

INVESTIGATION OF ENERGY EFFICIENCY IN TURKEY

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Abstract: The fact that the reserves of fossil energy resources are limited, the scientific studies on renewable and alternative energy sources are intensified and the share of the total installed capacity in the world is still small while the investments are increasing at a serious rate, the efforts of using energy more efficiently have been increased. When the geographical location is examined, it is observed that Turkey is located on the intersection of energy corridors. What is the level of energy efficiency studies? In this study, with the increasing population and energy consumption amounts, Turkey's analysis of the energy efficiency situation has been analyzed and some evaluations have been made for the future. It has also been shown that it may be possible to contribute to the protection of the country's economy and the environment without restricting civilian needs by using energy more efficiently on a sectoral basis from the example of Turkey.

Keywords: renewable and alternative energy sources, energy efficiency, Turkey

1. INTRODUCTION

For economic and social development and human life; reliable, cheap and clean energy supply today has become the most important problem. It is known that 1.3 billion people in the world still do not have the right to use energy. This is one of the problems expressed in the future that could lead to wars in world scale. The data show that the rate of increase in energy consumption in Turkey is more than twice that of the EU and OECD countries. The change in electricity consumption is four times higher than the average of other countries [1]. The world's energy consumption has increased by 45% since 1980. It is predicted that by 2030 it will have increased by more than 70%. The emerging Asia-Pacific markets include 75% of the new demand and put new pressure on the resources of the world.

However, there is a growing demand and limited resource problem in developed markets such as North America, Europe and Japan. These developed markets will continue to make the necessary adjustments to reduce consumption, use alternative energy sources and increase energy security.

2. GENERAL OVERVIEW OF WORLD ENERGY APPEARANCE

The oil crises of the early 1970s and subsequent embargoes on the producer countries led to western countries taking urgent measures for their energy needs. Since these countries have urgently deployed nuclear power plants, they have made serious investments in alternative energy sources and energy efficiency issues. The variation of primary energy consumption on the basis of resources is shown in Figure 1 [2].

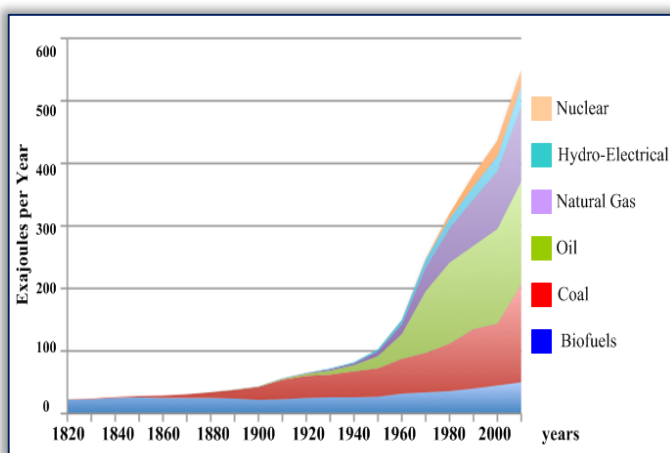


Figure 1. Change of world primary energy consumption on the basis of sources (1820 - 2010)

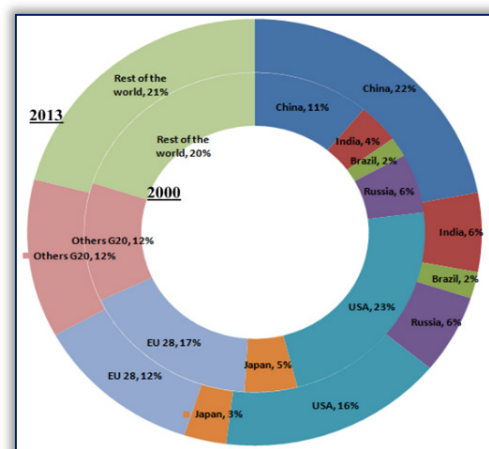


Figure 2. Change in primary energy consumption of some countries (2000 - 2013)

Today, fossil fuels have a dominant share in energy consumption. In 2010, 34% of 12 billion tons of equivalent petroleum (TEP) energy consumed by petroleum, 30% by coal and 24% by natural gas. In 2010, 54% of the world's energy is consumed by five countries. These are China, the United States, Russia, Japan, and India, where consumption is increasing in Figure 2. China's annual energy consumption has grown 2.4 times over the past 10 years, leaving behind the US annual consumption at the end of 2010 [3].

