

Energy Sector Overview and Future Prediction for Turkey

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Abstract: Energy is the most important area of the whole industrial sector. Within the three sector theory, every three sector uses energy. For any country, energy supply and consumption has a kind of equilibrium. Turkey, is energy importer country. So, under the fact that, Turkey has many alternative sources to be able to produce its own energy. From coal to thermal and renewable energy. This study, includes a literature review. This study makes a research on the energy as a market from different annual reports and conclude some advices for Turkey.

Keywords: Renewable Energy, Energy Markets, Energy Consumption

1. Introduction

Today, rapid population growth ranks first among the main topics affecting life and sustainability. In the reports prepared by many institutions such as the United Nations (UN) and the World Health Organization (WHO), it is predicted that the world population, which is around 7.7 billion today, will reach about 10 billion in 2050 (UN, 2018). Again, according to the estimates of the United Nations Economic and Social Affairs Office, it is estimated that 2.5 billion more people will be added to the urban population by 2050, thus 68 percent of the world's population will live in the cities (UN, Report of the International Civil Service Commission for the year 2017, 2017). It is stated in the reports that there were only ten mega cities with a population of over 10 million in 1990, and the number of mega cities will reach 43 by 2030 (WHO, 2017). It could be stated that, as a result of all these forecasts, this rapid population growth and urbanization that will be experienced in the next 30 years will increase the consumption of limited resources, and will cause a rapid increase in energy needs throughout the world.

Not just fast population growth! Developing technology and industrialization, the automation industry, the use of robotic technologies in the field of production, increase the energy need day by day in all these sectors, whose input is energy, which makes uninterrupted, cheap, reliable and clean (green) energy resources and the need for use inevitable.

According to the data in the 2018 Energy Outlook Report prepared by the International Energy Agency (IEA), 40% of the world's energy demand was in Europe and North America and 20% was developing economies in Asia, and this was the case in 2040. It is predicted that it will reverse. The ranking of world energy consumption in Turkey is on the rank of 19th, (IEA, 2017), while production of energy in 17th (2015). (IEA, The Future of Petrochemicals, 2018)

While the energy sector in our country has been maintained with a limited number of energy sources such as wood, coal, oil and electricity until the 1950s, from the past to the present, it is also possible to use different energy types such as hydroelectricity, geothermal, natural gas, alternative energy sources (solar, wind, etc.). it was used to benefit. As a result of all these developments, we can say that our country's energy sector and our strategies progress simultaneously with increasing needs, economic, environmental and technological developments.

In the light of all these developments, the legislations and standardization studies in the world energy markets have been regulated by the energy market of Turkey's under the construction of the Energy Markets Regulatory Authority in Turkey. All these studies, carried out in harmony with the European Union and global energy markets, continue to encourage sustainable and sustainable policies for investment, production and development activities in our country in all areas of the energy sector (electricity, gas, transmission, distribution, etc.).

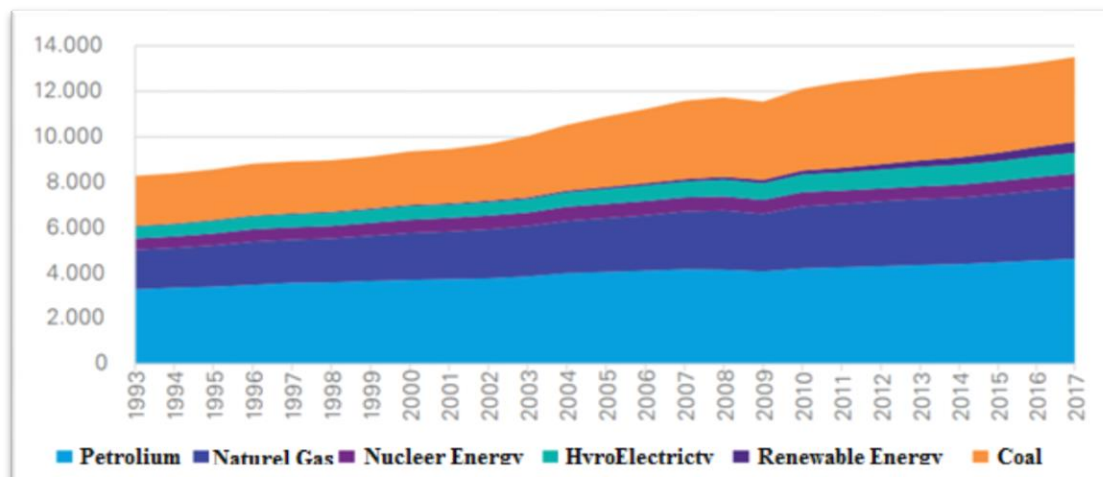


Figure 1. Energy Consumption of the World (BP, 2018)

