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## The Evaluation of Energy Efficiency in Turkey

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# **THE EVALUATION OF ENERGY EFFICIENCY IN TURKEY**

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## **Abstract**

Turkey enjoys strategic importance with its geopolitical location, as an intersection point between the Asian and European continents and its close proximity to 70% of the world's energy resources. The location presents a unique opportunity to act as an "energy corridor and terminal" among the Middle Eastern, Caspian and the Western energy markets. Emission growth rates are expected to rise rapidly due to rising energy demand driven by Turkey's rapid economic growth, industrialization, steady population growth and the countries reliance on fossil fuels.

Unless energy growth is moderated to optimum levels in terms of efficiency on both the supply side and demand side, Turkey may face an energy deficit in the near future. So as to ensure an energy efficient growth trend, careful planning and integration of effective demand side management alternatives are necessary in medium and long term. In recent years, Turkey has started to pay more attention to the benefits of energy efficiency for securing energy supplies to a rapidly growing economy, reducing pollution and easing the burden of energy costs on the economy.

This paper focuses on the national and local level of energy efficiency in Turkey. It is analysed the legal frame of any energy efficiency measure in Turkey. The following research questions are to be answered: What is Turkey's energy efficiency potential? What is the role of energy efficiency in climate change policies in Turkey? Therefore a national strategy that takes this important role of local stakeholders into concern would bear the chance for success.

Key words: Turkey, energy efficiency policy

## **1. INTRODUCTION: TURKEY'S GEOPOLITICAL POSITION**

In twenty first century, energy has become the key element in determining economical and political balances of power. While the basic concern in twenty first century is the security of energy supply, today energy has become the main factor in relieving political (security) and economical leadership concerns on a global level. Turkey has a strategic position on energy, which has reached a strategic position in establishing new global balances.

Turkey's position brings into prominence the strategies and policies which Turkey will develop and implement on energy. Turkey is not alone in the energy game, where there are also a lot of global and regional players, countries and companies.

72% of the world's proved natural gas reserves and 72.7% of the world's proved oil reserves are in a large area around Turkey. Its close location to natural gas and oil reserves increases Turkey's geopolitical importance. Turkey has an incomparable position for transmitting these reserves to international markets in a secure and economical way, and therefore it has become a transition country for energy.

Turkey makes significant contribution to the economic development of countries, which have oil and natural gas sources but will put these on international markets for the first time and

directly, via energy line projects it carries out jointly with such countries. Countries such as Azerbaijan, Turkmenistan, Kazakhstan, Georgia (as transition country) are transmitting their oil and natural gas sources to international Western markets via oil and natural gas pipelines over Turkey (they also connect to Asian-Pacific countries with other energy lines), apart from lines dating back to Soviet Union period. Turkey's transitional role in energy contributes significantly to these countries for transmitting their sources to Western markets and also for their economic development.

Turkey is in a foreign-dependent position in terms of its energy sources, and it has been envisaged that this external dependence will increase pursuant to the targeted economic development within the next twenty years. While trying to utilize alternative and renewable energy sources, Turkey has been increasing the number of countries to which it delivers energy against external dependence; and it aims to provide security of supply both economically and politically. It has been increasing the number of supplier countries in oil and natural gas.

### **Turkey's Energy Corridors and Energy Projects**

Turkey actualizes its position as a transition country with the energy corridors it has established. Turkey establishes two important energy corridors. These are East- West energy corridor and North- South energy corridor.

#### **a. East- West Energy Corridor**

It is the energy corridor which aims and realizes that Central Asia, Caspian and Caucasian oil and natural gas sources are transmitted to international markets over Turkey. The corridor, politically and economically supported by USA and EU, has been planned from mid-'90s. The East- West energy corridor has two main projects. The first of these is Baku- Tbilisi- Ceyhan oil pipeline. Only Azerbaijan oil is available on the line, which has an annual capacity of 50 million tons, and when it is operated in full capacity, 1.6 million barrels of output will be obtained. Another important factor that strengthens this project is Kazakhstan's target of connecting to Baku- Tbilisi- Ceyhan pipeline via Trans- Caspian project, which aims to increase oil production to 150 million tons on an annual basis in 2015. Kazakhstan and Azerbaijan signed an agreement on this subject in August 2007. Therefore, in 2010- 2011, Kazakh oil will get into international markets from Ceyhan.

The second important project of East- West energy corridor is the project that enables the transmission of Central Asia natural gas to Europe. Azerbaijan Shah Deniz natural gas is transmitted to Turkey with existing lines. The main target of the project is to transmit this natural gas to Europe via two different projects. The first of these is Greece- Italy line which has still been actualized; the second and most important one is the NABUCCO project which constitutes Bulgaria- Hungary- Austria line. It is aimed that both Azerbaijan Shah Deniz natural gas and Turkmenistan natural gas will be added to this project. Moreover, it is aimed that natural gas of countries such as Egypt, Syria, Iraq, and Qatar will be connected with new pipelines. Agreements were made for this with Egypt and Syria.

## **b. North- South Energy Corridor**

North- South Energy Corridor started with the Blue Stream natural gas pipeline between Russia and Turkey. This project for meeting Turkey's demand for natural gas has later started to develop with new pipeline projects. Russia looks positively to connecting Blue Stream pipeline to the NABUCCO project, with which Turkey aims to transmit gas to EU. Moreover, Russia has been planning a new oil pipeline between Samsun- Ceyhan. The complementary of this project is to get the oil pipeline to the Red Sea, Israel, and to export oil from here to Asian- Pacific countries.

Parallel to the increase European Union's demand for energy, its external dependence in energy has been increasing. The external dependence of EU 25 countries in energy has reached 49% in 1998. It has been predicted that this proportion will increase to 62% in 2020, and to 71% in 2030.

