PROMOTING ENERGY EFFICIENCY IN TURKEY IN THE LIGHT OF BEST PRACTICES AT THE LEVEL OF EUROPEAN UNION AND SELECTED MEMBER STATES: DENMARK AND GERMANY

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ABSTRACT

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Öner, Başak
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The aim of this thesis is to suggest the ways of promoting energy efficiency in Turkey in the light of best practices at the level of European Union and most energy efficient Member States, Denmark and Germany. This thesis provides a critical evaluation of Turkish energy efficiency policies in transmission, distribution and consumption phases of energy, by pointing out their weaknesses. The evaluations highlight the fact that Turkey has substantial energy saving potential in electricity distribution grids and end-use sectors. The EU, Danish and German experiences demonstrate that the greatest energy efficiency improvement could be achieved in industry sector. By taking these experiences and the problems of Turkey into consideration, this thesis recommends possible measures. It is concluded that, when the energy efficiency potential is evaluated, primarily attention could be paid to industry sector.

Key words: energy efficiency, energy intensity, energy policy, European Union, Turkey.

ÖZ

TÜRKİYE'DE ENERJİ VERİMLİLİĞİNİN AVRUPA BİRLİĞİ VE ÖRNEK ÜYE ÜLKE (DANİMARKA VE ALMANYA) UYGULAMALARI IŞIĞINDA ARTTIRILMASI

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Bu tez, Avrupa Birliği ve Üye Ülke, Danimarka ve Almanya, düzeylerindeki en iyi uygulamalar ışığında, Türkiye'de enerji verimliliğinin arttırılması yollarını önermektedir. Bu tez, enerjinin iletim, dağıtım ve tüketim aşamalarındaki enerji verimliliği politikalarını zayıflıklarına işaret ederek eleştirel bir değerlendirme yapmıştır. Değerlendirmeler, Türkiye'nin elektrik dağıtım şebekelerinde ve nihai tüketim sektörlerinde önemli enerji tasarrufu potansiyeli bulunduğunu vurgulamaktadır. AB, Danimarka ve Almanya deneyimleri ise enerji verimliliğinin en çok sanayi sektöründe geliştirilebileceğini göstermektedir. Söz konusu deneyimler ve Türkiye'nin sorunları göz önünde bulundurularak, bu tez olası önlemler önermektedir. Sonuç olarak, enerji verimliliği potansiyeli değerlendirildiğinde, birincil önceliğin sanayi sektörüne verilebileceği belirtilmektedir.

Anahtar Kelimeler: enerji verimliliği, enerji yoğunluğu, enerji politikası, Avrupa Birliği, Türkiye

To mummy and daddy,

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ADEME	French Public Agency for Environment & Energy Management
BOO	Build-own-operate
BOT	Build-own-transfer
BP	British Petroleum
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
Dena	Deutsche Energie Agentur
ECS	Energy Charter Secretariat
ECSC	European Coal and Steel Community
EEA	European Economic Area
EECB	Energy Efficiency Coordination Board
EFTA	European Free Trade Area
EMRA	Energy Market Regulatory Authority
EU	European Union
ESCO	Energy Service Company
GDP	Gross Domestic Product
GIS	Geographic Information System
DSM	Demand Side Management
GTZ	German Technical Cooperation Agency
GWh	Giga Watt Hour
IEA	International Energy Agency
JICA	Japan International Co-operation Agency
KfW	Kreditanstalt für Wiederaufbau
Ktoe	Kilo Tonne Oil Equivalent
KV	Kilo Volt
KWh	Kilo Watt Hour
MENR	Ministry of Energy and Natural Resources
Mt	Million Tonne
Mtoe	Million Tonne Oil Equivalent

MW_e	Megawatt of Electric Capacity
NECC	National Energy Conservation Centre
NGO	Non-Governmental Organization
NOVEM	Dutch Agency for Innovation & Sustainability
OECD	Organization for Economic Cooperation and Development
OG	Turkish Official Gazette
OJ	Official Journal of European Countries
OPEC	Organization of Petroleum Exporting Countries
PEEREA	Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects
R&D	Research and Development
SCADA/DMS	Supervisory Control and Data Acquisition/Distribution Management System
TCDD	Turkish Railway Company
TEDAŞ	Turkish Electricity Distribution Company
TEİAŞ	Turkish Electricity Transmission Company
TFC	Total Final Consumption
Toe	Tonne Oil Equivalent
TOR	Transfer of Operation Right
TWh	Tera Watt Hour
UCTE	Union for the Coordination of the Transmission of Electricity
UK	United Kingdom
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WEC	World Energy Council

CHAPTER 1

INTRODUCTION

Energy, as an essential input for social development and economic growth, plays a crucial role in society. Energy, like labour and capital, remains a critical factor of a nation's economic and social well being and, therefore, remains a continuing priority for government policies. As well as being a provider of basic needs and services in everyday lives, such as heating, cooling, cooking, lighting, transportation, energy is also a production factor of prime importance in industry.

Energy policies have been concerned mainly with ensuring adequate supply of energy. Generally, modern economies are energy dependent. The provision of sufficient energy, both through domestic production and imports, has been perceived as a central problem. Energy availability and consumption has been an important consideration to economies worldwide mainly due to the fact that per capita energy consumption has become one of the key indicators of modernisation and progress in a country.

There are large disparities in the level of energy consumption not only among different countries but also among the rich and poor groups in the same country. It should be pinpointed that in 2000, nearly 1.6 billion people had no access to electricity or other forms of commercial energy and that the richest 20% of the world's population had used 55% of primary energy, while the poorest 20% had used only 5% (Khan, 2000: 14).

At the same time, energy is responsible for major environmental degradation at all levels; local, regional and global. Energy production and consumption

place considerable pressures on the environment, including climate change, damaging natural ecosystems and the environment and causing adverse effects to human health. Global climate change associated with the increasing concentration of greenhouse gases in the atmosphere has become a major worldwide concern today.

The sustainability of the supply capacity of limited fossil resources of the earth is questionable when the increasing worldwide demand is taken into account. While this may be a long-term global concern, the security of supply and continued uninterrupted availability of imported energy is a short-term concern for countries that have limited indigenous energy sources and dependent on energy imports. Thus the provision of adequate energy services at affordable costs and in a secure and environmentally good manner is an essential element of sustainable development.

The oil price shocks of 1973 and 1979 introduced the energy problem into the awareness of individuals throughout the world. The resulting price increases led to economic disruption at international, national and local levels. The vulnerability of all economies to energy price and supply fluctuations became evident to governments. Some oil-importing countries faced serious balance-of-payments problems. The oil shocks highlighted the importance of national self-reliance and the need to diversify energy sources for distributing risk.

Energy efficiency concept started to be developed and gain importance following the first oil crisis in the early 1970s. Energy efficiency refers to the ratio between energy input and output. Energy efficiency, a broad concept, compromises all activities related to energy production, transmission and consumption. On the production side, energy efficiency refers to the amount of primary energy sources consumed for a given level of electricity production. When the efficiency of the power plant promoted, internal consumptions of the power plants would decline. On the transmission side,

energy efficiency refers to the efficiency in transmitting energy from power plants to the consumers. When the efficiency of the grids promoted, the losses would decrease during the process of transmission/distribution of electricity. And lastly but not least, on the consumption side, energy efficiency means using less energy to perform the same function. When the efficiency promoted, it is possible to produce more goods or services by consuming same amount of energy or to produce same amount of goods or services by consuming reduced amount of energy.

In this perspective, in the aftermath of oil price shocks, energy efficiency became a distinct area of national energy policy for most of the industrialised countries. Following the adjustment of energy prices after the two oil crises, environmental concerns and industrial competitiveness became driving forces of energy efficiency policies in western industrialized countries. It was at this point that energy efficiency programmes came to the forefront, both in terms of their cost-effectiveness and their capacity to diminish adverse environmental impacts.

Today, for countries in transition towards a market economy, developing countries or industrialised countries, which are concerned about changes in the world's climate systems, the concept of energy efficiency has gained great importance. Improving energy efficiency offers a powerful tool for achieving sustainable development by reducing energy costs, increasing competitiveness for businesses and providing welfare for consumers. It can create environmental benefits through reduced emissions of greenhouse gases.

Energy efficiency policies and measures are not well developed in Turkey. Although energy efficiency has been a popular concept in the world since the oil crises of 1970's, the importance of the issue has not been realized properly in Turkey in the past mainly due to disregarding its potential role in guaranteeing security of energy supplies. There have been limited studies for

the promotion of energy efficiency as it has been a lower priority. National energy policy focuses on supply security for meeting the growing energy demand rather than decreasing the demand by implementing energy efficiency measures. In recent years, an emphasis started to be placed on promoting energy efficiency in end-use sectors, the sectors that consume primary energy and electricity, transportation, industry and buildings, by the government particularly for reducing import dependency.

The EU, as a net energy importer, has well promoted energy efficiency when compared to Turkey, since the mid-1970's in order to tackle environmental and security of supply concerns. Especially EU-15 has launched many energy efficiency action plans and programmes nearly in each end-use sector. At the Member State level, Denmark and Germany had promoted energy efficiency most successfully among the other countries within the EU.

This study focuses on analysing the range of policies and measures in Turkey, in the EU and best practices within the EU at the Member State level, namely Denmark and Germany. The aim of this thesis is to determine the barriers to the promotion of energy efficiency in Turkey and to suggest possible solutions for overcoming these barriers by taking into consideration the EU experience at the Union and Member State levels. In order to achieve this aim, bearing in mind the horizontal aspects of energy efficiency, electricity transmission/distribution systems and all end-use sectors are examined in Turkey and the main problems concerning promotion of energy efficiency are identified. By taking into consideration these problems, the EU practices both at the Union and Member State levels are evaluated. Thus, a general perspective has been created for Turkey for promoting energy efficiency bearing in mind the lessons learnt from the best practices. The scope of this thesis is limited to energy efficiency policies and measures in transmission/distribution and consumption cycles of energy; the aspect of energy efficiency at the production cycle in the power plants is not taken into consideration.

In this respect, first of all, Chapter 2 gives main information about the energy efficiency concept. Energy efficiency definitions of some energy analysts and world's major energy institutions, namely World Energy Council and International Energy Agency are given and advantages of promoted energy efficiency are determined. After that barriers to the promotion of energy efficiency are clarified and lastly, main policies, instruments and measures for overcoming these barriers are specified.

In Chapter 3, firstly, Turkish energy policy is briefly given especially after the declaration of EU candidacy. Secondly, energy efficiency situation is evaluated by taking into consideration the positive developments. Under this section electricity transmission/distribution systems and main end-use sectors are examined so as to identify main problems concerned with promotion of energy efficiency. Lastly, bearing in mind the close relationship between energy efficiency and environmental protection, environmental policies of Turkey are also evaluated.

In the scope of Chapter 4, firstly, energy efficiency polices of the EU including energy efficiency legislation and measures at the EU level for further promotion of energy efficiency are mentioned briefly. Secondly, the most energy efficient Member States, namely, Denmark and Germany are analysed. Well-developed energy efficiency policies, strategies and measures are identified in transmission/distribution and consumption stages of energy.

In the light of findings of Chapter 3 and 4, Chapter 5 attempts to form a general perspective for Turkey on the basis of determined problems and bottlenecks. Possible measures are suggested by taking into consideration the lessons learnt from best practices of the EU, Denmark and Germany.

Lastly, the Conclusion Chapter summaries major findings of each chapter and tries to draw a conclusion.

CHAPTER 2

THE ENERGY EFFICIENCY CONCEPT

Energy efficiency plays an important role in energy policies of countries, due to its potential for decreasing demand for energy sources and reducing negative impacts of energy consumption on environment. Also, promoted energy efficiency has positive impacts on economy, like increasing competitiveness and employment. Therefore, governments wish to promote energy efficiency in all sectors. There can be some barriers preventing the promotion of energy efficiency. In this regard, policies, measures and instruments are introduced for overcoming the barriers to the promotion of energy efficiency.

This chapter clarifies energy efficiency concept in order to make proper analyses in the following chapters. Firstly, a comprehensive scope of energy efficiency has been drawn including advantages of promoted energy efficiency. Secondly, both common and specific barriers to the promotion of energy efficiency have been clarified. Lastly, main policies and instruments for overcoming these barriers and ensuring further promotion of energy efficiency have been determined.

2.1 The Scope of Energy Efficiency

Energy, as the main driving force of socio-economic development, is of vital importance to the world economy and world trade. Energy policy is an essential component for competitiveness and growth. At the same time, it is a crucial element of environmental policy since the generation and

consumption of energy (particularly fossil fuels) leads to negative national and international external effects.

A sustainable energy system is characterised by its ability to perform required services by sustainable amount of resources. Efficient use of all resources is necessary both in an environmental and economic sense. Using energy inefficiently creates burden in all the world's economies and has negative impacts on environmental. The steps to create a sustainable energy system begin with rational use of scarce energy resources. Energy efficiency is a top priority in moving to a sustainable energy system all over the world.

Energy policy cannot be developed in isolation from the rest of society and the economy. The same is true for energy efficiency. Improved energy efficiency brings important benefits to all sectors. Energy efficiency has become increasingly more important as it is considered one of the major elements of a comprehensive energy policy. Recently, energy efficiency came to world agenda once more, due to rapid increases in crude oil prices arising from supply disruptions.

There are common valid definitions of energy efficiency that are accepted in energy literature. For example, Brookes (2000) perceives the concept of energy efficiency as an engineering term. He identifies "energy efficiency" as raising the engineering efficiency of conversion of fuels to useful heat or work and increasing the effectiveness of the associated energy service. This process may be considered collectively; lowering the cost of the energy input to a given energy service or raising the level of the service obtainable from a given energy input cost.

International Energy Agency (2002a) gives the definition of energy efficiency more briefly, as the ratio between energy output (electricity, heat or mobility) and input (fuels). World Energy Council (2004) defines energy efficiency as the improvements resulting from the reduction in the energy used for a given

energy service or level of activity. Çalıkoğlu defines energy efficiency in a wider sense. According to Çalıkoğlu (2004), energy efficiency is the most effective utilisation of energy in all stages, including production, transmission and consumption of energy sources.

In the light of these definitions, energy efficiency concept can be considered at all stages of energy cycle. The first stage is the production of energy, the efficiency at the production stage of secondary energy source (electricity) from the primary energy sources, such as coal, gas or oil. At this stage, energy efficiency refers to the level of internal consumption of power plants[1] for producing a given level of energy. Kavak (2005) emphasizes that the internal energy consumption in hydro power plants is small when compared to thermal power plants due to flue gas desulphurisation, hydro cooling systems and ash/coal systems. He pinpoints the fact that the flue gas desulphurisation is the most energy consuming system in thermal power plants accounting for 6-7% of total energy production of the plant. In this respect, energy efficiency measures like rehabilitation and modernization of the power plants aim to increase the efficiency of boilers and ensure better frequency control and coordination of pumps in thermal power plants. Moreover, provision of fuels that are suitable for the design of the boilers is of crucial importance.

It should be noted that although efficiency at the production stage of energy has an important role in ensuring overall efficiency in the sector, it will not be further elaborated since it consists of a large research area more specifically focusing on micro level technical enginerring issues. In this perspective, throughout the rest of the study, energy efficieny refers only to transmission/distribution and consumption stages of energy.

[1] Internal consumption of power plants (station service consumption): The electricity consumed by a power plant including electricity consumed when out of service, together with the losses in its generator transformers.

Second stage is the transmission and distribution of energy[2], the efficiency in transmitting energy from power plants to the consumers. Some electricity losses may occur during the process of transmission and distribution from generators to consumers. Generally there are two types of losses, one is technical losses which cover transmission losses and the other is non-technical losses including distribution losses and the incidence of illegal usage. Technical losses are stemmed from long transmission lines, overloading or underloading of distribution and transmission lines, reactive power consumption and low power factor, whereas non-technical losses may occur due to inadequate information on consumer subscription, illegal interconnections, disordered meters and insufficient control. Most electricity losses occur within the lower voltage distribution networks. Within this perspective, at this stage, energy efficiency measures aim to prevent both technical and non-technical losses for ensuring highest efficiency through rehabilitation of lines or better state control for reducing theft.

The last stage is the consumption of energy, the efficiency at the end-use sectors. At this stage, energy efficiency can be defined as reducing the energy used by specific end-use devices and systems, without affecting the production/service and comfort level. Energy efficiency is improved when a given level of production/service is provided with reduced amounts of energy inputs, or services or products are increased for a given amount of energy input. For the consumption stage, energy efficiency measures are designed to reduce the amount of energy used to produce one unit of economic activity or to meet the energy requirements for a given level of comfort, either through greater insulation, less waste, or improved mechanical efficiencies, without losing any of the value of the product or amenity. As an example,

[2] Electricity is delivered to consumers by two processes. Electricity transmission system is the first process in the delivery of electricity from power plants to the distribution system. Due to the large amount of power involved, transmission takes place at high voltage (110 KV or above). Electricity distribution system is the second process in the delivery of electricity from transmission system to the final consumers. It is generally considered to include medium and low-voltage (less than 50 KV) power lines.

insulating a house makes it more energy efficient because less energy is consumed for heating for the same comfort level. The reduction in energy consumption or increase in production or service is associated with technical changes, better organization and management (WEC, 2004:2-3).

Two basic indicators, per capita energy consumption and energy intensity, show the development level of a country, regarding energy. In developed countries, the level of per capita energy consumption is high and the level of energy intensity is low at the same time.

The high level of per capita energy consumption demonstrates both vivacity of economic activities and high level of amenity of a country. Widespread usage of electrical appliances at homes or offices or the increased number of cars is good indicators of economic development and they raise per capita energy consumption. In addition to consumption level, contribution to Gross Domestic Product (GDP) is essential.

A statistical concept, energy intensity is used to indicate energy efficiency trends. Energy intensity is the ratio between the total final consumption of energy and GDP for a given calender year. Energy intensity is measured by the quantity of energy per unit of output or activity. In this perspective, using less energy to produce a product reduces the intensity. Therefore, higher energy intensity corresponds to a lower energy efficiency level. High levels of energy intensity have negative impacts on national economy as much more energy, in the same way money, is used for producing a unit of product.

Due to financial strains, e.g. high-energy prices, consumers may decrease their energy consumption through a reduction in welfare or production level. Such reductions should not be perceived as energy efficiency as they do not result in increased production.