Country	2013	2014	2015	Percentage (%)	rank
Çin	2.903,9	2.970,3	3.014,0	22,9%	1
ABD	2.271,7	2.300,5	2.280,6	17,3%	2
Hindistan	626,0	666,2	700,5	5,3%	3
Rusya	688,0	689,8	666,8	5,1%	4
Japonya	465,8	453,9	448,5	3,4%	5
Kanada	335,0	335,5	329,9	2,5%	6
Almanya	325,8	311,9	320,6	2,4%	7
Brezilya	290,0	297,6	292,8	2,2%	8
Güney Kore	270,9	273,1	276,9	2,1%	9
İran	247,6	260,8	267,2	2,0%	10
Suudi Arabistan	237,4	252,4	264,0	2,0%	11
Fransa	247,4	237,5	239,0	1,8%	12
Endonezya	175,0	188,3	195,6	1,5%	13
Birleşik Krallık	201,4	188,9	191,2	1,5%	14
Meksika	188,9	190,0	185,0	1,4%	15
İtalya	155,7	146,8	151,7	1,2%	16
İspanya	134,2	132,1	134,4	1,0%	17
Avustralya	130,7	129,9	131,4	1,0%	18
Türkiye	120,3	123,9	126,9	1%	19
Tayland	120,3	123,4	124,9	0,9%	20
Güney Afrika	124,6	128,0	124,2	0,9%	21
Tayvan	109,9	111,4	110,7	0,8%	22
BAE	97,2	99,0	103,9	0,8%	23
Polonya	96,0	92,4	95,0	0,7%	24
Ukrayna	114,7	101,0	85,1	0,6%	25
Total:	12.873,1	13.020,6	13.147,3	100,0%	

Figure 2. Country Based Yearly Energy Consumption, (BP, 2018)

Country	Consumption Amount TWh	Percentage, %	Rank
Çin	5.810,6	24,1%	1
ABD	4.303,0	17,9%	2
Hindistan	1.304,8	5,4%	3
Rusya	1.063,4	4,4%	4
Japonya	1.035,5	4,3%	5
Almanya	647,1	2,7%	6
Kanada	633,3	2,6%	7
Brezilya	579,8	2,4%	8
Fransa	568,8	2,4%	9
Güney Kore	522,3	2,2%	10
Birleşik Krallık	337,7	1,4%	11
Suudi Arabistan	328,1	1,4%	12
Meksika	306,7	1,3%	13
İran	281,9	1,2%	14
İtalya	281,8	1,2%	15
İspanya	278,5	1,2%	16
Türkiye	261,8	1,1%	17
Tayvan	258,0	1,1%	18
Avustralya	253,6	1,1%	19
Güney Afrika	249,7	1,0%	20
Endonezya	234,7	1,0%	21
Mısır	180,6	0,7%	22
Total of the World	24.097,7	100%	

Figure 3. Total Energy Consumption in Amount (BP,2018)

Table 1. Installation Power of Turkey Energy Sources (IEA, 2019)

Primary Source	Installation Power (MW) (28 Feb, 2019)
Natural Gas	25.623,80
Dam Production Facilities	20.538,00
Lignite Coal	9.842,00
Imported Coal	8.938,90
Streams, Rivers	7.839,10
Wind Power	7,031.10
Sun Power	5.238,80
Geothermal Energy Sources	1.302,50
Others (PitCoal, BioMass, WasteHeat etc)	Less than 1.000 each
TOTAL:	89.046,90

2. Sektörel Approaches

Increasing energy needs around the world made it inevitable for countries to create new energy resources with their own possibilities and opportunities. Turkey to meet its' energy needs as the negative impact of large current account deficit and the use of national facilities for the reduction of external dependence, there is continuous between the public and private sectors to promote the main agenda of cooperation. In all these processes, it brings threats and opportunities in the energy sector (InvestGovTr, 2019), (TSKB, 2018).

