OeEB

Oesterreichische Entwicklungsbank AG

Energy Efficiency Finance

Task 1 Energy Efficiency Potential

Country Report: TURKEY

Prepared for OeEB by Allplan GmbH
in cooperation with Frankfurt School and Local Partners
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Abbreviations

CHP -	Combined Heat and Power
EE -	Energy Efficiency
EIE -	The General Directorate of Renewable Energy (YEGM), formerly EIE as the General Directorate of Electrical Power Resources Survey & Development Administration
EMO -	Chamber of Electrical Engineers
ESCO -	Energy Service Company
EU -	European Union
GDP -	Gross Domestic Product
GHG -	Greenhouse gas
HVAC -	Heating, Ventilation and Air Conditioning
KOSGEB -	Small and Medium Enterprises Development Organization of Turkish Republic, a public organization affiliated with the Ministry of Industry and Trade
kWh -	kilo Watt hour
LED -	Light-Emitting Diode
MMO -	Chamber of Mechanical Engineers
MoENR -	Ministry of Energy and Natural Resources
MWh -	Mega Watt hour
ORC -	Organic Rankine Cycle
PJ	Peta Joule
SME -	Small and Medium Enterprise
TAEK -	Turkish Atomic Energy Authority
TMMOB -	Union of Turkish Architectural and Engineering Chambers
TÜBITAK -	Turkish Scientific and Technical Research Institution
VRF -	Variable Refrigerant Flow is an HVAC Technology
VSD -	Variable Speed Drive
YEGM -	General Directorate of Renewable Energy, MoENR (formerly known as EIE)

General Remarks

Most financial values mentioned in the available studies were provided as Turkish Lira. In the frame of this report those values were converted into EUR applying the following exchange rate: 1 EUR = 2.56 TL (OeNB, 12.07.2013).

1 Executive Summary

Turkey's energy situation is characterized by a **strong import dependency** (only 26% of its overall energy demand can be covered from domestic sources) on the one hand and a sharp increase of energy demand to about 4,600 PJ (or 63 GJ per capita) in the last decades on the other hand. Main fuels are natural gas and coal, which make up for 85% of the electricity and heat production of the country. Renewable energies (mainly biomass and hydropower) make up 10% of the primary energy input.

The **industrial sector** is the major energy consuming share in Turkey with 33% of final energy consumption being attributable to this sector, followed by the residential sector with 31%. Among the industrial sector iron & steel, cement, chemistry and the textile sub-sectors are the main energy consumers.

The second biggest energy consuming sector is the **residential sector** with a share of 31% of final energy consumption. It is anticipated that the consumption figures will increase considerably in the coming years (1,185 PJ 2008 and 2,000 PJ 2020).The major share of energy used (75%) is attributable to heating (& cooling) of buildings. Thus, energy saving measures mainly need to focus on improved insulation and windows replacement. Saving potentials can reach up to 50% of current consumption figures. Also new buildings in Turkey on average exhibit energy consumption rates which are 50% higher than average EU buildings. It is envisaged that additionally the energy demand for appliances could be reduced by 40% through the use of energy efficient products.
In contrast to the potentials in the industrial sector and the residential sector both the share (241 PJ) and the estimated savings potential (18 PJ) of the agricultural sector are rather small.

Concerning the **legal framework**, the most important laws are the **Law on the Utilization of Renewable Energy Sources for Purposes of Electrical Energy Generation** and the **Law on Energy Efficiency**. The latter stipulates – among others – the obligatory energy consumption reporting of industrial facilities consuming more than 42 TJ/year, the mandatory implementation of energy efficiency measures in public buildings, the appointment of Energy Managers for big power generation facilities as well as the promotion of energy efficiency awareness measures. There are also policy papers which support energy efficiency, such as the Climate Change Strategy (2010) or the industrial strategic document of Turkey for 2011-2014. Currently, public support for energy efficiency investments is available from YEGM, KOSGEB and voluntary agreements. However, bureaucratic application schemes reduce the attractiveness of such schemes.

Regarding **the technical framework**, the Turkish market of energy efficient equipment and material is well developed and relatively mature with the exception of a few technologies such as ORC units, small scale absorption chillers, small scale CHP and small scale biomass systems as well as PV systems.

In **economic terms**, it is important to note that energy tariffs (electricity, natural gas) are quite high in Turkey, their level being comparable to EU average. All energy source consumption including delivered heat is adequately metered (with the exception of wood/waste in some rural areas), which is a prerequisite for energy efficiency measures. According to average profitability expectations among Turkish industrial investors payback periods of EE investments should be limited to 4 years. There is a general interest in energy related issues in the public, especially due to the high energy prices; the overall awareness/information level however still needs to be improved.

2 Aim and Scope of this Report

The Development Bank of Austria (OeEB) aims at increasing its activities in the field of energy efficiency in selected countries via dedicated credit lines, but also via supportive programs for selected financial institutions and project developers. The present study is part of the overall study, which analyzes the status of energy efficiency in the countries Turkey, Ukraine, Armenia and Azerbaijan.

The Study is carried out in cooperation of ALLPLAN GmbH and Frankfurt School and is based on the latest available information collected directly in the country by local experts in June 2013.

This report focuses on Task 1, “Potential of the Energy Efficiency Market” in Turkey and analyzes the following questions:

- How is the Status of Energy Efficiency in different economic sectors?
- In which sectors is the efficiency potential considered to be highest?
- How can local framework for energy efficiency be characterized in terms of legal, economic and technical aspects?

3 Studies Available

3.1 Overview

There are a large number of studies prepared by international and national institutions with a high relevance to energy efficiency in Turkey. The more up-to date and comprehensive ones, which were largely referred to in the preparation of this study, are present in the table below. The available studies strongly focus on the industrial sector.

Table 1: Overview of available reports

Name/Author/Date/Link	Scope	Brief description
Energy Efficiency in the World and Turkey TMMOB, MMO (2012, turk) link	The report was prepared to provide a current overview on developments in energy efficiency issues in Turkey.	The report summarizes: ▪ The general outlook of energy and efficiency in Turkey ▪ Energy efficiency policies in Turkey ▪ Comparison of energy efficiency status in Turkey and worldwide ▪ Turkey's general energy policies and energy efficiency strategy ▪ Turkey's institutional structure in energy efficiency ▪ Turkey's legal structure in energy efficiency ▪ Available incentives and financing for energy efficiency investments ▪ Energy efficiency in sectors; industry, motors, buildings, heating systems, cooling systems, white goods, lighting, transportation The report also provides a comprehensive analysis of barriers for EE and potential solutions.
Energy Efficiency Map and Targets Koç University (2012, turk) link	The report provides scientific support to the formation of a national energy strategy through deep analyses of energy efficiency with an interdisciplinary approach.	The following issues are discussed: ▪ Energy security ▪ Energy efficiency and its status in energy policies ▪ Measures for improving energy efficiency, performance criteria and cost-benefit analyses ▪ Evaluation of consumption, targets and scenarios ▪ Benchmarking with Japan, Switzerland, Germany, Denmark, USA, BRICS, MIST and G20 ▪ Role of universities, research institutions and NGO's in energy efficiency ▪ The role of measures and policies recommended for energy efficiency. ▪ Conclusions and recommendations towards preparation of a national energy efficiency strategy
Blue Book 2012 MoENR (2012, turk) link	The *Blue Book* is an annual report on the activities of the Ministry of Energy and Natural Resources and its affiliates as well as related public institutions in 2011.	The report contains a chapter on the general energy situation in Turkey, with the following officially compiled data: ▪ Distribution of electricity production based on producers ▪ Development of electricity import/export figures through years ▪ Distribution of Turkey's installed power capacity based on producers ▪ Development of gross and net electricity production, import, export and transmission losses through years ▪ Long term projections of energy demand and production and other activities of the ministry ▪ Summary of the energy efficiency activities

