

Turkey’s Energy Demand, Production and Policies

Mehmet Toptas*

TÜBİTAK Marmara Research Center, Turkey. *Email: mehmet.toptas@tubitak.gov.tr

ABSTRACT

Turkey is currently one of the fastest growing economies in the world with the largest increase in the energy demand among the Organization for Economic Cooperation and Development countries. Since the country has limited reserves for oil, natural gas and coal, this increase in energy demand is not able to be met through domestic energy production alone, which possess a threat on the country’s economic growth, national security and industrial well-being and therefore various regulations and policies are being developed to reduce the reliance on foreign energy sources. In this paper, the natural energy sources of Turkey are evaluated, current efforts to fully utilize these potential sources are examined and the governmental approaches and incentives to increase domestic production are studied in a systematic manner. The study concludes that even though tremendous efforts have been made to explore and efficiently utilize the domestic resources by the government through various legislations, guidelines and taxation; the domestic resources will not seem to be sufficient in the short run and energy imports will be necessary to meet the energy demand in the next decades.

Keywords: Energy Demand, Natural Resources, Energy Policies, Turkey

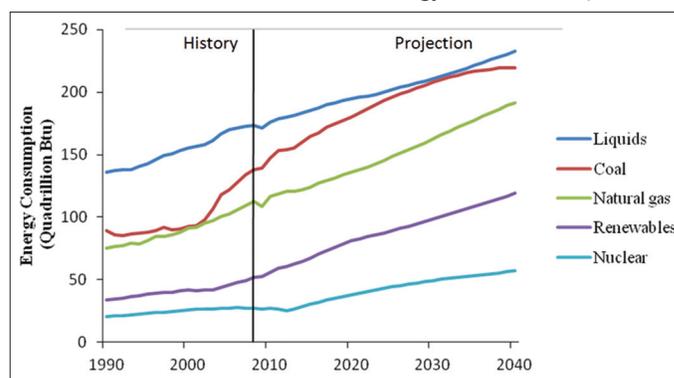
JEL Classifications: O220, O250, Q280

1. INTRODUCTION

Energy is considered to be a prime agent in the generation of wealth and significant factor in economic development as well as the production of all goods and the provisions of the services (Kilic, 2005). It is projected that the world energy consumption will grow by 56% between the years of 2010 and 2040, where the world’s energy use will reach up to 820 quadrillion Btu at the end of this time frame. Fossil fuels, especially petroleum based ones, are expected to be the main contributor of the energy mix in the world during this period. However, there will also be a switch from liquid fuels to other resources such as renewables since the cost of liquid fuels are estimated to increase significantly in the next decades. The world energy consumption in this period along with its sources are provided in Figures 1 and 2. This growth in energy consumption is likely to occur mainly in countries outside of Organization for Economic Cooperation and Development (OECD) due to their strong long-term economic growth (International Energy Outlook, 2013).

In the near future, fossil fuels are expected to continue supplying much of the energy used worldwide. International Energy Outlook of 2013 projects that, although liquid fuels-mostly

Figure 1: World Energy Consumption by fuel type (1990-2040) (Data Obtained from International Energy Outlook, 2013)



petroleum-based-remain the largest source of energy, the liquids share of world marketed energy consumption will fall between 2010 and 2040 due to the rise in its prices. Meanwhile, world natural gas consumption will increase by 64% from 2010 to 2040. World coal consumption is also expected to rise with an average rate of 1.3% per year to 220 quadrillion Btu in 2040. Meanwhile, the world’s net electricity generation is expected to increase by 93% to 39.0 trillion kWh in 2040 (International Energy Outlook, 2013).

While the world's primary energy demand is increasing significantly as mentioned above, Turkey is no exception to this trend. In 2012, approximately 242 TWh of electricity was supplied to the domestic market, corresponding to a 5.1% annual growth from the previous year and 7.5% compound annual growth rate between the years 2007 and 2012. The high growth in electricity demand is related to economic developments, industrialization and urbanization and further electricity growth demand is expected due to population growth expectations. However, currently Turkey still has considerably low energy use with 596 kWh per capita household electricity consumption, compared to European Union average of 1,786 kWh per capita (Deloitte, 2013). In primary energy consumption, Turkey was ranked 21st in the world with 0.9% of the total (BP Statistical Review of World Energy, 2010). However, the primary energy demand in the Turkey is increasing tremendously and was three times the world average between the years of 1990 and 2008 with 4.3%, which was the largest increase in the energy demand among the OECD countries. This is mainly attributed to having one of the fastest growing economies in the world with over 8% annual growth rates. As a result, in terms of electricity and natural gas, Turkey currently has the largest increase in demand in the world after China as shown in Figure 3.

Figure 2: World Electricity Generation Projection by energy source (2010-2040) (Data obtained from International Energy Outlook, 2013)