When we evaluate the size of the sector globally, according to the reports prepared by the International Energy Agency, it is estimated that a total of 42.2 trillion dollars will be invested in the energy sector by 2035. It is planned to allocate 17 trillion dollars to electricity, 9.4 trillion dollars to oil, 8.5 trillion dollars to gas sector, 0.8 trillion dollars to coal sector and 6.5 trillion dollars to renewable energy sector (IEA, The Future of Petrochemicals, 2018).

In Turkey, especially the developing economy in the last 10 years, approximately 100 billion USD investment has been made by the private sector in the production, transmission, distribution and retail sales areas of the electricity sector to meet the increasing energy demand with the industrial investments made. 70 billion USD of these investments were used for the construction of new production facilities and 30 billion USD for privatization and new network investments. While it is envisaged to invest between 225 and 280 billion USD for the energy sector in our country between 2010 and 2030, it is anticipated that approximately 80% of this will be machinery and equipment investments and will be covered by imports in these investments (IEA, Energy Technology Perspectives , 2017).

2.1. Elektriciry Market

While the public and private sector investments continue uninterruptedly in order to meet the increasing electricity need of our country every year, there has been a significant increase in the total installed power of our country and consequently in the production of electricity. Looking at the last 30 years, the installed power, which was below 10,000MW in the 1980s, reached 88,550MW as of the end of 2018. With the increase in the incentives given to infrastructure and enterprises producing electricity from renewable energy sources and domestic sources, the increase in the total installed power of the country continues day by day. However, as the fluctuating course in domestic electricity production and insufficient production capacity cannot meet the total demand, import obligation still continues (TeiasGovTr, 2018).

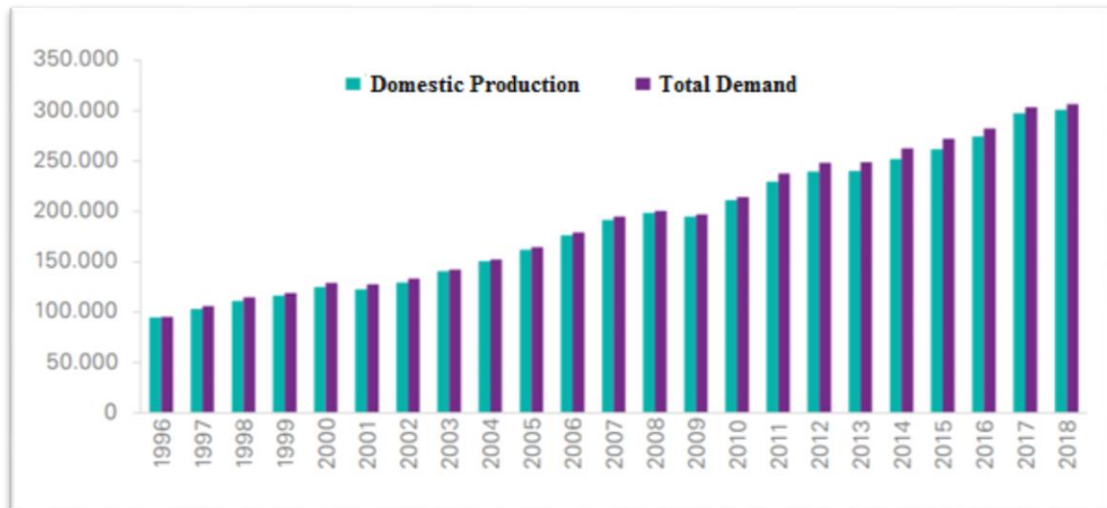


Figure 4. Domestic Electricity Production and Total Demand, (TEİAŞ, 2018)

2.2. Natural Gas Market

Turkey's natural gas consumption; the population is growing in direct proportion to industrialization and urbanization. Although this rate is Turkey's natural gas production rate is usually less than 2% of consumption in 2017 was realized as 0.66%. Natural gas production, which was around 969 million m³ in 2008, decreased to 354 million m³ in 2017. In other words, in Turkey's natural gas import dependency ratio increased to 99.44%. (Epias.Com.Tr, 2019)

2.2.1. Production

Although the countries with the highest natural gas reserves around Turkey does not meet even 1% of the annual consumption of about 18.5 billion m³ of reserves and low production. The production amount, which tended to decrease continuously after the production of 969 million m³ in 2008, was realized as 354 million m³ in 2017. (Epias.Com.Tr, 2019)

2.2.2. Consumption

Consumption in the energy sector, mainly in petroleum refineries, has increased by 6% compared to 2016, and consumption in the industrial sector has been close to 13.4 billion m³. The largest increase in industrial consumption was in the iron and steel industry with 18%, and the total amount of natural gas consumed in 2017 is over 1.5 billion m³. The natural gas consumed in houses was 13.5 billion m³ and increased by 15.5% compared to the previous year. In 2017, 55.25 billion m³ of imports were made and the amount of imports increased by 19.2% compared to the previous year. The difference between the amount of imports and consumption is the increase in the amount of storage.