3. TURKEY AND ENERGY

The development of primary energy consumption in Turkey in recent years based on resources can be seen in Figure 3. Petroleum, whose share of primary energy demand in the 1970s has reached 50%, now has a significant share of 26.7%. The demand for natural gas, which is 3.1 million TEP in 1990, has increased 11 times in the last two decades and reached 34.9 million TEP in 2010 [4]. Turkey's primary energy consumption reached 109.3 million TEPs in 2010, despite a slight decline due to the 2009 economic crisis. A trend of 5% increase has been observed since 2010. On the other hand, the rate of meeting the energy demand with domestic production is decreasing [5].

☐ Turkey's Population Projection

According to data from the Turkish Statistical Institute, it is expected that the population of Turkey will reach 94.6 million by 2050. This is to ensure that the energy needs of the population can be met from domestic sources and that external dependency on energy can be reduced; it is also important to use energy efficiently as well as to increase energy production. Figure 5 shows Turkey's present and future population projection. By 2050 then the population will decrease in scenario 1 [6].

☐ Turkey's Electricity Consumption

The consumption of electricity in Turkey between 2003 and 2013 is given in Figure 6 and the annual energy consumption is showing an increasing trend. When it is thought that the increase in consumption will continue in this trend; energy efficiency gains more importance [7].

Energy-intensive industrial sub-sectors are important in the industry. Energy costs are between 20% and 50% of total production costs. The iron and steel sector has the largest share of industrial energy consumption with a share of 22% and cement, glass, ceramics and brick have a consumption share of 19%. These sectors have a large share in energy consumption and have high energy efficiency potentials [8]. The energy saving potential in the industrial sector in Turkey is at least 20%, of which about 50% can be paid with small investments and less than two years back. According to the work of the General Directorate of Renewable Energy, Turkey has a potential to save 15% in the primary energy demand of 222 million TEP by 2020 [9]. According to the current legislation, industrial facilities consuming 1000 TEP energy and Organized Industrial Zones (OSB), which has more than 50 enterprises in it, have to implement energy management. Well-organized energy management it is possible to save 10% energy with no investment at all.

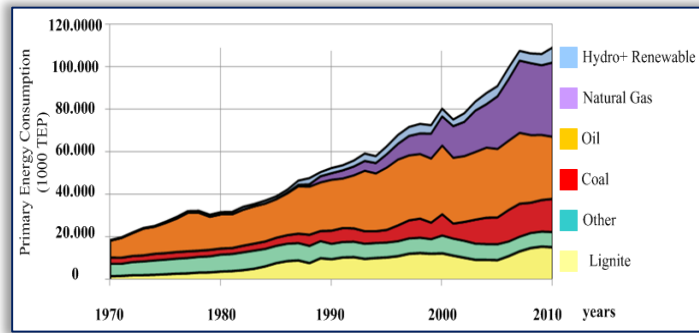


Figure 3. Development of Turkey's primary energy consumption on the basis of resources

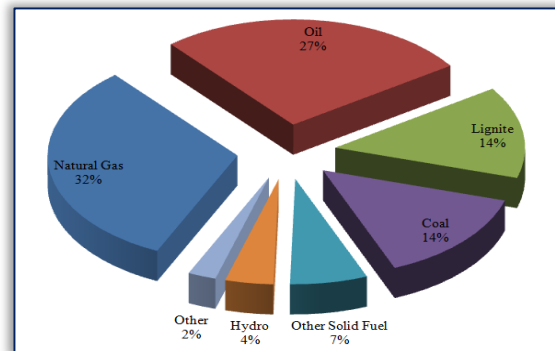


Figure 4. Distribution of primary energy consumption in Turkey (2010)