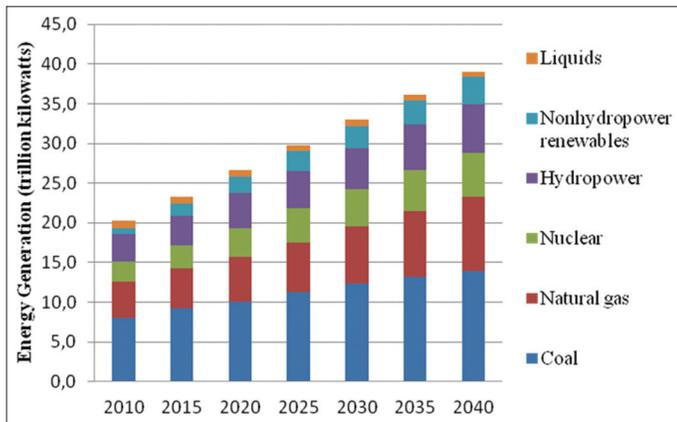
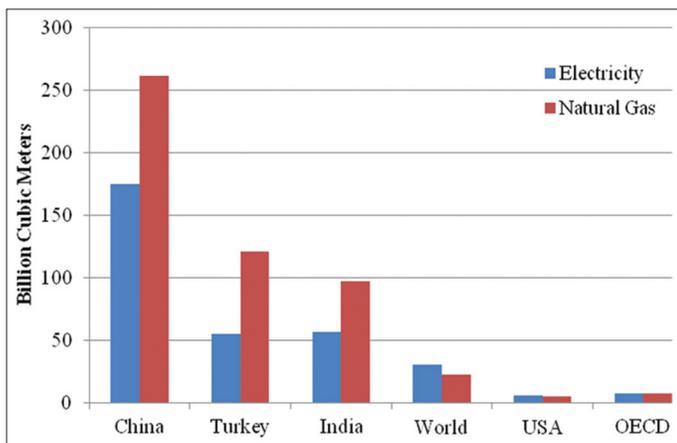


Figure 3: Total increase in electricity and natural gas demand (2000-2009) (EMRA, 2013)



This primary energy demand of Turkey is rising at a very fast pace and expected to increase by 90% to 218 million tons of oil equivalent (MTOE) over the next decade. The energy demand will mainly be composed of natural gas, coal and petroleum as these resources contribute to a significant share of the current electricity generation mix. The established energy generation mix in 2012 and the expected energy generation mix in 2023 are provided (ODA Report, 2012) in Figure 4a and b.

This significant level of growth in energy demand requires available energy sources in order to meet the demand. In this regard, Turkey's energy production was 32.493 MTOE in 2010 where almost half of it was lignite and asphaltite. The rest of it was hydro and other renewables along with wood and herbs. The production for hard coal, natural gas and petroleum was the lowest among the energy sources as provided in Figure 5.

As can be seen from the Figure 5, the production of petroleum, natural gas and coal is significantly low in Turkey compared to the high and ever-increasing demand. In order to be able to cope with this level of growth, significant investments in the energy sector as well as infrastructure, especially for natural gas and electricity, would be required. Currently, since the demand is not being able to be met through domestic energy production, a very large portion of the energy is being imported, causing the net imports to increase rapidly as shown in Figure 6.

In 1990, the total energy demand of the country was 52.9 MTOE, where it increased to 109.2 MTOE in 2010 (106% increase). During this time, the domestic energy production increased only by 26% (from 25.6 to 32.4 MTOE), whereas the total energy imports

Figure 4: (a) Turkey's energy mix in 2012 (b) Turkey's predicted energy mix in 2023

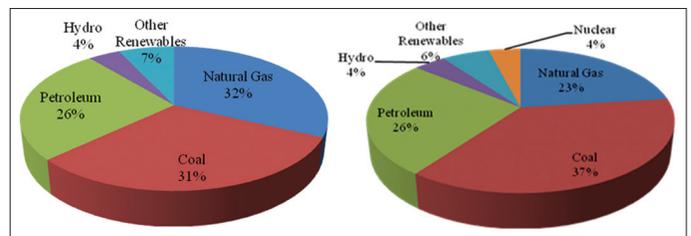
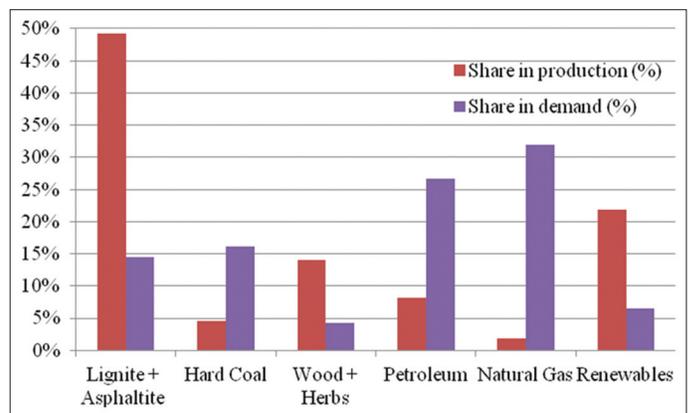


Figure 5: Turkey's Primary Energy Production and Demand in 2010 (Data obtained from ODA Report, 2012)



increased by 182% (from 30.9 to 87.4 MTOE). Therefore, the percentage of the produced energy meeting the demand is reduced by 40% in this period (ETKB – Petform, 2011). As a result, in 2011, the cost of energy raw material imports composed almost a quarter of the total imports with \$54 billion and this number is projected to increase significantly in the next couple of years.

2. TURKEY'S NATURAL RESOURCES

In order to better understand the gap between the domestic production and consumption of energy in Turkey, first a close look at its main energy sources as well as energy policies would be required. Currently, Turkey has limited oil, natural gas, coal and renewables that are used to satisfy the energy demand either directly or through generation of electricity.

2.1. Oil

Oil plays a significant role in satisfying the energy demand of various sectors and is currently supplying much of the energy used worldwide. Turkey has discovered 1180 petroleum wells in 118 production sites between the years 1934 and 2011. After 1,688 expletory shafts, 166 explorations were conducted yielding 10% accuracy on the explorations (PIGM, 2011). However, approximately 80% of the countries land and 99% of its water has still not been explored yet. Thus, only over 3000 wells have opened since the country was established, which is highly insignificant compared to the world average of 20,000 wells per year (Turkey's Power Supply Policies Report, 2009).