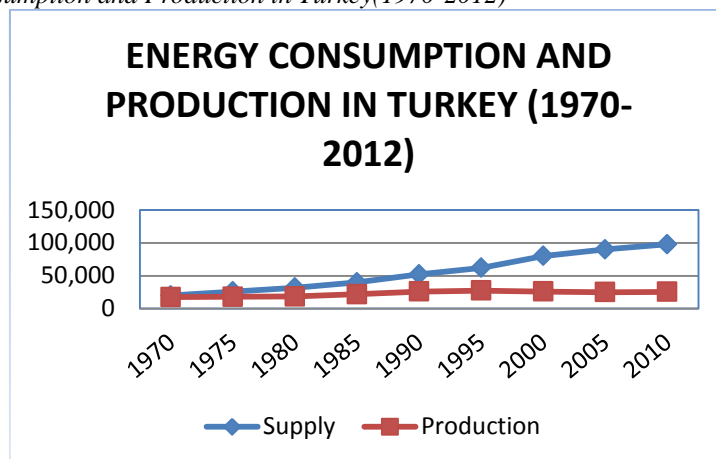
EU has been facing a serious problem in security of supply. Gradually focusing on natural gas in utilization of energy sources, EU has to diversify its natural gas sources. Turkey is the only alternative in the long term for diversifying Europe's energy sources and for the need to meet the security of energy supply. Turkey will be able to transmit the alternative natural gas sources (Central Asia, Caspian, Iran, Middle East, N. Africa) that Europe is in need of.

## **2. AN OVERVIEW OF ENERGY PRODUCTION, DEMAND AND CONSUMPTION FOR TURKEY**

Turkey faces considerable and growing demand for energy. Between 1990 and 2008, primary energy consumption in Turkey has been continuously increasing with an average, %4,4 annual increase. Turkey's primary energy consumption in 2008 was 106,3 millions TOE (Tons of Oil Equivalent), which is among the 25 countries that have the highest energy consumption in the world. However, the economic crisis in last quarter of 2008 and throughout 2009 decreased demand.

Although the demand for energy has risen dramatically, primary energy production has remained relatively constant. In 1990, production was at 25,5 Million TOE and in 2004 it was 24,3 MTOE. Total primary energy consumption increased from 99,6 Million TOE in 2006 to 106,3 MTOE in 2012. Since Turkey has very limited domestic resources to meet this increasing demand, a high energy import dependency of %73 in 2008 will only grow further. 48,2 billion dollars has been paid for energy imports in 2010.

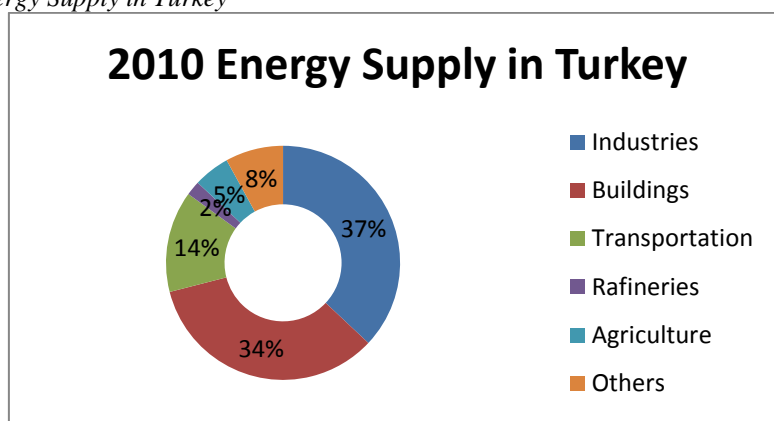
**Figure 1.** Energy Consumption and Production in Turkey(1970-2012)



Source: *McBDC Business Development & Consultancy Services (2013),*

According to the supply of the Country, industry and buildings are competing in means of supply of the energy in Turkey. Total of those volumes are almost 2/3 of all. Transportation is the third with 14%. This distribution looks almost the same in the last 2-3 decades.

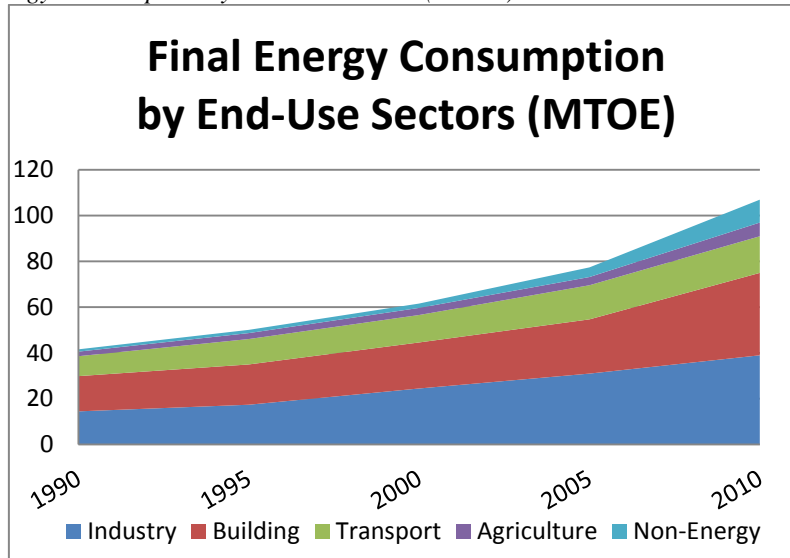
**Figure 2:** 2010 Energy Supply in Turkey



Source: [http://www.enerji.gov.tr/yayinlar\\_raporlar/Sektor\\_Raporu\\_TTK\\_2012.pdf](http://www.enerji.gov.tr/yayinlar_raporlar/Sektor_Raporu_TTK_2012.pdf)

The total consumption of all end use sectors was 79,5 MTOE in 2008, with industry being the dominant consumer for the past 15 years (see table below). However, because of the economic contraction in 2008, the building sector has become the largest energy consuming sector with a share of %36 in total consumption in 2008 (28,3 MTOE).

