



Energy overview of Turkey

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Abstract

This study is aimed to assess the dynamics, developments and expectations in the energy sector. It analyzes the global and Turkey energy dynamics and the other factors of energy sector on the basis of the selected main items. Following chapters address the macroeconomic developments in Turkey and providing an overview of the Turkish energy sector. This analyze report respectively focus into the sub-sectors of electriccity, natural gas, oil, coal, nuclear and renewable energy. At the end of the report offers a conclusions in light of the result of the analysis and findings, more over to the conclusion short term expectations.

Keywords: renewable energy, coal energy, wind energy, solar energy.

1. Macroeconomic overview of Turkey

According to current Gross Domestic Product (GDP) of 2018, Turkey ranks as the 18th largest economy in the World and 7th in Europe. Turkey is one of the fastest growing economies among Europe and OECD member countries. After a decrease during the 2009 global economic crisis, Turkish economy bounced back with strong growth rates and than settled into a more sustainable pace of 4.1% in 2013, 2.9% in 2014 and 4.0% in 2015 in real TL terms. Gross domestic product (GDP) grew by 5.2% year-on-year in the

second quarter of 2018. It was rising beyond expectation in the first quarter of the year, GDP growth decreased to 6.2% by the end of first half. The economic growth decrease started from end of 2017 and still continue on some sectors. The economists are expecting to start to grow in the first quarter of 2020. Below economic parameters are the key point for following the future of the Turkish economy.

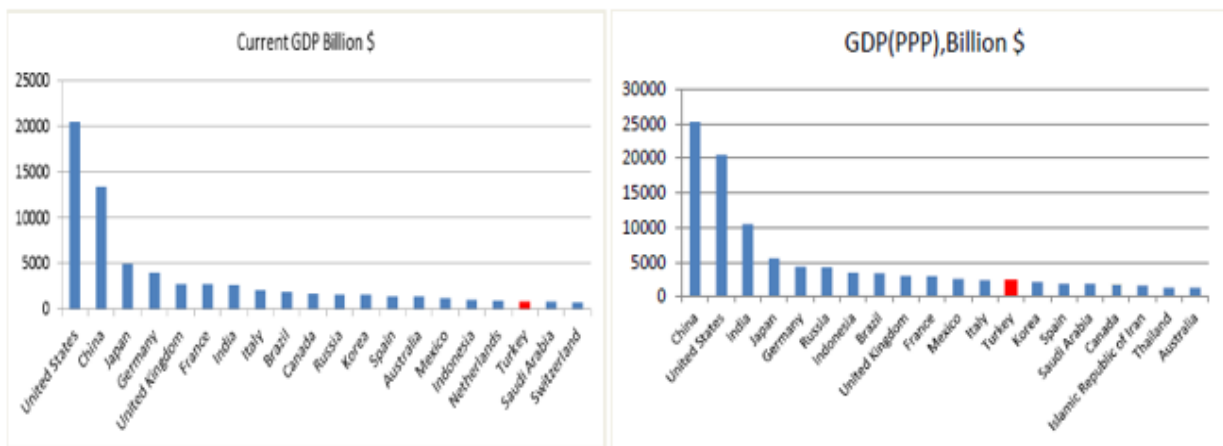


Figure 1. Top 20 Economies (Current and Purchasing Parity (PPP)).

1.1. Gross domestic production of Turkey

After suffering from the effects of the global economic turmoil in 2009, Turkish economy bounced back with strong growth rates of 9.2% and 8.8% in 2010 and 2011, respectively. The growth

then settled into a more sustainable pace of 2.2% in 2012, 4.1% in 2013 and 2.9% in 2014 in real TL terms. Between 2006 and 2015, European Union countries and OECD member countries have grown

with the CAGR (Compound Annual Growth Rate) of 0.7% and 1.1%, respectively. In comparison, GDP (Gross Domestic Production) in Turkey has grown with a CAGR of 3.5% during this last decade, which makes Turkey one of the fastest growing economies among the EU (European Union) and OECD member

countries. In terms of purchasing power parity, a continuous increase with higher pace was experienced with a CAGR of 6.3% through the last decade.



Figure 2. GDP Growth Rates (2003-2019).