Among the wells that are operated, the domestic production of petroleum was 3.5 million tons in 1995 and is decreased to 2.4 million tons in 2011. However, during this time Turkey's consumption has increased considerably. In 2011, Turkey's oil consumption averaged 706 thousand bbl/d. Since the daily domestic production of the country was 45,000 barrels a day, around 93% of its supplied oil was imported in 2011. In addition, the price of the crude oil has increased significantly over this time, increasing the cost associated with these imports. In 2012, the crude oil production slightly declined from 16.4 to 16.2 million barrels compared to the previous year (Ministry of Energy and Natural Resources [MENR], 2013). The Brent crude oil prices between the years 2002 and 2012 are provided in Figure 7.

Among these imports, Iran has the highest share with 51% (based on 2011 statistics), followed by Iraq and Russia as shown in Figure 8. In addition to crude oil, Turkey also imports other oil products where the majority are of diesel fuel, jet fuel and liquefied petroleum gas.

These imports in total creates 90% of Turkey's total liquid fuel consumption due to very limited domestic reserves (located in Hakkari Basin, Batman and Adiyaman Provinces) that shows no sign of any meaningful increase in the short-term and the country's imports are expected to double over the next decade (IEA, 2013). As a result there is a considerable gap between imported and produced crude oil as shown in Figures 9 and 10, and this gap is projected to widen much more in the future. This may cause significant dependency of imported fossil fuels, reliance on a

Figure 6: Energy demand and supply of Turkey (2001-2010) (Data obtained from EIA, 2013)

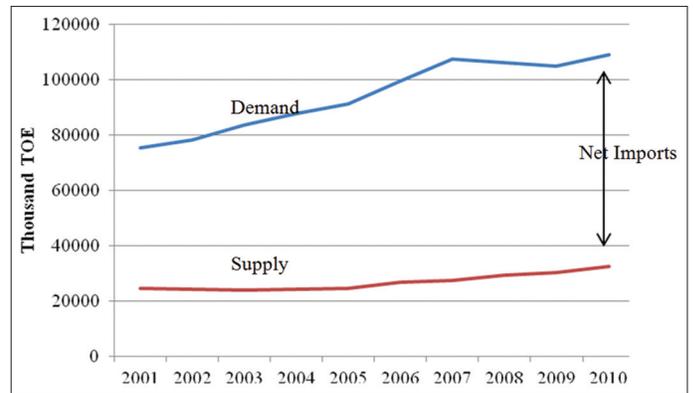


Figure 7: Average Brent crude-oil prices during 2002-2011 (Data obtained from Turkey's Power Supply Policies Report, 2009)

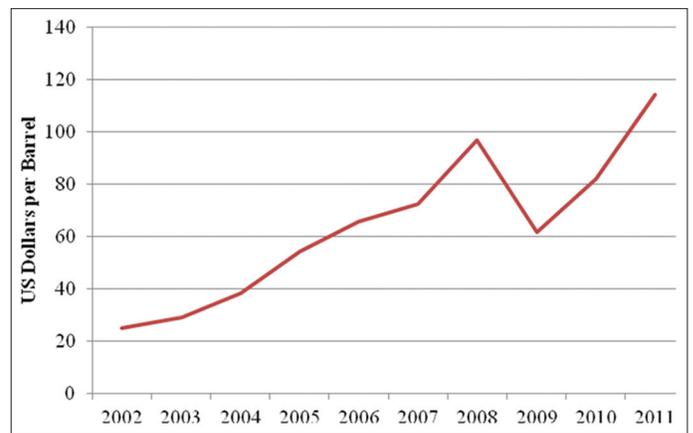
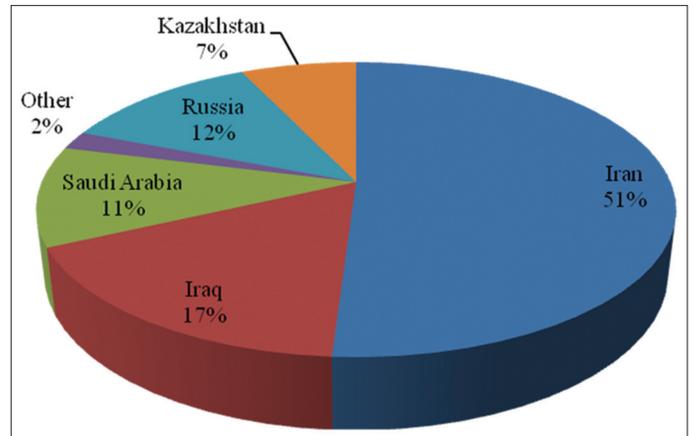


Figure 8: Share of Turkey's crude oil imports by country in 2011 (Data obtained from EIA Notes, 2013)



limited number of energy suppliers, attaining high energy intensity and expenditure on the energy sector (Balat, 2010).