Figure 3. Final Energy Consumption by End-Use Sectors (MTOE)



Source: MENR, 2012

## 2.1.Fossil Energy Sources

Fossil energy sources are basically, coal, oil and natural gas. The evaluation of these energy sources in Turkey is presented below:

### COAL

In 2011, coal had a 23,1 % share in Turkish Total Primary Energy Sources. Currently, coal is primarily used for power generation, steel manufacturing and cement production, as well as residential heating. The state has the largest share in Turkey's coal industry ([http://www.enerji.gov.tr/yayinlar\\_raporlar/Sektor\\_Raporu\\_TTK\\_2012.pdf](http://www.enerji.gov.tr/yayinlar_raporlar/Sektor_Raporu_TTK_2012.pdf), last accessed: 02.06.2013)

The state owned economic enterprise, Turkish Hard Coal Enterprises (TTK), is the only producer of hard coal. Hard coal consumption has steadily been increasing since 1998. Domestic coal production will grow under pressure of demand and Turkey will continue to import coal so as to cover the needs of power generation sector as well as the iron and steel industries. While hard coal production was 2,8 mton in 1990, it fell to 2,2 mton in 2012. On the other hand, 5,6 mtons of hard coal was imported in 1990 and it reached 19,5 mtons in 2012, increasing 4 times. Considering that 7,470 MW of new hard coal power plants have licenses from EMRA, hard coal imports will be increasing in the coming years.

The most important domestic coal resources in Turkey are lignite. There are large, widespread lignite mines across the country. Between 1998 and 2004 lignite production decreased continuously from 65 million tons to 43 million tons. However, it has been increasing significantly for the past five years, reaching 75 million tons in 2008. The state owned Turkish Coal Enterprises (TKI) controls more than 50% and the private sector provides only 10% of Turkish lignite production. The Electricity Generating Corporation (EUAS) also produces lignite for three of its own power plants. Despite the fact that 88% of lignite reserves are economically feasible, only 8,4% has a heat content of more than 3.000

kilocalories per kilogram. The rest of the calorific values of the remaining reserves are not referees to high quality of coal.

## **OIL**

Compared to its neighbours Turkey is not an oil rich country. The available amount of extractable oil is assumed to be approximately 40,1 million tons in 2011. Domestic oil production has been fairly small and fluctuates between 2 and 3 million tons. In 2012, oil production, which is mostly in the southeast of Turkey, was only 2,4 million tons. This production continues approximately 7% of total oil demand. The state owned Turkish Petroleum Corporation (TPAO), producing almost 70% of oil, dominates oil production in Turkey. There are also domestic and foreign private companies as well as consortia in this sector.

The oil sector is undergone important changes due to the Petroleum Market Law which stimulated competition in the sector by abolishing price ceilings and removing import quotas on petroleum products at the beginning of 2005. TUPRAS (a petroleum refinery corporation) and POAS (a major petroleum products retailer) have been privatized.

Turkey has a critical strategic role due to its location on the increasing important oil and gas transit routes to Europe from the Caspian Sea and the Middle East and is working on many pipeline projects for both oil and natural gas avoiding the crowded Bosphorus Straits. Once the projects are completed, energy security will be increased for Turkey and Europe.

The main crude oil pipelines are Baku-Ceyhan, Batman-Dörtyol, Selmo-Batan and Yumurtalık-Kırıkkale. After the Baku-Ceyhan pipeline, the total crude oil lines reached to 3.373 km and nominal capacity became 130,2 million tons per year.

## **NATURAL GAS**

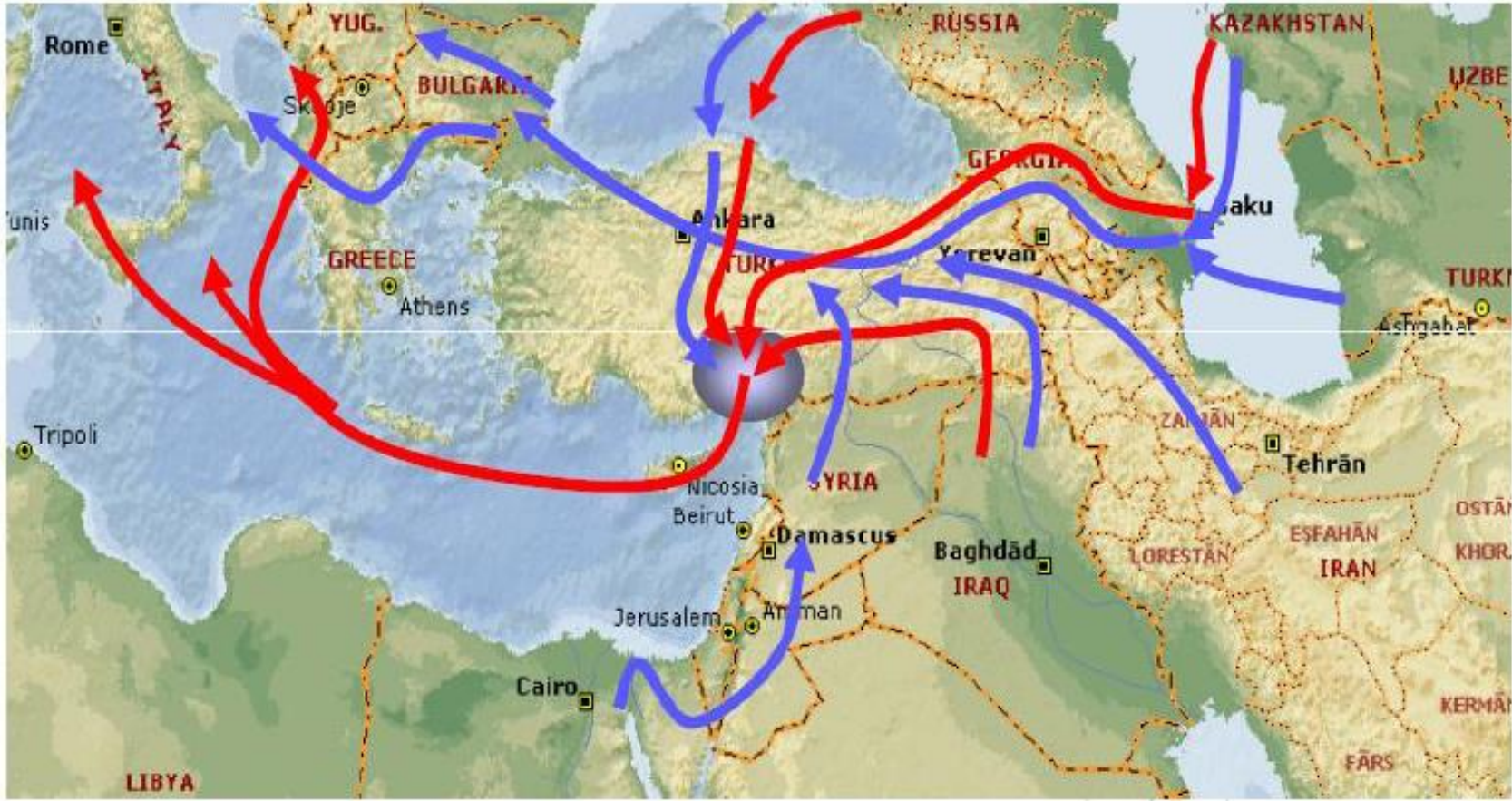
Turkey is an important natural gas transit country and also a fast growing consumer. With a 33% share in 2012 natural gas took the lead in Turkey's TPES. The total import volume of natural gas reached 37 billion cubic meters in 2010 and by the year of 2012 the length of gas transportation lines reached 11.282 km and supplied 71 cities of 81. In 2010, industrial and residential sectors consumed 32% and 17% of natural gas and power generation stations used natural gas taking up 51% of total consumption ([http://www.deloitte.com/assets/Dcom-Turkey/Local%20Assets/Documents/turkey\\_tr\\_enerji\\_dogalgaz\\_200312.pdf](http://www.deloitte.com/assets/Dcom-Turkey/Local%20Assets/Documents/turkey_tr_enerji_dogalgaz_200312.pdf), last accessed: 31.05.2013). But, within domestic sources, the ratio of demand is only 1,8 %.