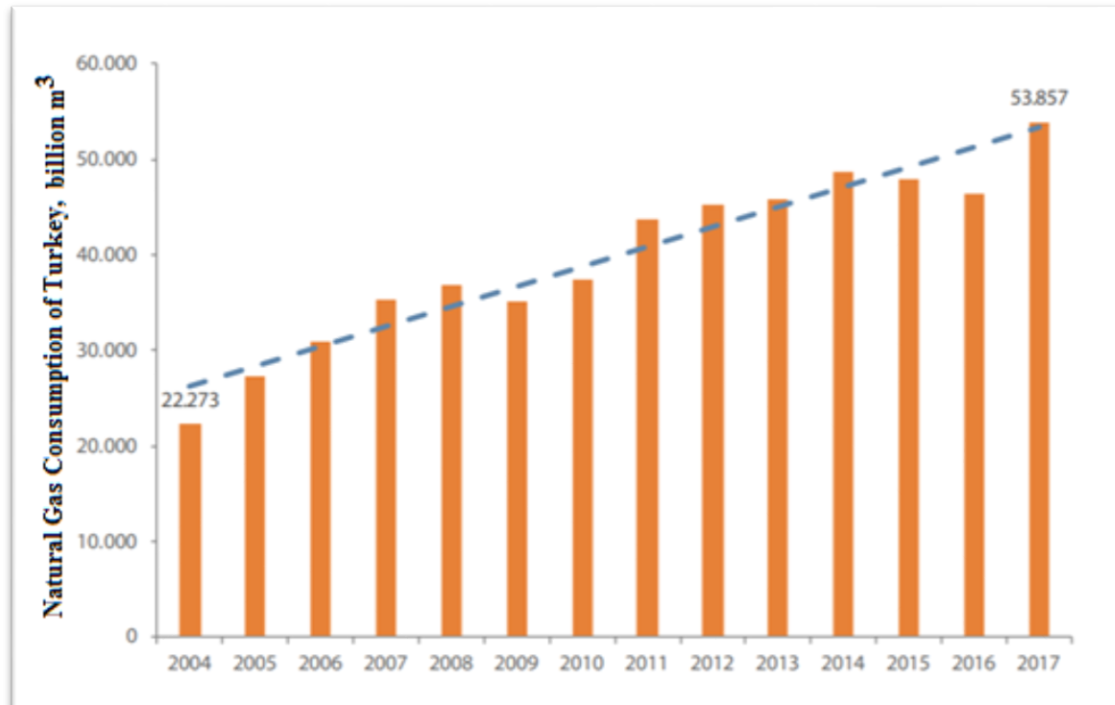


Figure 5. Turkey's Natural Gas Consumption (KPMG, 2019)

2.3. Petroleum Market

From the past to the present, oil remains the most important energy source among all other energy types, and it is estimated that it will retain it for longer years. On the other hand, the scarcity of oil resources and the fact that it is located in certain regions of the world increases the importance of oil, and occasionally faces countries that do not have this energy source with important energy problems. Our country is one of the countries with limited oil resources. Looking at the current situation, the oil reserve, which has been determined as a result of searches carried out by various domestic and foreign organizations, seems far from meeting the present and future needs of our country (TMMOB, Elektrik Mühendisleri Odası Enerji İstatistikleri, 2017).

As of 2017, the oil reserves that can be produced in our country have been recorded as 324 million barrels. In the absence of new discoveries and oil resources, the remaining productive crude oil reserve has a lifetime of about 18 years, given the current production amount.

