydro Power Energy

Hydro Power is a RE system in which, energy generation is done by movement of water. To reduce GHG in the atmosphere and to provide green energy, this energy system has been used like other RE systems. Although quality and quantity of hydro energy systems are directly affected by climate change-conditions and rely on water flow, hydro energy systems will have been drastic energy systems [67, 68, 69].

Hydro energy systems presents some advantages such as high reliability, proven technology, high efficiency, flexibility, large storage capacity, very low operating and maintenance costs [70]. Because of these advantages, these energy systems has widespread worldwide and the usage of it has continued to increase in the global energy market recent years (Table 7). About 16 % of generated electric energy is gotten from hydro energy systems. Some countries produce a large part of their electricity energy needs through hydro power energy systems. For example, 99 % of electric energy of Norway, 84 % of electric energy of Brazil and 58 % of electric energy of Canada are obtained from hydro energy systems [71].

Table 7. World hydro power energy demand [17, 18, 64, 65, 66, 19, 13, 14, 15, 16]

Years	Energy Demand Value (Mtoe)
1971	104
1990	184
2000	228
2002	224
2004	242
2007	265
2008	276
2011	300
2012	316
2013	326
2014	335

2.7 Wind Power Energy

Wind power system first started in the early 1900s in North America. This early system was important in farms for supplying required electric during works. [72]. After World War II, improvement of wind energy systems occurred due to research and developments focusing on wind energy systems in most of Europa. Therefore, wind energy has taken part in RE worldwide [73]. The global warming is a big environmental problem for the whole world. In the 21st century, global temperature has increased approximately 2 ^{o}C. It is thought that the main reason of this is greenhouse gasses (GHG) originating from fossil energy systems. [74, 75]. In order to manage environmental costs, global use of a RE systems having technical, economical and environmental advantages must become widespread. This can be achieved by using wind energy systems. Many countries aim to improve wind energy systems so that it will became a main energy system in 2050. Thus, wind energy systems will be a significant key in energy planning in the future [75, 76]. As a result of developing society and advanced technology, energy demand topics have gained importance in new strategic planning. Many countries trends to focus on new green energy systems. Wind energy system is one of these new green energy systems. Whereas wind energy carries out environmental noise, relying on wind features (wind speed continuity optimum-wind speed 10 m/s, number of blows), it may also cause possible fatalities of birds, bats, and etc. Especially it is preferred by developed countries. In these

countries, using of wind systems has increased in the last years (Table 8) because it is non-polluting, does not have negative effect on global warming and is widely used in many regions. [77, 78, 79, 80, 73].

Table 8. World wind power energy demand [17, 18, 64, 65, 66, 19, 13, 14, 15, 16]

Years	Energy Demand Value (TWh)
1990	4
2000	31
2002	48
2004	77
2007	173
2008	219
2011	434
2012	521
2013	635
2014	717

2.8 Solar Energy

Buildings and other structures require eco-friendly, low cost and sustainable energy systems for heating, cooling and other needs requiring electricity. It is determined that the most suitable of these energy systems is solar energy system. Sun rays supplies almost all of the world's energy and the energy of the sun rays in a year is more than other systems (fossil and wind etc.) have. Sun is the most powerful energy resource for world. It can be called as an infinite energy source [81, 82, 83]. A first solar cell was invented in 1954. That was made of silicon. It was a turning point for solar energy systems [84]. Solar energy system has gained importance step by step because of the increase in electricity energy prices, national policy factors and fluctuations in oil prices. Although solar energy systems are installed in nature, cities and towns, its installation cost is high. However, depending on daylight, it energy costs have declined significantly compared with many other energy systems [85, 86, 87]. There are large-scale installed solar power systems in about 60 countries. And this number is estimated to increase in other countries. [88, 89, 90]. Using of solar energy systems continue to rise worldwide (Table 9).

Table 9. World solar energy demand [65, 66, 19, 13, 14, 15, 16]

Years	Energy Demand Value (TWh)
1990	0
2004	2
2007	5
2008	12
2011	61
2012	97
2013	139
2014	190

2.9 Biomass Energy

Once, biomass was one of the major energy resources like sunshine worldwide. During the industrial revolution, coal and oil were very necessary energy resource. Then, due to sustainable energy policies and other reasons (economical and environmental etc.), new energy systems have become as interest area. One of these new energy systems is nuclear. Due to emerging the Three Mile Island incident In U.S., nuclear energy have begun to look objectionable. Then, energy policies have focused on RE systems. After many debates about energy, removing the carbon tax from energy companies producing fossil energy was accepted. Hence, this issue has been a milestone for the use of biomass energy systems [91].

Biomass energy is supplied from organic materials which remain (decomposing and organic waste) from animals or plants, and then, biomass energy resource occur. [92, 93]. Bio materials (crop, herbaceous, woody, and waste materials etc.) that are the source of the biomass energy system are much more beneficial than fossil energy resources. It is one of the primary, domestic, clean and inexhaustible energy systems. It has a unique structure different from coal and oil. Biomass energy combustion systems are non-polluting and they contribute to protection of the environment and have increased world demand (Table 10) [94, 95, 93]. But they can cause dust pollution [96].

Table 10. World biomass energy demand [65, 66, 19, 13, 14, 15, 16]

Years	Energy Demand Value (Mtoe)
1990	905
2004	1176
2007	1176
2008	1225
2011	1300
2012	1344
2013	1376
2014	1421

3. Conclusions

The energy sector is significantly influenced by political, economical, social and environmental factors. Such as global warming, air pollutions, fluctuations of energy prices (especially in oil), global economic sector (energy bourse), national economic and energy resource situations, international and national industrial and eco-friendly policies, social planning stemming from emerge power plant accident (nuclear energy), and other issues relying on some energy system (oil, natural gas and coal) lead the global energy systems.

Although oil is considered as the most harmful energy source to environment (air, water and climate etc.), due to all types of transport systems requiring nearly half of the energy consumed in the world and the dependence of

industries and activities of developing countries, global oil market demand rates have continued to increase for a long time. It is also estimated that it will continue to increase about next two decades. But the situation in nuclear energy is very different. Nuclear accident, radioactive leaks, nuclear danger and risk factors have directly affected generation of energy from nuclear systems.

RE (wind, solar, geothermal, hydro, biomass, etc.) are attractive systems because of their sustainability, non-polluting features and lower cost. Most of countries encourage energy investors to install renewable systems. For this reason, RE demand values continue to grow in large quantities.

Coal energy used for thousands of years is an indispensable system for some countries although some other countries have given it up due to some reasons such as GHG emissions of coal mining which is harmful to workers. Needed energy from coal has been changing for years.

In conclusions, Energy systems are important issue worldwide. No country and corporations can exist without energy. Whatever the obstacles to energy systems are, for development, they will leave their place to someone else which fills their time.

Nomenclature

Mtoe : Million ton oil equivalent
BCM : Billion cubic meters
Mtce : Metric tons carbon equivalent
Mt : Megatons
TWh : Terawatt Hour

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