Energy Efficiency in Turkey and the Role of Municipalities Heinrich Böll Stiftung (2011, turk)	The report deals with the national and local level of energy efficiency in Turkey, analyzes the legal frame of any energy efficiency measure in Turkey and the role of possible stakeholders on the local level. The report also identifies civil society organizations and local administrations as main stakeholders in raising awareness of energy efficiency measures and in the implementation of energy efficiency.	The following issues are analyzed: ▪ Turkey's energy efficiency potential and the role of energy efficiency in climate change policies ▪ The authority of local administrations in energy efficiency applications ▪ The implementation of local energy efficiency action plans ▪ Autonomous municipalities as the key to energy efficiency ▪ The significant role played by cities and municipalities in the preservation of the climate and energy efficiency ▪ The Administrative Structure of Turkey ▪ Sustainable Development and Sustainable City ▪ Management and Planning of the Environment at the Local Level ▪ International Arrangements on Energy Efficiency and Local Administration ▪ Energy Effective Administration - Multi-Actor Administration ▪ Local Administrations and Local Services in Turkey ▪ Cooperation among Local Administrations ▪ International Relations of Local Administrations and Local Administration Associations in Turkey ▪ Civil Society and Participation in Administration at the Local Level ▪ Conclusions and Recommendations
Energy Efficiency Report TMMOB, EMO (2011, turk)	This report was prepared to address the general aspects of the energy situation in Turkey and a review of energy efficiency, in quite similar lines to the report of MMO.	The report addresses the issues below: ▪ Status of energy in the world and in Turkey ▪ Energy efficiency and climate change ▪ Energy efficiency in the world ▪ Energy efficiency in Turkey ▪ Energy efficiency in household appliances ▪ Energy efficiency, climate change and carbon trade ▪ Conclusions and recommendations
Turkish Energy Industry Report, Republic of Turkey, Prime Ministry, Investment Support and Promotion Agency of Turkey Deloitte (2010, engl) link	The *Turkish Energy Industry Report* prepared by Deloitte for the Turkish Prime Ministry summarizes overviews of the global and Turkish energy sectors.	Besides the information about the global and domestic energy sectors (e.g. oil, gas, coal, nuclear, electricity) the report contains a ▪ Sector outlook ▪ SWOT analysis of the Turkish energy sector ▪ Description of investment opportunities ▪ List of relevant establishments and institutions
Turkey Energy Efficiency Report ABB (2012, engl) link	The *Turkey Energy Efficiency Report* is a short report which addresses the topic of a 20% reduction in primary energy intensity by 2023.	*Turkey Energy Efficiency Report* provides an overview on energy consumption, power generation and CO_2 emissions in Turkey as well as energy intensities and the change of energy intensity in selected industries. Most of the many graphs shown cover the year from 1990 to 2009 which makes them especially useful to determine the respective trends.
Promoting Energy Efficiency in Buildings, Project Description Document UNDP/GEF/EIE (2010, engl)	The objective of the described project is to reduce energy consumption and associated GHG emissions in public buildings in Turkey by raising building energy performance standards, improving enforcement of building codes, enhancing building energy management and introducing the use of an integrated building design approach.	The document describes the UNDP/GEF project and provides an ▪ Analysis of energy efficiency in buildings in Turkey, ▪ Discussion of barriers to promoting energy efficiency in the building sector, ▪ Incremental cost analysis ▪ Stakeholder involvement plan ▪ Monitoring and evaluation plan. ▪ Description of climatic zoning in Turkey

3.2 Main results of existing studies

Nearly all available reports strongly focus on the **industrial** sector; still the **residential** sector is also covered, mainly by UNDP´s *Promoting Energy Efficiency in Buildings Project Description Document* and TMMOB´s *Energy Efficiency Report*.

The report *Energy Efficiency in the World and Turkey* from TMMOB published in 2012 covers a wide range of topics relevant to EE in Turkey (policies, EE strategy, institutional and legal structure, incentives and financing options, barriers and potential solutions, EE in sectors such as industry, buildings, heating and cooling systems, lighting, etc.) and also compares the energy efficiency status in the country and worldwide.

There are no energy efficiency studies publicly available which provide information about EE measures specifically for **SME**´s separate from those available for the respective sectors in which SMEs are active.

Due to its comparably low energy consumption share the **agricultural** sector is currently not the main target for investments by public reports. A detailed evaluation of EE measures in agriculture is not available from the existing studies. The only source providing a value for the energy savings potential is from 1998. A more recent study by the same author in January 2013 reports the energy consumption of the sector and points out the lack of analyses on the energy efficiency potential in agriculture. The report from 2013 does not contain specific EE measures or an updated value of the EE potential mentioned in the study from 1998.

4 Status of Energy Efficiency

4.1 Energy supply

Turkey's energy generation mainly relies on coal and natural gas. The limited domestic energy sources together with the growing energy demand lead to high dependency on energy imports, primarily of oil and gas. At present, only around 26 % of the total energy demand is supplied from domestic resources. The following chart provides a good overview of the energy flow in Turkey. Despite the fact that it depicts the situation in 2007 it is still considered a valuable document as it highlights the main factors of energy supply and use at one glance.

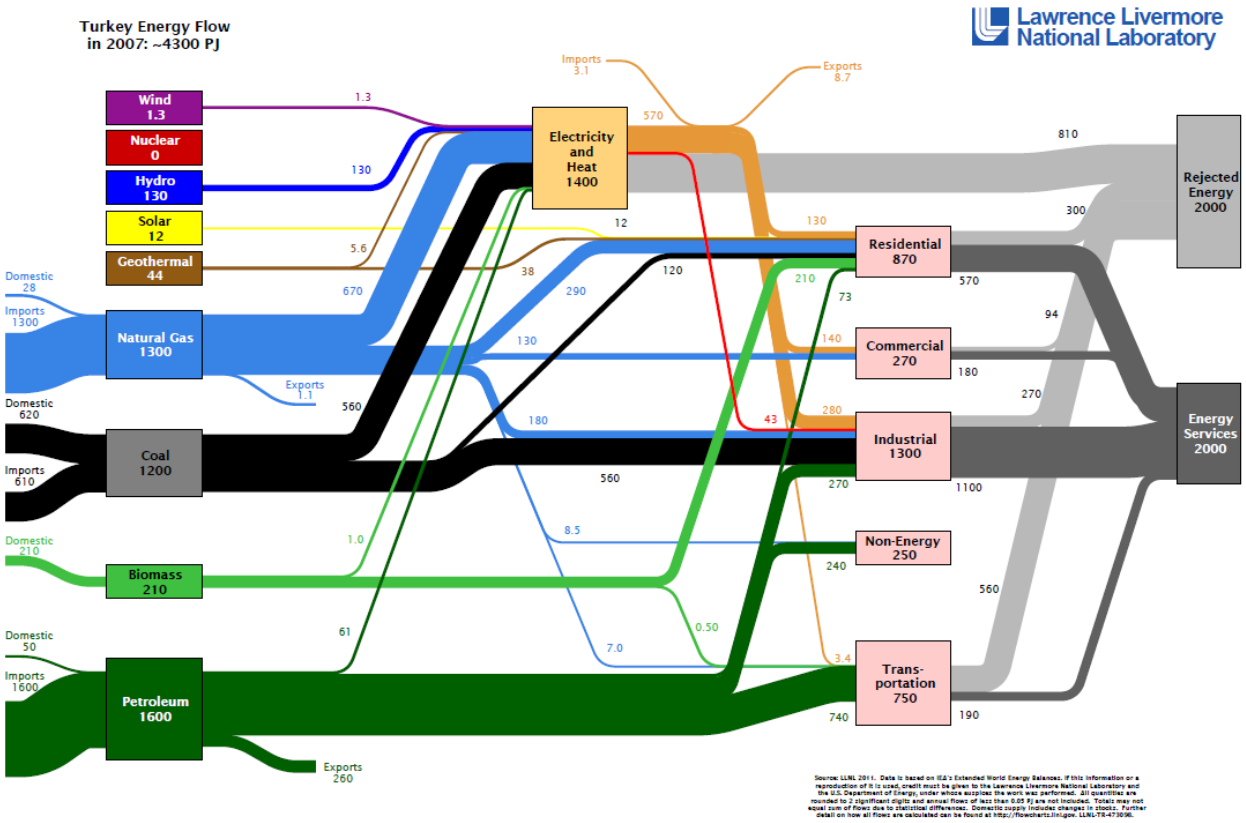

Figure 1: Energy flow Turkey 2007
Source: Lawrence Livermore Laboratories, 2011

From the chart above, which shows about 4,300 PJ primary energy, the following conclusions can be derived:

- Turkey is highly dependent on energy imports with a strong emphasis on petroleum and natural gas.
- Natural gas and coal make up more than 85% of the electricity and heat production.
- The only mentionable export product is petroleum with 260 PJ.
- Natural gas plays the major role not only for supplying electricity and heat producers, but also for supplying energy needs in the residential sector while coal is the most important energy source in the industrial sector.
- Biomass is mainly utilized in the residential sector for heating purposes.
- The rejected energy as depicted in the grey row, amounting to 2,000 PJ, is to a great extent due to losses in electricity and heat generation. Losses attributable to electricity and heat generation amount to 810 PJ, which is 58% of the delivered energy. In comparison to this figure the Austrian value (2007) amounts to 36%.
- There is a strong energy demand from the industrial sector.
- Renewable energies (mainly biomass and hydropower) make up almost 10% of the primary energy input.

Conventional thermal sources account for the largest share of electricity generation, with natural gas occupying the most prominent place among them. Conventional thermal and hydroelectricity generation accounts for nearly all of Turkey's electricity. Although Turkey currently does not generate any electricity from nuclear power, the government has been advocating construction of nuclear power plants in an effort to diversify Turkey's electricity supply portfolio (EIA, 2013).

The Turkish electricity market is one of the fastest growing in the world. Installed capacity has continued to rise regularly between 1998 and 2009 from 23,354 MW to 44,766 MW. The total installed capacity stood at around 54,000 MW in 2012 and continues to rise. The total electricity generation of Turkey is given in Figure 2.

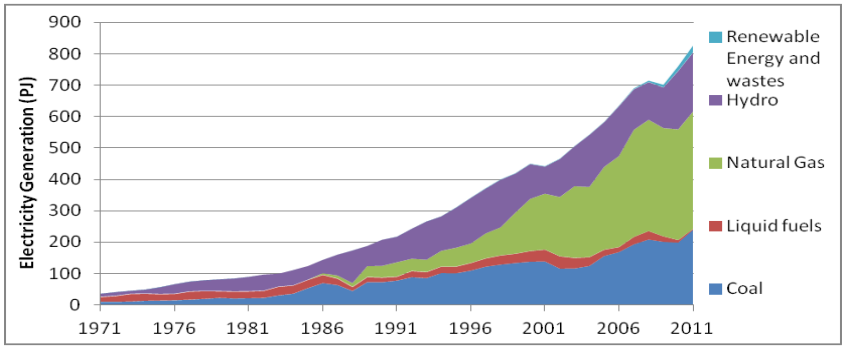

Figure 2: Electricity generation
Source: Turkstat, 2013

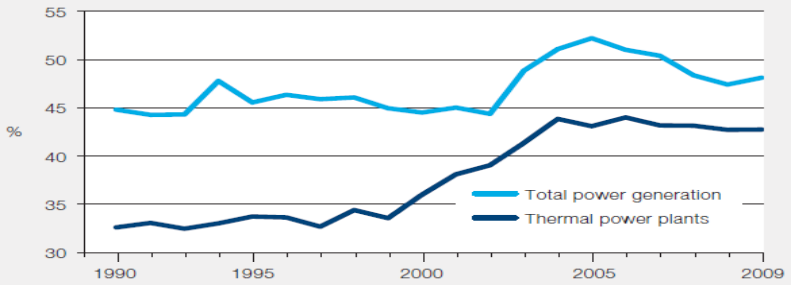

Figure 3: Efficiency of total power generation and thermal power plants
Source: ABB, 2012

The **efficiency of thermal power plants** has increased significantly, from 34% in 1998 to 43% in 2009. That increase is linked to the growing share of gas combined cycles in thermal electricity production; in 2009 they represented 28% of the thermal capacity.

The rate of **transmission and distribution losses** (T&D) in the Turkish power grid stands at 16% of the volumes distributed in 2010. It decreased sharply after 2000, following a noticeable surge. The world average stands at 9% (ABB, 2012).

4.2 Energy demand

The energy consumption in Turkey has reached a level of 4,600 PJ, or 63 GJ per capita, in 2010 with an increasing trend between 2004 and 2008. Giving the slowdown in the economy since mid-2008, the increase in energy consumption was reduced from 5.3% in 2007 to 1.4% in 2008. The decline continued in 2009 with a fall of 5.3% due to the global recession; however an annually increase of 2.5% is expected until end of 2013 (MoENR, 2012).

The role of industry in Turkey becomes apparent when the share of final energy consumption is compared with EU values (see Figure 4). Industry is responsible for the highest share of the final energy consumed in Turkey in 2011, while it only makes up the third place in EU 27 where the transport sector plays the major role.

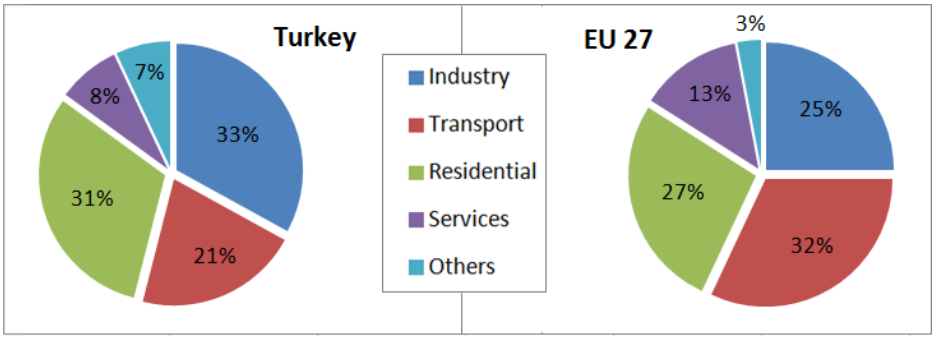

Figure 4: Share of final energy consumption according to sectors in 2011
Source: European Commission, 2013

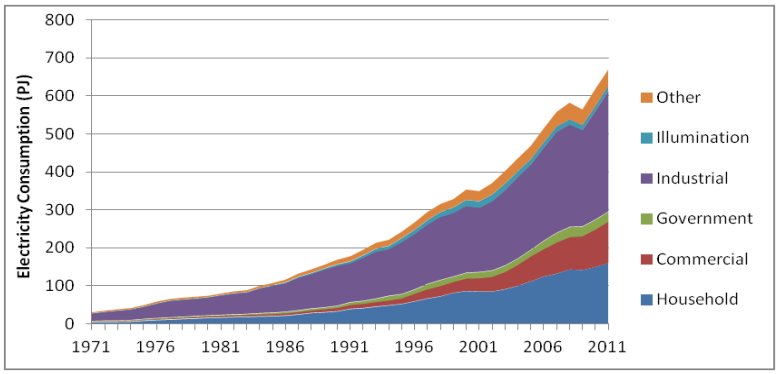

Figure 5: Electricity consumption by sectors
Source: Turkstat, 2013

The data from Turkey´s Statistical Institute (Turkstat, see Figure 5) shows a strongly increasing trend in electricity consumption. Turkey's electricity demand has seen a 70%-increase between 2001 and 2010, with much of the growth occurring between 2002 and 2008. After the economic slowdown in 2008 Turkey´s electricity consumption accounted to around 648 PJ in 2011.

As the industrial sector is the major consumer of electricity the total primary energy consumption in industry according to sectors in 2011 and the energy consumption in industry by source are provided in the following figures. The highest primary energy consumers in industry (2011) were iron & steel (314 PJ), cement (225 PJ), chemistry (119 PJ) and textile (81PJ). From this point of view, these industries may be a potential area for EE investments targeted on reduction of the energy consumption.