Chart above (Source of TURKSTAT- Turkish Statistical Institute) show that during period of 2003-2018 average annual growth rate in Turkey realized as 5.5%. Unfortunately economic growth started to

decrease since 2018 and reached to deep point in 2019. When we analyzed the sectoral growth it shows that the economy may start to grow within first quarter of 2020 as shown in Figure 3.

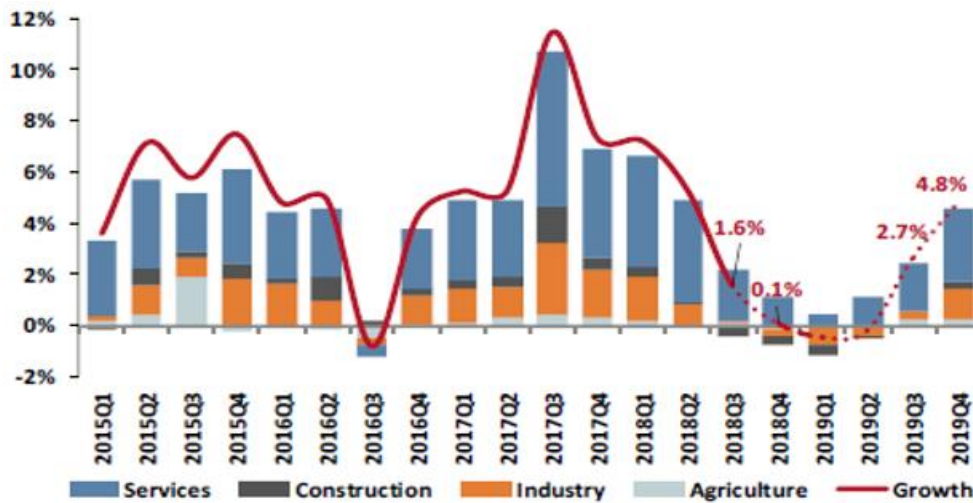


Figure 3. Sectoral growth within first quarter of 2020.

1.2. Foreign Direct Investments (FDI)

Regarding to economic growth in Turkey investors started to invest in some sectors since 2002. With respect to 2003 volumes, annual Inward Direct Investment values have increased about 10 times with recent reforms and regulations. FDI stock reached 209 billion USD in the 2003-2018 period. It was 14.6 billion USD in over 1984-2002. In July 2019, foreign direct investment decreased by 15.9%

compared to the same period of the previous year. This issue is not expected to be continue and expecting to rise again within following year. Energy, Manufacturing, Financial & Insurance Activities and Retailer Trade sectors are the leading ones which constitute 80% of the total FDI inflow of Turkey. The yearly trend for FDI is shown in Figure 4

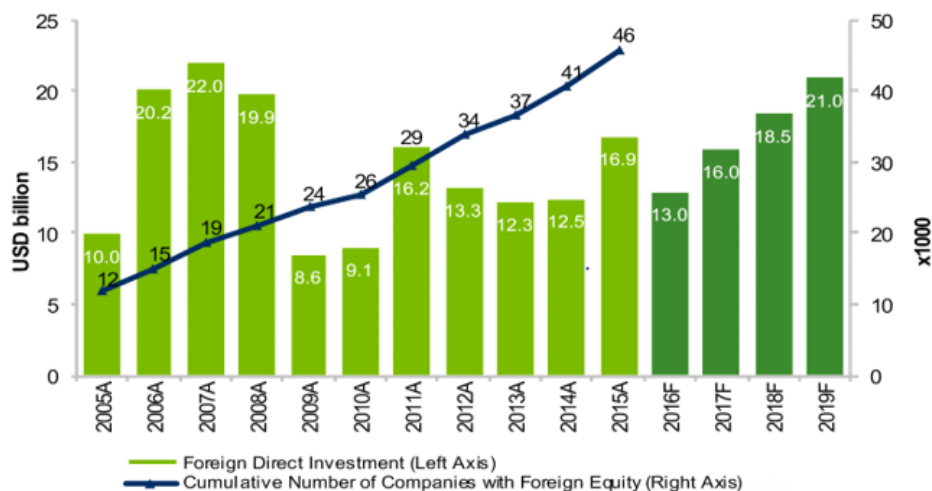


Figure 4. The yearly trend for foreign direct investments.

