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Exploring the Potential for Energy Efficiency in Turkey

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Summary

Energy efficiency is one of the key crossroads between energy, climate and economic issues. In fact, it represents one of the most cost effective ways to enhance security of energy supply, to reduce emissions of greenhouse gases and to enhance economic competitiveness at one fell swoop. This paper explores the potential for energy efficiency gains in Turkey, a country characterized by a strong growth in energy demand and by a strong need of better security of supply, emissions reduction and economic competitiveness.

Keywords: Energy Efficiency, Turkey, Sustainability

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EXPLORING THE POTENTIAL FOR ENERGY EFFICIENCY IN TURKEY

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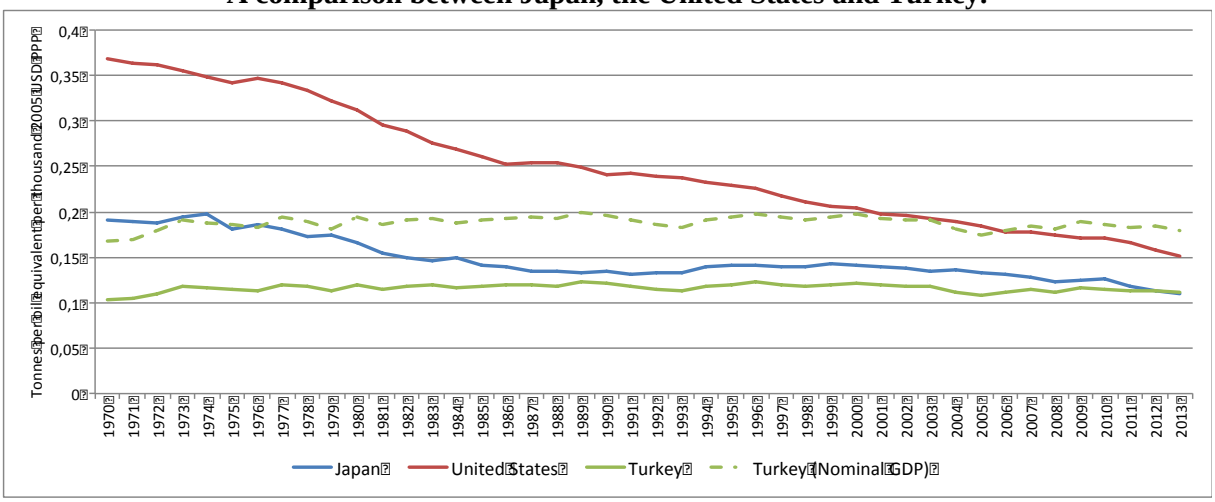
Energy efficiency is one of the key crossroads between energy, climate and economic issues. In fact, it represents one of the most cost effective ways to enhance security of energy supply, to reduce emissions of greenhouse gases and to enhance economic competitiveness at one fell swoop. For decades, the significance of energy efficiency was underestimated and its role debated, sometimes dismissively so, all over the world. This was due to the fact that, in contrast to supply-side options, energy efficiency options are often obscured as efficiency is rarely traded or priced. Furthermore, improving efficiency involves a wide range of actions affecting a variety of energy services across different sectors -including buildings, industry and transport- so the overall achievement is often difficult to quantify. But today, energy efficiency has moved from contention to consensus. Governments, energy companies and environmental groups generally agree that energy efficiency should be at the top of the agenda of what needs to be done to enhance the sustainability of world's energy, environmental and economic systems. The aim of this paper is to outline the position of Turkey with regard to this crucial sector, also providing an insight on the future challenges and opportunities concerning its development.

Energy intensity, defined as the amount of energy used to produce a unit of gross domestic product (GDP)[1], is the indicator generally used to measure the energy efficiency of a nation's economy. As an overall trend, the world's energy intensity has fallen over the last decades, primarily as a result of efficiency improvements in the power and end-use sectors and a transition away from energy-intensive industries. However, the rate of decline in energy intensity has widely differed from country to country. For instance, the best performers in terms of energy intensity reduction have been the United States and Japan, which started to lower their energy intensity already in the second half of the 1970s, when the oil crises of 1973 and 1979 seriously impacted their economies. On the contrary, Turkey (albeit starting from a structural lower level of energy intensity) has not improved its energy efficiency performance over the last decades. In fact, looking at the long-term evolution of Turkey's energy intensity (Fig. 1) it is impossible to recognize any sign of improvement as the trend remains basically fixed at a constant level.