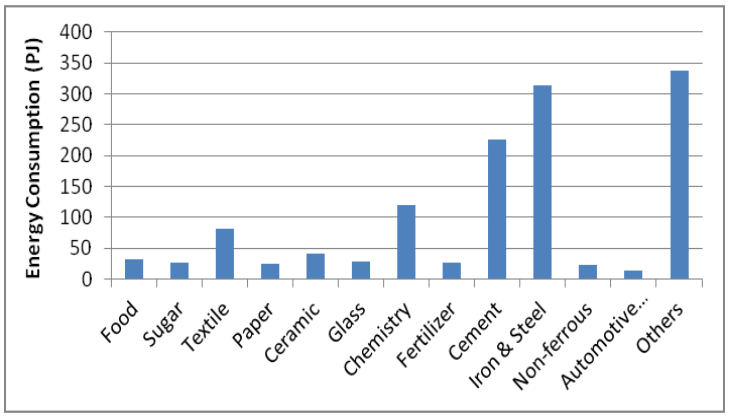

Figure 6: Total primary energy consumption in industry by sectors in 2011

4.3 Greenhouse gas emissions

GHG emissions arise mainly due to the combustion of fuel, technological processes in industry, farming and cattle-breeding. The generation of electricity and heat, with 113 Mt CO_2 in 2010, has the greatest share of the total CO_2 emissions (265 Mt). The remaining CO_2 sources are: manufacturing industries and construction (51 Mt), residential buildings and commercial and public services (42 Mt) and transport (40 Mt) in 2010.

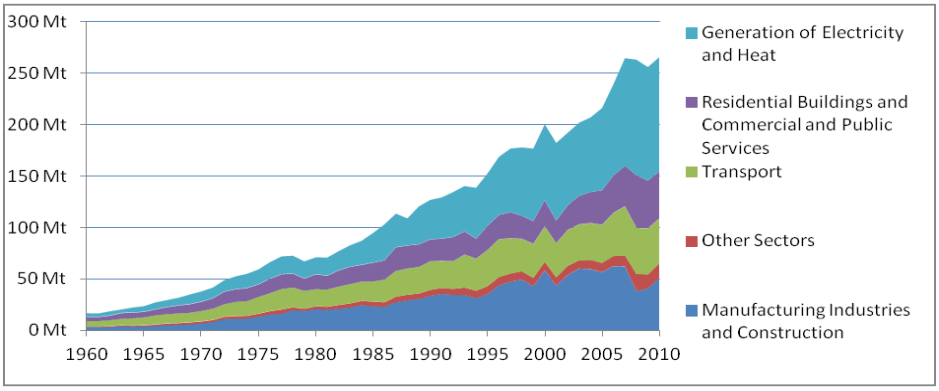

Figure 7: Development of CO_2 emissions according to sector
Source: EIA, 2011

4.4 Energy efficiency in the industrial sector

Industry makes up 27% of the country´s GDP (CIA, 2013). The following table provides an overview of EE opportunities in Turkish industry.

Table 2: Manufacturing sectors with energy saving potentials

Sector	Percentage of Industrial Energy Consumption (%)	Estimated Energy Saving (technical potential) (%)	Energy Saving Potential on whole Industrial Energy Consumption (%)
Iron and steel, basic metals	26	22	5.72
Non–metallic minerals (cement, ceramic, glass)	20	20	4
Chemicals, oil, rubber, plastics	12	20	2.4
Food	6	25	1.5
Textile, clothing, leather	7	20	1.4

Source: World Energy Council - Turkish National Committee Report, 2007

“Energy Saving Potential on whole Industrial Energy Consumption” is the product of the multiplication of the “Estimated Energy Saving” per sector with the percentage of “Industrial Energy Consumption” per sector and can be used as an indicator for the overall possible saving potential on the whole industry energy consumption of the sector. The “Iron and steel, basic metals” sector contains the highest overall potential as this sector has by far the highest share in total industrial energy consumption and an average estimated energy saving potential of 22%. Detailed analyses for heat and electricity saving potentials based on 2009 data per industrial sector are provided in the CTF (2012) study.

Turkey is the eleventh among global **iron and steel** manufacturers and third in Europe in terms of crude steel production volumes. The iron and steel subsector is among the most energy intensive sectors. Energy costs amount to 20-30% of the total production costs. The **estimated potential of energy savings are 60 PJ/year**. **Saving potential if compared to EU average energy intensities: Heat 30%, Electricity 0.4%** (CTF, 2012).

Cement producers are among the largest energy consumers in Turkey. As of year 2010, 46 integrated cement plants in Turkey were producing both clinker and cement, and 20 plants grind clinker that is produced by other plants. At the end of 2012, Turkish plants had an annual capacity of 56.8 million tons of clinker and 94.3 million tons of cement. Turkey has the largest cement-producing capacity in Eastern Europe and in 2010 it was the seventh largest cement consumer in the world.
Cement accounts for 12% of the total industrial energy consumption. It is energy intensive and energy costs account for 50% of the total production costs. Primary energy sources are coal, petro-coke, fuel oil and electricity. While much of Turkey's cement production capacity is relatively new and hence relatively

efficient compared to older machinery, alternative fuels are not commonly used in the industry. They only represented 2.4% of all fuels used by the industry in 2011.
Unlike many major cement industries in the EU and America, Turkey's cement industry has numerous waste heat recovery (WHR) systems that have been implemented in recent years (Globalcement, 2013). Using the benchmark approach, EIE analysis data (2009) indicates a saving potential of 25% in electricity and 29% in fuel consumption in the cement subsector. Turkish companies have made EE investments since then, but allowing for parallel improvements in the industry used to benchmark Turkish industry, these ratios may be assumed to continue to apply. The **energy saving potential** is estimated at around **46 PJ per year. Saving potential if compared to the EU average energy intensities: Heat 8%, Electricity (not indicated)** (CTF, 2012).

As Turkey produced over 2 million tons of **glass** in 2010 the country is among the leading European glass producers and a major exporter of glass products. The Sisecam Group (including Paşabahçe, Trakya Cam, Cam Elyaf, Anadolu Cam and Soda Sanayi) dominates the sector with half of Turkey's annual glass sector sales (2.3 billion EUR).
The energy consumption in the glass sector constitutes around 3.0% of the total industrial consumption and amounted to 8.37 GJ/ton glass in 2009, well above those selected European Countries (Source ENERDATA, EIE, 2009). 15% to 20% of manufacturing costs relate to energy. YEGM determined an **overall saving potential of 15%. Saving potential if compared to the EU average energy intensities: Heat 16%, Electricity (not indicated)** (CTF, 2012).

Turkey`s **textile sector** competes with China as the leading supplier of clothing and household textiles to the EU. Turkey's textile industry has the following processes fully integrated: spinning, weaving, dyeing, finishing and garment production, and the country is a major global producer of synthetic fibers. Due to the diversity of processes, the only available aggregated data for the sector is based on energy intensity - energy consumption per monetary outputs. Though, textile production is not energy intensive, its high share of total industrial consumption - 9.0% due to the large number of companies active in this sector - makes it a possible candidate for potential EE opportunities. The diversity of process technologies, industrial activities, and products makes it difficult to collect EE data in Turkey and to evaluate and identify the EE opportunities in the subsector, allowing for differences in process technologies and value-added among countries. **Saving potential if compared to EU average energy intensities: Heat 35%, Electricity 44%** (CTF, 2012).

Paper: Saving potential if compared to EU average energy intensities: Heat 12%, Electricity (not indicated) (CTF, 2012).

Food: Saving potential if compared to EU average energy intensities: Heat 9%, Electricity 17% (CTF, 2012).

Turkish **SMEs** (companies employing less than 250 persons and with annual turnover or net sales less than 15,625,610 EUR.[1]) are growing slower than both large Turkish enterprises and SMEs in comparable countries. Access to finance is perceived as the single most severe obstacle to growth for medium-sized firms. SMEs' share in total credit was around 24.5% as of December 2012 (WB Report Turkey). There were about 3.25 million SMEs in Turkey as of end of 2012 (KOSGEB, 2012).