The current natural gas pipelines are as follows:

- The Russian Federation- Turkey Gas main Transmission Line
- Eastern Anatolia Natural Gas Main Transmission Line
- The Russian Federation- Black Sea-Turkey Natural Gas Pipeline (Blue Stream)
- Azerbaijan-Turkey Natural Gas Pipeline
- Turkey-Greece Natural Gas Pipeline
- Nabucco Natural Gas Pipeline



Figure 4: Natural Gas and Oil Networks



Source: MENS, 2009

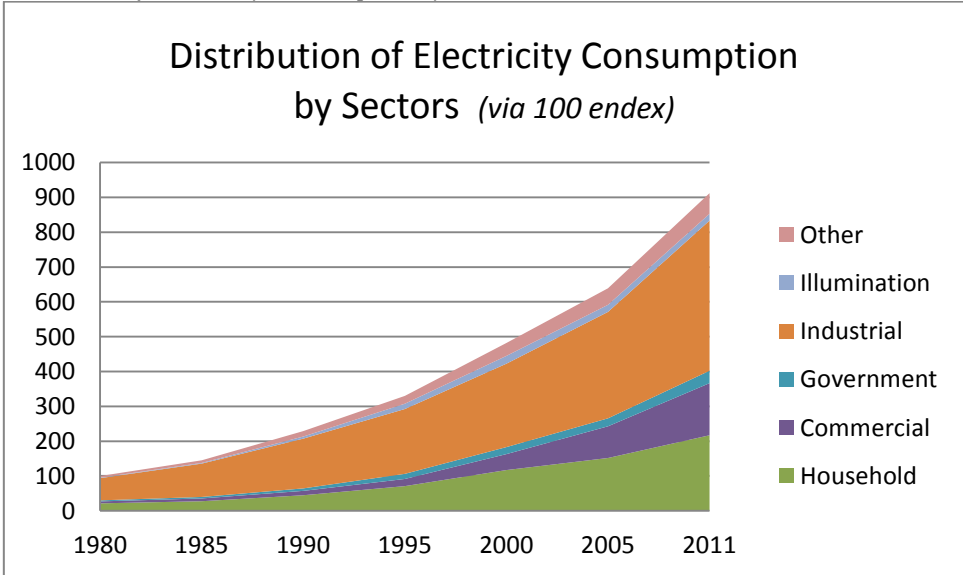


Nabucco project is one of the most important stages of the Turkish East-West Energy Corridor and Hub strategy. The Cooperation Agreement for the Nabucco Gas Pipeline Project was signed in 2002. Turkey is expected to become an important trade and transit center for natural gas exports. Thanks to Nabucco, natural gas could be transported from Turkey to Central and Western Europe.

**ELECTRICITY**

Turkey's electricity power output nearly doubled in the last decade, reaching 57000 MWs by the end of 2012. The distribution of electricity consumption has been almost doubled in last three decades. The ratio of illumination, household and government stabilized while the ratio of industry lost its rate. On the other hand, commercial performed the highest growing point. However, in 2011 the growth rate for electricity demands in increasing again and if new investments are not made, Turkey would fall into shortage by around 2015. Because, forecasts indicates that yearly increase in the demand for electricity in Turkey is 7% depending on the increasing population and social welfare.

*Figure 5: Distribution of Electricity Consumption by Sectors*



Source: MENS, 2009

Electricity consumption per capita is just below the world average (2,100 kWh, compared with a world average of 2,550 kWh). The share of electricity in final energy consumption surged between 1990 and 2011, from 9.5 percent to above 20 percent in 2011. Since 2001, electricity consumption has increased at the very rapid pace of 6.3 percent / year, much faster than final energy consumption. However, in 2009 it decreased by 2.4 percent. Although its market share is lower than in 1990 (58 percent), industry still accounts for 45 percent of electricity consumption.