In the last decade, Turkey has enhanced its regulations for foreign investors and become an attractive investment market. In 2016, more than 50,000 companies with foreign equity have

operations in Turkey. Government is working on new opportunity for foreign investor to invest in Turkey.

2. Turkey's energy overview

Turkey with its increasing economy experiences sustained growth in energy demand. Majority of the primary energy need is met by natural gas, followed by coal and petroleum. More than half of these primary sources are used for electric power sector.

Today, the global energy equation is a dominant issue for any country; on one hand, new energy resources and recently-discovered energy reserves affect multiple regions in the world. It is clear that the capacity, the approach to production and the use of energy have a direct impact on the development of civilization and modern life. In the last three decades, 1.3 billion people have started to use electricity and hundred of millions of people have gained access to modern energy resources for heating and cooking purposes. That is why these industry always growing in the world with new type of product and sources. This situation will never be ended and continue to grow forever.

Turkey's energy sector is influenced by all political factor either directly or indirectly but continue a dynamic structure through the last decade. The liberalization in the sector has been dropped and private sector investment has been increased. On the other hand Turkey started to use domestic sources and renewable energy in the 10 decades. Positive developments with respect to renewable energy include the Renewable Energy Resources Support

Mechanism (YEKDEM), which was launched to ensure stable income generation in renewable energy power plants; the rapid increase in the number of small-scale production plants; and the tenders for Renewable Energy Resource Area (YEKA), which aim to benefit from economies of scale and promote the production of local equipment.

Demand for energy and natural resources has been increased due to economic and population growth in Turkey. Electricity demand growth has been increased 5.5% annual since 2002. Turkey will increase by 50% its energy use over the next decade. Turkey's installed capacity has reached 88.5GW in 2018 and 90.4GW in August 2019.

On the other hand the electricity market sector has been regulated include promotion electricity generation using domestic resources and support power plant uses domestic coal ; feed-in tariff and capacity mechanism aimed at ensuring supply and system security. More over Turkey started to invest nuclear power plants posing minimized risks.

Natural gas surpasses other primary energy sources with its 33.4% share. Natural gas is a major source for electric power sector. The share of natural gas in primary energy sources stagnated in 2015 in conjunction with the decreasing usage in electric power sector. Residential and commercial usage

constitutes 26%. 18% of consumed natural gas is utilized for industry where iron and steel industries take the lead in consumption.

Coal constitutes 32.1% share in primary energy sources and takes the second place. Coal is mainly used for electric sector with 58% share. Industrial sector consumes 29% of coal. Cement, iron and steel are the main areas for industrial consumption of coal. The third largest energy source is petroleum with

24.7% share in primary energy sources. Petroleum is mainly utilized in transportation sector with a 65% consumption rate. On-road vehicles are the supreme actors in petroleum usage in transportation, with cars, buses, trucks etc.

Renewables and hydro sources constitute the smallest part with 9.8% share. Renewables and hydro are mainly utilized for electric power and residential & commercial sectors with 54% and 43%, respectively

2.1. Natural gas outlook

Natural gas has been used extensively for power generation in Turkey since the late 1980s. Turkey increase utilizing natural gas, both from its own reserves and from imported gas, having established long-term purchase contracts with the Rusan Federation, Algeria Nigeria, Iran and Azerbaijan. Turkey also buys spot and short and medium term

qualified natural gas (“LNG”) from the market. Turkey has very limited domestic gas reserves and national gas production represents less than 1% of the total domestic demand. Consequently, nearly 99% of natural gas demand is satisfied by imports. Figure 5 shows the breakdown of gas imports by countries as billion cubic meter (bcm).

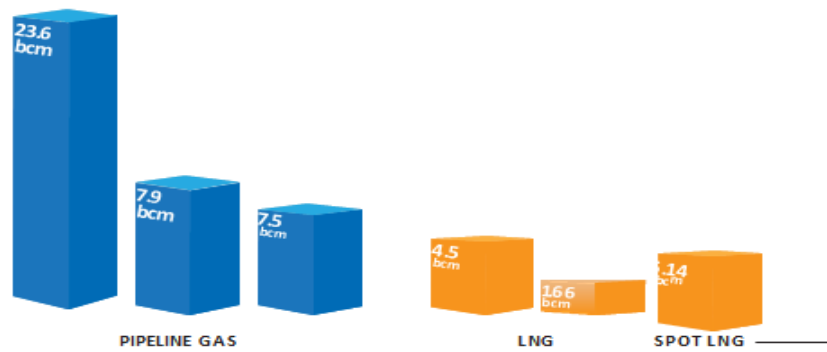


Figure 5. Breakdown of gas imports by countries as billion cubic meter (bcm).