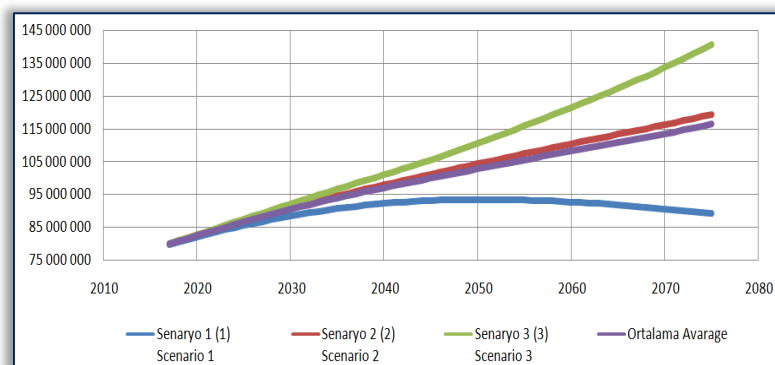


Figure 5. Turkey population projection based on various scenarios of Turkish Statistical Institute

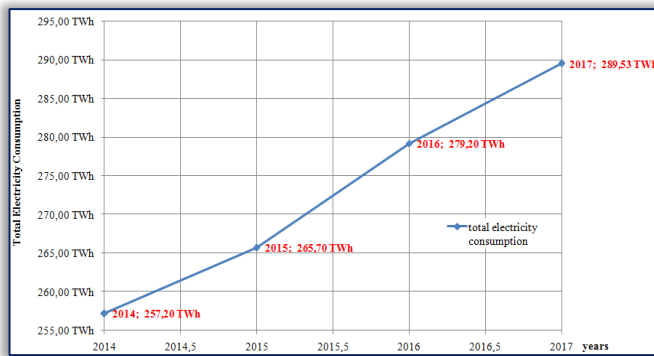


Figure 6. Electricity consumption in Turkey

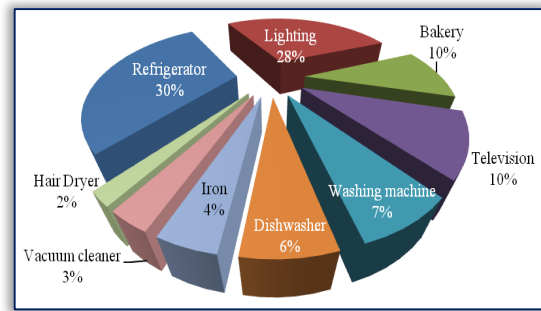


Figure 7. Electricity Consumption Rates in Buildings (%)

The electricity consumption ratios in the houses are given in Figure 7, and when these ratios are examined, it is observed that household appliances consuming the most electric energy are refrigerated with a share of 30% followed by enlightening by 28%. In order to reduce the high energy consumption due to refrigerator usage, energy saving models have been started to be used in refrigerator production and washing and dishwashing machines have been produced using saving models in the same way [10].

The share of enlightenment in energy consumption is great. The lighting industry is showing a trend towards Light Emitting Diode (LED) technology, which consumes less energy each passing day. It is expected that in 2020, 75% of the lighting industry will be formed by LEDs [11].

Energy Density

Energy Density, an important indicator of energy efficiency; It represents the amount of TEP energy consumed for the product of \$1000. In other words, the lower the density, the more energy is used efficiently. Turkey's energy intensity and the Tenth Development Plan are expected to take place as in Figure 5 for years [12].

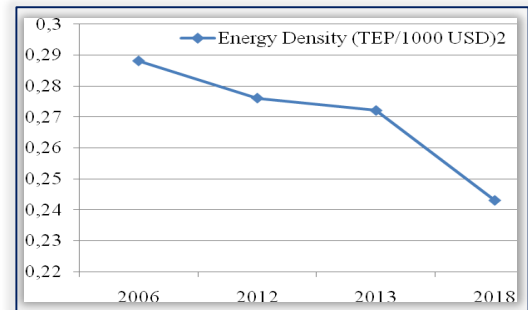


Figure 8. Energy Density Plan (between 2006 – 2018 years)

4. ENERGY EFFICIENCY

It is a concept that deals with a wide area such as energy efficiency, protection of the environment, contribution to world and country economy, some solution to unemployment, contribution to family budget. From another point of view, energy efficiency, energy generation, transmission and distribution, heating, cooling, lighting, home appliances, and office equipment, in the home and the service sector. As population growth and the development of technology increase the energy demand, when the current production is not enough to meet this need, new investments are made this need needs to be met.