In order to prevent this gap, the Turkish government has developed several types of tax breaks to encourage exploration and production, including lower corporate taxes, exemptions from import duties for material and equipment, and exemptions from value-added tax for exploration activities. For the oil sector, this is

Figure 9: Turkey's oil overview between 2011 and 2010 (Data obtained from EIA, 2013)

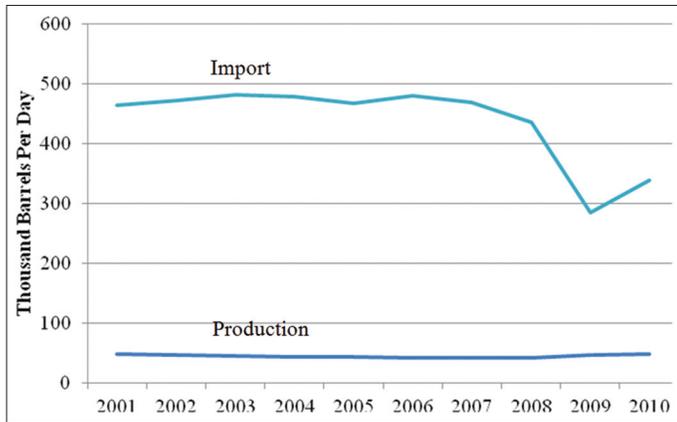
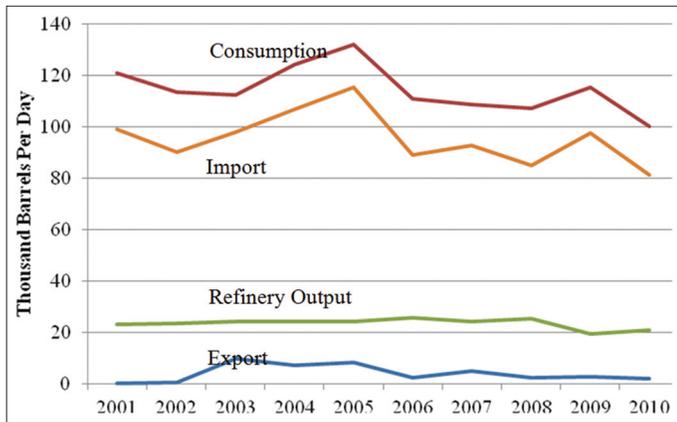


Figure 10: Turkey's refined petroleum gas overview (Data obtained from EIA, 2013)



primarily handled by MENR for formulation and implementation of these policies and the General Directorate of Petroleum Affairs, which is the main policy making body within MENR.

2.2. Natural Gas

Natural gas is the fastest growing energy source in Turkey and a big portion of the country's energy mix due to being highly efficient and environmentally friendly during consumption compared to fossil fuels. As a result, its utilization has been increasing significantly between 1987 and 2012 (from 0.5 to 43 billion m³), mainly used for power generation and space heating. When examined in terms of volume, it is the most important fuel for the country, exceeding oil and coal consumption. In this regard, Turkey is ranked 8th in importation and 24th in consumption of natural gas in the world (BP Statistical Review of World Energy, 2010). At the end of 2011, Turkish natural gas reserves were 23.9 billion cubic feet and have over a dozen operating gas fields with 793.4 million m³ production through the year (PIGM, 2011). However, this production only meets 2% of the consumption in Turkey and therefore the country has to rely almost exclusively on imports to meet domestic demands as shown in Figure 11 due to Turkey's low capacity for natural gas storage to meet its seasonal demand swings. Since the electricity consumption and the number of new power plants are projected to increase significantly, the demand for natural gas will also increase accordingly.

Figure 11: Turkey's natural gas overview (2001-2012) (Data obtained from EIA, 2013)

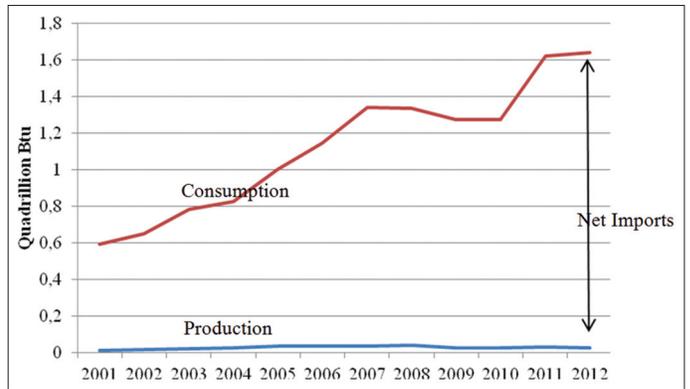
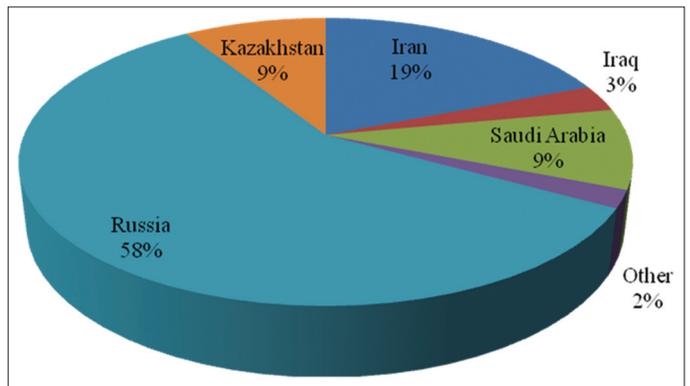


Figure 12: Share of Turkey's natural gas imports by country in 2011 (Data obtained from EIA Notes, 2013)



As for the countries where the natural gas is imported, Russia has the highest role followed by Iran as shown in Figure 12. In terms of liquefied natural gas, it accounted for 15% of the total supply with total storage capacity of 2966 billion m³ in 2011 and are the imported mainly from Algeria, Nigeria, Qatar, Egypt and Norway.