Turkey import 23.6 bcm natural gas from Russian Federation, 7.9 bcm from Iran, 7.5 bcm from Azerbaijan. Moreover Turkey import 4.5 bcm LNG from Algeria and 1.66 bcm from Nigerial. Turkey use this gases in differet sector. The total consumption at the end of 2018 was about 49.33 bcm. Electricity

production use 36.89%, industry 24.30 %, households 25.75%, service sector 8.20% and others 4.86%. Gas distribution is carried out by local companies. Figure 6 shows gas consumption related to sectors.

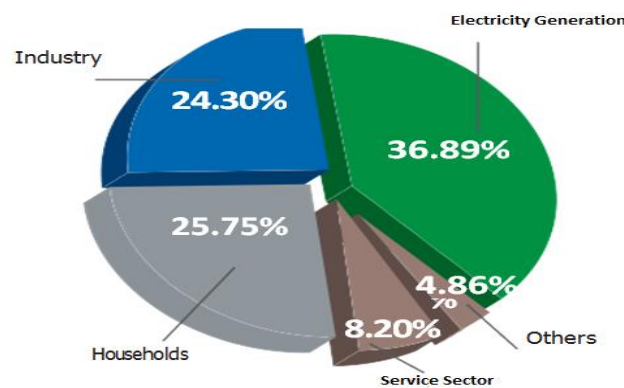


Figure 6. Gas consumption related to sectors.

2.2. Electricity outlook

Electricity is a secondary energy resource that is generated by primary energy resources. As well as fossil fuels (coal, oil, natural gas), nuclear and renewable energy resources (hydro, wind, solar, geothermal, biomass, etc.) are used to generate electricity. According to the British Petroleum (BP) Statistical Review (2018), coal had the largest share in total global electricity generation in 2017 with a 38.1% share, followed by natural gas (23.2%) and hydroelectric power (15.9%). The Turkish electricity sector has gone through a significant transformation in the past two decades. Throughout this period, the

electricity market underwent a liberalization process along with the establishment of a regulatory authority for the energy sector, went through reforms, and became a functional electricity market with large-scale private sector participation following privatization. Electricity demand increasing day by day in Turkey regarding to economic and population growth. Today we produce electricity in different sources. Government always focused on domestic sources. Figure 7 is about electricity product methods.

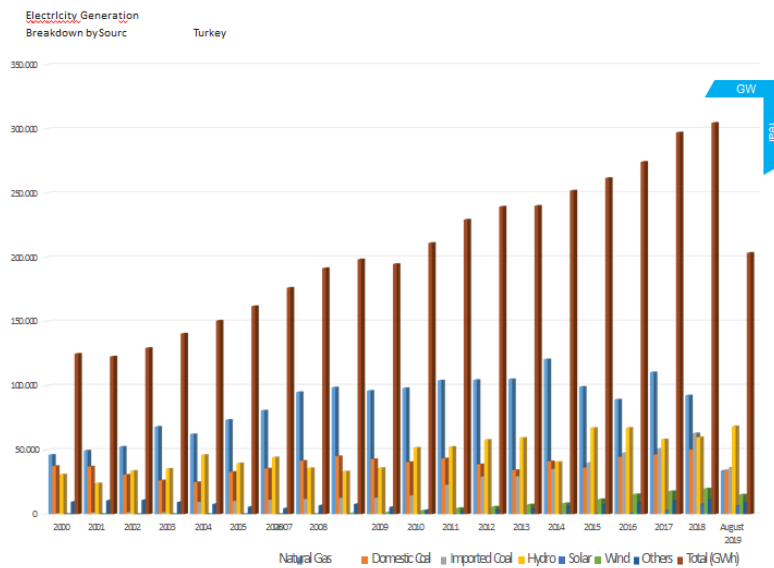


Figure 7. Turkey's electricity product methods by years.