Figure 6: Natural Gas Network inside Turkey



Source: [http://www.deloitte.com/assets/Dcom-Turkey/Local%20Assets/Documents/turkey\\_tr\\_enerji\\_dogalgaz\\_200312.pdf](http://www.deloitte.com/assets/Dcom-Turkey/Local%20Assets/Documents/turkey_tr_enerji_dogalgaz_200312.pdf)

In 1990-2010, installed capacity of hydroelectric energy increased from 6.764 to 13.829 MW. The installed capacity of thermal power plants reached 27.989 MW, increasing three times in the same period. Domestic installed capacity 2008 is app 41,8 GW, comprising lignite and coal fired 10 GW; gas and oil fired 17,5 GW, hydro 13 GW and wind, geothermal and biogas 1,1 GW.

However, actual available capacity is lower because of three reasons. One is, most lignite power plants are old and cannot produce at nominal capacity. The other reason is: some plants are off line due to lack of maintenance. And the last reason is that some larger hydro plants need upgrading. Hence; natural gas power plants provided almost half of the total consumed electricity in 2008. However, the trend in natural gas prices in recent years caused renewed interest in exploiting Turkish domestic coal resources. Several new conventional thermal power plants were put into operation, while 15 coal burning power plants and many new power stations are planned for construction.

The energy sources in electricity comprise of natural gas (app 50%) and imported and domestic coal follows this with app 29%. Shares of wind and geothermal were around 2,4 % in 2012. In 2012, conventional thermal power plants supplied almost 82% of natural electricity demand. Hydro electricity generation was only about %18,5 and rest constituted around 1%. Currently; Turkey does not produce any electricity using nuclear power.

According to the near to medium term demand forecast, significant growth rates in electricity demand (7-8% per annum) are expected in the coming years. This creates a stronger imperative for Turkey to build new capacity for electrical energy in order to ensure a secure supply. In the high demand scenario of TEIAS total generation is composed of existing capacities, state-owned capacities under construction, privately-owned capacity under construction granted by license and energy reverse. Depending on different scenarios by TEIAS, the energy supply gap will occur until 2017 ([http://212.175.131.171/Faaliyet2011/TR\\_Teias.pdf](http://212.175.131.171/Faaliyet2011/TR_Teias.pdf), last accessed: 30.05.2013)

The approach to Turkish energy policy so far has largely been supply-side oriented, in order to meet the growing demand, while energy efficiency, particularly on the demand side, has received relatively low priority. It is believed that potential energy efficiency improvements across various end-use sectors could be useful in moderating the energy demand projections of Turkey. Energy efficiency on the demand side should be taken into account in a more aggressive manner considering the opportunity for development of the energy market, international negotiations on climate change mitigation and energy price fluctuations.

### **3. ENERGY EFFICIENCY AND RENEWABLE ENERGY POLICIES**

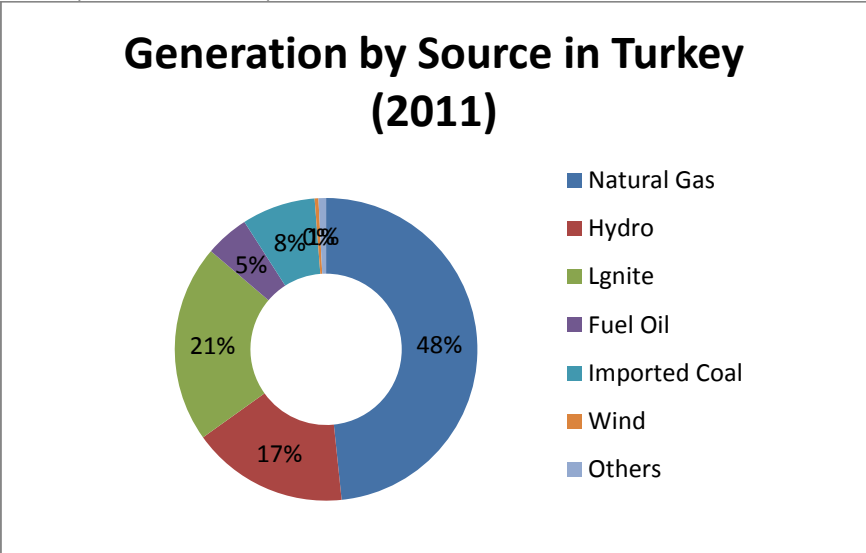
Unless energy growth is moderated to optimum levels in terms of efficiency on both the supply-side and demand-side, Turkey may face an energy deficit near future. So as to ensure an energy efficient growth trend, careful planning and integration of effective demand side management alternatives are necessary. In recent years, Turkey has started to pay closer attention to the benefits of energy efficiency for securing energy supplies o a rapidly growing economy, reducing pollution and easing the burden of energy costs on the economy.

Although there have been many achievements in recent years, like the Energy Efficiency Law, training and awareness activities, a limited grab program for industrial establishments and SMEs, Turkey needs a more aggressive strategy and actions on energy efficiency. On the institutional side, there is insufficient national level coordination among different agencies and activities related to EE, RE and all related laws and by-laws. To overcome this barrier, an Energy Efficiency Coordination Board (EECB) was mandated, comprised of all related ministers and actors at the highest governmental levels. However, it needs to be strengthened in its roles and actions. The Turkish economy is energy intensive in comparison with comparable economies. Although total primary energy supply per capita in Turkey is among the lowest, 1,35 tons of oil equivalent (toe) per capita in 2011 compared to the OECD average of 4,64 (toe) per capita, the Turkish economy is comparatively more energy intensive at 0,27 toe in energy to generate US\$ 1.000 of GDP, compared to the OECD average of 0,18 toe/US\$.

**3.1. Turkey’s Renewable Energy Policies**

Turkey has substantial renewable energy potential. Renewable make the second-largest contribution to domestic energy production and consumption after coal (See Figure 5).

*Figure 7. Generation by Source in Turkey (2011)*



*Source: Saygin, Çetin (2010)*

However commercial use of renewable energy in Turkey, excluding large-scale hydropower, has not developed in proportion to its large resource base. Renewable energy use has been dominated by large hydro and biomass (mostly wood and animal wastes). The huge potential of Turkey in renewable like wind, solar, and geothermal has not been used efficiently until recently (See Table 1 & Figure 8).