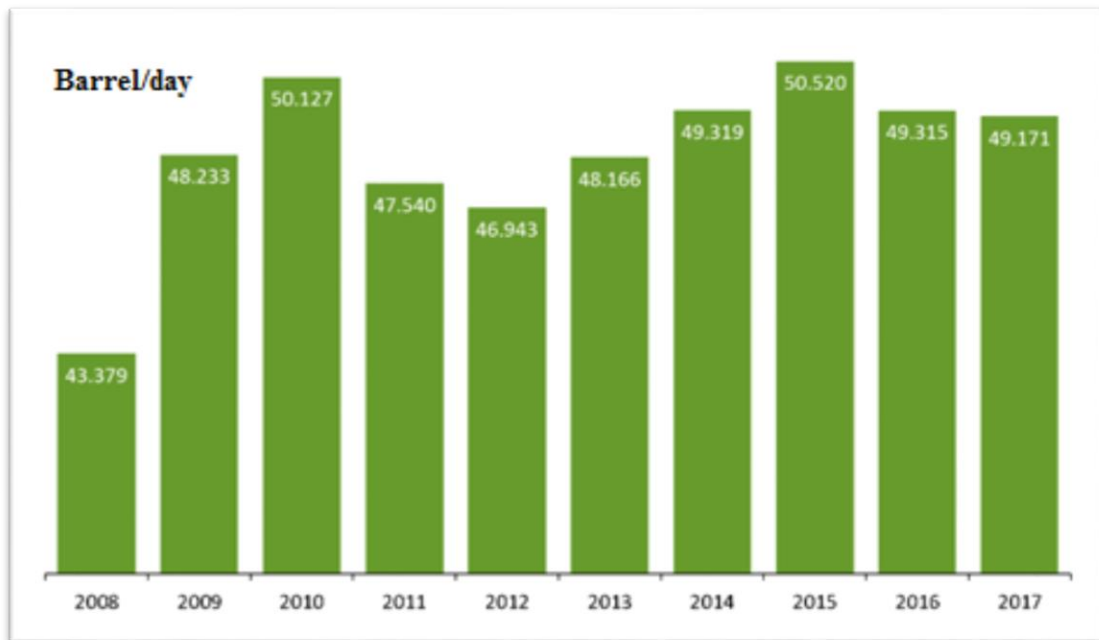


Figure 6. Turkey's Oil Production, (TPAO, 2018)

7% of the oil fields in Turkey, reserve is greater than 25 million barrels of reserves remaining 93% is less than 25 million barrels. In other words, 93% of undiscovered oil fields in Turkey small pitch, pitch range is medium-sized and 7%. We do not have a

site with a reserve of more than 500 million barrels in the large field class. The vast majority of the sites are older sites, and therefore well yields are gradually decreasing. In this context, production increasing techniques applied in the fields are of great importance for the efficiency of wells.

Turkey in 2017, 17.9 million barrels of oil (49 171 b / d) were produced. Again in 2017, an average of 49 thousand b / d crude oil was produced daily. however, 550 thousand b / d of crude oil was consumed; Crude oil imports were realized at 517 thousand b / d, and processed products were imported at 339 thousand b / d. In 2017, the ratio of domestic crude oil production to total consumption was 5.4%.