[1] As Suehiro (2007) points out, it is impossible to accurately evaluate how advanced a country's energy conservation is and measure it against that of other countries, which are different not only in terms of their economies and welfare but also in natural and social conditions. However, energy intensity of GDP is often used to see a country's energy conservation level as the approximate index. The problem is that this index largely differs depending on the currency conversion rate. Conversion based on market exchange rates (MERs) tends to overestimate the GDP of countries that have higher prices, while conversion based on purchasing power parity (PPP) tends to overestimate the GDP of countries with lower prices. This means energy intensity based on MERs is advantageous to advanced countries with higher prices and that based on PPP is advantageous to developing countries with lower prices.

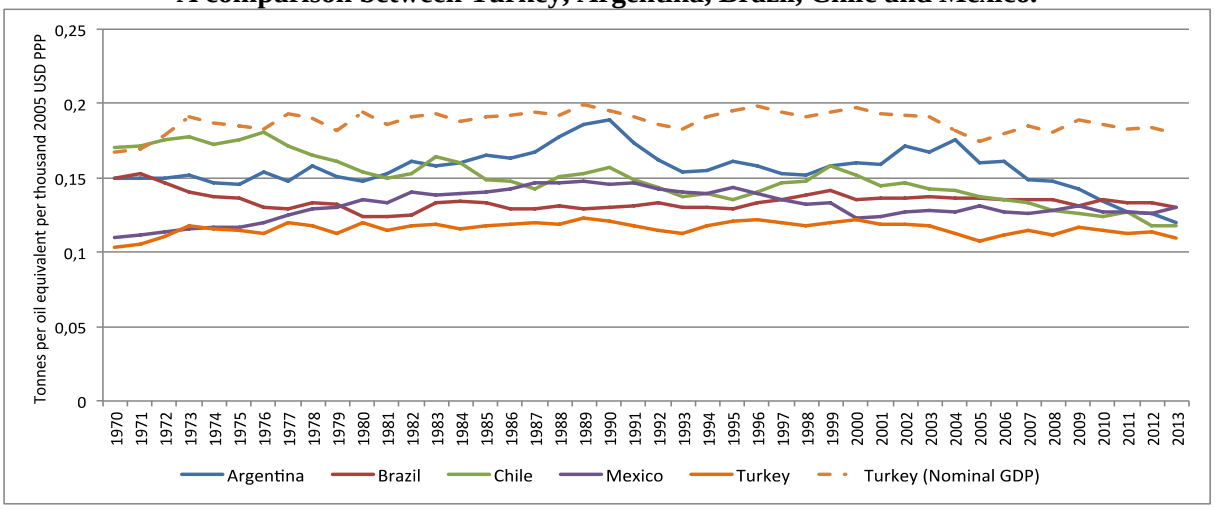
FIG. 1
Total primary energy supply per unit of GDP:
A comparison between Japan, the United States and Turkey.



Source: own elaboration on IEA World Energy Statistics and Balances, accessed in February 2016.

It might be argued that this difference is basically due to the different level of economic development of the three countries. For this reason, it may be useful to compare also the evolution of energy intensity in Turkey with that of countries placeable at the same level of economic development, in terms of GDP per capita, such as Argentina, Brazil, Chile and Mexico. Looking at this comparison (Fig. 2) it is possible to realize that Argentina and Chile are embarked on a path of energy intensity reduction; a trend particularly marked in the last decade. On the contrary, Mexico (albeit after a reduction in the 1990s) and Brazil (albeit after a considerable reduction in the 1970s) currently present a flat trend of energy intensity, well comparable with the one of Turkey. The point here is that Mexico and Brazil are both major energy producing countries, while Turkey is not. For this reason, Turkey should have been on the same energy intensity path than Argentina and Chile, rather than Mexico and Brazil.