Since energy is used in many activities, energy efficiency has horizontal aspects in a variety of sectors, buildings, transportation, industry and environment. Therefore, improving energy efficiency is an essential component of the energy policies of the states, motivated by considerations of security of supply, economics and environmental protection.

Although improved energy efficiency will not assure that fewer energy resources will be consumed in the future, it guarantees that the energy resources will be used more efficiently. This will have vital economic, environmental and energy security benefits. In countries with substantial indigenous energy resources, energy efficiency will increase exports and income. In energy importing countries the import bill will decrease and security of energy supply will improve. Also, enhanced energy efficiency will postpone or cancel the need for new energy supplies. The result is the overall economic savings for consumers, industry and governments.

An effective energy efficiency policy makes a major contribution to competitiveness and employment. Efficient use of energy is in many aspects a key factor in improving a national economy. Weak energy efficiency undermines competitiveness of national economies since using more energy per unit of GDP generally implies that goods and services are produced at a higher cost. It has implications for the competitiveness of companies, the stability and vulnerability of the economy. Also, investments for energy efficiency improvement always have a positive impact on employment. The need for energy efficient equipments and energy services leads to creation of new jobs. Wade and Warren (2001) argue that although providing solutions to the unemployment problem will never be a key aim of energy efficiency policies, the side-effects of energy efficiency policies and programmes can demonstrate positive impacts for social groups both for high skilled people, such as engineers, and for low skilled people, like workers.

For more than a decade, energy efficiency has been closely linked to climate change policies, since global climate change is one of the most important environmental areas that is impacted by energy consumption. The most immediate and direct environmental benefit of improving the efficiency of energy use is a reduction in the use of conventional resources, like coal, oil or gas, and consequently in the emission of air pollutants, in particular CO_2. The emission levels of pollutants (CO_2 and sulphur dioxide - SO_2) vary with the amount of energy used. Improved energy efficiency has a strong effect on environmental degradation. In an IEA study (1997a) it is stated that a reduction of 30% in energy consumption in the industrialised countries will correspond to an equivalent annual reduction of approximately 6.000 Mt of CO_2 and become one of the major elements to combating with climate change. As improved energy efficiency reduces the need for new energy capacity, thereby contributes to saving resources for investment in environmental protection measures.

In this perspective, promotion of energy efficiency became an important component of national energy policies. Haugland (1996) notes that energy efficiency measures have been promoted as a win-win option, meaning that appropriate measures will both benefit the environment and provide energy consumers and society a net economic gain. However, as a “win-win option”, promoting energy efficiency is not an easy function for governments due to the certain barriers. Especially developing countries have tremendous potential to increase energy efficiency but face several barriers. The following section identifies these barriers to promotion of energy efficiency.

2.2 Barriers to Promotion of Energy Efficiency

While energy efficiency is widely viewed as an important element of energy and environmental policy, there are major obstacles to prevent the promotion of energy efficiency nearly in all countries. These obstacles can be considered as “common barriers”, while a few obstacles which may not exist

in every country can be defined as “peculiar barriers”. These barriers can exist each stage of energy cycle; production, transmission/distribution and consumption. Bearing in mind the scope of this study, barriers concerning production stage would be ignored.

Lohani and Azimi (1992) identify the common barriers as lack of information and awareness, lack of capital and rapid payback requirements for energy efficiency investments.

Lack of information and awareness is one of the most effective barriers to energy efficiency improvement on the consumption stage of energy. Consumers have limited knowledge about energy consumption of home appliances or office equipment they use and the rationale of energy efficiency measures that could be implemented for reducing the energy consumption. Energy efficiency is often a minor consideration in the choice of equipment. Generally consumers often ignore energy characteristics of the products in the face of more concerns about performance, features and price of the products. Similarly, the people who are working in the energy sector or related sectors, e.g. architects, heating system installers, engineers may have inadequate knowledge about the latest technologies to make energy savings possible.

Limited access to capital for energy efficiency investments and measures constitutes an important barrier for promoting energy efficiency. The problem of limited access both refers to transmission/distribution and consumption stages of energy. Lack of finance is an important barrier especially in developing or underdeveloped countries. People in those countries have other priorities rather than energy efficiency due to financial strains.

Even when the costs of energy efficiency investment are much less than those of new energy supply, investments are often more difficult to finance. Generally, producers and consumers have different investment priorities due

to rapid pay back requirements. Since energy efficiency is often a minor consideration in the choice of equipment; its costs have to be paid back at a rapid rate. Haugland (1996) notes that required payback for energy efficiency investments in low-income households is less than one year. In addition, the value of investments in energy efficiency is subject to fluctuations of energy prices. In this respect, as Sutherland (1991) emphasizes, investments in energy efficiency are risky because the actual savings cannot be predicted precisely.

Apart from these afore-mentioned common barriers to energy efficiency, a few barriers can be defined which may not exist in every country. The most known so called “peculiar barriers” are non-cost reflective energy prices, lack of legislation, low level of coordination between relevant stakeholders and high level of energy losses.

The price of energy products stems from production costs and partly from the fiscal policy of the governments. Pricing is certainly one of the most important issues in the energy efficiency policy. Energy prices are obviously essential in determining energy consumption. In market economies, prices reflect the costs accurately and thus contribute to macro-economic optimisation. However, for social reasons, energy prices are often subsidised, thus, in some economies prices often do not reflect overall costs. Laponche (2004) states that subsidised energy prices hinder the efficient management and operation of energy companies. Moreover, they also increase government expenditure and reduce the effectiveness of energy efficiency policies since the consumer is not encouraged to save energy.

Lack of legislation is another obstacle for promotion of energy efficiency both for transmission/distribution and consumption stages. In general, regulations focus on imposing minimum efficiency standards or technical, behavioural and managerial energy efficient practices, and providing information to consumers like energy audits or labels. In this regard, mandatory legislation

covering all the sectors of the economy forces and encourages promotion of energy efficiency.

Since energy efficiency has horizontal aspects in different sectors, low level of coordination between various ministries and institutions in the area of energy efficiency prevents the promotion of energy efficiency. According to Bach (2001) low level of coordination between institutions is a political problem. Due to low priority of energy efficiency, different ministries or institutions have various understandings on energy efficiency and therefore it becomes difficult to reach a consensus for the required needs for stronger policies.

Concerning transmission/distribution phase of energy, one of the crucial concerns is the rate of losses in electricity transmission and distribution networks. Wilbanks (1994) underlines the fact that total losses often reach to 20-30% of the total electricity production in underdeveloped or developing countries and it is possible to reduce such losses to 6-7% by taking appropriate measures. The promotion of energy efficiency is an important opportunity for reducing both technical and non-technical (theft) losses.

As a result, besides common barriers to the promotion of energy efficiency, some peculiar barriers may exist due to the specific conditions of a state. In such cases of barriers, government intervention is necessary in focusing interest on energy efficiency. According to IEA studies (2002), the role of the government proved to be essential in the design of an energy efficiency support policy and related action plans. Ultimately, the actions of individual companies and customers are crucial. For alleviating these barriers, governments introduced energy efficiency policies, measures or instruments. The following section gives main policies and instruments for overcoming the barriers to the promotion of energy efficiency.

2.3 Energy Efficiency Policies and Instruments

For many countries, energy efficiency is a stated energy policy objective, but it is not given the priority it deserves. It is generally accepted by the important energy institutions, notably International Energy Agency, The European Energy Charter or World Energy Council, that clear and targeted energy efficiency policies are necessary to create a sustainable development. Therefore, there is a need for reinforcement and implementation of the energy efficiency policies in all sectors of the industrialised countries.

Most energy analysts and economists agree that the state should play a certain role in the promotion of energy efficiency. Laponche (2004) underlines the fact that energy efficiency needs permanent support of government not only for the formulation of policy but also for ensuring that the appropriate legislation is adopted and applied and necessary human and financial resources are devoted.

On the other hand, although developing a national energy efficiency policy is a governmental function, the policy needs to be grasped by a wide audience. An energy efficiency policy will be effective if it is all-encompassing, including all actors that effect the promotion of energy efficiency, such as energy supply companies, consumers, relevant government ministries, industries, NGOs and academics. The wider the group that participates, the greater the chance of acceptance of the energy efficiency policy by all parties and at all levels (ECS, 2001a: 7).

Also, since energy efficiency has horizontal aspects in a variety of sectors (such as, construction, transport, industry and environment), energy efficiency issues encompass a wide range of activities, issues and measures, cooperation and coordination between the main stakeholders and institutions. Therefore, increasing effectiveness and coordination of the related

organizations as well as enhancing their administrative capacity is of crucial importance.

There are crucial policy instruments, which can be used by governments to support the energy efficiency improvement. These measures can be grouped into six main categories: financial measures, legal or regulatory measures, voluntary measures, demand side measures, infrastructural measures and restructural measures. These measures sometimes comprise all aspects of energy, production, transmission/distribution and consumption stages. Financial measures or legal or regulatory measures may related with all these stages. Bearing in mind the scope of this study, transmission/distribution and consumption aspects of these measures are taken into consideration.

Farinelli et al. (2005) in their study give due emphasis on three main categories only, namely financial measures, legal or regulatory measures and voluntary measures.

Concerning financial measures, Farinelli et al. note that there are “positive” and “negative” financial measures. Positive financial measures, so called incentives, are subsidies, grants, low interest loans and tax exemptions, which are used for increasing energy efficiency investments. Taxation influences consumer behaviour. For example, reduced VAT for an energy efficient appliance probably makes the product attractive for consumers. Negative financial measures, so called “disincentives”, are energy or carbon taxes, taxation on less efficient devices. These negative measures make pressure on both producers and consumers for choosing energy efficient technologies.

Legal or regulatory measures refer to adoption and effective implementation of related legislation for transmission/distribution and consumption stages of energy. The most known regulatory measure is mandatory labelling of

products, which is an important instrument for promoting energy efficiency. Product labels give purchasers information about equipment performance and energy consumption. Providing consumers with the necessary technical and economic information by labelling of the equipment and devices they use, help them to make decisions to reduce energy consumption. Labelling also motivates manufacturers to produce more efficient products. Labels are most often applied to appliances and equipment, such as home appliances, office equipment, home electronics and lighting equipment, but can also be applied to buildings and automobiles.

Third party financing and voluntary agreements are the most important instruments regarding voluntary measures. Kemper[3] defines the concept of "third party financing" as an important vehicle for financing energy efficiency projects. Third party financing is proposed by companies who are interested in developing energy efficiency projects. Third party financing solutions often combine both technical and financial instruments securing that the most suitable technical solutions are backed up with the necessary financial resources to implement the projects successfully. Third party financing implementations, energy service companies, loan funds or leasing, can help consumers invest in energy efficiency improvements without straining public resources (ECS, 2003a: 5).

Within the scope of third party financing, energy service companies (ESCO) are the important applications for promoting energy efficiency. Painuly et al. (2003), consider the lack of appropriate financing mechanisms as one of the important barriers to energy efficiency projects. Particularly in developing countries, banks are usually unfamiliar with the energy efficiency projects and unwilling to fund them. Painuly et al. emphasize that ESCO is a new concept in developing countries and have potential to solve lack of financial resources.

[3] Ria Kemper: Secretary General of Energy Charter Secretariat.

An ESCO is a business that develops, installs, and finances projects designed to improve the energy efficiency and maintenance costs for facilities over a 7 to 10 year time period. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risks associated with the project. They design, and finance energy efficiency projects; install and maintain the energy efficient equipment involved; measure, monitor, and verify the project's energy savings. ESCO's costs are financed from the amount of energy that is saved by the project.

Voluntary efficiency agreements are crucial in overall government efficiency policies in nearly all sectors. Chidiak (1999) considers voluntary agreements as one of the most important policy instrument both for carbon dioxide (CO_2) reduction and energy efficiency promotion especially in industry. He states that in the early 1990s, many EU countries have considered voluntary agreements as an important instrument for CO_2 reduction and improving energy efficiency.

Voluntary agreements take many forms; from an agreement with an individual company to broad agreements covering millions of products. Key elements of a successful voluntary agreement include adequately ambitious, specific and measurable targets, careful monitoring and incentives. Typically, making the agreement is voluntary but once the company makes the agreement, it becomes binding. Different countries have introduced different incentives to encourage the industry for making agreements. Such incentives have included reimbursement of certain energy and environmental taxes, promises not to increase energy taxes, subsidised energy audits etc (IEA, 2005a: 63). Voluntary efficiency programmes in the industrial sector have already been established in nearly all-European countries and have worked successfully. For example, the EU refrigerator manufacturers negotiated a

voluntary agreement under which they will ensure that average efficiency would rise to the "A" level[4] on labels by 2006 (IEA, 2003a: 90-110).

In addition to Farinelli et al.'s classifications on energy efficiency instruments, demand side measures, infrastructural measures and restructural measures are of crucial importance for the promotion of energy efficiency both in end-use sectors and transmission/distribution stages of energy. Concerning demand side measures, promotion of public awareness is crucial in the achievement of further energy savings. According to Laponche (2004), information is the first type of measure to be considered since it necessitates smaller budget than the other types of measures.

Energy efficiency is related with individual behaviour of energy consumers. Avoiding unnecessary consumption of energy or preferring the most efficient equipment to reduce the usage of energy contributes to decreasing the individual energy consumption. In this respect, providing consumers with sufficient knowledge about rationale of energy efficiency and related measures contributes to increasing the overall energy efficiency of the country. Governments have a major role in establishing an energy efficiency information policy; including organization of conferences, seminars and workshops in order to enlighten consumers.

Another instrument, Demand Side Management (DSM), is being used in emerging energy efficiency policy measures. DSM refers to a wide range of actions to reduce demand for energy (electricity or gas) and/or to shift demand from peak to off-peak times. DSM programmes are implemented to influence the level or timing of public demand for electricity, to optimise the use of energy (Ergen and Yıldırım, 1997: 27-28). DSM programmes are implemented by energy companies and governments for encouraging the reduction of energy demand during peak periods, through from advisory

[4] Levels indicate the efficiency of equipment, for example "A" means most efficient, whereas "F" or "G" mean least efficient.

services on energy efficiency and conservation, education programmes and the setting up of an Energy Efficiency Centre and multi-timing tariffs for consumers. DSM is an important tool to help balance supply and demand in energy markets. Wilbanks (1994) considers DSM as a good instrument for reducing technical losses of transmission/distribution systems due to its potential to reduce excessive load in peak times.

For the transmission/distribution phase of energy, infrastructural measures generally play a crucial role in promoting energy efficiency, for example elimination of the least efficient transmission and distribution infrastructure. Energy losses would be reduced in this respect. Establishing data and control systems for transformers contributes to promotion of energy efficiency in particular in electricity distribution grids. For increasing the efficiency of both transmission and distribution systems, underground cabling is a proper option for reducing losses. Due to environmental, human health and efficiency concerns, underground electricity cables are used in almost all European countries. Transmission and distribution losses are lower with underground cables than aerial lines. Underground cables are not vulnerable to natural events such as rain, storm and to cause accidental contact with other lines. Also burying electricity lines especially in low voltage would prevent theft. On the other hand, underground cables are more expensive than overhead lines due to main reasons.[5] According to a study, the cost of burying lines is 3-4 times expensive than the overhead lines (ICF Consulting[6], 2003: 3).

[5] Additional insulation is needed because the cables are often laid only one metre below ground. Also due to ensuring access to the cables for repairs, the land above the cables cannot be used for farming or industrial purposes. Moreover, within an existing network of overhead lines, additional investment is needed to integrate underground cables with overhead lines (ICF Consulting, 2003: 3).

[6] ICF Consulting is a US consulting firm on defence, security, social programs, energy, environment and transportation which is serving major corporations, governments and multinational institutions.

In addition to infrastructural measures, restructural measures, sector restructuring, is of crucial importance for promoting efficiency in transmission/distribution stages of energy. Separating monopolistic activities (unbundling) such as transmission and distribution facilitates would promote energy efficiency. For instance, independent distribution companies have more incentives to provide demand side management services to increase customer satisfaction than in a vertically integrated company.

The degree of effectiveness and overall cost of each policy instrument vary according to country-specific circumstances, such as climate, energy price levels and economic activity. Large-scale energy efficiency gains are possible only if appropriate mechanisms for energy efficiency are devised and barriers are successfully addressed. The best results from energy efficiency measures occur when they are directly embedded into sectoral policies, like buildings, transport and industry, moreover into governmental policies on environment, urban planning, regional development and social issues, by encouraging more efficient energy use and technologies (IEA, 2004: 1-2).

CHAPTER 3

ENERGY AND ENERGY EFFICIENCY POLICIES IN TURKEY

With a young and growing population and located at the meeting point of 3 continents, Asia, Europe and Africa, Turkey has become one of the fastest growing energy markets in the world. National energy policy mainly focuses on ensuring adequate energy supplies for growing demand; hence, progress regarding promotion of energy efficiency has remained limited up to 2000s. By the declaration of candidacy for EU membership, Turkey accelerated efforts for harmonizing her energy legislation with EU acquis and has taken positive steps for market liberalization and promoting energy efficiency.

This chapter presents, firstly, a brief summary of Turkish energy policy especially after the Helsinki Summit of 1999. In this respect, main emphasis has been given to the liberalization of energy market for ensuring harmonization with the EU internal energy market. Secondly, the status of energy efficiency in Turkey has been explained by taking into consideration positive developments concerning promotion of energy efficiency. Thirdly, so as to identify main problems concerned with promotion of energy efficiency, electricity transmission/distribution systems of Turkey are evaluated. Fourthly, a deep sectoral review enclosing main end-use sectors, namely industry, building and transportation sectors, has been done. Lastly, bearing in mind the close relation between energy efficiency and environmental protection, environmental policies and measures are also taken into attention.

3.1 Turkish Energy Policy

Turkey is at the crossroads of Europe and several volatile, strategically and economically important regions, including Russia, the Caspian region and the Middle East, which are the biggest oil and natural gas deposits in the world. Turkey lies between the countries possessing 71.8% of the world's proven gas reserves and 72.7% of oil reserves. As Sasley (1998) stresses, "energy pipelines cannot be discussed without reference to Turkey", Turkey constitutes an "energy bridge" between major hydrocarbon[7] producing countries in the East and major energy importing markets in the West.