The weight of SMEs in the Turkish economy:

- Industrial and service SMEs account for a major share of the economy: SMEs constitute for 99.5% of the companies, 77% of the total employment and 55% of the value added
- The sectoral distribution of SMEs in Turkey is: 46% trade, 14% manufacturing sector, 14% transportation, 9% hotels and restaurants
- SME energy consumption of 603 PJ accounts for around 46% of the total industry energy consumption and 19% of the Total Final Consumption (TFC).

[1] Regulation on the Description, properties and classification of Small and Medium Size Enterprises, 19/10/2005

- SME estimated energy efficiency potential is sizeable at 42 PJ per year or 7% of the total SME energy consumption

4.5 Energy efficiency in the residential sector

Since 1980, the energy consumption has doubled and is expected to continue increasing. The final energy consumption in residential and commercial buildings accounted for 1,185 PJ in 2008. The Ministry of Energy estimates that the building sector's energy consumption will grow to 2,000 PJ by 2020 (UNDP, 2010). According to a building census carried out by the Turkish Statistical Institute TUIK in 2000, there were 7.8 million buildings in the country and the total heated area was approximately 900-1,000 million m^2. Between 2000 and 2008, additional 750,000 buildings received construction permits. According to the TUIK Building Census in 2000 and Annual Building Statistic on construction permits 2000-2006, the share of residential buildings stood at 86 %, while the remaining 14 % covered non-residential buildings, including public buildings like schools and government buildings.

As of 2011, the share of urban population was 71.5 % (CIA, 2013) with an annual growth rate of 2.4%. This results in an urban population share of 76.3 % in 2013. As a result, the number of residential and commercial buildings in large cities has risen rapidly. In recent years, rapid urbanization has brought more people into the major cities, and the building sector has shown significant increases in new buildings: 6% of the total historical building stock has been built in the last seven years. To keep pace and increase housing supply at the national level, as well as to create necessary infrastructures (including educational, health care and other facilities) for the growing population, The Housing Development Administration (TOKİ) built some 390,000 residential flats and a large number of other types of buildings in 2003 to 2009.

In various studies in Turkey, EIE has estimated a saving potential in holdings of **20 to 50%.** Heating accounts for 75% of the energy used in buildings, with natural gas as the primary energy source (30 %) (GEKA, 2012). The heating season usually lasts 5 months (November to March). Because of the high share of energy used for heating, most energy saving potential is associated with an increased use of thermal insulation to avoid heat loss. These investments are especially attractive in harsher climate zones like eastern Turkey, and in buildings where cooling costs are also of concern. Due to the relatively mild climatic conditions of most of the geographical regions of Turkey building envelope improvement investments, including insulation and windows replacement, have rather long payback times (typically 8-10 years).

Modern appliances, such as refrigerators, freezers, ovens, stoves, dishwashers, and washing machines and dryers, use significantly less energy than older models. Current energy efficient refrigerators, for example, use 40% less energy than conventional models did in 2001 so that many manufacturers such as Arçelik or Vestel chose to produce energy efficient products.

Many of Turkey's new buildings (built post-2000) are energy inefficient compared with new buildings in the EU countries with similar degree-days. Comparisons of Turkey's new buildings constructed in accordance to the Standard of Thermal Insulation Requirements for Buildings need at least 50% more energy for heating than their EU counterparts. According to a study conducted by EIE in 2002, Turkey's heat consumption in standard constructions was higher than that of other EU countries. For example, Denmark's maximum allowable was 23 kWh/(m^2*year), the Netherlands' was 34 kWh/(m^2*year) and United Kingdom's was 35 kWh/(m^2*year). These figures indicate that the Turkish average heating energy requirement of 110 kWh/(m^2*year) is still quite high (UNDP, 2010).

4.6 Energy efficiency in the agricultural sector

According to The World Factbook (CIA, 2013) Turkey´s agricultural sector makes up 9.1% of the country´s gross domestic product (GDP). While 99.7% of the 2.3 million (TARMAKBIR, 2012) agricultural establishments were single family establishments in 2011, only 0.3% were companies or multi-family establishments.

The sector´s energy consumption was estimated to be 241 PJ corresponding to 6.62% of the country´s energy consumption in 2011 (Öztürk, 2013). Direct energy sources used in agriculture are electricity, lignite, petroleum products, natural gas and biomass of which electricity and petroleum products make up the majority.

Based on some sectoral audits, the energy savings potential in the agricultural sector is estimated to be 17.6 PJ (Ültanir, 1998), Energy efficiency measures in the agricultural sector are particularly difficult to finance due to the subsidies on energy costs in agricultural establishments. These subsidies are i) 15% discount in electricity costs (TEDAS, 2013), and ii) subsidies in fuel oil (e.g. diesel) for farming (Resmi Gazete, 2013). As these subsidies increase the simple payback time of the investments many energy efficiency investments are financially less viable in the agricultural sector than similar investments in other sectors.
Publicly available reports do not contain an updated value of the above mentioned energy efficiency potential or a description of specific EE measures and their savings potentials. However, typical EE measures within the agricultural sector are: processing equipment, efficient refrigeration, thermal insulation for storage facilities and efficient irrigation systems.

5 Framework for Energy Efficiency

This section of the report analyzes the framework conditions for carrying out energy efficiency projects. The main questions to be asked are:

- Is energy efficiency, its actors, targets or specific measures mandated or supported in any legal or policy related document?
- Are technical capacities in place in Turkey in order to realize specific measures?
- Does it make sense to invest in energy efficiency in the country in economic terms?

5.1 Legal and policy framework

The following table provides an overview of the current energy and EE policies in Turkey:

Table 3: Energy and EE policies in Turkey

Year	Name of Legislation
2001	Electricity Market Law (No:4628)
	Natural Gas Market Law (No:4646)
2003	Petroleum Market Law (No:5015)
2004	Strategy Paper as Road Map of the Electricity Market Reform & Transition
2005	LPG Market Law (No: 5307)
	Renewable Energy Law
	Law on Utilization of Renewable Energy Resources in Electricity Generation
2007	Energy Efficiency Law (No:5627)
	Geothermal Law (No:5686)
	Nuclear Investments Law (No:5710)
2008	Significant Amendments to the Electricity Market Law (No:5784)
2009	Strategy Paper on Electricity Market & Security of Supply
2010	Strategy Plan on Energy Efficiency, 2010-2014
2011	**Amendments to the Law on Utilization of Renewable Energy Resources in Electricity Generation**
	Energy Efficiency Law (No:5627),
	secondary legislation
2012	**Strategy Plan on Energy Efficiency, 2012-2023**
The secondary regulations and by-laws of the EE Law can be summarized as follows:	
2006	By-Law on Energy Efficiency of Fluorescent Lamps,
2006, 2007	By-Law on Labeling of Domestic Air Conditioners,
2003, 2007	By-Law on Changing the Regulation of Application Principles of Promotion and Utilization Guide
2008	By-Law on Improving Energy Efficiency in Transport,
2008	By-Law on Efficiency requirements of New Hot Water Boilers
2008	By-Law on Individual Heat Meters Application to Share Heating Cost According to Used Energy amounts for Buildings Having Central Heating Systems
2009	By-Law on the Appointment of Energy Managers in Schools
2008, 2010	By-Law on Supporting Energy Efficiency in SMEs through training, audit and consultancy services, issued by KOSGEB
2008, 2010	**By-Law on Energy Performance of Buildings**
	By-Law on Minimum Energy Efficiency Standards for Energy Consuming Equipments such as electric motors, air conditioning, household equipment, lamps, boilers and burners
2006, 2010	By-Law on Energy Efficiency of Electrical Refrigerators, Freezers and Their Combinations
2008, 2011	**By-Law on Improving Energy Efficiency for the Utilization of Energy Resources and Energy**
2010, 2012	**By-Law on Unlicensed Electricity Production in Electricity Markets**

** the bold ones are of significant importance in terms of EE.*

Brief Information on Selected Laws:

The **"Law on the Utilization of Renewable Energy Sources for Purposes of Electrical Energy Generation"** is the main law governing use of renewable energy. Its purpose and scope is to ensure the widespread use of renewable energy sources in the generation of electrical energy, reliable, economic and high quality utilization of these resources in the economy, increasing resource diversity, decreasing

of greenhouse gas emissions, recovering waste, protection of environment, certification of electrical energy obtained from renewable resources and development of the manufacturing sector that would be necessary in the realization of foregoing objectives.