As of August 2019 Turkey reached 90.4GW (Giga Watt) capacity which over the the demand. Most of the product has been done by private sector. The private sector shareholder has been increased after some reforms since 2002. The type of the capacity additions in Turkey have been increased the last 15 years as a result of the investment made by private

sector. The share of the private sector electricity generation rose from 40% in 2002 to 81% as of August 2019. Turkey one of the fasted growing country in OECD members in terms of electricity consumption as can seen in Figure 8. However, on average, per capita electricity consumption is still much less compared to OECD average

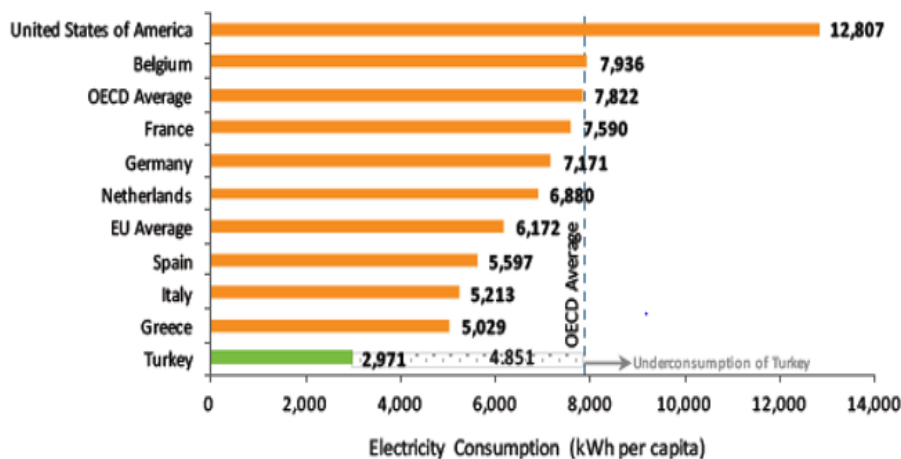


Figure 8. Electricity consumption in OECD member countries.

2.3. Renewable energy outlook

Turkey would like to use domestic sources as much as possible. Making full use of the RE (Renewable Energy) potential is at the top of Turkey’s agenda, and the potential is still to a large extent untapped. As of August, Turkey has an installed capacity of about 7.27 GW and more than 3 GW of licensed

wind capacity is under construction. On the other hand, Turkey has an onshore wind potential of 37 GW and a completely untapped offshore wind potential of 11 GW. Wind power in Turkey can be seen in Figure 9.

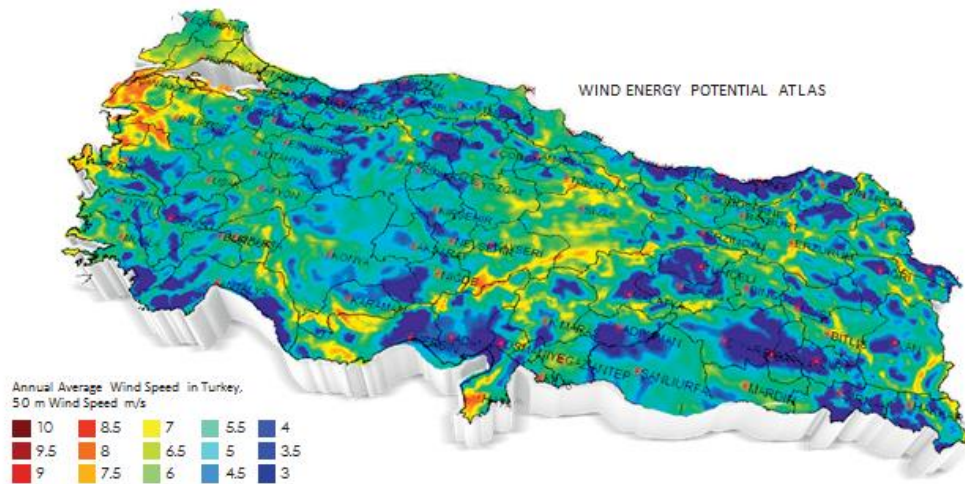


Figure 9. Wind power in Turkey.