FIG. 2
Total primary energy supply per unit of GDP:
A comparison between Turkey, Argentina, Brazil, Chile and Mexico.



Source: own elaboration on IEA World Energy Statistics and Balances, accessed in February 2016.

On the basis of these two comparative analyses it seems that Turkey is not yet on the optimum path as far as energy efficiency is concerned. This might signify that a considerable untapped potential in terms of energy savings is there; a potential that, if unlocked, could ultimately provide a considerable contribution to lowering the country's current account deficit.

But has Turkey ever tried to enhance its energy efficiency performance? As a matter of fact, Turkey did introduce a 20 percent primary energy intensity reduction target for 2023 compared with the 2008 level, with the "Energy Efficiency Law" adopted in 2007. This law sets the rules for energy management in industry and in large buildings, project support, energy efficiency consultancy companies, voluntary agreements, etc. It affects industry, power plants, transmission and distribution systems, buildings, services and transport. For instance, in the framework of this law industrial establishments consuming more than 1,000 tonnes of oil equivalent (toe) are obliged to report their energy consumption to the General Directorate of Electric Power Resources, Survey and Development Administration (EIE) and have an energy manager to monitor energy efficiency. In addition, larger companies that consume over 50,000 toe must establish energy management units. In 2009, the regulation "Increasing Energy Efficiency in the Use of Energy Resources and Energy", which sets out the provisions of the "Energy Efficiency Law", was adopted to support energy efficiency projects and voluntary agreements in industry. Accordingly to this regulation, the EIE can subsidize up to 20 percent of the project costs of industrial establishments investing in energy efficiency. In addition, if they are committed to reducing their energy intensity by 10 percent on average over a period of three years under a voluntary agreement, the EIE will subsidize 20 percent of their energy costs during the first year. In order to support small and medium enterprises (SMEs), the Administration for Supporting and Developing SMEs (KOSGEB) subsidizes up to 70 percent of the costs of energy efficiency training, study and consulting services procured by SMEs.

Up to date there is little evidence about whether these legislative tools have effectively had a concrete impact or not. Bearing in mind the energy intensity trend previously presented (Fig.1 and Fig. 2), it seems reasonable to argue that that although various legislative initiatives were taken to realize the country's potential in terms of energy efficiency, Turkey needs additional efforts to turn them into reality. At this point, the question is: what can be done to enhance the country's energy efficiency? As an overall trend, energy savings can be achieved both on the energy demand and supply sides. On the demand-side, savings imply reducing energy use at the point of consumption, either by increasing the efficiency of energy-using products, or by triggering behavioural change amongst end-users. Key areas of focus on the demand-side include improving the energy performance of buildings, implementing minimum standards of efficiency for energy-using products, providing information to consumers on their energy use, improving industrial energy efficiency and improving energy efficiency in the transportation sector. On the supply-side, efficiencies can be obtained either by improving the energy transformation process or through reducing losses arising from energy transportation.