In electricity production, natural gas resources make up for the 44.7% of the total electricity production with 102.1 billion kWh in Turkey. When the installed power plant capacity is compared, natural gas plants come second with a capacity of 16,820 MW after hydroelectric plants. In September of 2012, MENR proposed a new gas sector liberalization bill that transfers the gas import and export right to private companies in order to increase the plant capacity in the future.

In addition, Turkey also has considerable shale gas potential that gained a wide popularity in the past years. In September of 2013, Turkey has officially started hydraulic fracturing operations to extract shale gas from Dadaş shale field, which based on EIA estimations potentially has sufficient volumes to meet the countries energy demand for many years. However, from an economic perspective (based on mainly the drilling and completing well costs) it is not yet clear that the cost of shale gas extraction will be cheaper than importing natural gas.

2.3. Coal

Coal is by far the most plentiful energy resource in Turkey and plays a major role in the electricity generation mix of the country.

Unlike the scarce natural gas and petroleum reserves, Turkey has 1.3 billion tons (515 million tons of it being proved reserves) of hard coal reserves and 13.9 billion tons (13.4 billion tons of it being proved) of lignite reserves, together constituting 1.6% of the world reserves (General Directorate of Turkish Coal, 2012). Turkey's coal overview is shown in Figure 13.

Domestically produced sources are mainly to do with lignite, where 40% of the countries reserves are located in Afsin-Elbistan basin, while hard coal is only mined in Zonguldak basin, where Turkey is ranked 11th in coal production in the world (BP Statistical Review of World Energy, 2010). The breakdown of the reserves belonging to licensed coal sites and institutions are provided in Tables 1 and 2.

The lignite production in Turkey is mainly to satisfy the demands of three major, namely power generation, industrial and residential sectors. In 2010, 70 million tons of lignite production was done by three entities, EUAS (46%), TKI (43%) and private sector (11%). The main sector for lignite consumption is the thermal plants with 80% of the total. Turkey's lignite reserves would suffice to meet the country's needs for more than 140 years at current production levels (Balat, 2010). In 2012, hard coal production was 2.3 million tons which was 14.3% less than the previous year whereas the lignite production was estimated to be 70 million tons. The installed capacity of current thermal plants using domestic and imported coal was 8613 (15.1% of installed capacity) and 3913 MW (6.9% of installed capacity) respectively in 2012 (General Directorate of Turkish Coal, 2012). However, Turkey still imports around 90% of the hard coal it consumes and this number is expected to increase as coal's importance on electricity generation increases.

Currently, domestically produced coal is tried to take some of the shares of natural gas in electricity production mix in order to reduce the magnitude of energy imports and reduce the price of electricity in the country.

2.4. Renewable Resources

Rising oil prices, security challenges, and environmental concerns increased the interest in renewable energy sources in Turkey. Renewable resources play a significant role in Turkey's energy potential, however other than hydro, only a little fraction of this potential was being utilized until the past decades. Turkey receives on average 501 km³ rain water per year, which after evaporation and feeding underground water sources, 186 km³ of this goes to surface runoff. With the inclusion of springs and international rivers flowing to Turkey, the total amount of surface

runoff increases to 193 km³ on average. In total, the gross annual hydro potential of the country is 433 TWh/year, which equals to 1% of the hydro potential of the world and 14% of Europe. Among this potential, almost half of it is technically and 28% of it is economically exploitable (Balat, 2007). However, most of this potential has not yet been adequately explored. The installed capacity and electricity generation for hydroelectric plants provided in Table 3 and Figure 14.

Moreover, Turkey has significant other sources of renewables. In wind power, Turkey has very high potential since it is surrounded by seas in three directions and has 3500 km of coast line, ranking 16th in capacity in the world with technical and economical wind energy potentials of 83,000 MW and 10,000 MW respectively (MFA, 2006). According to Wind Energy Potential Atlas, Turkey

Figure 13: Turkey's coal overview (2001-2011) (Data obtained from EIA, 2013)

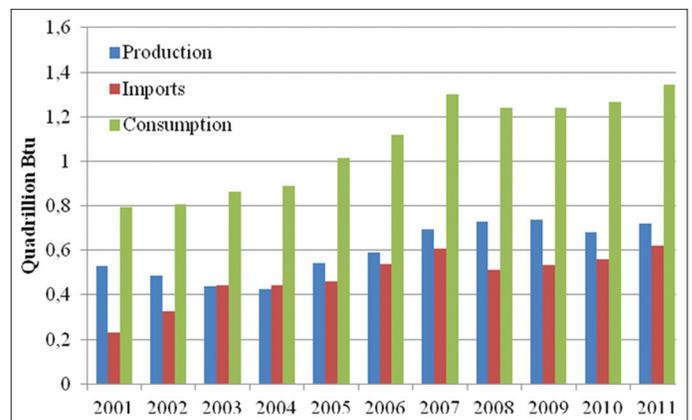


Figure 14: Share of hydroelectric power generation in total electricity production (2001-2011) (Data obtained from ODA Report, 2012)