As for the solar potential, annual average daylight duration in Turkey is 7.5 hours and average annual radiation is 1,527 kWh/m², which is higher than most of Europe. Turkey’s installed solar capacity is only around 5.53 GW, although solar power potential in Turkey is nearly twice that size of Northern

Europe’s. The effort to invest in RE will lead to growing demand for RE equipment such as turbines and photovoltaics (PV) panels. Turkey will continue to incentivize through providing bonuses for locally manufacturing equipment. Figure 10 shows the solar energy potential in Turkey.

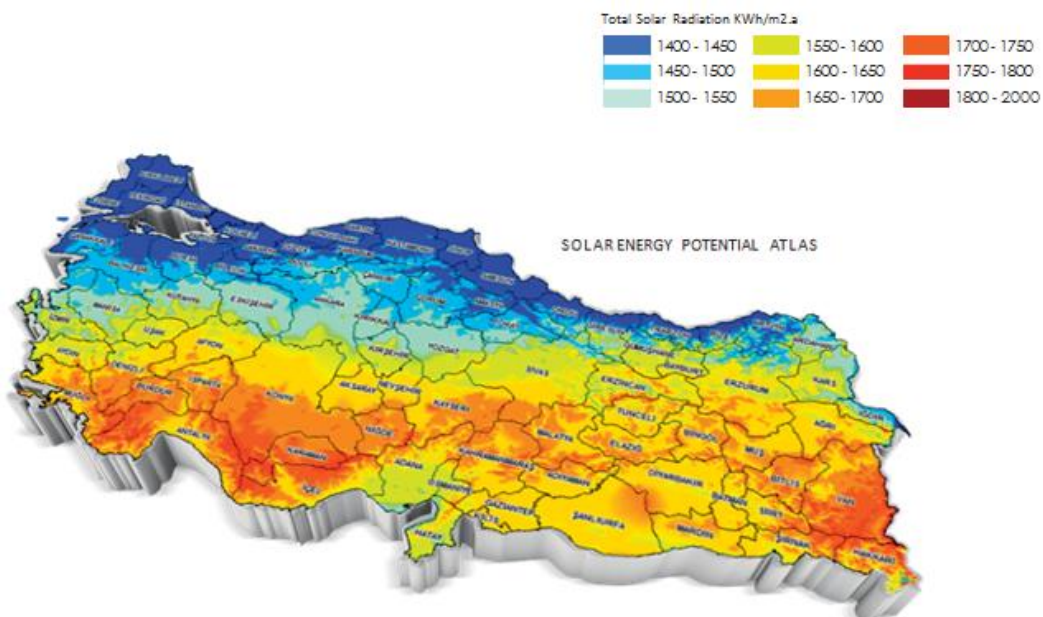


Figure 10. Solar energy potential in Turkey.

2.4. Renewable Energy Outlook

One of the oldest fuels on earth, coal is a reliable fossil fuel that can be extracted at low cost. Coal is also popular as a fuel because of its production in many countries around the world and its common trade. Coal is mainly classified into two as hard coal (anthracite) and brown coal (sub-bituminous coal and lignite) in the consideration of its calorific value, volatile constituents, fixed carbon, coking and caking features. According to the BP 2018 Statistical Review of World Energy, out of the proven coal reserves for 2017, 323.6 billion tonnes of coal (31.3%) is located in European- Eurasian countries, 424.2 billion tonnes of coal (41.0%) in Asia-Pacific countries, 258.7 billion tonnes of coal (25.0%) in North American countries, 14.4 billion tonnes of coal (1.4%) in African-Eastern Mediterranean countries and 14.0 billion tonnes of coal (1.4%) in Central and South American countries. The report also states that the U.S. is host to the largest coal reserves in the world. It is followed by Russia, Australia, China and India. Between them, these five countries account for around 77% of the world's total coal reserves. Global coal production increased by 105.1 mtoe (million tonnes) in 2017, with China accounting for 56 mtoe of this increase and the USA accounting for 23 mtoe. The growth in consumption of coal was less than the growth in coal production.

Taking into consideration the proven reserves and production, global proven reserves have the capacity to meet 134 years of production based on 2017 figures. Ranking countries by their proven reserves,

2.5. Nuclear Energy Outlook

Nuclear power will contribute to the diversification of energy resources and security of supply. Turkey has been taking concrete steps regarding the additional of nuclear power plants to its fuel mix. An agreement with Russian has been made to build the first nuclear power plant in Mersin and expected to start operation in 2023.