The Law on Energy Efficiency (EE Law) is the fundamental law regulating energy efficiency. This law concerns all public and private entities, other volunteer organizations, as well as citizens at a national level and requires multi-disciplinary work such as protection of the environment, effective and efficient utilization of energy by benefiting from renewable energy resources in the generation, transmission, distribution and consumption stages of energy, in industrial establishments, buildings, transportation, electrical energy generation facilities, transmission and distribution networks and improving energy awareness of the community in general.

Table 4: Selected measures under the EE Law

Sector	Selected Measures under the EE Law
Industry	Industrial establishments consuming more than 42 TJ are obliged to report their energy consumption to the YEGM and have an energy manager to monitor energy efficiency. In addition, larger companies that consume over 2,090 TJ must establish energy management units. Alteration projects that may increase efficiency in industry, as well as utilization of renewable energy sources and efficient co-generation will be supported.
Buildings	It is mandatory to implement EE measures in public buildings. TOKI, the Mass Housing Development Administration, shall implement cogeneration, heat pumps, and solar systems in mass housing projects if the cost does not exceed 10% of total project costs. During the hand-over of buildings, an "energy identification certificate" will be sought. The construction of new buildings shall be conducted according to the efficiency criteria. In buildings with central heating systems, temperature control and share measuring devices shall be used. The managers of buildings in possession of certain specifications will appoint an "Energy Manager" or outsource the services of such a manager. Moreover, the law stipulates that inventories showing progress towards energy efficiency in buildings will be prepared on a regional and sectoral basis;
Appliances	Label household appliances with their energy consumption. Sale of inefficient goods consuming excessive energy will be prohibited, while efficient utilization information with regard to efficient goods will be indicated in their manuals.
Power Generation, Consumption, Distribution and Transmission	It is among others stipulated to appoint Energy Managers in power generators with an installed capacity of 100 MW or more. All plants need to report their annual energy consumption, and all equipment used in generation, transmission and distribution shall meet international standards, Entities using renewable resources to establish facilities up to 200 kW can be connected to the network without obtaining a license.
Energy Efficiency Awareness Raising Measures	Assign the second week of January as EE Week and require metropolitan municipalities and local education authorities to conduct awareness programs. The topics of energy efficiency and environment shall be included in school curriculum.

There are two important energy strategy documents regarding the EE sector in Turkey. The first is the **"Electricity Energy Market and Supply Security Strategy**," approved in 2009, followed by the **"Ministry of Energy and Natural Resources Energy Efficiency Strategic Plan-2012-2023"** approved in 2010 and revised in 2012. These documents define the government's preferences and approach to energy policy.

Policy papers that support the EE Strategy Paper: Ninth Development Plan, 2007-2013, Medium Term Program, 2011-2013, Industrial Strategic Document of Turkey, 2011-2014 and Climate Change Strategy Document, accepted in 2010. According to the Climate Change Strategy Document the following strategies were defined in the relevant sectors (some examples are listed):

- **Energy:** The share of renewable energy in total electricity generation shall be increased up to 30% by 2023. In this framework, the technical and economic hydropower potential will be fully utilized, wind electricity generation capacity will be raised to 20,000 MW and geothermal electricity generation capacity will be raised to 600 MW. Electricity generation from solar energy will be supported.
- **Industry:** All industrial facilities with annual energy consumption of more than 58,150 MWh shall conduct annual energy studies. Heat recovery options in industry, engine speed control systems, and industrial cogeneration systems shall be stimulated and encouraged.

Currently, public support for energy efficiency investments from the YEGM exists, via Voluntary Agreements and from KOSGEB.

Table 5: Public support systems (incentives)

Title / Organisation	Available Support	Description
Energy Efficiency / YEGM	Maximum incentive: Up to 30% of the investment but not more than 117,192 EUR	Sector: Industry Maximum pay-back period: 5 years Maximum investment: 390,640 EUR Project components: – Rehabilitation of existing system – On site power generation (Co-generation, micro co-generation and renewable) – Energy efficiency services by ESCO The project max. funding amounts to 30% of investment cost and follows a ranking of submitted proposals.
Voluntary Agreements / YEGM	Maximum incentive: Up to 20% of the investment but not more than 78,128 EUR	Sector: Industry Commitment: 10% reduction of energy intensity Length of time period allowed proving the commitment: 3 years In-direct support mechanisms by voluntary agreement: – Co-generation – Renewable energy – Waste utilization
KOSGEB	Maximum total incentive for energy efficiency: 11,719 EUR	Support is provided for audits, consultancy projects and certification of energy managers and is limited to about 500-1,000 EUR depending on the measure. Focuses of the support are SMEs. The requested minimum energy consumption of 2,333 MWh/year - despite already lowered – is considered too high.
Undersecretariat of the Treasury	Tax benefit	Projects with a fixed investment amount that exceeds 195,320 EUR can be granted tax or custom duties or VAT exemptions, under the “Decree Concerning State Encouragement of Investments”.

By 1/1/2014, to get incentive or voluntary support it is necessary to have ISO 50001. Current long and bureaucratic application procedures of existing support schemes are considered a major barrier for their successful uptake, especially for SMEs.

5.2 Technical framework

The Turkish market of energy efficiency related equipment and material is well developed and relatively mature with the exception of a few technologies. Due to Turkey’s close trade relations with Far East, Europe, USA, and recently China, a wide variety of products from these countries are freely available in Turkish markets, even in sectors where Turkey is a main producer. This leads to a wide variety of equipment and materials (with also a very high variation of models and efficiencies as well as prices) available to consumers, who would often need support in selecting the “best” equipment due to the large amount of types available.

Turkey is a major producer of **HVAC-R equipment** (mainly split and VRF units as well as boilers), solar water heaters, efficient windows and insulation materials. The producers are well distributed as Turkish (Arçelik, Alarko, LG, Vestel, İzocam, Ezinç, Pimapen, ODE) and international companies (Ferroli, Buderus, BSH, Vaillant, Rehau). HVAC-R is a well-developed sector which consisted of 3,643 companies in 2010 (including the side sectors of pipes, heat exchangers, valves etc.), providing employment for nearly 200,000 workers, making up 1.3% of employment in Turkey’s workforce (ISKID, 2011). Turkey has some production and even exporting capacity, but is mainly an importer of higher added value equipment with smaller market volumes such as CHPs, electrical motors, efficient lights (including LEDs), automation equipment, compressors and PV.

The only equipment type that is very new and largely unavailable in the market are ORC units. Small scale absorption chillers, small scale CHP units, small scale biogas systems, and PV systems are also relatively new to the market. However, markets for these equipment can be expected to expand rapidly in the coming few years, possibly leading to production investments as well.