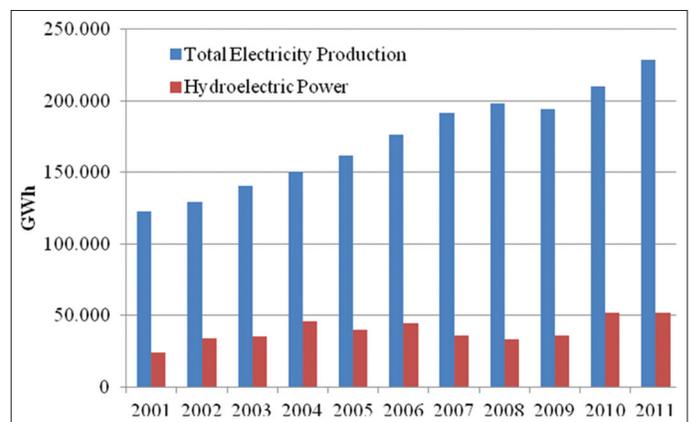


Table 1: Turkish hard coal reserves belonging to licensed coal sites*

Location	Reserves (1000 tons)					Total	LHV
	Ready	Identified	Hypothetical	Speculative			
Zonguldak/armutcuk	1,701	7,595	15,859	7,883		33,883	6050-7050
Zonguldak/kozlu	2,393	66,221	40,539	47,975		157,129	6400-6950
Zonguldak/uzulmez	789	135,533	93,342	74,020		304,684	6400-6950
Zonguldak/karadon	2,593	131,863	159,162	117,034		411,652	6200-6950
Bartın/amasra	385	170,036	115,052	121,535		407,009	5450-6050
Total	7,863	512,250	424,954	368,447		1,313,515	

*Data obtained from General Directorate of Turkish Coal Reports, (2012). LHV: Lower heating value

Table 2: Turkish institutional lignite reserves*

Location	Reserves (1000 tons)			
	Identified	Hypothetical	Speculative	Total
EÜAŞ	7,589,156	207,706	-	7,797,862
TKİ	2,313,793	226,832	1,560	2,542,185
MTA	2,502,861	15,826	6,237	2,524,924
Private sector	1,036,555	N/A**	N/A**	1,036,555
Total	13,442,365	450,364	7,797	13,900,526

*Data obtained from General Directorate of Turkish Coal Reports (2012). **Data not available

Table 3: The installed capacity and electricity generation for hydroelectric plants in Turkey (2012)

Producer	Installed capacity (MW)		Energy generation (Gwh)	
	2011	2012	2011	2012
TEIAS	11,589.5	12,213.8	36,888.2	38,311.1
TOR	127.7	240.2	119.8	203.5
BOT	952.8	952.8	3,406.5	3,604.7
FPC	3,922.9	5,658.4	10,629.9	14,096.5
AP	544.2	544.2	1,240.2	1,657.9
Total	17,137.1	19,609.4	52,338.6	57,873.8

*Data obtained from TEIAS Electricity Generation Sector Report (2012).

TEIAS: Turkish Electricity Generation and Transmission Corporation, TOR: Transfer of operating rights, BOT: Build, operate and transfer, FPC: Free production companies, AP: Auto-production

has wind levels between 4 and 7 (medium to exceptional) with total wind energy potential of 131,756 MW in its 3.57%. Moreover, as of October 2013, Turkey had installed capacity of 2689 MW from wind energy (MENR, 2013).

In geothermal energy, Turkey is predicted to have 31,500 MW_t of thermal power (ranked 14th in capacity in the world), enough to heat around 5 million residential buildings. However, 95% of this thermal power is low and medium enthalpy heat, mostly compatible with residential heating, greenhouse cultivation and thermal springs and the identified heat capacity is determined to be 4.078 MW_t. At the end of October 2013, Turkey had installed capacity of 311 MW from geothermal power plants (MENR, 2013).

In solar energy, Turkey has daily sun of 7.2 h and 3.6 kWh and ranked 29th in capacity in the world. Geothermal energy potential atlas has determined the Turkish solar energy potential to be 380 billion kWh, which 40% of it could be used economically. 75% of the economically usable potential is efficient for thermal use and the remainder for electricity production (Ogulata, 2007). In 2012, the total installed solar collector area in Turkey was 18.64 million m² with annual flat solar panel production of 1.164 million m², vacuum tube panels of 57,600 m². In this year 768,000 TOE thermal energy has been produced, where 500,000 TOE of it was used in residential applications and the rest in the industry.

In terms of biogas and biofuels, Turkey has established over 200 biodiesel facilities with a combined capacity of 1.5 million tones, however most of these facilities are closed down due to lack of domestic raw materials. Based on 2011 statistics, only 36 licensed biodiesel production facilities currently exist in Turkey, and only one of them can produce biodiesel from domestic crops. The current bioethanol capacity is 149.5 million liters.

The potential bioethanol production capacity from sugar cane is between 2 and 2.5 million tons, enough to satisfy the entire fuel consumption in the year 2011. The license operations with respect to these renewable sources are provided in Table 4.

3. DOMESTIC ENERGY PRODUCTION DRAWBACKS AND PROVISIONS

Turkey's capacities of producing various resources are described in the previous sections. Even though Turkey does not have very significant magnitude of its various resources (especially fossil fuels), there has been a remarkable effort to explore and utilize these potential sources the country already has. The main projects associated with the action plans for this purpose are briefly described in this section.

In terms of being able to discover and utilize the majority of the fossil fuel sources, drilling plays a significant role. It is estimated that the Black Sea Cost of Turkey contains 10 billion barrels of oil reserves and could meet 40 years of the countries requirement. However, the oil is likely to be trapped 3000 m under the ocean floor and that the drilling would have to take place where the sea is 2000 m deep. Besides, the cost of a single drilling operation is averaged to be \$3-5 million on land and can increase up to \$200 million under water depending on the depth. These costs are estimated to be up to 5 times more in Turkey compared to its resources rich neighbor countries due to the geological structure of the country. Turkey has 17 companies and 74 towers for drilling, which can provide 500,000 m/year of drilling capacity but currently only 50% of the capacity is being used. However, with the help of the 1999 Constitutional Amendments which considerably developed the trade and investment and accelerated the infrastructure projects (Kilic and Kaya, 2007) as well as new policies, production investment on mining exploration licenses are increased 13-fold and the meters of drilling increased 5-fold between the years of 2002 and 2011 (PIGM, 2011). Moreover, the Turkish Petroleum Corporation has made plans to work with international oil companies to drill various areas in the Black Sea for exploration (Balat, 2010).