Russia has 391 years of capacity, followed by the USA with a capacity of 357 years and Australia with a capacity of 301 years, but with China only having enough coal to last 39 years at its current rate of production. Turkey is globally considered to have a medium level of lignite resources and a low level of hard coal, in terms of reserves and production quantity. Although Turkey accounts for 0.6% of global coal production, it is a net importer, as its consumption is higher. Turkey has a substantial amount of coal reserves, totalling 17.3 billion tons and composed of mostly lignite. Main coal reserves are located in Kangal, Orhaneli, Tufanbeyli, Soma, Tuncbilek, Seyitomer, Çan, Mugla, Çayırhan, Afşin-Elbistan, Karapınar, Tekirdag, Alpu, and Afyonkarahisar. Among these reserves, the Afsin-Elbistan alone has 4.8 billion tons of lignite resources, which constitute 28% of Turkey's total lignite reserves. The reserves to be tendered with auctions bear 6.4 GW of installed generation capacity potential. Turkey use coal especially in heating and electricity product. Turkey aims to increase the share of domestic coal in electricity generation by transferring coal reserves to the private sector with the obligation of building and operating coal-fired power plants in the vicinity. Coal still has a major share in the electricity generation mix of Turkey. As of the end of August 2019, electricity generated from domestic coal is 34,039 GWh (16.7% of the total generation 203,548 GWh) and installed capacity of domestic coal is 11.3 GW (12.5% of total installed capacity 90.4 GW).

Second NPP (Nuclear Power Plant) will be establisher in Sinop by a Japanese-French consortium with 51 % share and EÜAŞ with 49% share. There are ongoing negotiation for the third nuclear power plant. Turkey's map of the NPPs can be seen in Figure 11.

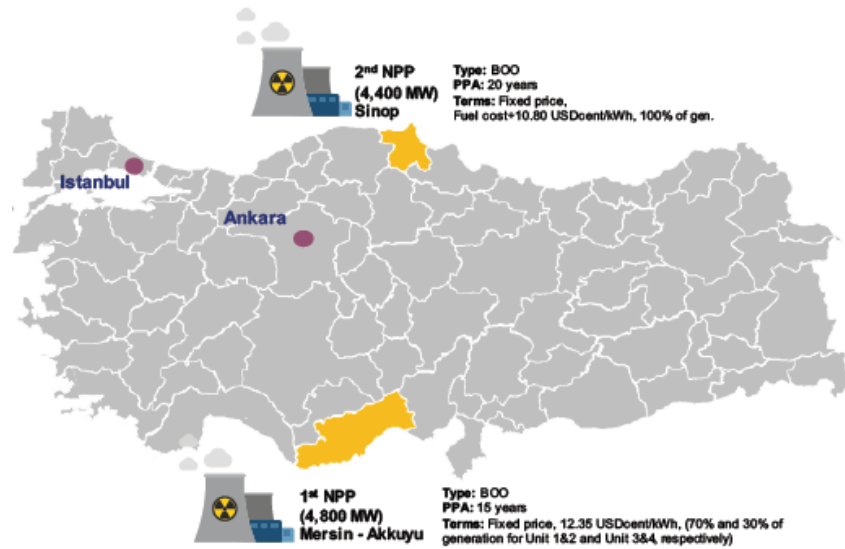


Figure 11. Map of the NPPs in Turkey.

2.6. Oil outlook

Oil playing key roul in world economy and polisy. That is why all war in the world started for that source. The volume of global crude oil reserves stood at a total of 1.7 trillion barrels. On a regional basis, the Middle East commanded the highest share in global oil reserves, followed by Central and South America and North America. Venezuela, Saudi

Arabia, Canada, Iran, Iraq and Russia hold the world’s largest proven oil reserves. Members of the Organisation of Petroleum Exporting Countries (OPEC), which are sitting on the bulk of oil reserves in the Middle East, hold approximately 70% of the world’s oil reserves. Figure 12 shows the proven oil reserves in world.