Turkey's role as an energy bridge is becoming increasingly important as the EU grapples with the problems of ensuring energy security and the provision of energy supplies from multiple sources at competitive prices. Robert (2004) attributes importance to Turkey for its ability and willingness to develop major transit systems for gas and oil, thus enabling hydrocarbon resources to access European markets by pipelines from such diverse regions, Caspian, Central Asia, the Middle East and the Eastern Mediterranean. Turkey's goal is to become Europe's fourth main artery for oil and gas.[8] In this respect, functioning as a corridor and terminal in transporting oil and natural gas from the East to the European and world markets constitutes one of the primary components of national energy policy.

Although almost all conventional energy resources exist in Turkey, these resources are not sufficient to meet energy demand, except for lignite and hydropower. More than half of the energy demand of the country is met through imports. The gap in energy supply and demand is the key element, which determines national energy policy. As Stern (2003) also highlights, a developing country with a rapidly growing economy, Turkey is facing a rising

[7] Oil and natural gas.

[8] The other three main arteries are Russia, the North Sea and North Africa.

demand for energy. Turkey is among the fastest growing energy markets in the world with total primary energy supply growth rates of 4% to over 5% per annum and total final consumption growth of around 4% since mid 1970s. Turkey has been experiencing demand growth rates of 5-6% per annum in primary energy and 7-8% per annum in electricity. Currently, electricity consumption is more than 150 TWh and is expected to reach 500 TWh by 2020.[9]

The Ministry of Energy and Natural Resources (MENR) determines Turkish energy policy objectives and is responsible for the implementation of energy policies, plans and programmes in coordination with its dependent and affiliated institutions and other public and private entities.[10] Particularly, after the Helsinki Summit of 1999, the main objective of the Turkish energy policy is primarily focused on meeting the national energy demand in a reliable, sufficient, timely, economic and environmentally sound manner so as to realize and sustain the economic and social development targets. Also, assigning due consideration to preventing environmental damages and promoting R&D activities on energy technologies for optimum utilization of alternative energy sources and facilitating projects for the transportation of hydrocarbons from the East to Western Europe in the context of the "energy bridge" concept have been adopted as additional objectives of the national energy policy (Dünya Enerji Konseyi Türk Milli Komitesi, 2003: 24). In this respect, increasing domestic production and optimum use of indigenous resources, diversifying energy sources for ensuring security of supply, promoting energy efficiency, ensuring transparency and creating competition

[9] Unpublished data are available from the MENR, Directorate General of Energy Affairs.

[10] The dependent institutions of the MENR are General Directorate of Petroleum Affairs, General Directorate of State Hydraulic Works, Turkish Atomic Energy Authority, General Directorate of Mineral Research and Exploration and General Directorate of Electrical Power Resources Survey and Development Administration, whereas the affiliated institutions are, Petroleum Pipeline Corporation, Electricity Generation Company, Turkish Electricity Transmission Company, Turkish Electricity Distribution Company, Turkish Electricity Wholesale and Trading Company, Turkish Hard Cole Enterprise, Turkish Coal Enterprises and Turkish Petroleum Corporation.

in the energy market through liberalization of the sector are the main instruments to achieve the energy policy objectives.

Motivating the participation of private and foreign investments plays a major role in pursuance of realization of these objectives. In this context, the main goal of the reforming and liberalization activities in the national energy sector with particular reference to electricity and gas sectors is creating an efficient, stable and competitive energy market through encouraging private and foreign involvement in the sector.

Since the early 1980s, Turkish energy policy has concentrated on market liberalization in an effort to stimulate investment in response to increasing internal energy demand. Several waves of liberalisation have been launched since 1983, leading to a gradual opening of the Turkish energy market. Turkey has made early and extensive use of financing models such as build-own-operate (BOO)[11], build-own-transfer (BOT)[12] and transfer of operation right (TOR)[13]. These models were implemented in the projects, which require large investments (Atılgan, 2000: 32).

Energy services have been offered at comparatively high costs for a long time, especially for business users. The main reason is limited competition and private investments. In response to these problems, market liberalization activities have been accelerated after the Helsinki Summit in 1999, where Turkey was declared a candidate for accession to the EU.

[11] BOO: The private sector finances, builds, owns and operates a facility or service in perpetuity.

[12] BOT: A private entity receives a franchise to finance, design, build and operate a facility (and to charge user fees) for a specified period, after which ownership is transferred back to the public sector.

[13] TOR: A private operator receives a license or rights to operate a public service, usually for a specified term.

In order to encourage private investment and to ensure harmonisation with EU legislation, the Electricity[14] and Natural Gas[15] Market Laws were adopted, which are in full compliance with the EU Electricity and Gas Directives. The new laws introduced a new legal framework for the liberalization of the electricity and gas markets, such as unbundling of market activities (i.e. transmission, distribution, generation, trading and import), providing regulated non-discriminatory third party access and ensuring implementation of the necessary measures for protecting consumers and the environment.

An independent regulator, The Energy Market Regulatory Authority (EMRA) has been established to be in charge of regulation and supervision of the electricity and the gas markets in November 2001. As regards functioning of the national energy market, the MENR is responsible for determining policies at macro-level while the EMRA carries out monitoring, regulating and supervising activities in accordance with national energy policies. The main functional responsibilities of the EMRA are centralized on granting licenses (transmission, distribution, generation, auto-production, wholesale and retail), approving tariffs, ensuring non-discriminatory access to grids, issuing secondary legislation, ensuring fair and effective competition and determining eligibility thresholds for market opening.

The efforts for liberalisation of the national energy market and aligning energy legislation in line with the EU legislation have been continued by the adoption of Petroleum Market Law[16]. The Law aims to remove state controls on the sector, to liberalize pricing of oil and oil products, to establish a national petroleum stock system.

[14] Electricity Market Law No: 4628, (OG 24335, 20.02.2001).

[15] Natural Gas Market Law No: 4646, (OG 24390, 18.04.2001).

[16] Petroleum Market Law No: 5015, (OG 25322, 04.12.2003).

By adopting new Electricity and Natural Gas Market Laws, Turkey has made great strides towards market liberalisation and privatisation. It is declared by the MENR that 29% of the electricity market is free to choose suppliers, while this ratio is 80% in natural gas market as of 2005. In order to ensure full competitive environment in electricity market, The High Planning Council has adopted a Strategy Paper in 2004.[17] The Strategy Paper covers procedures for privatization of distribution and generation assets, measures on transitional issues and security of supply mechanism.

According to the Strategy Paper, privatization of generation assets is envisaged to start in 2006, while for the distribution sector, it is planned to be completed by the end of 2006. The Strategy also entails a further market-opening plan. The Strategy Paper fixed the eligible consumer limit at 7.7 GWh[18] until the beginning of 2009. Within the framework of schedule to be determined, the eligible consumer limit be decreased starting at the beginning of 2009 in line with the objective of opening the whole market to competition by 2011.

Concerning renewable energy sources (hydropower, geothermal, solar), the Law on renewable energy sources[19] has been adopted for promoting electricity production from the renewable energy sources in liberalized energy markets. Also, the MENR is preparing a law on energy efficiency and it is envisaged to be put into effect by mid 2006.

To sum up, Turkey has made great progress towards market liberalisation and privatisation since 2000. It has introduced new laws to liberalise energy markets, to reduce the role of the government and to strengthen market

[17] Electricity Sector Reform and Privatization Strategy Paper, (OG 2004/3, 17.03.2004).

[18] Consumers, who are using more than 7.7 GWh electricity annually, are free to choose their suppliers.

[19] Law on Utilization of Renewable Energy Sources for the Purposes of Generating Electricity No: 5346, (OG 25819, 18.05.2005).

forces in line with the EU energy acquis. Although national energy policy approach was highly supply oriented with emphasis placed on ensuring additional energy supply to meet the growing demand and energy efficiency has been a lower priority, recently, Turkey assigns due importance to enhance energy efficiency in all sectors of the economy in order to decrease import dependency and ensure the protection of the environment.

3.2 Energy Efficiency in Turkey

Turkey is one of the OECD countries characterised by the highest increase in energy demand since mid 1990s. The growing population, industrialization and increasing standard of living have considerably increased the demand for energy. Table 3.1 illustrates primary energy supply and demand balance of Turkey for the years 1990 and 2004. Since domestic resources are not sufficient enough to meet the energy demand of the country, dependence on imported energy has increased. Therefore, energy policy is dominated by concerns related to security of supply. Due to growing energy demand and import dependency, promotion of energy efficiency became an increasingly important issue in recent years.

Table 3.1 Primary Energy Supply and Demand Balance of Turkey

	1990	**2004**
Demand (Mtoe)	53.0	87.5
Production (Mtoe)	25.5	24.4
Import (Mtoe)	30.9	67.5
Export (Mtoe)	2.1	4.6
Production/Demand (%)	48.1	27.8
External Dependence (%)	51.9	72.2

Source: MENR-Directorate General of Energy Affairs

As it is underlined in Chapter 2, the indicators of the development level of a country concerning energy sector are per capita level of energy consumption and level of energy intensity. Ideal conditions are high level of per capita energy consumption and low level of energy intensity. However, when Tables 3.2 and 3.3 are examined, it is seen that Turkey has not accomplished the above-mentioned ideal conditions. Firstly, Table 3.2 shows the level of per capita energy consumption of various countries for the year 2003.

Table 3.2 Per Capita Energy Consumption of Selected Countries

	Population (million)	Per Capita Energy Consumption (Toe)
USA	291.09	7.83
Germany	82.52	4.26
France	61.54	4.40
Japan	127.62	4.05
India	1032.4	0.51
Turkey	70.80	1.11

Source: Derived from IEA, 2005b and 2005c.

When developed countries are taken into consideration, it is seen that per capita energy consumption of Turkey is far below the average. Kavak (2005) underlines the fact that per capita energy consumption of Turkey is only above African and Asian countries. Concerning energy intensity, the situation is not different for Turkey. Table 3.3 illustrates the energy intensity of various countries for the year 2003.

Table 3.3 Energy Intensities of Selected Countries

	GDP (billion US $ in 2000 prices)	Energy Intensity (Toe/thousand $)
USA	10330.00	0.17
Germany	1885.19	0.09
France	1357.97	0.10
Japan	4876.13	0.06
India	492.5	1.08
Turkey	210.50	0.27

Source: Derived from IEA, 2005b and 2005c.

As it is seen from the Table 3.3, energy intensity of Turkey is far above the developed countries. Kavak (2005) highlights that, energy intensity of India, which is above Turkey, can be explained due to its crowded population. The figures of Table 3.3 demonstrate that Turkey uses energy in an inefficient manner when compared to developed countries. Korucu (2004) pinpoints that these values imply energy consumption can be decreased without any reduction in standard of living or services provided. Similarly, Çalıkoğlu (2004) considers that it is compulsory to decrease energy intensity to 0.15 % level through long-term planned studies.

The figures of Table 3.3 verified that Turkey has a great degree of energy conservation potential. It is estimated by the MENR that total energy conservation potential of Turkey is about 20 Mtoe annually, which is equal to one fourth of the primary energy consumption. The financial value of the potential energy conservation is 3 billion US dollars annually (Enerji ve Tabii Kaynaklar Bakanlığı, 2004: 41).

The first planned studies regarding promotion of energy efficiency has started in 1980s by the establishment of a department within the Directorate General of Electrical Power Resources Survey and Development Administration under the MENR. The MENR is the principal organization responsible for formulation and implementation of the energy efficiency policies. At the end of 1992, the MENR assigned to this department the task to act as the National Energy Conservation Centre (NECC) for enhancing the activities on improving energy efficiency in all end-use sectors.

Since then, serving as a public establishment, NECC has been carrying out training, energy auditing, legislation preparation and public awareness promotion activities for enhancing energy efficiency in all end-use sectors, through a collaboration mechanism with the related ministries and

institutions[20] since energy efficiency has horizontal aspects in many sectors. Hepbaşlı and Özalp (2003) highlight the fact that NECC is relatively new when compared to that of other countries. Also NECC has no regional offices. Within this perspective, being a new centre without regional branches, NECC is not sufficient enough for dealing with energy efficiency issues throughout the country.

In 2000, a positive development has been realized concerning promotion of energy efficiency through the ratification of Energy Charter Treaty and the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) [21]. These international agreements aim to maximise energy efficiency and protect the environment. In this context, efforts have been accelerated to develop policies for the promotion of energy efficiency in Turkey.

In addition to legally binding international commitment under PEEREA, Turkey is also obliged to increase energy efficiency in the context of EU Membership. Promotion of energy efficiency is identified as one of the short-

[20] Other ministries and institutions involved in energy efficiency policy are the Ministry of Environment, the Ministry of Reconstruction and Resettlements, the Ministry of Industry and Trade, Turkish Standards Institute and the Scientific and Technical Research Council of Turkey.

[21] The roots of the Energy Charter date back to a political initiative launched in Europe in the early 1990s. Russia and many of its neighbours were rich in energy resources but needed major investments to ensure their development, whilst the states of Western Europe had a strategic interest in diversifying their sources of energy supplies, thus reducing their potential dependence on other areas of the world. There was therefore a recognized need to ensure that a commonly accepted foundation was established for developing energy cooperation between the states of the Eurasian continent. On the basis of these considerations, the Energy Charter process was born and The European Energy Charter was established on 17 December 1991. On the basis of European Energy Charter, The Energy Charter Treaty and was signed in December 1994 and entered into legal force in April 1998. The Treaty's provisions focus on five broad areas: the protection and promotion of foreign energy investments, free trade in energy, freedom of energy transit through pipelines and grids, reducing the negative environmental impact of the energy cycle through improving energy efficiency and mechanisms for the resolution of state-to-state or investor-to-state disputes. Within this perspective, Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects was signed in December 1994.

term priorities in Accession Partnership with Turkey[22], which is issued in 2003. According to Accession Partnership, Turkey should ensure harmonization with related EU acquis and enhance implementations for further promotion of energy efficiency.

In this perspective, there is a growing commitment in Turkey to improve energy efficiency. Turkish government attaches due importance for increasing efficiency by retrofitting existing power plants and improving energy efficiency in the main end-use sectors, by promoting rational use of energy and optimum utilisation of domestic resources. In this context, studies for promotion of energy efficiency have been accelerated and many positive steps have been taken, such as issuing legislation and establishing international cooperation in the field of energy efficiency.

Regarding adoption of legislation, most parts of the EU acquis in the area of energy efficiency are already transposed or scheduled for implementation.[23] Energy standards and labelling of electrical appliances, standards for boilers, building codes for new buildings have already been transposed to national legislation. Besides, a Draft Energy Efficiency Law is under preparation by the MENR. The objective of the Draft Law is to increase the efficient use of energy and energy resources for reducing the burden of energy costs on the economy as well as protecting the environment. The law is comprised of both principles and procedures for the production, transmission/distribution and consumption stages of energy including promotion of energy efficiency awareness and improvement of administrative structures for energy efficiency services.

According to the Draft Law, an Energy Efficiency Coordination Board (EECB) will be established for ensuring effective management of the energy

[22] Council Decision of 19 May 2003 on the Principles, Priorities, Intermediate Objectives and Conditions contained in the Accession Partnership with Turkey (OJ L 145/140, 12.06.2003).

[23] The Revised National Programme, which has been issued in July 2003, encompasses detailed and targeted time schedule for harmonization of the related EU acquis and includes a section on energy efficiency.

efficiency activities throughout the country. With the approval of EECB, state or private universities and chamber of commerce shall be authorized by NECC in order to carry out energy efficiency activities. NECC in collaboration with competent authorities will prepare energy efficiency analyses and projections concerning energy consumption of the industry, buildings and transportation sectors. Concerning public sector, NECC will prepare and publish annual reports on energy efficiency analyses including its own evaluations.

The Draft Law also envisages tax incentives[24], subsidies and soft loans given to industry for energy efficiency investments. VAT exemptions will be provided for energy efficient household appliances and equipment used in buildings and subsidies will be provided for biomass-based cogeneration. Third party financing for all sectors and voluntary agreements will be introduced for industry. In addition, electricity and natural gas distribution companies will be obliged to provide information to consumers on energy efficiency measures.

Although the enactment of the Draft Energy Efficiency Law has been foreseen as of end of 2004 according to the National Programme, the studies have not been completed. Draft Law is still in Prime Ministry for the enactment as of December 2005.

In addition to legislation studies, international cooperation has been increased in the area of energy efficiency. By the declaration of candidacy for EU Membership, Turkey became eligible for using EU funds. Within the framework of the EU Financial Cooperation Programme[25], a Twinning

[24] Before the Draft Law, there are no tax incentives to encourage energy efficiency projects directly.

[25] EU Financial Cooperation Programme is the main financial instrument of the pre-accession strategy for Turkey.

Project[26] for promoting energy efficiency has been approved in 2003. The Project aims establishing know-how transfer and training in the area of EU energy efficiency policies and practices from the selected European energy efficiency agencies, twin partners, ADEME and NOVEM[27]. The Twining Project concentrates mainly on three topics, namely, strengthening the legal and institutional capacity, assessing of energy saving potential and identifying barriers to energy efficiency, while planning support to implementation of energy efficiency measures.

In this perspective, for assessing energy saving potential, identifying barriers and determination of efficiency measures, a National Energy Efficiency Strategy for Turkey has been endorsed by MENR in 2004. The adopted energy efficiency strategy concerted between all relevant stakeholders constitutes the roadmap for improving the rational use of energy in the end-use sectors. The Strategy focuses on, supporting governmental and local administrations in formulating and implementing effective energy efficiency policies and measures and supporting final consumers through appropriate technical assistance and establishing financial incentives for identifying and installing the right measures for improving efficiency.

As an important barrier to promotion of energy efficiency, energy consumers in Turkey have limited information about energy efficiency issues. Thus, in addition to 2003 Twinning Project, in the scope of EU Financial Cooperation Programme 2005, a new Technical Assistance Project[28] has recently been approved for enhancing development and implementation of education programs for specified target groups, such as housewives and students, in

[26] The name of the Twinning Project is “Improvement of Energy Efficiency in Turkey”.

[27] ADEME: French Public Agency for Environment & Energy Management. NOVEM: Dutch Agency for Innovation & Sustainability. These agencies are selected by a tendering process.

[28] The name of the Technical Assistance Project is “Increasing Public Awareness on Energy Efficiency in Buildings”.

order to increase energy efficiency consciousness of the public. This project will be beneficial for promoting public awareness on energy efficiency measures.

These two projects which are supported by the EU, demonstrate that both EU and Turkey attach due importance for promoting energy efficiency in Turkey. Recently, Turkish projects on energy efficiency easily get support from the EU when compared to other energy issues.