The ratio of wind energy of all renewable energy sources is around 5,22% of all. The highest renewable energy resource is hydro with 92,76%. Solar is only 0.82 % of all energy sources. While it is taken into account that, Turkey’s all renewable energy sources can supply only the 18% of all. Briefly, in the general view, if hydro excepts, the ratio of renewable in energy production is only app.2%. While the ratio checked for electricity production; it is observed that hydro sources could procure 23% of all electricity production is comprised of hydro while only 2,4% is occurred by wind energy.



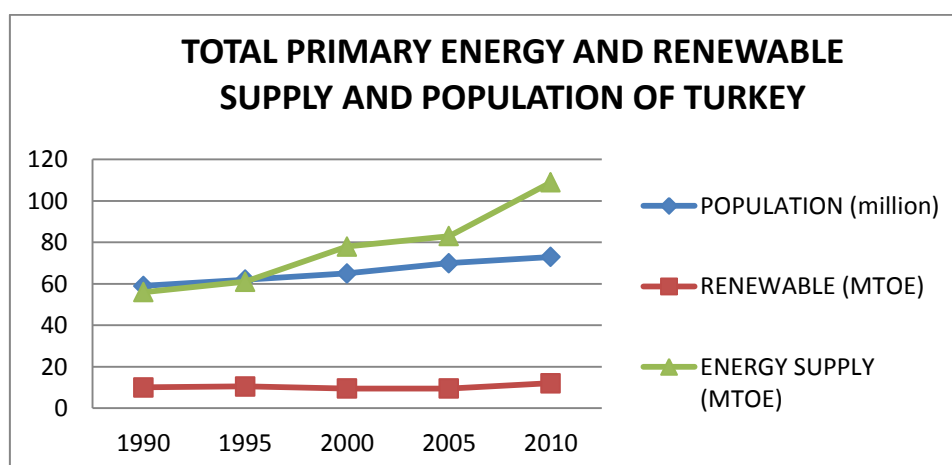
**Table 1. Comparison of Renewable Energy Potential With Capacity Under Construction**

Source (MW)	Potential	Under Construc. (MW)	Under	Opera.
<b>Hydraulic</b>	130000 GWh/y	9400	13852	
<b>Wind</b>	48000 MW	488	425	
<b>Solar</b>	32.6 M TOE	-	-	
<b>Geothermal</b>	600 MWe	64	30	
<b>Biomass</b>	8.6 MTOE	24	63	

Source: Saygın, Çetin (2010)

Unfortunately, the use of new renewable (renewable excluding large hydro) is therefore still extremely limited because of low growth. Although the absolute value of renewable energy use grows, its share of the Total Primary Energy Supply (TPES) does not increase since it doesn't grow in proportion with energy consumption as illustrated in Figure 6. So, the share of fossil fuels continues to increase.

**Figure 8. Total Primary Energy and Renewable Supply and Population of Turkey**



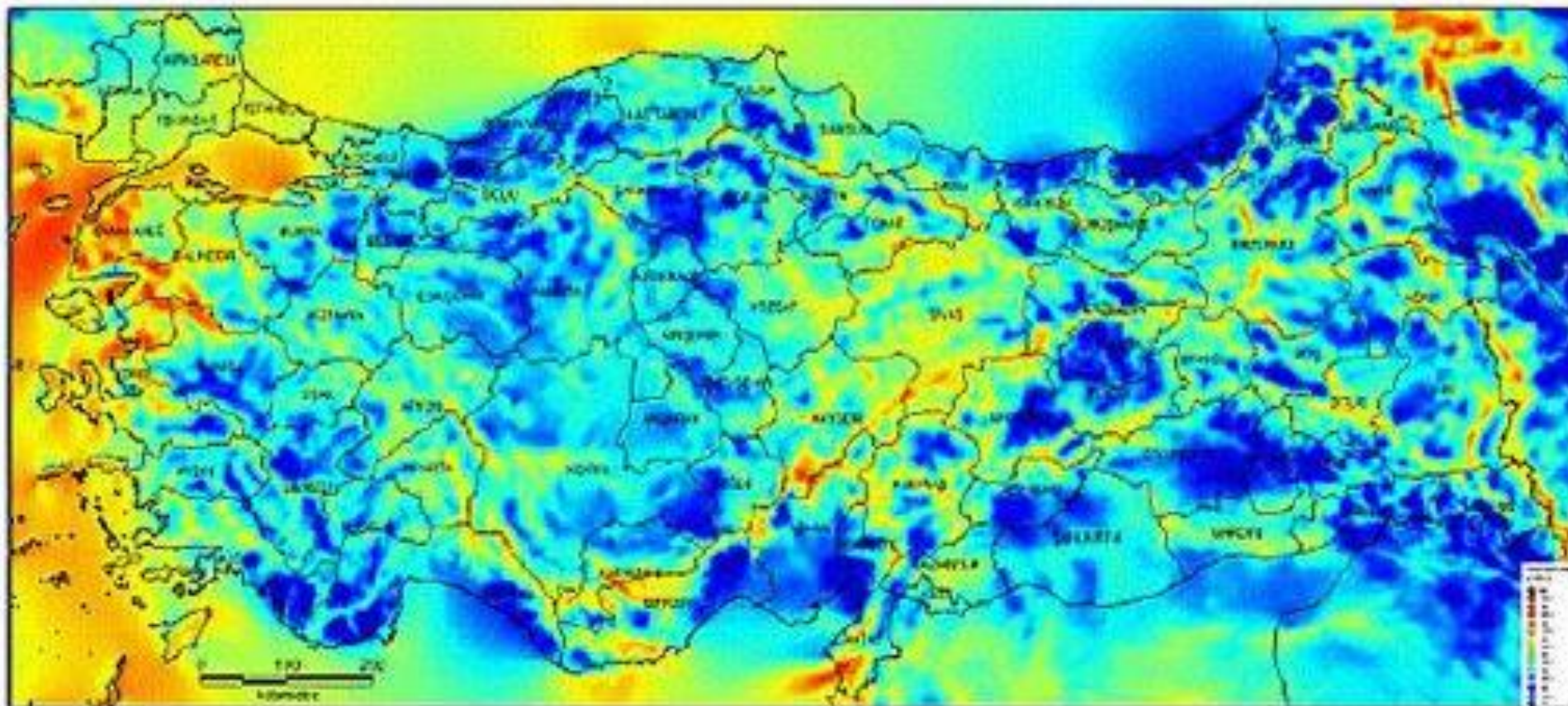
Source: Saygın, Çetin (2010)