- **Solar water heaters** have been produced and installed in Turkey for over 20 years, resulting in a mature market in terms of supplier, installer and geographical distribution. There are 26 local producers and a number of international companies that import European and Far Eastern products. The majority of solar water heaters installed in Turkey are flat panel units, often used for domestic hot water heating systems for seasonal use in southern and western Turkey. The vacuum type units are recently coming into use in climate zones, in which freezing temperatures occur regularly, like central Anatolia, eastern Turkey and the rest of the northern regions. The annual production is approximately 750,000 m^2 including exports to 80 countries all over the world.
- There are more than 10 companies **producing PVC window frames**. The market is well developed with a large number of distributors and installers.
- Turkey has the 4th biggest market for **insulation materials** in Europe with over 20 main suppliers. The market is well developed with a large number of distributors and installers.
- There are 8 companies currently involved in the **PV production**, two of which are cell producers and the others are assembling panels. The market is very young due to the relatively high investment costs, regulatory difficulties in grid connections, and low feed-in-tariff until recently. The recent drop in panel prices and the increase in electricity costs have made PV investments rather attractive.
- There is a small number of well established producers of **electrical motors and pumps** high quality/performance products in the Turkish market as well some major international producers' products from Europa, USA and the Far East. There are also a small number of compressor producers competing with the international providers for the lower performance equipment.
- There are no producers of **LEDs** but a very large number of companies assembling LEDs in final products.
- Likewise the **automation hardware and software** is also largely dependent on imports for base products, with the final products produced in Turkey.
- There is a small and growing number **of small scale wind and hydro power turbine manufacturers**, however, the quality and performance of their products are questionable in the absence of international certification.
- There are no producers of **ORC, CHP, absorption chiller systems, small scale biogas systems and gasification& pyrolysis systems** in Turkey at present.
- High efficiency **heat pumps** (mainly air-to-air types) are getting highly popular for heating and cooling demands. These equipments are replacing many boilers and electrical chillers used for area heating and cooling. The water and ground source heat pumps are relatively less popular, as energy efficiency investments are unfavourable due to higher investment costs and land-use limitations. These types are more often used in new building investments.

5.3 Economic framework

There are no publicly available studies on the economic viabilities of energy efficiency investments. The economic viability values provided below are estimations from a local expert. The economic viability of energy efficiency investments depend on several factors such as the unit energy costs, investment costs, O&M costs before and after the investment, annual operating hours of the system, the ROI expectations of the investor and the general investment environment. Secondary factors such as the availability and quality of energy and fuel types, installation and operation know-how and the availability of equipment are also decisive on the applicability of these measures.

Energy prices in Turkey have been increasing steadily. Indicative current prices in industry are shown in the table below:

Table 6: Energy costs in industry

Indicative Energy Costs in Industry May 2013		
Type of Energy	Turkey (EUR/kWh)	EU 27 (EUR/kWh), 2012
Electricity	0.110	0.0967
Natural Gas	0.032	0.0376
Lignite	0.020 - 0.025	---
Fuel oil	0.070	---

Sources: Various (Local expert) and Eurostat 2012

Energy prices in the building sector are slightly higher, and the highest energy prices are applied to residential users. The residential users are also the final payers of VAT, which is applied as 18% over all other energy costs.

As energy is mainly an imported and expensive commodity, all sources of energy are metered. There are very few centrally heated districts (largely in the provinces of İzmir, Uşak and Kütahya) and those are also metered. The only source of heat that is not invoiced is from the wood and waste sourced biomass available in rural areas, although it has an intrinsic cost of collection and storage.

In nearly all private commercial enterprises the investor in energy efficiency is the beneficiary of the savings. This rule often does not apply if the investment involves changes in the building and if the investor is not the owner of the building. However, this type of investments is rare. Based on the local expert´s experiences a variety of energy efficiency measures are highly viable and popular in Turkish industry:

Table 7: Simple payback period of project types

Type of project	Simple payback period (years)	Remarks
Thermal insulation for high temperature equipment and utilities	0.5 – 1	Low payback period due to the very low investment costs and high operating hours.
VSD systems, high efficiency production machines, heat recovery for medium and high temperature heat sources	1 – 1.5	---
Co-generation of Heat and Power (CHP) and tri-generation systems	3 - 4	The relatively high cost of natural gas (compared to lignite) and the even higher cost of electricity are the main drivers for this market. These systems are less popular among companies located in industrial organized zones where the unit thermal and electrical energy costs are significantly lower than elsewhere.
Utility equipment replacements, like boilers, air compressors, pumps, electrical motors etc.	> 5	Depending on the condition of the existing equipment.
Building envelope improvements	8 - 10	Long playback period due to the relatively mild climatic conditions of most of the geographical regions of Turkey. These investments become more attractive in harsher climate zones like eastern Turkey, and in buildings where cooling costs are also of concern.
Wind turbines	5 – 6	If designed to meet the consumption of an existing plant or building. Investments planning to sell or exchange energy with the grid are less attractive due to the losses introduced by the grid, and the low feed-in-prices compared to final user energy costs.
PV systems	6 - 7	

The average simple payback expectations of many industrial investors are limited to 4 years.

5.4 Awareness and information level

Energy efficiency is a frequent topic in legislation and policy (also see chapter 5.1) and different awareness raising campaigns have been carried out in the past:

- With the support of the MoENR, “The Energy Efficiency Association – ENVER” was established as an NGO. Its primary purpose is to raise people’s awareness and helping them to use energy efficiently and productively. Furthermore, it aims to continually conduct scientific research and also to increase public knowledge by sharing those findings with public enterprises and citizens.
- “National EE Forum” is another public awareness activity carried out annually. Conferences and seminars are organized under the forum by the contribution of important actors including ministries, energy service companies, industrial companies, NGOs etc. Since 2008, every year, the second week of January is celebrated as Energy Efficiency Week and conferences and exhibitions are organized during the week. Also, successful energy conservation projects receive awards from the minister. The concept of energy saving has been promoted through the media.
- Seminar programs on the efficient use of energy sources and also their environmental impact have been initiated by EIE for primary and high schools as well as for the public. Videos, brochures and posters have been prepared and distributed nationwide free of charge. Various national and international seminars, conferences, and workshops have been organized, also mainly under the coordination of EIE.

Mainly there is a general interest of the public, among individuals and companies for energy efficiency, because of the energy price. Energy efficiency can be described as “the current fashion“. The bottleneck is the lack/weakness of understanding the technical issues and confusion about what are good practices.

6 Conclusions

Based on pertinent studies and local experts' experience, there is large untapped potential for energy efficiency measures in Turkey.

Heat and especially **electricity consumption** are seen to further increase rapidly and it can be expected that the energy production will be extended accordingly to meet the increasing demand. This will lead to investments in new and more efficient plants and equipment. EE measures in energy supply directly reduce the amount of fuels used and are therefore able to reduce Turkey´s dependency on imports of energy sources.

The **legislation** provides framework for developing EE and implementing RE, as EE is a common topic in recent laws and action plans.

With a view on the growing energy demand another increase in **energy prices** - which are already quite high - is likely. Regional and local experience shows that such a change can increase the interest for energy conservation dramatically. Already at this point, expenditures related to energy put a considerable burden on the residential and industrial sector.

The **ESCOs** are relatively small and local. They neither have sufficient financials or track records to take on the debt under a Shared Savings model, nor to offer a credible performance guarantee under the Guaranteed Savings model yet. The slow uptake of ESCO models in Turkey suggests that in order to strengthen the country's ESCO market, it would be important to both broaden the range of current ESCO models being promoted in Turkey, as well as bringing other types of local companies (e.g., leasing firms, equipment suppliers, construction firms) into the ESCO market. Public buildings and institutions often use low efficient equipment/buildings and could benefit from EE investments. However, the public sector cannot make its own investments since the capital is not accumulated, but share with central budget at the end of every fiscal year. So these institutions are potentially an ideal target group for ESCO's who would invest in EE or RE on the premises of public institutions, and allow the investment to be financed by the savings. However, according to the Public Procurement Law the public institutions are not allowed to sign this kind of contracts with ESCOs. So this big potential for ESCO's that would also help the market to mature will remain untapped as long as the law remains the same.

Proper **metering and understanding** of energy costs can help companies estimate better potential savings and increase interest in investing in more complex EE measures. This should include definition of certain performance indicators that can be tracked before and after the implementation of a particular EE investment project. Energy efficiency measures should go hand in hand with **awareness raising programs** to reduce the energy consumption so that less net energy in a more efficient way is produced.

The main **target group for EE investments** is especially seen in **industry** as the sector applies for more than 30% of the primary energy consumed (1,300 PJ consumed out of 4,300 PJ supplied; also see Figure 1) in 2007.