In addition, the 2001 Natural Gas Market law modified the gas market considerably by transforming the monopolistic structure of the market into a highly competitive one through encouragements of new market entry and investments (Bilen et al., 2008). However, issues such as Petroleum Pipeline Corporations (BOTAS's) acting as a monopoly in imports and the lack of independent transmission system operator hampered the competition which had to be addressed by the following legislations and policies in the natural gas market.

Besides, the compound annual electricity demand growth rate 6.2% in the past decade along with the high population growth, the electricity demand of Turkey is projected to reach around 546 TWh in 2020 with installed capacity of approximately 96,000 MW (TAIK, 2008; Deloitte, 2013). Thus, in order to reduce this gap between the demand and the production the government is planning to install a number of lignite, natural gas, coal, hydroelectric and even nuclear energy plants (Kilic and Kaya, 2007), which would require huge annual investments by the government. Due to having a limited budget, MENR implemented

Table 4: License operations with respect to renewable sources (March 2012)*

Resources	Application		Under review		Endorsed		Total	
	Qt.	Capacity (MW)	Qt.	Capacity (MW)	Qt.	Capacity (MW)	Qt.	Capacity (MW)
Wind	4	64.60	9	408.60	59	2,592.90	72	3,066.10
Geothermal	6	110.00	8	225.95	1	24.00	15	359.95
Biogas	5	12.56	2	2.50	4	29.41	11	44.47
Biomass	7	79.73	3	40.00	4	19.45	14	139.18
Total	22	266.89	22	677.05	68	2,665.76	112	3,609.70

*Data obtained from EMRA (2013)

methods for energy project financing and ownership, which have several models; build, operate and transfer, build own and operate, transfer of operating rights as well as auto-production which is self-generation by industries who sell surplus energy to the national grid (MENR, 2013). Thus, the additional investments are expected to increase significantly with the help of these models. As one of the results of these ongoing work, the cost of electricity for residential is ranked 3rd and industrial is ranked 2nd (including taxes) among OECD countries in 2013. The relative price for natural gas compared to other OECD countries is even lower with 2nd place in both residential and industrial (MENR, 2013b).

Furthermore, in order to increase the low utilization renewable energy sources, several policies and regulations have been implemented. For solar power, "Renewable Energy Sources Supporting Mechanism" (YEKDEM) has provided various tax and licensing exemptions and fixed prices for surplus energy. For biogas, "Use of Renewable Energy Resources for Electricity Generation Law Number 5346" has provided support to increase the share of renewables in the electricity generation mix. Moreover, "Energy Market Regulation Agency" provided exemption from special consumption tax when the 2% share of biodiesel produced from domestic raw products that are mixed with diesel fuel, in order to increase the share of domestic biogas production. The same goes for bioethanol produced from domestic raw products that are mixed with gasoline.

In addition there are numerous "Renewable Energy Sources" (YEK) incentives based on the "4628 Electricity Market Law" which fixed the purchase price of electricity (depending on the renewable energy source) until 2015. Besides, when the mechanical and electromechanical components were produced domestically, additional incentives were also provided for 5 years. In addition, under this legislation, Turkish Electricity Generation and Transmission Corporation was broken up into separate generation, distribution and trade companies, and a new regulatory board was set up to oversee the Turkish power market, set up tariffs, issue licenses and prevent uncompetitive advantage to utilize the domestic resources more efficiently and economically.

Additionally, due to the "Free Market Practice" in September of 2002, several electricity production plant licenses have been received, reaching to a total power of 16,017.7 MW as of early 2012. Among these, natural gas is the highest with 44.1% of the total with 24 plants, hydro is 24.4% with 206 power plants and imported coal with 15.2% through 8 projects. Among all the power plant licenses, around 56% of them have not started investing as of the beginning of 2012. Thus, the electricity production is expected to increase with the inclusion of these new power plants.

Another difficulty with the utilization of the energy resources in Turkey was that in most cases they were handled and operated in low efficiencies. It was analyzed that there is a potential of increasing the efficiencies by 30% in residential, 20% in industrial and 15% in transportation sector. Thus, in 2007, an "Energy Efficiency Law" has established with "Increasing Efficiencies related to Energy Resources and Energy Utilization Regulations" in 2008 in order to implement the corresponding changes in the regulations for efficiency enhancements, including the prevention of loss and illegal use of electricity as well as wasteful expenditure, to better utilize the available resources. Moreover, In September 2009, a "medium term program" was established for the following years to increase privatization in the sector, start the implementation of nuclear power plants and play a more active role in being the transit route and a terminal country.

Finally, in order to create a road map for the future and lead the market through various policies and regulation, the government passed the "Electric Energy Market and Security of Support Strategy Document" in 2009 that is expected to have significant impact on the domestic production of energy sources.