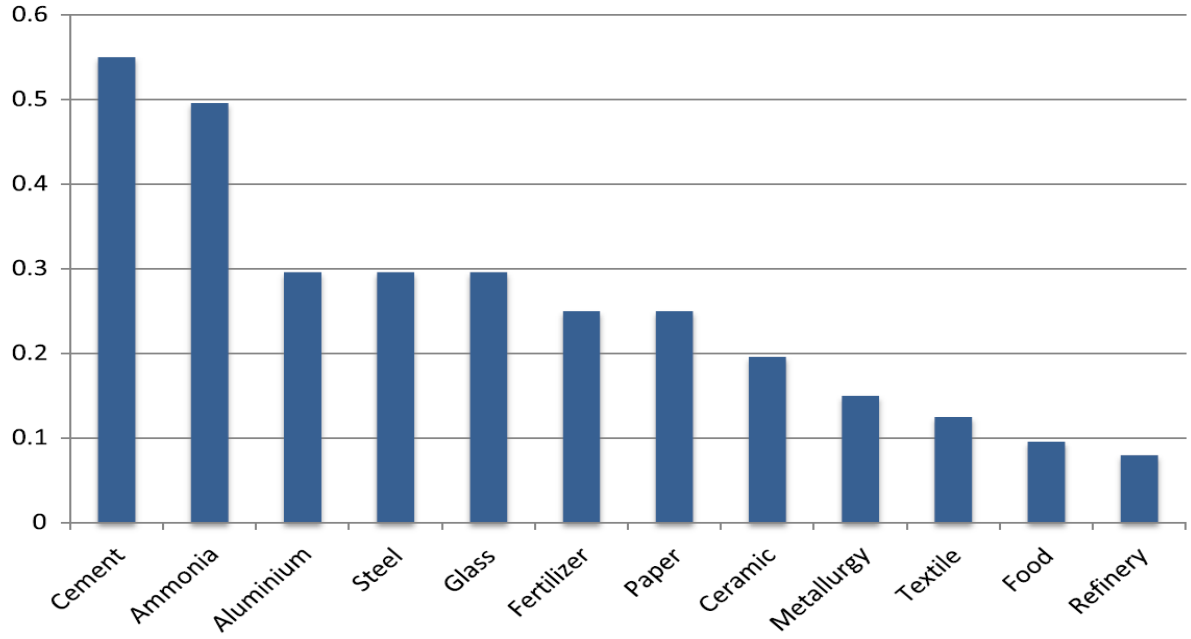
In Turkey three sectors have the potential to provide the most tangible opportunities for energy efficiency improvements: industrial, residential and transportation.

According to a major study carried out by the World Bank (2010), in Turkey the industrial and residential sectors alone offer an aggregated energy savings potential of over 15 million toe of energy consumption per year, or about 18 percent of the country's current total primary energy consumption.

The industrial sector accounts for about 35 percent of total final consumption and is the largest consumer of energy in Turkey, while the buildings sector accounts for about 30 percent of total final consumption (public/residential/commercial buildings). These two sectors also have the highest projected energy demand growth. Therefore, they offer the largest potentials for energy savings, making them priority sectors for promoting energy efficiency investments.

Turkey's industry is dominated by energy intensive industrial subsectors, where energy costs range approximately between 10 and 50 percent of the total production costs (Fig. 3).

FIG. 3
Share of energy costs in total production costs in Turkey's industry



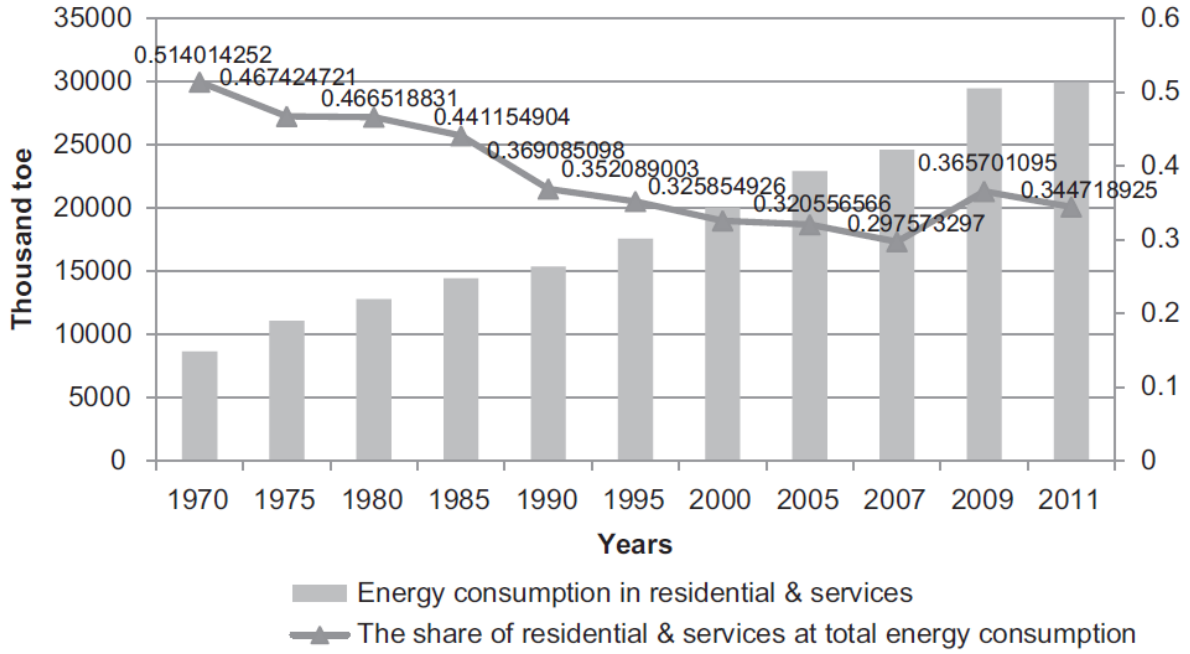
Source: Yalcin (2010).