However, apart from these positive developments, there are some general problems in Turkish energy sector, which also constitute important barriers in front of further promotion of energy efficiency. Energy prices, which also constitute a crucial element in promotion of energy efficiency, are not cost-reflective in Turkey. Energy prices below cost-recovery levels create extra demand and have negative impacts on the promotion of energy efficiency. Although the new Electricity and Gas Market Laws prohibit cross-subsidies, there are still some cross subsidies between the different consumer groups, industrial and residential consumers[29].

Electricity prices are uniform across the country although cost of supply varies from region to region. High supply cost often coincides with regions of lowest income levels in Turkey. Currently a cost-based regional tariff is in the preparation stage.

To sum up, Turkey has accelerated steps for improving energy efficiency since 2000s. Draft Energy Efficiency Law and other energy efficiency regulations that are in compliance with related EU acquis constitute positive developments concerning promotion of energy efficiency. Besides, cooperation with the EU and other donors in the field of energy efficiency has been increased in recent years. On the other hand, there are crucial energy

[29] Cross subsidies are in favour of residential consumer for both electricity and gas. Thus, residential consumers pay less for electricity and gas than industrial consumers.

efficiency problems regarding transmission/distribution and consumption cycles of energy. In this context, transmission/distribution systems and the main end-use sectors will be examined in the following section in order to identify obstacles for promoting energy efficiency.

3.2.1 Energy Efficiency in Transmission/Distribution Stages of Energy

Turkey has a large geographical area with a 781.000 km^2 surface. Being a large country, the distance between the power plants and main energy consuming areas are long in Turkey.

The losses arise from the resistance of lines and transformers in the process of transmission and distribution. The transmission loss rate of Turkey is 3% of total production and it is close to the world standards despite the existence of long transmission lines. Considering that the electricity loss rate increases as the length of the transmission lines is extended, the transmission loss rate of Turkey is acceptable when compared to developed countries.

However, distribution losses are considerably higher than developed countries. According to IEA figures (2005a) in 2000, losses reached 21.5% of total production, but declined to 19.5% in 2003 and 18.6% in 2004 costing considerably more than 1.5 million US dollars. Distribution losses in Turkey consist of both technical and non-technical losses. Technical losses are stemming from overloading or underloading of distribution lines, reactive power consumption and low power factor. According to 2004 data, technical losses in Turkey accounted for 7% of total electricity production. The important part of the distribution losses is non-technical losses, which is nearly 12% of total production in 2004. Non-technical losses are stemming from theft and non-payment of electricity bills. As a country with nearly 5.500 US dollars per capita GDP, Turkey faces with significant electricity thefts in particular in rural areas and outskirts of big cities due to insufficient state control. The highest losses exist in Southeast Anatolia (54.4%), Eastern

Anatolia (21.3%) and European part of Istanbul (13.5%) whereas the lowest losses are in Aegean Region (3.3%)[30].

Electricity losses both threaten human health/safety and distort economy. Therefore, Turkish governments have started to take measures for preventing both technical and non-technical losses since the end of 1990s.

TEDAŞ (Turkish Electricity Distribution Company) has launched initiatives for dealing with technical losses. The SCADA/DMS (Supervisory Control and Data Acquisition/Distribution Management System) is an on-line data and control system, which supervises, controls, optimises and manages distribution networks. SCADA/DMS enables utilities to collect, store and analyse data from hundreds of thousands of data points, perform network modelling, simulate power operation and pinpoint faults. By SCADA/DMS, the network defects are determined easily and in this respect the time required for repairs and rehabilitation is relatively short.

The other important initiative is Geographic Information System (GIS). The system creates a numerical map including characteristics and geographic coordinates of transformers in cities and helps to determine the failures of network (Kavak, 2005: 85).

Some consumers in Turkey damage their metering equipment in order to demonstrate their electricity consumption low and therefore cause high levels of electricity losses. In this perspective, for preventing such losses, controlling and registering subscribers are of crucial importance for determining thefts and non-payments. Table 3.4 illustrates data concerning subscriber information as of December 2004.

[30] Unpublished data are obtained from the MENR, Directorate General of Energy Affairs.

Table 3.4 Subscriber Data in Turkey (As of December 2004)

Number of total subscribers	~26.000.000
Number of controlled subscribers	~5.500.000
Number of illegal usage	~300.000
Number of trials	~50.000

Source: MENR-Directorate General of Energy Affairs

According to the figures of Table 3.4, out of approximately 26 million registered subscribers only 5.5 million are controlled. Among the controlled consumers, approximately 3 hundred thousand subscribers are identified as illegal users which correspond to nearly 5.5% of controlled subscribers. In order to increase the controls for identifying more illegal users, TEDAŞ is currently preparing a new software system, called ABONE-NET project, which aims to monitor the process from transmission lines to the houses of the customers. It is a web-based customer service project. All information (addresses, tax and citizenship numbers, old electricity bills, payments, non-payments) about subscribers will be kept under this system for monitoring electricity thefts and non-payments. The project is still under preparation and successful results have been obtained from the pilot implementations in Kastamonu and Çorum (Kavak, 2005: 85-86).

The uncontrolled increase in peak load causes high rates of electricity losses. Therefore, demand side management is of crucial importance in reducing or shifting demand in peak times to off-peak times. In this context, implementation of multi-timing tariff constitutes one of the components of demand side management. In this perspective, TEDAŞ has been implementing a multi-timing electricity tariff system that offers customers an opportunity for savings in electricity bills since 1999. Since excessive demand damages distribution lines and causes losses, this tariff system aims to reduce demand in peak times by selling electricity at higher prices when compared to off-peak times. Currently, a three-timing tariff is being implemented for certain customers who are equipped with proper meters.

When all customers have been equipped with more advanced meters, a more sophisticated tariff (different tariffs for each hour) would be implemented.

The other important component of demand management is ensuring increased electricity interconnections with neighbouring countries. According to the Report of State Planning Organisation (2001), ensuring synchronous parallel electricity interconnections[31] with the neighbouring countries would reduce transmission losses due to meeting demand mutually. That means excessive demand would be met from other countries automatically in peak periods owing to the time differences between countries.

Although Turkey has asynchronous interconnections with some of its neighbours, namely Bulgaria, Georgia, Armenia, Azerbaijan, Iran, Iraq and Syria, no synchronous parallel electricity interconnections exist. TEİAŞ (Turkish Electricity Transmission Company) is pursuing studies for synchronisation of Turkish electricity system with the European grid, namely, Union for the Coordination of Transmission of Electricity (UCTE)[32]. The studies are planned to be completed in 2007. When the synchronisation is ensured, it would be much easier to control peak load and increase efficiency. In the scope of EU Financial Cooperation Programme, TEİAŞ is implementing two projects[33] for ensuring synchronisation with the UCTE.

[31] A synchronous parallel interconnected system is a network that can be regulated in its overall performance, both nationally and internationally in such a way that it enables electricity demand to be met with electricity generation optimally.

[32] UCTE is the association of a synchronous parallel interconnection system in continental Europe, providing a reliable market base by efficient and secure electric power highways. Members of the UCTE are Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Hungary, Italy, Luxembourg, Macedonia, Netherlands, Poland, Portugal, Romania, Serbia and Montenegro, Slovenia, Slovak Republic, Spain and Switzerland.

[33] Name of the Projects are “Complementary Technical Studies for Synchronisation of the Turkish Power System with UCTE Power System” and “Improvement of Frequency Performance of the Turkish Power System in Accordance with the UCTE Criteria”

In addition to synchronisation studies, TEDAŞ has made investments for preventing technical and non-technical losses. According to IEA data (2005a), investments totalled 320 million US dollars in 2003 and 280 million US dollars in 2004. Currently, TEDAŞ is installing underground distribution cables in big cities for increasing efficiency.

However, these afore-mentioned studies required additional large investments that TEDAŞ could not meet and more investments are needed for the rehabilitation of lines. In this regard, the government planned to privatise distribution network for increasing efficiency and quality bearing in mind the fact that private sector could allocate higher budget for the rehabilitation of lines. Within this perspective, for ensuring higher efficiency, the Electricity Sector Reform and Privatization Strategy Paper[34] envisages the privatisation of the distribution sector until the end of 2006.

To sum up, electricity losses are high in Turkey and should be reduced in order to ensure energy efficiency. According to Işık (2004), apart from social and technical factors, these high losses are also the result of management deficiencies. For example, TEDAŞ is still supplying customers who are not paying their electricity bills. It is imperative that such losses are drastically reduced and the social motives are dealt with separately from the functioning of the electricity distribution system with more effective and rational means. Within this perspective, after privatisation, it is envisaged that there will be an increase in efficiency of the electricity sector as private companies have better management systems since they have more financial and human resources than public sector. It should be noted that the private distribution companies would certainly not supply non-payers.

[34] For detailed information see page 26-27.

3.2.2 Energy Efficiency in End-Use Sectors

Consumption of energy in the main end-use sectors is of paramount importance for ensuring higher energy efficiency, as a substantial amount of energy is used in these sectors. In the scope of this section, main end-use sectors, namely industry, building and transportation sectors are evaluated.

3.2.2.1 Industry Sector

Industry, accounting for almost 45% of total energy consumption, is the largest energy consumer sector amongst all end-use sectors in Turkey. According to IEA statistics (2005a), the iron and steel sector constitutes the biggest energy consumer branch among the industrial sectors with a share of 3.3 Mtoe in total energy consumption in 2003.

Between the period 1990-2003, industrial energy consumption more than doubled reaching 29 Mtoe, although the industrial production grew by only 49.5% over the same period (IEA, 2005a: 52). These figures demonstrate that the structure of industry in Turkey is energy intensive. Hepbaşlı and Özalp (2003) highlight the fact that Turkish industry sector has an annual 30% energy saving potential. Thus, industry sector should have been given priority in energy efficiency policies and programmes. Indeed Turkish government pays more attention to the industry when compared to other end-use sectors.

For promoting energy efficiency in the industry sector, the MENR issued a Regulation[35] in 1995. According to the Regulation, industrial establishments are required to take precautions to increase the energy efficiency, conduct

[35] Regulation on the Measures to be Taken to Increase Energy Efficiency in Industrial Establishments (OG 22460, 11.11.1995).

energy efficiency researches, prepare energy efficiency plans and built energy management systems in their plants.

The 1995 Regulation envisages that industrial establishments with annual energy consumption of 2.000 Toe or more must set up an energy management system in their plants for making energy audits in order to identify energy savings potential and monetary savings. The results must be reported to the NECC. The mandatory energy management system affects 600 large industrial establishments out of 10.000, which are consuming 70% of the total industrial consumption in the country.

The 1995 Regulation also states that the NECC shall establish short-term courses in order to train energy managers for the industry. Energy managers are responsible for preparing audits and taking measures for the promotion of energy efficiency in their plants. These courses have been organised for nearly all sectors (iron and steel, arc furnaces, paper, cement, textile, fertilizer, food, ceramic, non-ferrous metal and car industry) since 1997.

Like in building sector, a bilateral cooperation has been established for promoting energy efficiency in Turkish industry. In March 2000, an agreement was signed between NECC and the Japan International Co-operation Agency (JICA). The project aims at solving potential problems associated with infrastructural deficiencies in promoting energy savings and establishing a common basis in the industrial sector. It encompasses efficiency courses with practical applications, including training, technology and information transfer, as well as donations for the acquisition of the necessary equipment in the period 2000-2005. A training centre, which contains a class and a model factory with equipment such as a boiler, a furnace, an air pressure system and a fan and a pump system, was established. The training centre began operation in 2001. It is expected by NECC that by 2010 most energy managers will be trained and an efficiency increase of 10% will be achieved throughout Turkish industry by 2020. The

project is not only directed to Turkish industry, but it is open also to neighbouring countries (Çalıkoğlu, 2004: 61-62).

For raising awareness, the NECC has various activities on energy efficiency in industry. In the scope of promotion of awareness activities, NECC teams started to visit factories with a mobile teaching unit, a training bus, since 1993. The buses are designed as classrooms and have necessary technical equipment to enable energy efficiency courses. In addition to awareness activities, NECC has been preparing publications to Turkish industry and a technical manual for energy managers, organising national and international conferences, seminars and workshops or granting energy conservation awards to companies.[36]

Some industrial companies, which are called ”autoproducers”, are generating electricity for their own usage. These industries often need heat (steam) in addition to electricity; therefore combined heat and power (CHP) technology is often used. CHP, which is an appropriate instrument for promoting energy efficiency[37], has developed fast due to governmental support in Turkey especially in industry sector. According to IEA figures (2005a) in 1992 there was only 4 MWe of capacity installed while in 2004 there was around 3,400 MWe and its share of electricity production was around 15%. Almost all the CHP plants are installed in the industry sector.

[36] For promoting energy efficiency in the industry sector, a competition is organised by the NECC every year under the “Energy Conservation Week”, taking place in the second week of January. There are two prize categories: “the most successful conservation practice” and “the most efficient product”.

[37] Combined heat and power (CHP) or cogeneration, is the simultaneous production of heat and electricity. Conventional generation of electricity in power stations is normally only 30-40% energy efficient. Combined cycle generation can improve this to 55%, excluding losses for the transmission of electricity (ECS, 2001b: 30).

3.2.2.2 Building Sector and Households

Energy consumption of buildings has always occupied an important position in overall energy consumption in the world. Koch (2001) underlines the fact that one-third of total final energy consumption of IEA countries is attributable to residential and commercial buildings. He stresses that space-heating, water-heating and electrical home appliances cause large amount of energy consumption in buildings in most of the IEA countries.

Similarly, building sector constitutes the second largest consumption group within the total energy usage in Turkey. The building sector accounts for 34% of the total final energy consumption and 43% of the total electricity consumption. Heating systems account for 82% of the residential energy consumption (ECS, 2003b; 27). Although stoves are generally used for space heating; the usage of central heating system has been increased especially in big cities in Turkey. Keskin (2000) stresses the efficiency of both stoves and central heating systems are very low due to the low efficiency of combustion, therefore high level of heating losses occur in buildings.

Apart from space heating problems, insulation of the buildings is also insufficient in Turkey. Keskin (2000) give emphasis to a NECC study, which is carried for building sector in 1998. According to the results of this study, only 10% of residential buildings had good roof insulation and only 12% had double-glazing, while 40% of public buildings had roof insulation and 48% had double-glazing. Buildings without insulation cause high-energy losses. Kavak (2005) emphasizes the fact that the losses from roofs, windows and walls account for 60-70% of buildings total heat loss. Taking these facts into consideration, it is evident that a substantial energy saving potential exists in building sector. According to Keskin (2000), 7 Mtoe energy saving potential exists in building sector annually. In parallel, Çalıkoğlu (2004) estimates that there is a potential financial saving of 1.3 billion US dollars in the buildings.

However, the efforts for realizing this potential are largely limited to legislative measures that are adopted by the government. For promoting energy saving and efficiency in buildings, a number of legislative measures have been issued by the Ministry of Reconstruction and Resettlements, which is responsible for preparation of regulations on building insulation and monitoring and inspecting of their implementation. The most important regulation is about insulation standards for new buildings, namely TS 825[38]. TS 825 defines rules for the calculation methods of heating energy requirements in buildings in compliance with international standards. TS 825 is completed by a Regulation[39], which has introduced new insulation conditions for new buildings. According to the Regulation, the most convenient construction and insulation materials are to be chosen in order to minimize the energy needed and to maintain the desired comfort level. TS 825 is updated in 2000 due to the 2-3 times higher energy consumption in Turkey for space heating when compared to the EU.

In addition to residential buildings, Karadeli (2000) highlights the fact that some of the governmental buildings have excessive energy consumption and measures have to be taken for reducing both electricity and primary energy source consumption. Therefore, a series of measures have been undertaken for governmental buildings since 1997. These measures are introduced by circulars or regulations issued by the Prime Ministry. These measures include, monitoring energy consumption, creating awareness among the personnel on how to limit energy consumption, using low consumption office equipment, adjusting the working hours to daylight, automatic switch-off of lighting during non-office hours, avoiding electric heating and limiting the use of air conditioning.

[38] National Insulation Standards for New Buildings TS-825 (OG 23756, 14.07.1999).

[39] Regulation on Heat Insulation in Buildings (OG 24043, 08.05.2000).

Electrical home appliances have an important share in total energy consumption of buildings. Approximately 30-40% of total electricity consumption is used for lighting, whereas 60-70% is used for household appliances. Although household appliances account for a substantial amount of energy consumption, energy consumers in Turkey have limited information about energy consumption of appliances they use. Energy efficiency is often a minor consideration in the choice of equipment. Generally consumers in Turkey often ignore energy characteristics of equipment in the face of more pressing concerns about sales price of the equipment.

Therefore, for promoting energy efficiency of these appliances and raising consumer awareness, a number of regulations on energy efficiency labelling standards for refrigerators, washing machines, dryers, dishwashers and lamps have been issued by the Ministry of Industry and Trade in 2002. In this perspective, most of the EU acquis on energy efficiency labelling standards has been transposed into Turkish legislation. These regulations aimed to reduce energy consumption of electrical home appliances and increase public awareness on energy consumption of the related equipment.

In addition to legislative measures, a bilateral cooperation was also started in order to promote energy efficiency of buildings. A project[40] was signed between the Turkish and the German Government in 2002. The project was carried out in cooperation with the German Technical Cooperation Agency (GTZ), NECC and the municipality of Erzurum. Within the scope of the project, an energy efficiency unit in Erzurum municipality and two education centres for training energy managers were established and training programmes and energy efficiency policy studies for cities were conducted. The project continued 3 years and lasted in October 2005. The cooperation was beneficial for increasing knowledge and experience on preparing building research for the promotion of energy efficiency of buildings.

[40] Name of the project is “Efficient Utilisation of Energy in the Building sector in Turkey”.

3.2.2.3 Transportation Sector

The most important issue concerning ensuring energy efficiency in transportation sector, which is highly dependent on oil, is the rapid decline of world oil reserves. According to BP statistics (2004), world's total oil reserves are 1.147.800 million barrels by the end of 2003 and world's daily consumption is 78.11 million barrels. The figures show that there is only a life span of 40 year for the existing oil reserves. In this perspective, promoting energy efficiency in transportation sector is inevitable for worldwide. However, oil consumption in transportation sector has been increasing despite the limited oil reserves. It is anticipated by the IEA (2003b) that the share of oil consumption in transportation sector will reach to 62% by 2020, as it was 35% in 1971 and 54% in 1997.