### Wind Energy

Wind power is seen by many as one of the best bets to achieve a sustainable energy future. It is the most popular source of renewable electricity. At the end of the 2012, wind-powered generators achieve the record figure nameplate capacity of 238 GW, which was 41 GW more than the previous year. The World Wind Energy Association says that wind power has the capacity to generate 430 TWh per year, or 2.5 percent of the global electricity usage.

Turkey intends to increase its wind energy capacity 16-fold to 20,000 MW by 2020 from 1,265.5 MW in 2010, despite some concerns over the inconsistency of power generation intensity. The Ministry of Energy and Natural Resources in 2007 produced the country's first wind energy map, showing areas of Turkey that are suitable for wind energy development. The provinces of Balıkesir, Çanakkale, İzmir, and Manisa in northwest Turkey, and Hatay on the Mediterranean Coast have the strongest and most consistent winds needed for the development of wind farms.

Figure 9. Turkey Wind Velocity Map (Red connotes high wind power)



Source: McBDC Business Development & Consultancy Services, 2013

## **Solar Energy**

Concentrating solar power (CSP) generation is a proven renewable energy technology and has the potential to become cost-effective in the future, for it produces electricity from the solar radiation. In Turkey, the electricity demand is rapidly increasing, while the solar resources and large wasteland areas are widely available in the western and southeastern part of Turkey.

To change the energy-intensive and environment-burdensome economical development way, Turkish government supports the development of this technology strongly. These factors altogether make Turkey a suitable country for utilizing CSP technology.

With an average 2,640 hours of sunny weather throughout the year, or 7.2 hours a day, “Turkey is luckier than many countries because of its location and its higher potential for solar energy,” the state Electricity Affairs Research Administration reported. Solar energy panels (collectors) are widely used in the Aegean and Mediterranean regions of Turkey, which have the most sunshine in the country.

## **Thermal Energy**

Turkey has the richest geothermal resources in Europe and seventh biggest in the world, with the “theoretical potential” for 31,000 MW of electricity generation capacity a year, according to the state Mineral Technical Exploration Agency (MTA).

Turkey has 1,000 known geothermal wells and mineral springs. Of these 184 have temperatures of over 104 degrees Fahrenheit. Some 13 have temperatures averaging anywhere between 266 degrees Fahrenheit and 467.6 degrees Fahrenheit and are suitable for electricity production, the Electricity Affairs Research Administration reported.

Some 77.94% of the country’s geothermal resources are located in the Aegean region, while 8.52% and 7.43% are situated in Central Anatolia and the Marmara regions of the country while 4.77% are in Eastern Anatolia. Other areas of the country have insignificant geothermal resources.

Central heating from geothermal energy currently is used in some 103,000 homes and 215 SPAs in Turkey, the Electricity Affairs Research Administration said. It said six percent of the country’s geothermal energy is used to produce electricity, 55% for heating homes and 39% for other usage, including heating of SPAs and electricity for industrial usage.



Figure 10. Solar Map of Turkey



Solar Map of Turkey

Source: McBDC Business Development & Consultancy Services, 2013

## **Policy Evaluation of Renewable Energy**

In the event that Turkey continues pursuing the same policy, it is more likely that renewable shares will continue decreasing rather than increasing. Just as, total share of renewable in TPES has declined depending on, mainly, decreasing biomass use (see Table 2) and the growing role of natural gas in the system. It has been estimated that the share of renewable energy will decrease to % 9 of TPES in 2020. The share of installed renewable capacity in total installed capacity dramatically decreased in the last decade. In addition, Turkey's highly supply-oriented energy policy dominated, with emphasis placed on ensuring additional energy supply to meet the growing demand, while the sustainability criteria remained a lower priority.

Turkey is currently faced with serious environmental and energy security challenges. The share of imported fuels continues to increase and more than about 70% of the total primary energy consumption in the country is met by imports. And emissions are rapidly increasing. Energy intensity remains too high in comparison to the other OECD Countries. Therefore, environmental and energy security risks continue to increase in Turkey. Turkey's energy situation is evidently unsustainable and in conflict with the emerging energy paradigm as well as with contemporary global energy trends. Changing these unsustainable patterns is one of the main challenges for Turkey. It is clear that the existing renewable energy potential must be realized in a reasonable time period. It is a step in the right direction that decision makers in Turkey have already placed on the agenda to utilize hydro and other renewable resources such as wind, solar, and geothermal energy to meet growth in demand in a sustainable manner.

Recently, progress has been made with regard to renewable energy regulations. The First Renewable Energy Law entered into force in 2005. The Renewable Energy Law was a key step for strengthening the country's decentralized renewable energy sector. However, much more still needs to be done. It is an urgent need to improve the country's Renewable Energy Strategy. Turkey is also trying to take new steps for stimulating renewable energy use and investments to accelerate the transition to renewable energy.

Following the Law in 2005, investor interest in the renewable energy sector has risen distinctively. This is especially the case in relation to the generation of electricity through hydro plants and wind farms. A sharp increase in the number of licence applicants for renewable has occurred. Despite a rise in the numbers, the interest in renewable energy projects was hindered by the lenders' reluctance because of the uncertainty in the purchase guarantees. The efforts successfully resulted in substantial increases in the wind and geothermal capacity. Wind Capacity enlarged almost 40 times within 10 years, and reached almost 850 MW in 2010. And similarly, geothermal energy power enlarged almost 4 times in ten years and reached to app.80 MW. However, as Table 1 demonstrate solar capacity has not developed and it clearly needs further promotion.