The iron and steel subsector uses the largest share of Turkey's industrial energy consumption (about 25 percent), followed by the non-metallic subsector (cement, glass, ceramics, bricks; about 23 percent), the chemical-petrochemical subsector (9 percent) and the textile subsector (6 percent). These subsectors have the highest energy efficiency gains potential. The largest companies have already implemented some energy efficiency improvements and investments to maintain their global competitiveness. However, a systematic effort to prioritize and encourage investments could provide additional energy efficiency benefits to the country.

Turkey has also a considerable energy savings potential in the residential sector. Due to rising living standards linked to economic growth (including increased use of appliances and air

conditioning), together with substantial increase in the national building, the energy consumption of the residential and services sectors has increased three fold over the last 40 years, yet its share in the total energy consumption continues to decline (Fig. 4).

FIG. 4
Energy consumption of residential and services and their share in total energy consumption



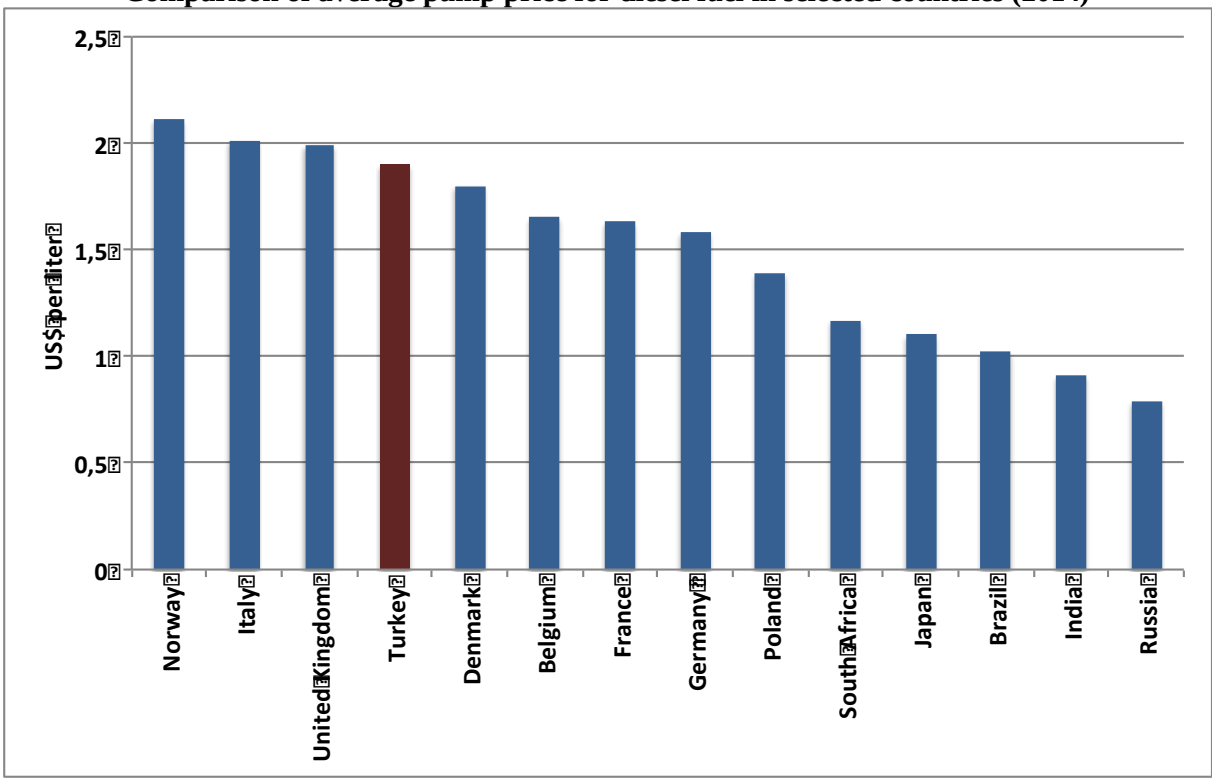
Source: Duzgun and Komurgoz (2014).