4. CONCLUSIONS

The use of energy is essential to economic and social development and improved quality of life in Turkey. Due to strong population growth, urbanization and economic expansion, the primary energy demand of Turkey is increasing significantly every year. Turkey is still behind the per capita consumption compared to OECD average, which shows that there is still more room for further growth. Even though Turkey has very small reserves for most of its energy resources, tremendous efforts have been made to explore and efficiently utilize these resources in the past years. Moreover, Turkey has limited renewable energy resources which were heavily underused due to lack of investments, but in the past years major breakthroughs happened in this area. However, currently the production cannot keep up with the growth in demand, which leads to heavily importing which possess a threat on the country's economic growth, national security and industrial well-being.

In the past years, various international treaties, legislation on commercial activities, guidelines for energy production, taxation and other policy techniques were developed in order to reduce the associated imports and meet the countries energy demand domestically. In addition, significant incentives on investments were provided to increase the share of renewable energy sources in the electricity generation mix.

Based on these aforementioned issues in the domestic energy production and measures taken by the government, the following topics are needed to be concentrated by the policy makers;

- Prioritization of the use of reliable and cost effective domestic energy sources
- More efficient utilization of the resources
- Diversification of the energy portfolio through new technologies
- Reducing the risks created by importing energy
- Benefiting more from being a transit country and central hub of energy transportation
- Reconstruction of the energy sector to be as transparent and competitive as possible
- Being involved in regional cooperation projects
- Completing privatization of the sector
- Starting in production of nuclear power plants
- Increasing the share of sustainable and renewable energy sources

In addition, based on these key areas, the corresponding future targets of the Turkish government for 2023 can be summarized as;

- Using all identified lignite and hard coal reserves for electricity production
- Utilizing all technically and economically available hydroelectric potential for generating electricity
- Increasing the installed wind, solar and geothermal power generation to be 20,000 MW, 3,000 MW and 600 MW respectively
- Having 10,000 MW nuclear power plant capacity with \$40 billion investment
- Investing \$5 billion to the energy sector each year
- Increasing the share of private sectors to be 75% by having the energy production facilities to be privatized
- Increasing the installed electricity generation power to more than 100,000 MW in order to cope with the increasing demand
- Reducing the share of natural gas to be <30% in electricity production and the difference will be provided by coal (30%) and nuclear (10%) resources.

As a result, the imports associated with primary energy demand and the corresponding expenditure and security risks they impose are targeted to be reduced significantly in the next decades by increasing domestic production through aforementioned guidelines and policies.

REFERENCES

Balat, H.A. (2007), A renewable perspective for sustainable energy development in Turkey: the case of small hydropower plants.

- Renewable and Sustainable Energy Reviews, 11, 2152-2165.
- Balat, M. (2010), Security of energy supply in Turkey: challenges and solutions. *Energy Conversion and Management*, 51, 1998-2011.
- Bilen, K., Ozyurt, O., Bakirci, K., Karli, S., Erdogan, S., Yilmaz, M., Comakli, O. (2008), Energy production, consumption, and environmental pollution for sustainable development: a case study in Turkey. *Renewable and Sustainable Energy Reviews*, 12(6), 1529-1561.
- BP Statistical Review of World Energy. (2010), BP Statistical Review Report.
- Deloitte. (2013), The Energy Sector: a Quick Tour for the Investor, November 2013.
- EIA. (2013), U.S Energy Information Administration Overview Notes. [Last updated on 2014 Jan 02].
- EIA. (2013), U.S Energy Information Administration. Available from: <http://www.eia.gov>. [Last accessed on 2014 Mar 05].
- EMRA. (2013), Energy Market Regulation Agency, Turkey. Available from: <http://www.epdk.gov.tr/elektrik/yururluk.htm>. [Last accessed on 2014 Feb 10].
- ETKB – Petform. (2011), Petroleum Platform Association, 2010. Activity Report, Turkey.
- General Directorate of Turkish Coal. (2012), 2012 Coal Sector Report, May 2013. p27, 32-33.
- International Energy Outlook. (2013), June 2013 Presentation, U.S Energy Information Administration, DOE/EIA-0484.
- Kilic, A.M. (2005), Turkey's natural gas necessity, consumption and future prospects. *Energy Policy*, 34, 1928-1934.
- Kilic, F.C., Kaya, D. (2007), Energy production, consumption, policies, and recent developments in Turkey'. *Renewable and Sustainable Energy Reviews*, 11, 1125-1132.
- MENR. (2013a), Energy Outlook of the World and Turkey Report, Turkey.
- MENR. (2013b), Energy and Natural Resources Outlook of Turkey Report, November, 2013.
- Ministry of Energy and Natural Resources. (2013), Budget Presentation for the Year 2014, Turkey.
- Ministry of Foreign Affairs (MFA). (2006), Turkey's Energy Strategy, Ministry of Foreign Affairs Deputy General Directorate for Energy, Water and Environment, Ankara, Turkey.
- ODA Report. (2012), Turkey's Energy Outlook, Turkish Chamber of Mechanical Engineers, Edition Number: MMO/588.
- Ogulata, R.T. (2007), Potential of renewable energies in Turkey. *Journal of Energy Engineering*, 133, 63-68.
- PIGM. (2011), Turkish Petroleum International Company Ltd. Statistics. <http://www.pigm.gov.tr/istatistikler.php> [Last accessed on 2014 Feb 02].
- TEIAS. (2012), Turkish Electricity Transmission Company, Turkish Electric Energy 10 year Generation Capacity Projection (2912-2021), December, 2012.
- Turkey's Power Supply Policies Report. (2009), 26th Meeting of Turkey, EU Consultative Committee, Turkey.
- Turkish-US Business Council (TAIK). (2008), Turkey Brief: The US-Turkish Relations. Sector Reports & Opportunities, DEIK/TAIK Istanbul, Turkey.