Like the other OECD countries, transportation sector has a significant role with its share 20% in final energy consumption in Turkey. According to IEA data (2005a), energy consumption in the transport sector grew by 29% between 1990 and 2003, reaching 12.4 Mtoe. The share of consumption of petroleum products by sub-sectors was 87% for road transport, 1% for rail, 2% for sea and 9% for air. These figures proved that road has been the dominant means of transport for a few decades. There are about 67 cars per 1000 inhabitants. The shares of rail and sea transport have remained almost unchanged since the early 1990s, as has the share of air transport.

Transportation sector has received less priority from the government when compared to other end-use sectors concerning promotion of energy efficiency, despite its substantial capacity for energy saving. In the scope of energy efficiency studies, there has been no legislation, regulation or standard on efficient use of energy in transportation sector. The measures are limited to motivating alternative transportation modes and rational use of energy in private fleets or urban public transportation.

Motivating alternative transportation modes for passenger and freight travelling for decreasing the dominant share of road transportation, has been assigned due priority in the Five Year Development Plans and annual implementation programmes prepared by the State Planning Organization. Within this context, Ministry of Transportation has initiated a master plan for obtaining a balance between the different transportation modes in 2003. The major component of the master plan is identifying standards for energy usage and emissions. The master plan has not been completed yet.

In the scope of motivating alternative transportation modes, limited projects aiming rational use of energy in private fleets or urban public transportation have been implementing by the large municipalities. These projects also aim to reduce the usage of private cars, thus, they have positive impacts on energy efficiency. These projects include improving the public bus transport service and extending the subway, light rail and light tram networks. At present subway and light rail studies have been continuing in Ankara, İstanbul, İzmir, Adana, Konya, Bursa and Eskişehir. Also, the government plans to increase the length of rails and number of modern locomotives so as to increase the service efficiency of public railway company (TCDD).

Regardless of studies for motivating alternative transportation modes, Kavak (2005) foresees that road transportation will continue to be based on oil in the next 30 years. In this perspective, he stresses the importance of using alternative fuels in transportation sector. Alternative fuels are considered to be an important option in the longer term to mitigate energy security concerns and reduce greenhouse gas emissions. In addition, they have economical benefits.

In this perspective, recently, alternative fuels became popular in the world as well as in Turkey. Liquefied petroleum gas (LPG) usage has been increased since 1990s. Petrol Ofisi, a Turkish petrol station, has very recently started to

sell bio-fuel[41], which contains agricultural substances. In addition, for promoting the usage of bio-fuels, Draft Energy Efficiency Law includes provisions for tax reductions.

Generally, old vehicles have high fuel consumption and therefore cause high levels of emissions. A Regulation[42] on air quality was issued in 2004 to reduce air pollution from road transport by mandating annual emission inspections for all motor vehicles and in connection with the sale of used vehicles. Emission testing is mandatory for the sale of used vehicles, however, the testing does not include any specific energy efficiency control.

3.2.3 Energy Efficiency in Relation to the Environment

Energy is either a contributing factor or the main cause of a significant number of environmental concerns. Energy use, especially fuel combustion, which generates an important share of emissions, is at the centre of environmental problems. Growth in energy consumption has a direct impact on the deterioration of the environment and on climate change. Within this perspective, energy efficiency measures have also contributed to the improvement of the environment.

Although new mechanisms have been introduced for addressing environmental problems since 1980s, notably adoption of Environment Act of 1983[43], the establishment of Ministry of Environment in 1991 and emergence of non-governmental environmental organizations, environmental issues have not yet been adequately incorporated into economic and social decisions of government in Turkey (Demirbaş, 2003: 206). In fact it is a

[41] The name of the bio-fuel is “yurtsever benzin”.

[42] The Regulation for Protecting Air Quality (OG 19269, 11.11.2004).

[43] The Environment Law, No: 2872 (OG 18132, 11.08.1983).

traditional problem in developing countries, since priority has been given to industrialization rather than protecting environment.

Generally energy efficiency is integrated in environmental policy of countries through ensuring the promotion of energy efficiency in order to decrease greenhouse gas emissions. In this perspective, in the Eighth Five Year Development Plan[44] of Turkey (2001-2005), increasing energy efficiency is mentioned as one of main priorities concerning protection of environment:

> "Energy is the basic input for economic and social development. Energy consumption has been increasing due to growth in population, urbanization and industrialization. Therefore, energy consumption should be minimised to a possible level... Within the scope of sustainable development, minimum amount of energy, which has a minimum destructive impact on the environment, shall be used." (SPO, 2000: 142)

Although energy efficiency is indicated as a priority for environmental protection, no targeted policy or carbon taxation is introduced for ensuring further promotion of energy efficiency. Besides, Turkey has no binding national or international commitments for decreasing emissions, which would make pressure on promotion of energy efficiency.

Turkey's total energy related emissions[45] amounted to 193 Mt in 2002. According to IEA figures (2005a), emissions grew by 4% compared to 2001 levels and over 50% compared to 1990 levels in 2002. Even though emissions have risen in line with increased energy consumption, the energy related emissions of Turkey are low when compared to OECD average. Similarly, Turkey has the lowest energy related CO_2 emissions per capita among the IEA countries. Per capita CO_2 emissions were at 2.8 tonnes in 2002, much lower than the OECD average of 11 tonnes (IEA, 2005a: 37-38).

[44] SPO, Long Term Strategy and Eighth Five Year Development Plan (2001-2005) No: 679, 07.06.2000.

[45] "Energy related emissions" specifically means CO_2 from the combustion of the fossil fuels, such as coal, coal products, peat, crude oil and natural gas.

Low level of CO_2 emissions arises from using natural gas that has low CO_2 emissions, imported coal with high calorie and renewable energy sources for meeting increased electricity demand.

As in Turkey, the recent increases in emission levels threaten human beings throughout the world. Global warming is the result of increasing greenhouse gases[46], which retain some of the heat from the sun as it is reflected back off the earth. Therefore, the temperature of the ground is increasing. Since 1990, global warming has been speeding up and the earth has warmed up by an average of 0.3°C - 0.6°C (IEA, 1997b: 15). Global temperatures are expected to increase by 1.4-5.8°C by the year 2100 (compared to 1990 temperatures) and by 2-6.3°C in Europe (EC, 2005a: 3). In this respect, governments realized that more strict measures are required for combating with climate change.

This combat against climate change led to a Convention, United Nations Framework Convention on Climate Change (UNFCCC), on a package of objectives at the Earth Summit held in Rio in 1992 under the auspices of the United Nations. In the scope of UNFCCC, it was recognized that countries while promoting sustainable development should tackle global environmental issues. [47] Turkey ratified UNFCCC on October 23, 2003 and the required legal process has been completed on May 24, 2004.

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[46] Greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrus oxide (N_2O), perfluorocarbons (PFC_s), hydrofluorocarbons (HFC_s) and sulphur hexafluorides (SF_6). CO_2 is the most important anthropogenic greenhouse gas.

[47] Within the context of the UNFCCC, there are two different lists of countries, namely Annex-I and Annex-II countries. Annex-I countries, OECD Countries plus economies in transition, Bulgaria, Estonia, Hungary, Latvia, Poland, Romania etc., have to take steps to reduce emissions while Annex-II countries, only OECD countries, have to provide financial and technical assistance to developing countries for reducing emissions. When the Convention has been signed, even if World Bank, OECD and United Nations Development Programme (UNDP) have classified Turkey as a developing country, Turkey was included in both Annexes without taking into consideration the lower level of economic development in comparison to other OECD countries. Turkey rejected this placement and requested its deletion from Annex-II. Therefore, following a number of negotiations, in 2001, it was decided to remove Turkey from the Annex-II list, due to its relatively early stage of industrialisation.

Following the ratification of the UNFCCC, working groups were set up with the objective of identifying a climate change strategy. The strategy aims to reduce greenhouse gas emissions through the implementation of appropriate measures and the development of climate-friendly technologies. Energy efficiency and the promotion of renewable energy sources are two important components of the strategy. However, the strategy does not include a specific target for reduction of emissions or introducing carbon taxation.

The UNFCCC was followed by a Protocol signed in Kyoto in December 1997 containing more detailed commitments binding on the industrialized countries. Turkey has not yet signed the Kyoto Protocol, which constitutes a part of EU environment acquis. Thus, Turkey has no international binding requirements to decrease emissions. Turkey rejects adopting a binding emission reduction target in the near term due to its relatively low level of economic development and low level of per capita emission compared to other OECD countries. Hence, Turkey has abstained from signing Kyoto Protocol at least in near future. However, international pressure, especially through the EU, may lead Turkey to adopt emission reduction target. As Karakaya (2003) also highlights, ratification of the Kyoto Protocol will be one of the important preconditions in the process of EU Membership and may force Turkey to consider emission reduction targets as soon as possible.

3.2.4 Main Problems Preventing the Promotion of Energy Efficiency

As it is highlighted in Section 3.2, energy intensity in Turkey has been above the EU, OECD and even the world average. Furthermore, it is estimated by IEA (2005a) that energy intensity will increase if further measures are not taken. However, energy intensity has demonstrated a stagnant trend since 1970s. Energy intensity trend is given in Table 3.5.

Table 3.5 Energy Intensity Trend in Turkey (TFC*/GDP)

	1973	1990	2002	2003	2010**	2020**
Energy Intensity	0.29	0.28	0.28	0.29	0.31	0.29

*Total Final Consumption.
**Projections.
Source: IEA, 2005a: 171.

This trend is partly attributable to increasing living standards, and similar trends can be observed in other countries in the same stage of development. This is a matter of concern, which requires the introduction of strong policies and measures. As main emphasis has been given to ensuring security of supply, Turkey has used relatively limited measures to pursue energy efficiency policies.

After having examined Turkish energy efficiency situation, a number of problems preventing the promotion of energy efficiency in Turkey can be identified. These problems can be grouped into four main categories:

- General problems like financial, institutional and managerial barriers concerning all sectors,
- Problems regarding electricity transmission/distribution systems,
- Problems regarding end-use sectors,
- Problems regarding environmental protection.

In the scope of general problems, lack of targeted and integrated energy efficiency policies, lack of finance, inadequate legislation and ineffective implementation, insufficient administrative capacity and low level of coordination and non-cost reflecting energy prices can be identified. Concerning electricity transmission and distribution systems high level of electricity losses constitutes the main barrier to the promotion of energy efficiency. At the consumption stage of energy, lack of sectoral policies and measures prevents the promotion of energy efficiency in buildings, industry

and transportation sector. Lastly but not least, bearing in mind the effects of environmental measures on the promotion of energy efficiency, lack of environmental policies and lack of binding emission reduction targets are the main deficiencies concerning both environmental protection and energy efficiency.

These problems constitute important barriers for promoting energy efficiency in Turkey. In fact, some of these problems are general problems of Turkey not specific to energy efficiency, like lack of finance or inadequate legislation and ineffective implementation; nevertheless, they create difficulties in ensuring promotion of energy efficiency.

For ensuring the promotion of energy efficiency, Turkey should deal with these problems. In order to overcome these barriers, it would be beneficial to take into consideration the best practices of countries that are energy efficient. Within this perspective, in the following chapters, energy efficiency policies and measures of the EU are examined, both at the Union and Member State level, namely Denmark and Germany.

CHAPTER 4

ENERGY EFFICIENCY POLICIES IN THE EUROPEAN UNION AND SELECTED MEMBER STATES: DANISH AND GERMAN CASES

Since the first oil crisis, the European Union's economy has grown faster than its energy consumption. Despite this achievement, energy needs of the EU are still increasing and internal production is insufficient for meeting energy demand. Consequently, external dependence for energy sources is rapidly increasing. In this respect, the increasing external dependence trend led the European Commission to identify measures for increasing energy efficiency, managing demand for imported oil and boosting the usage of renewable energy sources.

Energy efficiency measures have been taken by the EU since the mid 1970s. At the Union level attention is generally paid to issuing legislation related to energy efficiency since 2005. Ensuring the security of supply has always been the first concern of the EU. However due to recent high oil and gas prices and Kyoto Protocol, which became legally binding at the beginning of 2005, energy efficiency has recently gained more importance by taking into consideration the considerable potential of energy efficiency on reducing the external dependence and protecting environment. Within this perspective, in 2005, the European Commission identified energy efficiency as a main objective of the Union's energy policy and stated that energy efficiency would be the first priority for the future.

On the other hand, at the Member State level, energy efficiency measures and policies have been always on agenda since the first oil crisis. Energy

policies of the Member States sought to ensure energy supply security throughout 1970s. Efforts to reduce dependence on imported oil were at the centre of the national energy policies. At this point, energy efficiency issue gained importance both for reducing the import dependence and promoting environmental protection. Member States have launched initiatives and adopted action plans, programmes or legislation in order to increase energy efficiency at state level. Among the all Member States, Denmark and Germany has accomplished well-developed policies and strategies for the promotion of energy efficiency.

The scope of this chapter deals with the EU energy efficiency policies and measures both at the Union and Member State levels for developing a perspective for Turkey in this area. In addition, the opportunities and advantages that are offered by the EU are identified for Turkey as an accession country. In this context, firstly, energy efficiency issue at the EU level is studied by taking into consideration energy efficiency legislation and measures to further promotion of energy efficiency. Secondly, the most energy efficient Member State cases, namely Danish and German policies, strategies and measures are evaluated.

4.1 Energy Efficiency Policies in the European Union

Before examining energy efficiency policies and measures, giving brief information on historical development of energy policies of the EU is considered to be beneficial in order to show the recent emphasis given to energy efficiency in the over all energy policy in the EU.

4.1.1 Historical Development of Energy Policies in the EU

Energy concerns have been important issues since the beginning of the European integration. Implementation of energy policy issues dates back to the roots of the European Communities. Western Europe had established

policies mainly by encouraging the maximum possible expansion of the coal industry for consuming as much domestic fuel as possible. The European Coal and Steel Community (ECSC) Treaty[48] was the first step toward European integration.

By 1957, new proposals for nuclear power emerged when it became obvious that coal output could not be significantly expanded. According to Gorgon (1965), before 1957 had ended, two events produced pressure for more thorough re-evaluation of energy policy. Competitive pressures began to damage coal market seriously and the Member States of ECSC agreed to establish two new communities, namely, European Atomic Energy Community[49] (Euratom) and European Economic Community (EEC).

Even though energy policy lay at the heart of European integration, a common EU energy policy has not been created. The Treaty of Rome does not mention energy as an area of explicit EC competence. Hitiris (2003) pinpoints that there had been two attempts for shaping a common energy policy in the 1960s. First step for a common policy was taken in 1964 when the ECSC adopted the Protocol of Agreement on Energy[50] which set as Community objectives fair competition among the different sources of energy, security of supply, low-priced supply and freedom of choice for consumers. It also established a coordinated system of state aid for coal production.

[48] Robert Schuman, French Foreign Minister in 1950, announced a plan to place "the whole of Franco-German coal and steel production under a common High Authority, within the framework of an organization open to the participation of the other countries of Europe" (Dinan, 1999: 9). The Schuman Plan, as it became known, was the basis for the ECSC that was established in 1952. It was agreed that the six countries that signed the Treaty of Paris, Belgium, France, Italy, Luxembourg, the Netherlands and West Germany, would pool their coal and steel resources together.

[49] Euratom is established by the Treaty of Rome (1957). The members obliged themselves to the common development of Europe's nuclear energy resources by coordinating their nuclear research and development programs and permitting the free movement of nuclear raw materials, equipment, investment, capital and specialists within the Community.

[50] 41964A0430(01) Protocol of Agreement on Energy Problems was adopted in April 21, 1964.

Second attempt was taken after the merger of the three Communities in 1968. The Commission proposed a Memorandum consisting of a set of objectives and procedures for establishing a common market in the energy sector leading to lower energy prices. This would have meant removing the state monopolies which many member states operated, harmonizing energy taxes and proceeding with a common transport policy. Although the Council generally approved the Memorandum, no measures were introduced. Hitiris (2003) highlights the fact that no common energy policy was established because of plentiful cheap energy sources from abroad and different needs of the Member States.

The conditions changed radically when the oil producing countries united in OPEC (Organization of Petroleum Exporting Countries) decided to raise the price of crude oil drastically[51]. OPEC, operating as a cartel, raised prices by more than 475% after the first oil shock in 1973 and by another 134% after the second oil shock in 1979. These two crises led to a severe economic recession and energy savings and energy efficiency became the priority in energy policies of states.

The oil crises created a new focus on the need to create greater security of supply. The Member States and the EU sought to minimize their quantitative reliance on external energy sources. According to European Commission's (2005a) data, while world energy consumption has risen since the first oil crisis, the EU succeeded in reducing its energy dependence over this period, from 62% in 1973 to 50% in 2005. Policies focusing on demand management (energy conservation, efficiency measures), developments of indigenous resources (North Sea oil) and diversification of sources (revival of nuclear programmes, providing Community funding for renewable energy sources

[51] The oil shock of 1973 began in October 17, 1973, when Arab members of the OPEC in the midst of the Yom Kippur War between Israel and Arab allies, announced that they would no longer ship petroleum to nations that had supported Israel in its conflict with Egypt that is to the United States and its allies in Western Europe.

such as wood, wind and water power) helped to reduce energy import dependency to around 40% by the mid 1980's (Johnson, 2003: 5). From the mid 1980's, expansion of supply and a lower long-term trend in energy demand growth resulted in declining real oil prices and import dependency started to move up again, reaching 50% in 2005.

Although a common energy policy did not be established throughout the Union, the belief that a common energy policy will further strengthen economic integration within the EU and contribute to the realization of a single European market has began to gain strength in mid 1990s. In order to create an legal basis on which to build a common, community-wide energy policy, the European Commission issued a White Paper[52] in 1995, which emphasized that energy policy must form part of the general aims of the EU's economic policy, which focuses on market integration and deregulation, aiming to minimize policy interventions.

When the price of crude oil has tripled in 1999, the EU's chronic structural weakness, namely growing dependence on imported energy, has come up to the agenda once more. A debate on the EU's energy policies and strategies has been emerged and it became evident that there is a need for determining a clear policy and basic elements of a policy strategy to be implemented at both EU and Member State levels. In this perspective, the European Commission issued a Green Paper[53] in 2000. The Green Paper constitutes an important milestone in the EU energy policy, as it opened up a wide debate on energy options in Europe. The Green Paper states that EU Member States are interdependent both because of climate change issues and the process of the creation of the internal energy market, thus any

[52] Commission of the European Communities "White Paper: An Energy Policy for the European Union" [COM(95) 682].