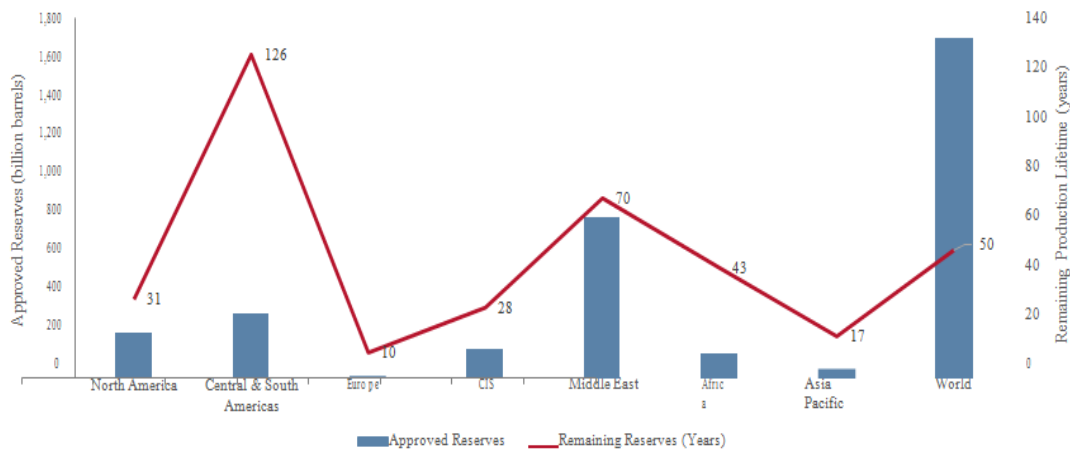


Figure 12. Proven oil reserves to estimated remaining production.

Oil constitutes 30% of Turkey's total primary energy supply and an average of 35% of Turkey's final energy consumption. Turkey's crude oil production stands at around 2.5 million tones per annum while the annual crude oil imports amount to an excess of 25 million tons on average in the last 3 years. More than 90% of oil needs is covered through imports. Turkey's energy imports (natural gas and

oil) are so significant due to the country's limited natural resources, a fact emerging as a key factor contributing to the increase in foreign trade deficit. Unfortunately Turkey is import huge amount of oil from abroad especially Russia, Iran, Azerbaijan and Iraq. Figure 13. Shows oil product and import cooperation.

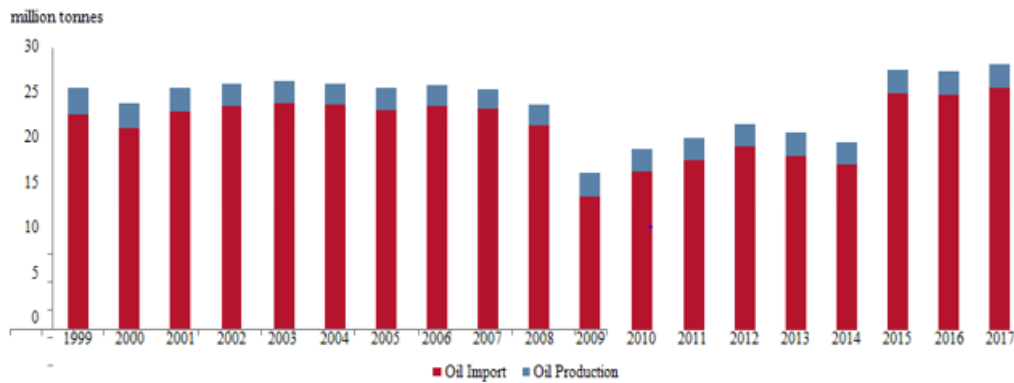


Figure 13. Turkey's crude oil production and imports.

3. Conclusion

- Energy will be the key point on world economy and policy,
- The energy source type will be changed day by day regarding to consumption,
- Type of manufacturing technology will be improved for efficiency,
- End user energy safe and sustainable will be the key point on the supplying process,
- Turkey energy demand will be increased day by day,
- Regarding to increase in demand in turkey new investment will be needed,
- As a bridge on energy transfer Turkey will play a great role on energy industrial,
- Turkey will increase the use of domestic sources,
- Turkey will encourage investre to invest domestic sources,
- New technology on domestic sources will be improved,
- Renewable energy will be the key point on all over the world,nd power output.

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