- As industry mainly uses coal (including lignite) to serve its needs the GHG reduction potential is high (e.g. compared to natural gas).
- Especially owners of outdated equipment make up a good potential target group as GHG savings potential and the will to invest in new and more efficient equipment will be high.
- Energy intensive industries like the iron & steel sector (20-30% energy costs of total production costs) or the cement sector (50% energy costs of total productions costs) provide a suitable target group for EE investments, although much of Turkey´s cement production capacity is relatively new and hence relatively efficient compared to older machinery.
- EE measures carried out on centralised heat/electricity producers contain high GHG savings potential as GHG emissions of every consumer connected to the grid will be reduced. In addition, full load hours of such plants are generally high.
- The highest energy savings potential of heat is given by the textile subsector (in percent, not absolute values).

There are no studies publicly available about the energy efficiency / saving potential of **SMEs,** except for those available for the respective sector. The potential EE measures are specific to the sector and do not

discern between SMEs and corporate (or other) establishments. The sectoral distribution of SMEs, however, is given as 46% trade, 14% manufacturing sector, 14% transportation, 9% hotels and restaurants. SMEs' energy efficiency potential is estimated to be 42 PJ per year which corresponds to 7% of the total SMEs' energy consumption.

The **residential sector** makes up a little more than 20% of the primary energy consumption. In various studies in Turkey, EIE has estimated a saving potential of 20 to 50%. As heating accounts for the most energy used in buildings most energy saving potential is associated with an increased use of thermal insulation to avoid heat loss. Due to the relatively mild climatic conditions of most of the geographical regions in Turkey, building envelope improvement investments, including insulation and windows replacement, should be preferentially carried out in harsher climate zones like eastern Turkey or in buildings where cooling costs are also of concern.

7 Relevant Institutions

The following table provides an overview of institutions relevant for EE in Turkey.

Table 8: Institutions relevant for EE in Turkey

State bodies	
The Ministry of Energy and Natural Resources (MoENR) www.enerji.gov.tr	The MoENR is the primary organization responsible for implementing energy policy, including energy efficiency. It coordinates/supervises developing and implementing national energy policies, plans and programs, including EE, and is responsible for determining the energy and natural resource requirements of Turkey, conducting surveys to improve the utilization of energy and natural resources and also for the preparation and approval of energy legislation and regulations.
The General Directorate of Energy Affairs (EIGM)	The General Directorate of Energy Affairs is the main policy analysis body within MoENR. The EIGM is responsible for the coordination of energy policy measures including natural gas and electricity sector reform programs. It conducts long term energy planning and develops different policy scenarios. It also carries out studies on general energy and environmental policies, renewable and energy efficiency. This Directorate has an **Energy Conservation Division** as part of the **Department of Energy Policies and Coordination** which only has the function of coordinating studies between related organizations.
The General Directorate of Renewable Energy (YEGM; formerly EIE)	YEGM, formerly EIE as the Gen. Directorate of Electrical Power Resources Survey & Develop. Administration is an agency under the administration of MENR that has been mandated with research and promotion of EE, and with providing advice on EE-related secondary legislation and regulations. The main task of the YEGM is to promote the rational use of energy and to improve EE on the demand side, in the context of concerted and integrated collaboration mechanisms with the related institutions. YEGM provides certain financial incentives and conducts international EE projects (e.g., funded by EU, WB, JICA, UNDP-GEF and other bilateral cooperation).
Energy Efficiency Coordination Board	Main activities of the Board: Approval of EE projects, including those proposed by ESCOs and also those subject to YEGM funding, monitoring of voluntary agreements, setting up of specialist subcommittees, evaluation of secondary legislation and laws.
The Ministry of Environment and Forests (MoEF)	MoEF issues environmental licenses and is responsible for the enforcement of environmental legislation. Within the MoEF there are departments related to the energy sector responsible for emission control and environmental impact assessment. The Ministry is involved in cooperation on environmentally friendly projects, e.g. MoEF is the GEF Operational Focal Point in Turkey and Energy Efficiency Projects in both the industry and building sectors with the financial support of GEF started in 2010 under the coordination of MoEF. The Ministry also ensures that policy (such as on EE) is in line with EU environmental standards.
The Directorate of Small and Medium-Sized Industries Improvement and Support Administration (KOSGEB)	KOSGEB provides development services and support programs to SMEs through the various KOSGEB service and support centers. Synergy Focuses established in collaboration with Chambers of Commerce and Industry and other organizations carrying out projects related to SMEs in order to spread KOSGEB's service and support programs targeting SMEs all over the country. KOSGEB has been providing financial support (usually loans) to eligible R&D projects. According to the Turkish Energy Efficiency Law, KOSGEB is entitled to provide support to SMEs on energy efficiency topics such as training, audits and consultancy services.
Energy Service Companies (ESCOs)	ESCO companies have been designated by Energy Efficiency Law dated 2007. They provide EE training, auditing and consulting. They can also be involved in technology implementation and financing through guaranteed savings or shared savings schemes. The ESCO model has not been very active in the Turkish EE projects yet. The ESCO's are mostly involved in energy audits and consultancy work as opposed to ESCO projects, since they often do not have the financial strength for investing in Energy Performance Contracts.
Other related institutions	
Turkish Development Bank (TKB)	TKB (Development Bank of Turkey) is working together with the European Investment Fund (EIF), KOSGEB and TTGV in the Istanbul Venture Capital Initiative (iVCi).World Energy Council Turkish National Committee (WEC TNC). Its mission is to promote the sustainable supply and use of energy for the greatest benefit of all.
TUBITAK	TUBİTAK-MAM is involved in R&D and coordination studies on renewable energy, energy efficiency and clean energy technologies and pilot and Demonstration projects.
The Technology Development Foundation of Turkey (TTGV)	TTGV is a non-profit organization, established by law in 1991, as a public-private partnership for enhancing the competitiveness of Turkish producers, by supporting technological innovation. TTGV has a mandate to act as an intermediary for publicly funded programs. It has provided the private sector with financial support (grants and soft loans) for their technology development projects. On the environment, TTGV supports technology-using companies through its Environmental Projects Support, for their environmental projects including environmental technologies, energy efficiency and renewable energy and has a funding window for environmentally sound projects.
The Union of Turkish Engineers and Architects (TMMOB)	Chambers of TMMOB, the Mechanical Engineers and Electrical Engineers were indicated as the authorized organizations to carry out energy management training and to assign and monitor ESCOs by EE Law.

Industrial Branch Associations	These Associations represent the various branches of industry and carry out debates with the Government on promoting the benefits of their groups. The Association will be important in providing statistical data on the branch, including benchmarking and (energy) efficiency improvements; dissemination of best practices; support the organization of events; outreach to top management on reducing costs through EE; expert contribution for EE potential analysis.
Universities and technological institutes	Universities carry out fundamental and applied research and provide education and training. They are important in providing experts for specific measuring, diagnostics and certification measures, provide know-how on impacts of EE technology implementation, as well as in organizing training and lectures on energy efficiency and energy management.
Turkish Cogeneration Association	It was founded in 1998. Its principal goal is to work towards the wider and true use of cogeneration in Turkey for a sustainable energy future; it is a member of the European Association for the Promotion of Cogeneration.
Clean Energy Foundation (TEMEV)	The organization was established in 1994 by individuals and organizations that recognized the importance of supporting studies regarding clean and renewable energy sources, more efficient use of energy and energy conservation.
Wind Power and Hydropower Plants Businessmen's Association (RESSIAD)	Its mission is to increase collaboration, coordination between business stakeholders who are working in the field of producing water turbines, wind mill machinery, and power plant construction to expand the utilization of wind and hydraulic energy resources for generating electrical energy.
Geothermal Association of Turkey (TJD)	This non-governmental organization was founded in 1992 to encourage research, development and utilization of geothermal resources. TJD has been a member of the IGA-International Geothermal Association since 1998.
Turkish Green Building Association (CEDBIK)	CEDBIK was founded in 2007 to build the infrastructure that would enable green building design and construction, and encourage eco-material fabrication. The new association will probably be a key stakeholder of the project on training and awareness-raising.

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