[53] Commission of the European Communities "Green Paper: Towards a European Strategy for the Security of Supply" [COM(2000) 469].

energy policy decision taken by a Member State will inevitably have repercussions on the functioning of the market in other Member States.

The Green Paper sets the EU energy policy and designates the significant pillars in order to attain Community objectives. The primary aim of the EU's energy policy is to ensure supply of energy to all consumers at affordable prices while respecting the environment and increasing competitiveness in the EU. This goal is supported by activities in significant pillars of the EU energy policy, increasing competitiveness, ensuring security of supply, and protection of environment. Since 2000, the EU has initiated action plans and has introduced measures for realizing these important pillars of energy policy.

The EU has a limited capacity for self-sufficiency regarding energy sources. Currently, energy demand continues to increase in the EU, however, domestic production is not adequate for meeting energy demand. Moreover, domestic production slows down due to exhausted reserves and high cost for extracting. In addition, there is an expected decrease in production of nuclear energy in near future[54]. In this perspective, the external dependence is constantly increasing. The Green Paper anticipates that external energy dependence will reach 70% by the year 2030 and the enlargement process is going to reinforce this trend, despite the fact that certain new Member States or candidates are producers of primary energy.[55]

Within this perspective of more demand and less domestic production, the EU is becoming more and more energy dependent. Like Palacio[56] (2004)

[54] Germany has announced its decision to close its last nuclear reactors in 2021 and there is a political agreement in Belgium for an end in 2025. The Netherlands, Spain and Sweden intend to continue production during the lifespan of their reactors. (EC, 2005c: 5)

[55] Poland is producing coal and Romania is producing oil and gas.

[56] Loyola De Palacio: Former Vice-President of the European Commission and Former Commissioner for Energy.

emphasizes, the EU is also seeking to enhance its energy security through a variety of policy actions aimed at diversifying both Europe's internal fuel mix and its external sources of energy supply. All major fuel types (fossil, nuclear, renewable) and energy efficiency are considered as important elements of long-term energy security, thus maintaining a wide portfolio of energy supply options in all Member States has recently become an important issue.

4.1.2 Energy Efficiency in the EU

As it is highlighted in the previous section, the EU energy policy focuses on increasing competitiveness, ensuring security of supply and protection of environment. Although energy efficiency is not adopted as a pillar within the scope of EU energy policy, enhanced energy efficiency has a potential role in increasing EU competitiveness and employment, enhancing security of energy supply and reducing greenhouse gas emissions.

As energy is the key element for realizing competitiveness and economic development of national economies, energy efficiency is potentially an important tool in improving the competitiveness of the European economy. Increased external energy dependency stemming from high level of energy consumption has negative impacts on economy. Instruments developed for improving energy efficiency naturally support actions oriented towards a cleaner environment, restructured economies and a higher standard of living. Energy-efficient technologies can bring greater economic efficiency to the ongoing reform of the internal energy market, thus make contribution to increase EU competitiveness.

Within the EU, it is generally accepted that the EU could save 20% of its present energy consumption, equivalent to the present combined energy consumption of Germany and Finland (EC, 2005b: 4). This saving will have a positive impact on EU industrial competitiveness by reducing cost and improving the effectiveness. The energy import dependency, which is 50% in

2005, would also improve due to reduced energy imports and thus reflected to the trade balance of the EU. In addition, improved energy efficiency contributes to creation of jobs in Europe. As energy efficiency requires services and technology, number of jobs can be created in the EU.

For several years, the European Commission has underlined its concern regarding the growing dependence on energy imports, the weakening of the European economies as a result of high and volatile oil prices and the impact of the growing dependence on fossil fuels. Therefore, the Commission is currently developing a series of actions in order to reinforce the Union's energy supply security. In this respect, promoted energy efficiency has important contribution in ensuring security of supply without discussion. The target for the EU is to save 70 Mtoe per annum by 2010. This amount represents a yearly saving of 15 billion euros, a reduction of around 140 Mt of CO_2 emissions and a significant reduction in terms of external supply dependence compared to 2004 – equivalent to about 4% of oil imports (EC, 2005c: 2).

Although promoted energy efficiency has a positive impact on competitiveness and security of supply, the EU has given more emphasis to the promotion of energy efficiency for dealing with environmental concerns. Air quality is a major concern for the EU. Energy efficiency is the quickest and cheapest way for reducing greenhouse gas emissions. Therefore, it would help Member States in meeting their Kyoto commitments. The EU is willing to maintain its world leadership in terms of environmental responsibility. The EU has given an initial commitment to stabilize its CO_2 emissions at 1990 levels in 2000 and then to reduce its overall greenhouse gas emissions over the period from 2008 to 2012 by 8% compared with 1990 levels, equivalent to a 346 Mt reduction in CO_2 (European Environment Agency, 2002: 11). Petroula et al. (2004) pinpoint the fact that as long as the EU as a whole meets its target, all Member States do not have to reduce their greenhouse gas emissions by 8%. This rule is commonly known as the

"emissions bubble" and was introduced in Article 4 of the Kyoto Protocol due to pressure from the EU, which wanted to differentiate targets internally.[57]

After the Kyoto commitment, in accordance with Article 4, the EU agreed on 17 June 1998 to the Burden-Sharing Agreement towards achieving the 8% EU commitment to reduce emissions. The Burden Sharing Agreement had distributed the Kyoto emission reduction target between the Member States. Burden Sharing Agreement targets for 2008-2012 for each Member State are illustrated in Table 4.1. Overall reduction target of 8% had been shared amongst Member States in a way that allows for their different economic circumstances and different development patterns.

Table 4.1: Greenhouse Gas emissions commitments of EU Member States for 2008–2012 in accordance with Article 4 of the Kyoto Protocol

Member States	Emission Commitments Percent Change (%)
Austria	- 13.0
Belgium	- 7.5
Denmark	- 21.0
Finland	0.0
France	0.0
Germany	- 21.0
Greece	25.0
Ireland	13.0
Italy	- 6.5
Luxembourg	-28.0
Netherlands	-6.0
Portugal	27.0
Spain	15.0
Sweden	4.0
UK	-12.5
EU-15	**- 8.0**

Source: European Environment Agency, 2004: 11.

[57] Concerning the emissions bubble, under Article 4 of Kyoto Protocol all countries are allowed to conclude an agreement for a joint target equal to the sum of the targets of the participating countries.

Compliance with the Kyoto commitments and control of greenhouse gas emissions are essentially a matter of energy and transport policy. Energy efficiency is one the key policy tools for achieving the EU's Kyoto target. As Kyoto Protocol has become legally binding on 16 February 2005[58], improved energy efficiency has become a more important element of the EU strategy than before. The Commission in its Communication[59] on climate change stresses the importance of energy efficiency for reaching greenhouse gas emission targets.

As a result, as Shu Yu (2004) also notes, energy policy in the EU faces two major challenges. The first challenge is posed by EU's commitments to reduce greenhouse gas emissions in the scope of Kyoto Protocol and the other one is to keep ensuring European security of energy supply, while its import dependency is projected to increase. Improving the energy efficiency in end-user sectors is an important instrument of the energy policy within the EU, since envisaged efficiency improvements will contribute to the alleviation of greenhouse gas emissions in a view of meeting the EU's Kyoto emission reduction target, as well as the individual targets of the acceding counties, and to improving the EU's security of supply because energy efficiency measures will reduce energy demand and thus lessen import dependence.

The annual improvement in energy efficiency is 1.6% per year in the EU (EC, 2005b: 48). Rommerts (2003) claims that energy efficiency made contribution to reduce energy imports of the EU and improvements in energy efficiency since the beginning of 1980s have contributed as much to the energy balance as coal and nuclear power produced inside the EU.

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[58] Kyoto Protocol is put into effect 7 years after it was agreed. Protocol required nation's ratification that are accounting for at least 55% of world greenhouse gas emissions. The world's top polluter, the USA, has not signed the Protocol. When Russia ratified the Protocol in November 2004, the 55% target was met and Protocol became legally binding.

[59] Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions "Winning the Battle against Global Climate Change" [COM (2005) 35 final].

For ensuring promotion of energy efficiency, studies throughout the EU date back to oil crises in the mid 1970s. Energy efficiency measures have already been taken in the past, but they are mainly limited to Member States initiatives only. The EU has adopted legislation for increasing energy efficiency but no attempt has been made to tackle this issue at EU level since 2005. However, these legislation have contributed to the promotion of energy efficiency in Member States. The following section gives brief information on the most important energy efficiency legislation that are adopted since 1970's.

4.1.2.1 Energy Efficiency Legislation

In order to promote energy efficiency, the EU has been issuing legislation since the oil crises in the mid 1970s at a sectoral or product basis. However, at the Union level there has been no binding comprehensive action plans or programmes or an overall energy efficiency directive until 2005.

The first important legislation on energy efficiency is issued just after the first oil crisis. In 1974, the Council published a Resolution[60] on a Community action programme on the rational utilization of energy. According to the Resolution, the objective of "reducing the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives" is adopted by the Council, bearing in mind the existing situation prevailing on the world energy market and the rise in the prices of energy resources.

[60] Council Resolution of 17 December 1974 on a Community Action Programme on the Rational Utilization of Energy (OJ C 153, 09/07/1975)

In 1975, the Council adopted a new Resolution[61], which set out targets for savings in energy and oil consumption in the Community. According to the Resolution, Community energy consumption would be stabilized in 1976 at a level slightly lower than that for 1973 (932 Mtoe), and would be increased in 1977 by approximately 3.75 % in relation to the 1973 level, and oil consumption for 1976 and 1977 was to be maintained at approximately 10 % below the 1973 level.

In 1980, the Community adopted a Resolution[62], based on necessities of energy pricing and measures to encourage the rational use of energy. Programme envisaged that energy pricing should reflect conditions on the world market. Also new energy saving measures, notably demand side measures (publicity campaigns), financial measures (financial aids for necessary improvements to existing houses or small and medium-sized businesses) and regulatory measures (compulsory performance standards for offices and performance standards and control of servicing of heating, cooling and ventilation systems) in building industry, agriculture commerce and transportation sectors were introduced and recommended to each Member State.

The EU continued to issue energy efficiency related legislation during 1980's. The legislation on encouragement of investment for the rational use of energy, improvement of energy saving programmes, rational use of energy in the building sector and improving energy efficiency in industrial firms have contributed to the promotion of energy efficiency throughout the Union.

As an increase in energy efficiency has a crucial role in minimising the dependence of fossil fuels and thereby reducing CO_2 emissions, the SAVE

[61] Council Resolution of 9 December 1975 setting a Short- term Target for Energy Saving 1976/77 (OJ C 289, 17.12.1975).

[62] Council Resolution of 9 June 1980 concerning New Lines of Action by the Community in the Field of Energy Saving (OJ C 149, 18/06/1980).

Directive[63] was adopted in 1993. The Directive focuses on limiting CO_2 emissions by improving energy efficiency, by means of drawing up and implementing energy efficiency programmes by the Member States. In this perspective, SAVE Directive is of crucial importance and has made pressures on Member States for increasing energy efficiency in order to reduce CO_2 emissions.

In order to reduce fuel consumption of cars, a Car Labelling Directive[64] was adopted in 1999. The aim of the Directive is to ensure a consumer information system relating to the fuel economy and CO_2 emissions of new passenger cars offered for sale or lease in the EU. In the scope of this consumer information system attaching a fuel consumption and CO_2 emissions label to the vehicle, publishing a guide about fuel consumption and CO_2 emissions and displaying posters in car showrooms are adopted as methods.

Although the EU has issued energy efficiency legislation since 1970's, the series of most important measures are adopted during 2000's. This legislation covered lighting, buildings, labelling of the equipments and cogeneration that have great energy saving potentials.

Fluorescent lighting accounts for a significant share of electricity consumption in the EU, and the various models of ballasts for fluorescent lighting available on the market show very different consumption levels. In this perspective, the Commission adopted a Directive[65] for fluorescent lighting, for ensuring the

[63] Council Directive 93/76/EEC of 13 September 1993 to Limit Carbon Dioxide Emissions by Improving Energy Efficiency (SAVE) (OJ L 237, 22.09.1993).

[64] Directive 1999/94/EC of the European Parliament and of the Council of 13 December 1999 relating to the Availability of Consumer Information on Fuel Economy and CO_2 Emissions in Regard of the Marketing of New Passenger Cars (OJ L 12/16, 18.01.2000).

[65] Directive 2000/55/EC of the European Parliament and of Council of 18 September 2000 on Energy Efficiency Requirements for Ballasts for Fluorescent Lighting (OJ L 279, 01.11.2000).

harmonisation of ballasts. The purpose of the Directive is to achieve energy savings in fluorescent lighting in commercial buildings. The Directive covers only newly produced ballasts, which are responsible for high-energy consumption and offer considerable potential for energy savings. The Member States must take all necessary measures to ensure that ballasts covered by the Directive can be placed on the Community market, and put into service only if their power consumption is less than or equal to the maximum allowable power consumption value for their category.

The EU has established cooperation with the USA for coordinating the labelling of energy-efficient office equipments in 2001 and a Decision[66] has been adopted on energy-efficient labelling programs for office equipments. Office equipments (computers, monitors, fax machines, scanners, copiers, printers, etc.) account for a large proportion of electricity consumption in the tertiary sector. The coordinated labelling programme, known as Energy Star[67], enables consumers to identify energy-efficient appliances and therefore result in electricity savings that will help both protection of the environment and ensuring the security of energy supply. The programme also helps to encourage the manufacture and sale of energy-efficient products.

In 2001, final energy demand of buildings accounted for over 40% of the EU's total final energy demand. The sector therefore offers the largest potential source for energy efficiency improvements. Commission considered that, with initiatives in this area, more than one fifth of the present energy consumption could be saved by 2010 by applying more ambitious standards when constructing or refurbishing buildings (EC, 2004: 26). For creating a common framework to promote the energy performance of buildings, the

[66]Council Decision 2001/469/EC of 14 May 2001 on the Conclusion of the Agreement between the United States of America and the EU on the Coordination of Energy-Efficient Labelling Programs for Office Equipment (OJ L 172, 26.06.2001).

[67] ENERGY STAR is the name of the joint programme and logo and is a US-registered service mark owned by the United States Environmental Protection Agency.

Commission adopted a Directive[68] on the energy performance of buildings in 2003. The Directive envisaged a common methodology for calculating the integrated energy performance of large buildings (over 1000 m^2). Minimum standards on the energy performance and systems for the energy certification of new buildings and existing buildings are identified. The Member States are responsible for drawing up the minimum standards. They will also ensure that qualified and independent personnel carry out the certification and inspection of buildings.

For harmonising national measures relating to the publication of information on the consumption of energy and of other essential resources by household appliances, thereby allowing consumers to choose appliances on the basis of their energy efficiency, a Directive[69] on energy labelling of equipments is put into effect in 2003. According to the Directive, household appliances offered for sale or hire must be accompanied by a label providing information relating to their consumption of energy. Consumers can easily identify those appliances, which consume the least energy by referring to the indications "A" (most efficient) on the sales labels of such products. (The most energy-consuming appliances are classified as "F" and "G").

Due to its potential for increased energy efficiency and its lower impact on the environment, the promotion of combined heat and power (CHP) is a priority area for many Member States. There is considerable unexploited potential for CHP in the Member States. In this context, a Directive[70] was adopted on the promotion of CHP aims at facilitating the installation and

[68]Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the Energy Performance of Buildings (OJ L 001, 04.01.2003).

[69]Directive 2003/66/EC of the Commission of 3 July 2003 on the Energy Labelling of Household Electric Refrigerators, Freezers and Their Combinations (OJ L 170, 09.07.2003).

[70] Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the Promotion of CHP based on a Useful Heat Demand in the Internal Energy Market (OJ L 052, 21.02.2004).

operation of electrical CHP plants in order to save energy and combat climate change.

In addition to energy efficiency legislation, Electricity and Gas Directives[71] were updated in 2003 in order to ensure full opening of energy markets, which also contribute to promotion of energy efficiency. The main thrust of these Directives concern the liberalization of the production of electricity and natural gas and access to the market, which allow certain electricity and natural gas buyers to take advantage of competition through prices between producers. This gradual liberalization implies the privatisation of distribution grids. Within this perspective, the privatisations are introduced in various Member States in energy sector for eliminating the national monopolies of distribution for improving efficiency and performance of grids.

Although energy efficiency legislation has been adopted on a sectoral or product basis (such as through the Buildings Directive, or through energy labelling for some products,) there has been no comprehensive and binding legislation. Therefore, a more strategic and all-encompassing legislation, a new Directive[72] on Energy Efficiency is proposed, in 2003. The proposal tackles one of the remaining challenges, improving the way in which energy is consumed by end-users. The draft directive is the first attempt to tackle this issue at EU level.

The proposal has the objective of increasing end-use energy efficiency, using a number of operational measures. The main mechanism to achieve this objective will be to improve the functioning of the Union's internal energy

[71] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning Common Rules for the Internal Market in Electricity and Repealing Directive 96/92/EC (OJ L 176/37,15.07.2003) and Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning Common Rules for the Internal Market in Natural Gas and Repealing Directive 98/30/EC (OJ L 176/57, 15.07.2003).

[72] Proposal for a Directive of the European Parliament and of the Council on Energy End Use Efficiency and Energy Services (COM 2003 739 Final, 10.12.2003).

market by removing barriers hampering the development of a well functioning, commercially viable and competitive market for energy efficiency measures. The proposal covers electricity and natural gas, together with other important energy types, such as district heating, heating fuel, coal and lignite, forestry and agricultural energy products and transport fuels.

The Directive foresees two energy efficiency targets for the period 2006 to 2012. First target is an overall energy savings target of annually 1%, Member States would have to save each year 1% of their cumulative average energy consumption. Member States may reach their 1% annual target by establishing new or by using already existing energy efficiency programmes and measures.

Second target is related with public sector. Member States should ensure that the annual improvement of total energy efficiency in the public sector, mainly through public procurement of energy services and efficiency measures, leads to 1.5% energy savings.

Member States will apply measures to meet both the general and public sector targets. These saving targets would have both economic and environmental impacts as well as promoting energy efficiency. Scott (2005) attracts attention to the fact that national governments would be free to decide how to achieve the efficiency improvements. The proposed Directive is presented to the plenary session for the first reading in Parliament in April 2005. It is expected to reach a political agreement in 2006.