Heating accounts for 80 percent of energy consumption in buildings. Most of the buildings in Turkey were built years before 2000 and not regulated on energy performance. As such, a large improvement in energy efficiency can be achieved by increasing use of thermal insulation to avoid heat loss. The enforcing of the regulation "Energy Performance of Buildings" adopted in 2008 could allow the achievement of major energy savings not only from buildings' thermal insulation but also from a series of new energy efficiency standards for home appliances, such as air conditioners, refrigerators, light bulbs and so on. The introduction of eco-labelling and technical, mandatory, standard regulations on consumption for equipment and appliances concerning cooling, heating and lighting have proven to be the most effective and durable at low (or even negative) costs. The implementations of these energy efficiency requirements will also have a positive spillover on the international competitiveness of Turkey's industry, as by meeting the EU labelling standards, its products could have a number of additional export opportunities. All these elements demonstrate how energy efficiency could well be seen by Turkey as a unique opportunity for further growth, both in macro- and micro-economic terms.

Furthermore, major energy efficiency improvements might also be obtained in the transportation sector. In fact, this sector has rapidly expanded over the last decade, mainly due to strong population and economic growth. Just to provide an idea of this expansion, it might be useful to outline that the number of vehicles in Turkey has increased from around 4.4

million units in 2000 to around 9 million in 2013. Considering that the country still lags behind the most developed economies in Europe in terms of vehicle penetration per capita, it is possible to expect this rising trend to further expand in the future. But how is the country's vehicle fleet currently fuelled? As a matter of fact, the country's transportation sector is mainly fuelled by diesel (68%), LPG (20% - a share rapidly increased over the last decade due to favourable taxation) and gasoline (12%). Considering that in Turkey the average pump price for diesel ranks among the highest in the world (Fig. 5), energy efficiency improvements in the transportation sector should represent an economic imperative for the country, as they would considerably enhance the competitiveness of the economy.

FIG. 5
Comparison of average pump price for diesel fuel in selected countries (2014)



Source: own elaboration on World Bank, World Development Indicators, accessed in February 2016.

But how can these efficiency improvements be achieved? Looking at the previous international experiences (most notably of Japan, the United States and the European Union), in the transportation sector major energy efficiency gains could well be achieved by implementing the following policies:

To improve tyre energy efficiency, mandating tyre pressure monitoring systems on all vehicles and setting minimum requirements for rolling resistance and other essential tyre performances;

To improve fuel economy standards for both light-duty and heavy-duty vehicles, tightening vehicle CO2 emissions standards and enhancing fuel economy labelling;

To promote fuel-efficient driving, implementing eco-driving programmes. In fact, these initiatives are increasingly recognized as a low cost method of reducing vehicle fuel consumption without the need for vehicle technology improvements. A major advantage is that they can be implemented with drivers of both new and old passenger cars, as well as those of all sizes of commercial vehicles. However, regular updates through information campaigns and driver training are needed in order to ensure long-term savings.

To enhance the energy efficiency of the public transportation sector, increasing the share of railways on freight and passenger transport, increasing the share of public transport in cities and promoting a more energy efficient fleet of public buses. In particular, this latest target might be pursued by a progressive switch of public buses fleet from diesel to CNG (as is already being done in major cities, such as Istanbul).

If appropriately implemented, all the energy efficiency policies just illustrated with regard to the industrial, residential and transportation sector might contribute to achieve the triple-target of enhancing security of energy supply, reducing CO2 emissions and enhancing economic competitiveness of Turkey.

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