Turkey is also now at the stage of setting targets for renewable energy development. The Higher Board of Planning adopted the "Electric Energy Market and Supply Security Strategy Paper" in 2009. In this Strategy Paper, the long term primary target is "to ensure that the share of renewable resources in electricity generation is increased up to at least 30% by 2023." This strategy document was published as a general road map to increase the share of renewable

energy in electricity generation. Within the framework of the Strategy Paper, long term efforts will take into consideration the following targets by 2023:

- Ensure that available technically and economically hydro-electric potential is fully utilized,
- Increase installed wind energy power to 20,000 MW,
- Commission all geothermal potential of 600 MW that is currently considered as suitable for electric production,
- Generalize the use of solar energy for generating energy and ensure maximum utilization of country potential,
- Follow and implement closely technological advances in the use of solar energy for electricity generation,
- Amend accordingly the Law No. 5346 to encourage generation of electricity using solar energy,
- Prepare and produce plans that will take into account the potential changes in utilization potentials of other renewable energy resources based on technological and legislative developments and in case of increases, utilization of such resources, share of fossil fuels and particularly of imported resource, will be reduced accordingly.

## **CONCLUSION**

The approach of Turkey's energy policy is mainly supply-oriented -, in order to meet the growing demand, while energy efficiency has a lower priority. The potential increase in energy efficiency should be taken into account in the energy demand projections of Turkey in a more aggressive manner considering the impact of the liberalization of the energy market, international energy developments and price fluctuations.

The energy intensity of Turkey is higher more than that of EU 15 and most of the OECD countries. Moreover, while EU and OECD have lowered their energy intensity over the last decades, energy intensity in Turkey has been relatively stagnant over the same period.

Although energy efficiency is important for all sectors, industry has the priority in energy efficiency initiatives with regards to the recent and upcoming years' energy consumption trends and also the energy intensity trend of the sector. The energy efficiency enhancement of the technological infrastructure of energy intensive industry has especially important effects on the future energy demand of the country. In industry, utility energy efficiency measures such as motor drive have extensive application and big energy efficiency potential.

Although Turkey has significant renewable energy resources for electricity production, this potential has not yet been used efficiently. The legislator in Turkey has taken important steps in order to promote the use of renewable energy resources in the production of electricity and to encourage the investments in this market. However, Turkey is making relatively slow progress in the realization of its aims of renewable energy. The reason for this is that policies and measures adopted in the country aiming to enhance the use of renewable energy sources are mainly driven by the requirements of the EU accession process. It seems that Turkey couldn't internalize the new energy paradigm specifically enough, although it has adapted to the EU's regulations. First of all, the paradigm change should correctly be understood and internalized by the Turkish institutions. This would allow the policy makers to set up a legal and institutional framework conducive to this new energy paradigm, draws up the

specifications of what the energy system of the future should look like, and formulate policy adopting the new energy paradigm.

If Turkey wants to catch up with leading developing countries, such should immediately accelerate the transition process to renewable energy. Technological leapfrogging is one of the ways to achieve this goal. From a conventional point of view, developing countries passively adopt technology as standard products, which have been developed in industrial countries. However, leapfrogging represents an attractive option for these late industrializing countries. The role of technological leapfrogging within a sustainable development context is not automatic, since leapfrogging alone does not guarantee or even encourage prosperity. However, from a more philosophical perspective, it has been argued that there is, in fact, no alternative to leapfrogging for developing countries. If these countries do not attempt to update their technologies, they face exclusion from the global mainstream economic trends as well as continued deprivation and poverty for their people. Turkey should also not repeat the energy history of the industrialized countries. Similarly to the success stories of the Indian and Chinese wind industries, leapfrogging opportunities may also exist for Turkey with its vast potential of renewable resources.

Decision makers in Turkey should internalize the concept of leapfrogging as an integral part of their renewable energy vision and should seek to implement its many potential applications. However, in order to protect the investment of the country's scarce resources available for advanced technologies, as is the case in most developing countries, and to distinguish between circumstances where leapfrogging may or may not be successful, careful and detailed analyses should be carried out.

The policy from now on should emphasize that the investments should be made primarily for energy saving, and if the savings from these investments are not enough, only after that should new energy generation plants be built. Energy power generation should be based on local, new and renewable sources. Energy planning should aim at protecting national and public interests, and increasing social interests.

The angle between the policies that have been under implementation for the last thirty years, the social needs of the Turkish people and the capacity to meet those needs are increasing day by day. The privatization policies being followed in essence function to satisfy the benefits of capital to get maximum profit. However, the fact that energy is a public and social service should be a basic principle that should be considered in all works done in this field. To benefit from energy is a human right. Thus, high quality energy should be provided to all consumers at a low cost, and in a sustainable, continuous manner.

Turkey's energy sector needs a centralized structure for the coordination of regulation, planning, and controlling activities because it has strategic importance and it requires a rational use of resources. The implementation of this structure should take Turkey's real conditions into account.

In determining the policies of the energy sector, a National Energy Platform should be formed, where all segments of the society (universities, chambers, professional organizations, public organizations, trade unions, consumer associations, etc.) are represented. By means of the National Energy Platform, strategic plans for all the energy sectors (i.e. petroleum, natural gas, coal, hydro, wind, geothermal, solar, etc.) should be prepared. Based on these sub-sector

plans, a National Energy Strategy must be prepared. This Strategy should be supported with roadmaps and action plans. Within the Ministry of Energy and Natural Resources, a National Energy Strategy Center which would coordinate and cooperate with the National Energy Platform should be formed.

A realistic and updated inventory of Turkey's energy should be prepared. Privatization policies based on a rejection of public planning, public power generation or use of local sources should be abandoned. The public sector should be given the right to make investments for power generation.

The legislation that would support power generation based on renewable sources must be renewed in the light of a macro strategy that aims to base Turkey's energy policies solidly on local, new and renewable sources. In addition, the local manufacture of equipment for power generation should be supported.

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