This legislation that are adopted since the oil crises of 1970s have contributed to the promotion of energy efficiency throughout the Union. In addition to these legislative measures, Member States have developed voluntary, financial or demand side measures for ensuring further promotion of energy efficiency. However, it is realized in 2005 that more strategic and comprehensive measures are needed for promoting energy efficiency in

particular to challenging with high oil and gas prices and high emissions. The following section gives the measures that are developed by the European Commission for promoting energy efficiency at the Union level.

4.1.2.2 Measures for Promotion of Energy Efficiency at the EU Level

In the aftermath of the oil price shocks in the 1970s, the EU reconsidered its energy consumption to become less dependent on oil. All Member States adopted energy efficiency measures in order to reduce energy consumption. The absence of in-depth and all-encompassing structural measures led to rising energy prices on world markets since the beginning of 2000s. As a consequence, growing dependence on imported energy has always threatened the Union.

Apart from adopting energy efficiency legislation, few measures have been introduced for the promotion of energy efficiency at the Union level. In 1998, the European Commission adopted a Communication[73] for a strategy for the rational use of energy. According to the Strategy, although there is an economic potential for improving energy efficiency, this potential is not being fully realized due to the institutional, technical and financial barriers to improving energy efficiency. The Strategy focuses on actions, which are realistically and economically feasible in the short and medium terms.

In 2000, the Commission adopted an Action Plan[74] for improving energy efficiency in the EU. The action plan is a follow-up to the Commission Strategy adopted in 1998 on the rational use of energy. It constitutes a framework for the related activities to be implemented until 2010. The action

[73] Communication from the Commission on Energy Efficiency in the European Community-Towards a Strategy for the Rational Use of Energy [COM (1998) 246 final].

[74] Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions on a Action Plan to Improve Energy Efficiency in the European Community [COM (2000) 247 final].

plan envisaged integrating energy efficiency into non-energy policies and programs, such as transport, urban and taxation policies. The action plan aims to strengthen existing policies and measures regarding promotion of energy efficiency, including increasing fuel standards of vehicles, extending energy efficiency labelling so as to cover all major appliances, and implementing new EU-wide policies and measures based on successful initiatives at the level of Member States, such as energy audits and best practice programs.

Although the Strategy of 1998 and Action Plan of 2000 covers wide range of measures for the promotion of energy efficiency, they have not been implemented effectively due to their non-binding nature.

In addition to afore-mentioned Strategy and Action Plan concerning with promotion of energy efficiency, the EU had established a multiannual framework programme[75] for supporting Member States actions in the field of energy in 1998. The framework programme seeks to enhance the transparency, effectiveness and coordination of the activities of the EU in the energy sector. The framework programme consists of six sub-programmes[76], one of which is related with energy efficiency. SAVE[77] is the only Union-wide programme dedicated exclusively to promoting energy efficiency and encouraging energy-saving behaviour in industry, commerce and

[75] Council Decision 1999/21/EC of 14 December 1998, adopting a Framework Programme for Actions in the Energy Sector (1998-2002) and connected measures, (OJ L 7, 13.01.1999).

[76] **ETAP** (regular monitoring of market developments and energy trends in order that policy decisions can be taken on the basis of a shared analysis), **SYNERGIE** (strengthening of international cooperation in the energy sector.) **ALTENER** (promotion of renewable energy sources) **CARNOT** (promotion of the use of environment-friendly technologies in the solid fuels sector), **SURE** (promotion of safety in the use of nuclear energy and better monitoring of the carriage of radioactive materials through increased industrial cooperation with Russia and the New Independent States) **SAVE** (promotion of energy efficiency)

[77] SAVE: Specific Action for Vigorous Energy

transportation sectors through policy measures, information, studies and pilot actions and the creation of local and regional energy management agencies.

Many actions and projects of the Member States and the Candidate States have been supported in the framework of SAVE, between the periods 1998-2002. All programmes including SAVE were successful on their subject. Therefore, in 2002, when the framework programme has expired, the European Commission formed a new multiannual programme entitled "Intelligent Energy for Europe"[78] which ensures the continuity of EU action as developed in the previous energy framework programme.

"Intelligent Energy for Europe" is the EU's support programme for non-technological actions in the field of energy, precisely in the field of energy efficiency and renewable energy sources. "Intelligent Energy for Europe" is intended to support the EU's policies in the field of energy. Its aim is providing financial support for local, regional and national initiatives in the field of renewable energy and energy efficiency for achieving the general objectives of security of energy supply, competitiveness, and environmental protection. The programme is open to any legal, public or private person established in the territory of the EU, the Candidate Countries and the countries of the European Free Trade Association (EFTA) and the European Economic Area (EEA). The programme covers 2003-2006 period and its budget is 200 million euros.

The specific aims of the Programme are providing the necessary components to promote energy efficiency and develop renewable energy sources with a view to reducing energy consumption and CO_2 emissions. The Programme focuses on developing instruments which can be used by the Member States, monitoring and evaluating the impact of the measures

[78] Decision No 1230/2003/EC of the European Parliament and of the Council of 26 June 2003 adopting a Multiannual Programme for Action in the Field of Energy: "Intelligent Energy for Europe" Programme 2003-2006, (OJ L 176, 15.07.2003).

adopted by the Member States, and promoting schemes for the production and consumption of energy through promoting awareness and education.

The Programme developed instruments for achieving the determined targeted policies. Member and Candidate States have benefited from the Programme, getting support for their actions and projects. In this perspective, taking into consideration the continual success of Intelligent Energy for Europe, for ensuring further promotion of best practices and technology the Commission has proposed extending the Programme for the period 2007-2013, and with an increased budget of 780 million euros. The Programme will support a broad range of promotional activities and address non-technological barriers (legal, financial, institutional, cultural, social) in the fields of energy efficiency and renewable energy sources.

These support programmes in the field of energy are important instruments for encouraging Member States for taking steps for the promotion of energy efficiency. However, they are not adequate for the promotion of energy efficiency. Determined targeted policies are needed both at the Union and Member State levels for ensuring further promotion of energy efficiency.

On the other hand, bearing in mind the fact that the responsibility of the Union in the energy field is not clearly defined in Treaties establishing the EU, establishing an energy policy for the EU is always difficult. Moreover, energy efficiency is an area with a large number of players; governments, national regulators, large enterprises, local authorities and people. Within this perspective, establishing a Union wide energy efficiency policy is an extremely difficult task. Therefore, promoting energy efficiency has mainly been left to Member States initiatives in the past.

However recent higher oil and gas prices and legally binding Kyoto commitments, make the energy efficiency a core objective of the EU energy policy. It is realized that Member States initiatives are not sufficient for

promotion of energy efficiency, and it is needed to adopt measures at the EU level. Farinelli et al. (2005) consider the proposed Directive on Energy Efficiency as a concrete step in this direction. In addition to the proposed Directive on Energy Efficiency, European Commission has launched a European energy efficiency initiative at the beginning of 2005.

In 2005, European Commission has identified six key priorities on which the EU energy policy will be focused until 2010, notably, increasing energy efficiency, achieving a properly functioning internal market for gas and electricity for the benefit of citizens, promoting renewable energy, strengthening nuclear safety and security, security of Europe's energy supplies and further developing external energy policy relations and improving the links between energy policies and environmental and research policies. The European Commission identified energy efficiency as a core objective of the energy policy. In a statement of Piebalgs[79] for the European Power News (2005), he announced that energy efficiency would be his top policy priority for his five-year term. Piebalgs has elaborated on his top priority at the Ministerial Conference of the International Energy Agency in May 2005:

> "The experience of the first oil shocks in the 1970's clearly demonstrated that measures in favour of energy efficiency could reduce the energy intensity of our economies. It should be recalled that 40% of energy consumption accounted for by buildings and 40% by the transport sector. It is important to relaunch an ambitious policy in favour of energy efficiency in Europe in order to stabilize oil imports at their current level." (Piebalgs, 2005)

In the scope of Commission's new priorities, in June 2005, the European Commission adopted a Green Paper[80] on Energy Efficiency, outlining an ambitious programme with the objective of accomplishing cost-effective

[79] Andris Piebalgs is the Commissioner for Energy.

[80] Commission of the European Communities "Green Paper: Energy Efficiency or Doing More with Less", [COM (2005) 265 final].

energy savings for Europe equivalent to 20% of the EU's current energy consumption, which is pursued as a partnership between the Commission and Member States at national, regional and local levels.

Within the scope of European energy efficiency initiative, the European Commission identifies certain measures to be taken at the EU level. The Green Paper on Energy Efficiency draws a comprehensive framework for measures to be taken at the EU level. Main measures identified by the European Commission are focusing on promoting best practices and technology, research and technological development, raising public awareness, EU and state level action plans and better use of taxation policy and state aids.

For promoting information and raising awareness on energy efficiency, the EU has recently launched a broad public awareness campaign, "Sustainable Energy Europe 2005-2008", on sustainable energy across the EU, EEA countries and EU candidate countries for ensuring adequate information to citizens, industries, energy efficiency experts and service providers through better targeted publicity campaigns and improved product labelling within the EU. It encompasses issues on clean and sustainable energy production and consumption schemes based on renewable energy sources and energy efficiency, including in transport. The campaign is financed under the Intelligent Energy for Europe Programme, with a budget of 3.6 million euros.

For ensuring promotion of energy efficiency at EU level, it is essential to mobilise all related players. The combination of measures at the various levels (EU, Member States, regional and local levels, industries) contributes to alleviate the barriers to energy efficiency. Ensuring all national, regional and local authorities, as well as industry, for implementing necessary measures in line with the subsidiarity principle, is of paramount importance. Besides, bearing in mind the fact that energy efficiency has horizontal

aspects in many sectors, integrating energy efficiency policy in other EU policies is identified as a priority.

In this respect, the Commission has decided to set up a "European Sustainable Energy Forum" based on the models of the "Florence" and "Madrid" Forums[81] to stimulate debate and create effective input for promoting energy efficiency. Similar to Florence and Madrid Forums, European Sustainable Energy Forum is a large platform that brings together the Commission, Member States, the European Parliament, National Energy Regulators and representatives of European industry and NGOs. It is envisaged to publish an annual benchmarking followed by each Forum for ensuring widespread dissemination of best practices and outcomes.

In addition to European Sustainable Energy Forum, a wide range public consultation has been established. A network has been founded in many European cities for submitted comments, suggestions or consultation of the interested public.

Following the debating and consultation processes, the EU plans to draw a concrete action plan, outlining the actions to be taken at the EU and national levels in 2006. The Commission expects that such an action plan will cover all the energy producing and consuming sectors and mobilise all players, national governments, regions, municipalities, industries, and consumers and include all types of cost-effective actions, notably taxation, public subsidies, economic incentives, partnerships with industry. Also establishing annual energy efficiency action plans at national level will contribute to improving energy efficiency throughout the EU. Such plans might identify measures to be taken at national, regional and local levels and subsequently monitor and report their success both in terms of improving energy efficiency and their

[81] Florence (for electricity) and Madrid (for gas) Forums, which are organised by the European Commission, are the broad range platforms for developing consensus on how to proceed with energy market liberalisation.

cost-effectiveness, so that Member States can easily learn from the successes and mistakes of others and to ensure the rapid spread of best practice throughout the EU (EC, 2005b: 18).

For promoting research and development policy, which is directly linked to energy efficiency policy, the Commission adopted a proposal for the 7th Framework Programme for Research and Development in April 2005. For energy, it is proposed to concentrate on a limited number of key priorities, among which are renewable energy sources for power generation and fuel production, clean coal technologies, smart energy networks and energy efficiency. Energy efficient technologies are essential for promoting energy efficiency especially in industry sector. Within this perspective, Community and industry investments in R&D for the creation of more energy efficient technologies will contribute to further improvement of energy efficiency. The EU attaches due importance to 7th Framework Programme and allocates a doubling budget of 6th Framework Programme. The allocated budget for energy is nearly 3 million euros. 7th Framework Programme will be adopted in June 2006.

Taxation policy is one of the effective instruments regarding promotion of energy efficiency. The taxation of energy appliances falls under EU competence. The Directive[82] on energy taxation draws a favourable context for cogeneration (CHP), development of renewable energy sources and rail and river transport. The Commission envisages harmonising tax regimes, for example reducing tax levels on specific devices with low energy consumption, for promoting energy efficiency. A new framework of energy taxation will be established allowing mechanisms to be introduced for differentiating taxes according to energy consumption and CO_2 levels. Similarly, for state aids, it is envisaged to revise the Community guidelines on

[82] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, (OJ L 283, 31/10/2003).

state aid for environmental protection by taking into consideration the measures designed for increased energy efficiency.

In addition to Union-wide actions, the European Commission foresees a complete package of measures to be taken across Europe concerning sectoral policies and energy efficiency legislation. Extending the Labelling Directive to installed equipment and car components, extending the scope of Energy Star Agreement on office equipments, extending the Building Directive for involving the smaller existing buildings (under 1000 m^2), promoting long-term voluntary agreements especially for industry and setting targets for CHP systems have been identified as priorities.

To sum up, although energy efficiency legislation has been issued since the first oil crisis in the 1970s, energy efficiency policies and measures were limited to Member States initiatives up to 2005. However, the concern regarding the growing dependency on energy imports, the weakening of the European economies as a result of high oil prices, the impact of the growing dependency on fossil fuels and Kyoto commitments led the EU to adopt energy efficiency policies and measures to be taken at the EU level in 2005. Energy efficiency is claimed as a top priority in the energy policy of the EU and the Commission developed a series of actions in order to reinforce energy efficiency.

As it is mentioned briefly, the European Energy Efficiency Initiative has comprised series of comprehensive measures to be taken at the EU level as well as all layers of society. It is a new initiative with a huge potential on developing competitiveness, sustainable development and security of supply. The near future will only show the effects of these measures, if properly implemented, on the bottlenecks to be overcome. Therefore, it is worthwhile to examine Member States practises for obtaining a full picture of how to promote energy efficiency in Turkey.

4.2 Energy Efficiency in the Selected EU Member States: Danish and German Cases

As it is mentioned, promoting energy efficiency throughout the EU remains mainly limited with Member States initiatives up to 2005. Member States have launched initiatives, adopted action plans, programmes or legislation in order to increase energy efficiency at state level. All Member States have their individual energy efficiency programmes. There are a number of similarities between practices of countries, such as every country has building regulations, as well as differences such as tax breaks.

In the scope of this section, energy efficiency policies of two Member States, which can be considered as best practices, are deeply examined in order to derive inputs from their experiences for Turkish energy efficiency policies.

Throughout the Union, the EU 15 Member States have accomplished well-developed energy efficiency measures and most of the Member States have reduced the energy intensity value since the first oil crisis. Table 4.2 illustrates total final energy consumption (TFC) per unit of GDP, which is used to indicate energy efficiency trends of the EU-15.

Table 4.2 Energy Intensity Values of EU-15

TFC/GDP Ratios (Toe per US $ 1.000 of GDP at 1995 prices)				
	1973	**1979**	**2000**	**2002**
Austria	0.12	0.12	0.09	0.10
Belgium	0.20	0.18	0.14	0.13
Denmark	***0.13***	***0.12***	***0.08***	***0.07***
Finland	0.24	0.21	0.16	0.15
France	0.14	0.13	0.10	0.10
Germany	***0.16***	***0.15***	***0.09***	***0.09***
Greece	0.11	0.11	0.14	0.14
Ireland	0.20	0.19	0.11	0.10
Italy	0.15	0.13	0.11	0.11
Luxembourg	0.35	0.32	0.15	0.15
Netherlands	0.19	0.19	0.12	0.12
Portugal	0.11	0.12	0.15	0.15
Spain	0.11	0.13	0.12	0.13
Sweden	0.21	0.19	0.13	0.12
United K.	0.20	0.18	0.13	0.12

Source: IEA, 2003a: 371.

When the figures of Table 4.2 are examined, it is seen that Denmark and Germany have the lowest two energy intensity values for the year 2002. Besides, both of these countries have achieved a reduction in their energy intensity values since the oil crisis of 1973. Therefore these two Member States can be considered as best practices in energy efficiency and it is worthwhile to examine the energy efficiency policies, programmes and measures of these two Member States.

4.2.1 Energy Efficiency in Denmark

Energy efficiency activities in Denmark date back to 1976. Since the first oil crisis in 1973, energy policy has occupied a significant position. The Danish economy was severely affected during both oil crises due to the large share of oil in energy supply (IEA, 2002b: 18). Therefore, in order to reduce the effects of external shocks, like oil crises and ensure security of supply, energy efficiency became a major priority objective in Danish energy policy, as well as promotion of CHP and renewable energy sources.

The Danish energy efficiency policy is well developed and quite strong compared with the policies in many other EU Member States. Despite considerable economic growth, Denmark achieved to keep gross energy consumption more or less constant. Denmark's energy intensity is lower than the EU average. This is due to improved efficiency in energy consumption at the end user, and more efficient energy supply, partly as a result of greater use of CHP plants. Denmark has the highest share of electricity generated in combined heat and power plants in the world, as well as with one of the largest district heating systems.

Danish energy policy has been strongly influenced by environmental policy objectives since the second half of 1970s. Denmark has developed many policy goals that are inspired by both energy and environmental considerations. These goals led to a broad range of initiatives nearly in each area for ensuring sustainable development in the energy sector.

Since 1976, a wide portfolio of initiatives has been developed, and is still in force in Denmark. After the first oil crisis, government formulated its first energy plan that was focused on reducing the proportion of imported oil (Varone and Aebischer, 2001: 622). At the same time, the Danish Energy Authority "Energistyrelsen" was established in 1976, primarily as a reaction to the problem of ensuring security of supply, but gradually the focus was

directed on domestic energy production (North Sea oil and gas, renewable energy), energy supply and distribution (the natural gas grid, combined heat and power) and energy efficiency (insulation, labelling schemes).

According to Varone and Aebischer (2001), the most important energy plan in Denmark is Energy 2000[83], which introduced the goal of sustainable development in the energy sector and formulated the national objective of a 20% reduction in CO_2 emissions by 2005 compared to 1988. Energy 2000 focused on promotion of energy efficiency, expansion of the use of renewable energy sources, especially wind, and R&D activities.

Government had set strict targets in the energy sector for reducing energy intensity by adopting a new energy plan, Energy 21[84]. One of the targets of Energy 21 is reducing the energy intensity by 20% in 2005 and by 34% in 2012 in relation to 1994 figures.