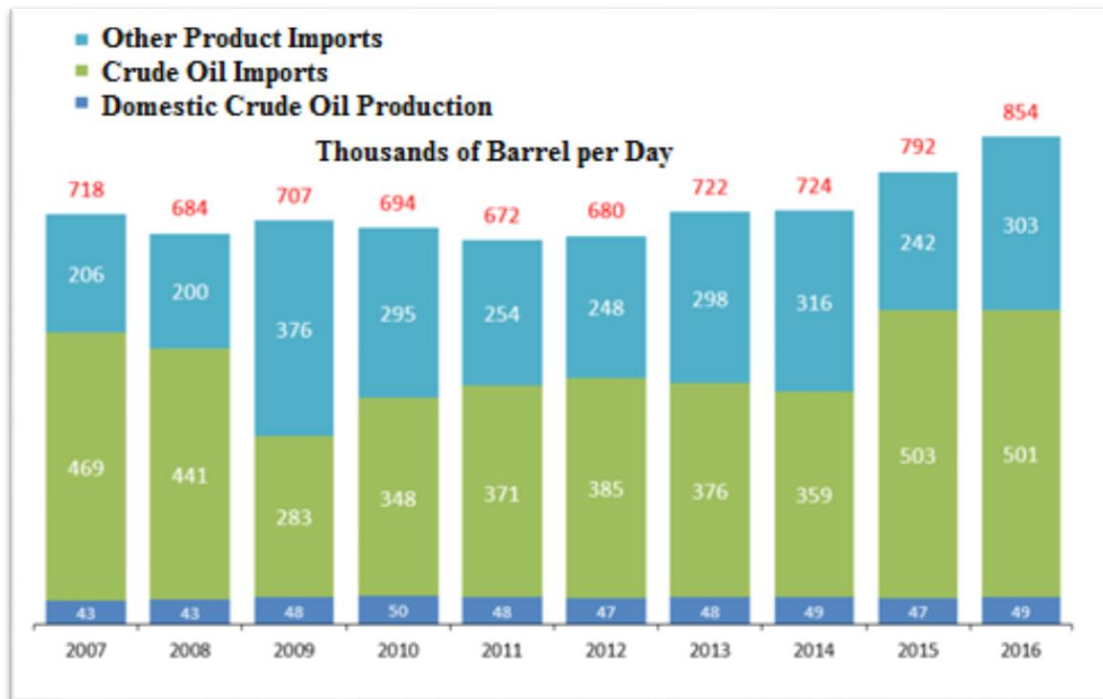


Figure 7. Turkey's Oil Consumption, (TPAO, 2018)

3. Future of the Energy Markets and Conclusion

Approximately 50% of energy consumption in the world is used in industry, industrial production and related sectors, 30% in residential and living areas such as buildings, houses, and 20% in the transportation and logistics sector. The ratio is almost the same for Turkey: 45% in industry, 25% in residential and lightings, 30% in service sector (Eroğlu, 2019). The ongoing technology, the effects of carbon footprint and carbon emissions, the transition from fossil fuel energy sources to alternative energy

sources, electric vehicles, low emission zones (Low Emission Zone) that are becoming widespread all over the world, especially in Europe, and ongoing emission zones (Zero Emission). Standards and regulations show that it will bring many different opportunities in the energy sector in the coming years (Eroğlu, 2019).

While the smart grid (Smart Grid) solutions in the transmission and distribution headings, which are one of the most fundamental subjects of the energy sector, create new opportunities in every field of the industry, the need for end-to-end solutions (from Production to End user) will keep continuous renewal and the market in the sector attractive. All new technologies and solutions such as big data, blockchain, internet of things, artificial intelligence, deep learning, which are trending today for effective, efficient and sustainable energy management will take place in different areas of the industry (TMMOB, 2014). Especially applications such as energy consumption measurement, pricing policies, loss leakage control, smart measurement technologies (Smart Metering), Remote control and remote reading solutions (OSOS–Automatic meter reading system), precise measurement, intervention, (smart digital meters, ultrasonic measurement systems) systems will be among the active solutions in this sector (PwC, 2018).

All these developments will enable the transition to a more efficient and sustainable energy management with the increasing population and urbanization and energy demand, as well as the regulation, developing technology and infrastructure, innovative applications to be realized in the sector. With the developments and improvements provided in the past 20 years, 2% initial growth in energy demand is estimated to be 1.3% annual growth over the next 20 years, indicating that the sector will be continuously supported by innovative systems and products, and investments and incentives will continue (Eroğlu, 2019).

In the next 10 years, especially the use of alternative energy sources will depend on the solar, wind, etc. It shows that it will bring important developments in the fields of energy production industry. According to the estimations in the international energy sector reports, the EU will consume the same energy as in 1975 by 2040, but it is predicted that the GNP will be exactly 3 times of 1975. In addition, by 2040, 40% of EU energy demand will be from non-fossil fuels. Accordingly, the use and development of energy efficient solutions in all areas from transportation, household goods, production to consumption will continue.

It is estimated that there will be 2 billion passenger cars in the world in 2040, with the developing electric vehicle industry, 300 million of this number is expected to be electric vehicles. The sign that there will be a balanced growth in many different areas with energy efficiency in this change. The developing electric vehicle industry will provide the creation of sectoral areas such as electric charging stations, the development of the battery and battery industry with high storage capacity, the dissemination of energy sources supported by alternative energy, mobile payment technologies and dozens of new systems and products (WorldEnergyCouncil, 2006).

We can say that the future will be mainly on electrification throughout the energy sector. About 65% of the growth in energy is directed towards electricity. In electricity, the transition from traditional methods to alternative energy sources continues effectively and decisively. Renewable energy production, which is around 8% in general production today, will be around 25% in 2040, while coal will decrease to 30% in electricity generation, while it will be 20% in natural gas sourced production (ETKB, 2017).