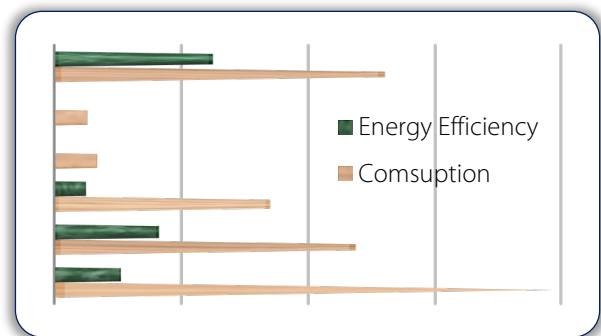


Figure 9. Turkey's energy saving potential of 2020

On the other hand it is possible to meet the energy deficit with primarily energy efficiency investments and energy efficiency, which can be called free energy. Energy efficiency is defined as negawatt, negajoule in the sense of negative energy in some sources. As a result of studies on energy efficiency in Turkey, it has been determined that there is an energy saving potential of approximately 2.5 billion USD, 30% in the building sector, 20% in the industrial sector and 15% in the transportation sector [13]. According to the projections made for 2020, the primary 222-MTEP it has been seen that there is potential to reduce energy demand by at least 15%.

The coal-fired power plants in Turkey are 92% owned by the state and the average age of these power plants is over 30%. It is known that the conversion efficiencies of these plants are around 30% and that these efficiencies can be increased to 90% [14]. Technically, 94% of hydraulic power generation can be achieved. In our country, hydraulic plant efficiencies other than those built in recent years can be reduced to 80%. Continued for the rehabilitation of public-owned hydraulic power plants According to a preliminary survey conducted within the scope of the studies, 615 million kWh can be obtained annually by the rehabilitation of hydroelectric power plants over a certain age in Turkey [15].

In Turkey, the ratio of total transmission and distribution losses to consumed electricity is around 14.5% in 2009 [16]. This rate is in Germany and Japan about five percent, four percent in South Korea, and seven percent in the United States [17].

5. CONCLUSIONS

- » Evaluating the saving potential in the sectors where there is a lot of energy consumption and decreasing the loss rates in transmission they will reduce their energy expenditure. Effective management of energy management in parallel with current legislation and future plans in the energy sector will make a significant contribution to energy saving [18].
- » Reduction of energy intensity in the industrial sector, energy improvement in productivity and structural changes. Savings in the iron and steel, cement, glass, petrochemical and petroleum sectors should be increased in this sector where energy saving potential is high and energy consumption is high. If the energy intensity needs to be reduced regularly and necessary precautions are not taken; In Turkey As energy consumption increases, the economy is likely to be more energy intensive.
- » In the transportation sector, increasing the use of rail systems and public transportation will significantly reduce energy consumption.
- » Large-scale enterprises, such as factories, hospitals, shopping malls, public life centers and similar places where there is a lot of energy consumption, such as cogeneration systems the preference of efficient systems will greatly contribute to energy efficiency.
- » Saving the energy of citizens it is seen that it will be beneficial to raise awareness about usage, to develop public transportation culture and to make electrical household appliances used in houses more energy efficient ones.
- » In the industrial sector, it is necessary to replace energy consuming instruments and systems, such as diesel engines, with those that are conservative, make market transformations, and attach importance to heat insulation in the houses.
- » In order to reduce energy demands and carbon emissions of buildings sustainable eco-friendly buildings using renewable energy sources seem to be necessary.
- » While planning for the future is planned in Turkey, the needs of the society can be analyzed in a proper and sustainable manner in terms of economic and social development. The approach must be exhibited and energy policy must be created.

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