As a result, while the need for global energy consumption continues to increase, we will be able to do cleaner and more jobs with less energy use through developments in the energy sector and technology. The diversity in energy resources will continue to increase in the coming years. The increase in energy production and consumption will continue to increase the importance of alternative clean energy sources and zero emission consumption to reduce the carbon footprint and minimize environmental impact. Under the energy sector, it will be possible to find a place for information and opportunities in all areas of the industry, from information technologies to infrastructure.

Finally, there is an opportunity to calculate an approach regarding where to reach energy consumption with artificial intelligence and nerve endings network. As a proposal, it is possible to make a forward-looking estimation with a series of post-data control and realized data if all the inputs and database are created (Sati, 2016).

According to Turkish Statistical Foundation (TÜİK) it has been in increase on renewable energy production during last decades. It has been rising up to the 12 % of the total electricity consumption from 1-2 % in the beginning of the 21st century. (TUIK, 2018) So this implies that, Turkey has to continue to produce on renewable energy beyond increasing its productivity. It is necessary because its foreign trade deficit occupies

mostly energy. Since, Turkey is not supplier but consumer and transporter of every kind of energy.

References

- Epias.Com.Tr. (2019). *Natural Gas Market*. March 2020 tarihinde Enerji Piyasaları A.Ş.: <https://www.epias.com.tr/en/spot-natural-gas-market/natural-gas-market-reports/> adresinden alındı
- Eroğlu, M. (2019). *Enerji Hukuku*. İstanbul: BAU.
- ETKB. (2017). *Enerji ve Tabii Kaynaklar Görünümü 2017*. Ankara: TC Enerji ve Tabii kaynaklar bakanlığı .
- IEA. (2017). *Energy Technology Perspectives* . International Energy Agency.
- IEA. (2018). *The Future of Petrochemicals*. International Energy Agency.
- InvestGovTr. (2019, August). *Invest In Turkey*. March 2020 tarihinde Invest In Turkey: <https://www.invest.gov.tr/en/news/newsletters/lists/investnewsletter/investment-office-aug-2019-newsletter.pdf> adresinden alındı
- KPMG. (2019). *Sektörel Bakış*. Ankara: KPMG.
- PwC. (2018). *Türkiye'nin Enerji Sektöründeki Birleşme ve Satın Alınmalar Raporu*. İstanbul: PwC.
- Sati, N. U. (2016). Predictions of Students' Success in Mathematics by a Classification Technique via Polyhedral Conic Functions. *The Eurasia Proceedings of Educational and Social Sciences*, 190–195.
- TeiasGovTr. (2018). *TEİAŞ*. March 2020 tarihinde Yıllar İtibariyle Türkiye Kurulu Gücünün Üretici Kuruluşlara Dağılımı (2006–2018): <https://www.teias.gov.tr/tr-TR/turkiye-elektrik-uretim-iletim-istatistikleri> adresinden alındı
- TEİAŞ. (2018). *Türkiye Elektrik İletimi Sektör Raporu*. Ankara: Türkiye Elektrik İletimi AŞ. Genel Müdürlüğü.
- TMMOB. (2014). *Türkiye'nin Enerji Görünümü*. İstanbul: Makina Mühendisleri Odası.
- TMMOB. (2017). *Elektrik Mühendisleri Odası Enerji İstatistikleri*. İstanbul: TMMOB.
- TPAO. (2018). *Türk Petrolleri Anonim Ortaklığı Yıllık Rapor*. Ankara: TPAO.
- TSKB. (2018). *Türkiye Sanayi ve Kalkınma Bankası Sektörel Görünüm Enerji*. Ankara: TSKB.
- TUIK. (2018). *Electric Consumption*. Ankara: Türkiye İstatistik Kurumu.
- UN. (2017). *Report of the International Civil Service Commission for the year 2017*. United Nations.
- UN. (2018). *United Nations*. 2020 tarihinde Daily News: <https://research.un.org/en/docs/journals> adresinden alındı
- WHO. (2017). *Global programme to eliminate lymphatic filariasis: progress report, 2016*. World Health Organization.
- WorldEnergyCouncil. (2006). *Dünya ve Türkiye Enerji İstatistikleri*. Ankara: Turkish National Committee.