With the main aim of saving electricity, the Electricity Saving Trust was established as an independent fund in 1996. The purpose of the Trust is to promote electricity conservation in homes and public sector in accordance with social and environmental targets. The primary goal of the Trust is supporting the replacement of electrical heating by district heating or heating by natural gas in houses and in the public sector by offering conversion grants to consumers, in particular in large cities. The Trust is managed by an independent board that comprises representatives of consumer interest groups, utilities and experts in energy saving and economics.

The Trust is funded by a volume-based levy of 0.08 Eurocent/KWh paid by domestic customers and public institutions and collected by network companies. Danish government envisages, 750 GWh electricity saving

[83] The Energy 2000 Plan-Energi 2000 was approved in 1990.

[84] Energy 21 was approved in April 1996.

leading to a reduction of the Danish total CO_2 emission by 1% with the contribution of the Trust as the beginning of 2007 (Wuppertal Institute, 2003; 18).

In addition to Electricity Saving Trust, an Energy Saving Act[85] was adopted for strengthening energy-saving initiatives, which were necessary to reach energy and environment policy targets. The Act determines the framework for coordination and priority given to both centralised and decentralised energy efficiency initiatives for all sectors, actors and measures. Bach (2003) notes that the Act enables the appointment of local energy conservation committees to coordinate local efforts to save energy, and establishes new initiatives for energy conservation in the public sector.

The afore-mentioned regulatory measures have been successful for enhancing energy efficiency and to reach long-term energy and environment policy targets. In addition to regulatory measures, other official activities for enhancing energy efficiency have been pursued by the Ministry of Environment and Energy, the independent Danish Energy Authority and a fund under the auspices of the Ministry of Transport and Energy, namely Elsparefonden since 2002. Energy efficiency policies changed in 2002, responsibility of energy issues moved from the former Ministry of Environment and Energy to the newly created Ministry of Economic and Business Affairs. The new Ministry mainly focuses on promoting energy efficiency in industry and buildings sectors.

The Energy Authority takes care of overall planning and prioritisation of energy efficiency and saving measures. Besides, Elsparefonden also specialises in the promotion of electricity saving in residential and public sectors. Also, the electricity network companies, the natural gas distribution and the district heating companies are responsible for promoting

[85] Energy Saving Act (No: 450) was adopted on 31 May 2000.

energy efficiency amongst their customers, including provision of advice and consultancy.

In addition to general energy plans, acts and adopted targets, Denmark has established sectoral instruments and measures for ensuring promotion of energy efficiency. These initiatives are well developed and all sectors have contributed to the significant improvement in energy efficiency. In the following sections, firstly, the efficiency in electricity transmission and distribution systems of Denmark is studied. Secondly, a sectoral review is done for examining end-use sectors and related measures and instruments. Lastly, bearing in mind the close relation between energy efficiency and environmental protection, environmental policies and measures are also taken into consideration.

4.2.1.1 Energy Efficiency in Transmission/Distribution Stages of Energy

The liberalization of Danish electricity markets is based on the EU Electricity Directive[86] which was adopted in 1996. The aim of the Directive is to achieve competition at the generation stage as well as at the retail stage. In this regard, liberalisation and privatisation studies have been started in order to ensure full opening of energy markets in 1997.

The Danish electricity industry was developed in the form of municipal non-profit organisations and private companies. The ownership of Danish electricity transmission system is separated among state and municipal entities, whereas electricity distribution system is owned by both municipal and private companies. With a land area of about 43.000 km^2, Denmark has two separate high voltage networks. The network in Western Denmark is operated and managed by Eltra, and in Eastern Denmark network is

[86] Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning Common Rules for the Internal Market in Electricity, (OJ L 027 30.01.1997).

operated and managed by Elkraft Transmission. Western Denmark is an associate member of UCTE.

According to the study of ICF Consulting (2003), Denmark's total transmission and distribution losses are about 7.1% of total electricity production. It is a quite acceptable amount and very close to the OECD average of 7.4%. Denmark has been implementing infrastructural and demand side measures for increasing efficiency of transmission and distribution lines.

Efficiency in transmission and distribution stages of energy is closely related to economic wealth of the country. Per capita GDP was nearly 29.000 US dollars in 2003 in Denmark (IEA, 2005b: 56). Therefore, economic wealth is reflected to well developed infrastructure of the country as well as quality of electricity transmission and distribution systems. Similarly, theft (non-technical losses) is relatively low due to prosperity of people.

As it is previously pinpointed, underground electricity cables are used in almost all European countries, as well as in Denmark, due to environmental, human health and efficiency concerns. Denmark has considerably great amount of underground cables in extra-high, high, medium and low voltage. Regarding extra-high voltage lines (750 KV), only Denmark and the UK have more than 100 km of underground cables within the EU (IFC Consulting, 2003: 4). Table 4.3 indicates the length of aerial lines and underground cables of Denmark for high, medium and low voltages.

Table 4.3 The Length of Transmission/Distribution Lines of Denmark (km)

High Voltage		Medium Voltage		Low Voltage	
Overhead	Underground	Overhead	Underground	Overhead	Underground
10.256	1.902	32.450	22.550	32.200	59.800

Source: ICF Consulting, 2003: 36.

As it is pinpointed in Section 2.1, most electricity losses occur within the lower voltage distribution networks. Figures of Table 4.3 demonstrate that the length of low voltage underground cables is much longer than aerial lines. In this respect, Denmark has ensured more efficiency in distribution system by burying the low voltage lines.

In addition to infrastructural measures, Denmark has developed demand side measures. Ergen and Yıldırım (1997) emphasize that Denmark has been implementing demand side management regarding consumers since the beginning of the 1980's. Elsparefonden together with electricity network companies have been implementing demand side measures for the promotion of electricity saving in homes and in the public sector. The most crucial measures are promotion of consumer awareness about reducing demand in peak times and implementation of multi-timing tariff. Electricity network companies are sending detailed informative electricity bills to their customers, which indicate the level of electricity consumption in hour base (Bach, 2001: 86-87).

In summary, Denmark has been implementing infrastructural and demand side measures for ensuring efficiency in electricity transmission and distribution networks. According to Ergen and Yıldırım (1997) Denmark is one of the best performing countries regarding demand side management. As a result of these measures, transmission/distribution systems in Denmark became quite efficient. Thus, more attention is paid to end-use sectors for the promotion of energy efficiency.

4.2.1.2 Energy Efficiency in End-Use Sectors

This section gives a brief review on Danish end-use sectors for determining instruments and measures that contribute to the promotion of energy efficiency.

4.2.1.2.1 Industry Sector

Since 1993, a number of different policy instruments have been adopted in Denmark in order to reduce industrial energy consumption and derived CO_2 emissions. Bjorner and Jensen (2002) note that the dominating instrument for reducing energy consumption and improving energy efficiency is the voluntary agreements. These policy instruments include general CO_2 taxes and subsidies given to individual companies for investments in energy-saving projects.

The Danish tax on industry has been revised to improve energy efficiency in industry. Enterprises pay carbon taxes to government depending on the amount of CO_2 emissions they cause. The Green Tax Package[87] envisages different carbon tax rates according to energy consumption levels of the companies.

In the scope of the Package, the company can reduce its tax rate through a voluntary agreement negotiated between the company and the Danish Energy Agency (government). The company must first present an energy audit prepared by an independent consultant and an action plan based on the audit. O'Neill and Warren (2001) emphasize that the action plan must comprise how the enterprise will implement a system of energy efficiency management, apply procurement policies favouring energy efficiency and educate staff in energy efficiency.

The company must oblige to implementing the energy efficiency investments recommended by the action plan. On the basis of the action plan, the company signs an agreement with the government and is guaranteed partial compensation of carbon tax rates conditional on the fulfilment of the obligations that are identified in the action plan. The companies must submit

[87] Green Tax Package was adopted in January 1996.

regular reports to the Danish Energy Agency. If the reports are not found satisfactory, the Agency can cancel the agreement and require paying back of the taxes from the company.

Green Tax Package is an appropriate instrument for promoting energy efficiency and environmental protection and as well as increasing competitiveness of the industry. The Green Tax Package system has contributed a lot to the promotion of energy efficiency in industry since 1996. According to IEA data (2003) by 2001, more than 300 enterprises, accounting for 60% of total industrial energy consumption, had concluded an agreement with the Danish Energy Agency.

Apart from voluntary agreement practices, usage of industrial CHP has also promoted energy efficiency level of the industry. CHP, which is an efficient power source, is well developed in Denmark. Vital Energi[88] (2004), notes that Denmark is the best performing European country in terms of CHP development and was one of the first to use CHP as a major power source. Industrial CHP is used in industries with high demand for process heat, especially the petrochemical, wood and paper industries. The government plans to further promotion of industrial CHP further in future, by initiating subsidies to industry sector.

Consequently, Danish voluntary energy agreements and industrial CHP have had a significant effect on energy efficiency in the industrial companies.

4.2.1.2.2 Building Sector and Households

As it is mentioned in previous chapters, building sector together with household equipment account a substantial share in total energy consumption. In this perspective, Danish government adopted a Labelling

[88] Vital Energi is a UK company for CHP and district heating.

Scheme[89] in order to demonstrate energy saving potential in buildings. The scheme envisaged that, if a building has an area of 1500 m^2 or less, every house-owner may have an audit of his building, describing the present energy conditions with recommendations for possible energy saving measures in the building shell and heating equipment. The result of the audit is an Energy Label describing the energy condition on a scale from A1 to C5, A1 being the best.

Larger buildings with a surface of more than 1500 m^2, except industrial buildings, must register their consumption of heat, electricity and water monthly. Once a year, a consultant makes an audit resulting in an Energy Label (rating energy consumption relative to comparable buildings) and an Energy Plan (recommending long and short term saving and efficiency measures). The Energy Label evaluates the consumption of heat, electricity and water on scales from A to M (A is the best) in comparison with average figures for comparable buildings (IEA, 2004b: 5).

The implementation of Labelling Scheme showed that there is a large energy saving potential in buildings in Denmark. The results of Labelling Scheme encourage people to take energy efficiency measures. Every year from 40.000 to 50.000 buildings are labelled and 45% of the owners of labelled houses are those who actually have invested in saving measures (IEA, 2004b: 5).

In addition to building labels, government attaches due importance to the electrical equipment. For promoting the efficiency of such equipment, an act was adopted for setting efficiency standards for electrical appliances and other equipment in 1996. Moreover for raising consumer awareness, a Danish labelling system, so-called "energy arrows", has been established for informing consumers of the electricity consumption of various appliances and

[89] Danish Energy Labelling of Buildings Scheme was adopted in 2000.

for facilitating comparisons between different competing products. The implementation of “energy arrows” has contributed to promotion of awareness of Danish consumers.

Apart from labelling practices, for promoting energy efficiency in buildings, the Danish Energy Authority entered into a voluntary agreement with related industry branch on phasing out traditional double glazing windows and promoting more energy-efficient window solutions in 2004. The agreement ensures that the traditional double-glazing with its large energy losses is replaced by more energy-efficient glazing, which is economically feasible for society and for the individual. The study for the replacement of windows is continuing (Danish Energy Authority, 2004: 8).

In addition to legal and voluntary measures that are introduced for the buildings and equipments, like in industry, CHP plants have been widely used in Denmark. Almost 80% of district heating system is supplied from CHP plants. The CHP plants lead to large energy efficiency and simultaneously contribute to protection of environment. After the three decades of CHP operation, Denmark has reduced CO_2 emissions by 7-10 Mt per year (Vital Energi, 2004: 12).

To sum up, Denmark is implementing legal and voluntary measures for promoting energy efficiency in building sector. Labelling both for buildings and equipment, the voluntary agreement for the replacement of traditional windows and large usage of CHP plants have contributed to promotion of energy efficiency. According to Danish Energy Authority (2004), despite these measures concerning buildings, there has been still a great potential for energy efficiency exists in building sector.

4.2.1.2.3 Transportation Sector

As energy and environment are strongly linked in Danish policy making, policies for the transportation sector are also highly influenced by environmental concerns in Denmark. Thus, government initiated many action plans for increasing energy efficiency of the transportation sector in order to decrease CO_2 emissions since 1990s. In 1990, the government adopted an Action Plan[90], which aims at stabilising CO_2 emissions by 2005 and reducing the 25% by 2030, compared to the 1988 level for this sector. The Action Plan was followed up by a White Paper[91], which reviewed the implementation of the energy and environmental targets.

In 2000, after the evaluation of the effectiveness of the policies and measures of the action plans, government realised that, without new initiatives, the earlier objectives were unrealistic. Policies have not been successful in halting the upward trend in transport emissions, owing in part to higher than anticipated economic growth and increases in transport needs. In this perspective, Denmark proposed additional measures in a Policy Report[92]. The Report includes measures for promoting efficiency of vehicles among other objectives. Besides, in January 2000, the purchase tax for cars was changed in order to provide more incentive to purchase more energy-efficient vehicles.

In 2001, the Danish government published a new Action Plan[93] for reducing CO_2 in the transport sector. The Action Plan includes target for a 7% reduction in CO_2 emissions from the transport sector by 2010 compared to

[90] Transport Action Plan for Environment and Development was approved in May 1990.

[91] The White Paper on Transport-Traffic 2005 was approved in December 1993.

[92] Limitation of CO_2 Emissions from the Transport Sector - Possibilities, Policies and Measures was approved in March 2000.

[93] The April 2001 Action Plan was approved in April 2001.

1988 levels and a 25 % reduction of CO_2 emissions from the transport sector in 2030 compared to 1988 levels. In order to attain these targets, the Action Plan announces new measures, such as promoting higher efficiency for vehicles, enforcement of speed limits and energy labelling of new cars (IEA, 2004b: 14-15).

As a result of the reinforced efforts, CO_2 emissions started to decrease in the transportation sector. The Danish government estimates that the new measures in the Action Plan of 2001, when implemented properly, will allow the achievement of the 7% reduction by 2010.

4.2.1.3 Energy Efficiency in Relation to Environment

As it is highlighted before, environmental concerns have significant impact on energy policies of Denmark. Denmark has taken the climate change problem very seriously and has set a series of targets through significant policy initiatives and legislation. In this context, Denmark has two ambitious targets for decreasing emissions. First one is a national commitment, in the scope of Energy 2000 Plan, to reduce overall CO_2 emissions by 20% by 2005, compared to 1988. The Energy 2000 Plan of 1990 contained ambitious programmes to expand the use of renewable energy sources, especially wind, to achieve sustainable development and reduce CO_2 emissions.

Second target is an international commitment under the 1997 Kyoto Protocol[94] and the European Union's internal Burden-Sharing Agreement of 1998, to reduce greenhouse gas emissions by 21% in the period 2008-2012, compared to the 1990 level.

In order to comply with its national and international commitments, government has adopted the Climate Change Strategy in 2003. Strategy

[94] Denmark has ratified Kyoto Protocol on 30 May 2001.

includes measures such as window standards, oil and gas boiler standards, heat pumps that replace oil-fired district heating and establishment of biogas plants.

As a result, two commitments of Denmark, stress the importance of well-designed and strong energy efficiency policy as a contribution to reduction of greenhouse gas emissions. Figures on greenhouse gas emissions for 2000 showed that overall CO_2 emissions in Denmark have been reduced by 11% since 1988, and that the country is on the way to meeting its 2005 commitments for a 20% CO_2 reduction with initiatives already launched (IEA, 2004b: 3).

4.2.1.4 Overall Evaluation of Energy Efficiency in Denmark

After the oil crises, Denmark had launched a series of action plans and programmes for promoting energy efficiency in all sectors of the economy. Ambitious targets are identified, especially in transportation and environment sectors, and then policies and measures are introduced in order to achieve these targets on time. After monitoring and evaluating the effectiveness of policies and measures, if they are not satisfactory, action plans are renewed and updated. These systematic efforts have contributed to promotion of energy efficiency in Denmark since mid-1970s.

After having examined energy efficiency policies of Denmark, major measures are identified that have contributed to the promotion of energy efficiency. Within this perspective, the findings of Section 4.2.1 are summarised in Table 4.4.

Table 4.4 Energy Efficiency Measures of Denmark

Sectors	Measures
All	- Energy 2000 of 1990 - Energy 21 of 1996 - Electricity Saving Trust - Energy Saving Act of 2000
Electricity Transmission/Distribution Systems	- Underground cabling - DSM
Industry	- Green Tax Package of 1996 - CHP
Building and Households	- Labelling Scheme of 2000 - Energy Arrows of 1996 - CHP
Transportation	- Action Plan of 1990 - Limitation of CO_2 of 2001 - Action Plan of 2001
Environment	- Kyoto Protocol - National Commitment of 1990 - Climate Change Strategy

Source: Derived from the findings of Section 4.2.1

To sum up, the national energy plans together with further development of policies, e.g. expansion of CHP systems and comprehensive energy efficiency programmes, have contributed to promotion of energy efficiency in Denmark. Within this perspective, Table 4.5 illustrates the improvement of energy efficiency in end-use sectors.

Table 4.5 Energy Efficiency Change in End-Use Sectors in Denmark

	1990			2002			Change in Energy Intensity 1990-2002 (%)
	TFC* (Mtoe)	GDP (billion US $ in 2000 prices)	Energy Intensity (TFC/GDP)	TFC* (Mtoe)	GDP (billion US $ in 2000 prices)	Energy Intensity (TFC/GDP)	
Industry	2.99	125.72	0.0238	2.93	162.32	0.0180	- 24.3
Buildings	3.62	125.72	0.0288	4.24	162.32	0.0261	-9.3
Transport	4.58	125.72	0.0364	4.84	162.32	0.0298	-18.2

*Total Final Consumption
Source: Derived from IEA (2005b) and IEA (2002b).

According to Table 4.5, the highest energy efficiency increase was realized in industry sector with a reduction of about 25% in energy intensity from 1990-2002. In this respect, it can be pinpointed that the dominating instruments of the sector, namely the Green Tax Package and industrial CHP, have substantial impact on reducing energy intensity. Figures of the Table 4.5 demonstrate that the reduction in energy intensity is less than industry sector. Danish Action Plans have contributed to the promotion of energy efficiency as indicated by the 18% reduction in energy intensity over the same period. Lastly, the lowest reduction is realised in the building sector. Danish building sector exhibited an improvement of 9.3% in energy intensity. Within his perspective, it can be concluded that the impacts of measures concerning building sector, namely labelling both for buildings and equipment, the voluntary agreement for the replacement of traditional windows and large usage of CHP plants, have remained less as compared to industry and transportation sectors.

4.2.2 Energy Efficiency in Germany

The Federal Republic of Germany, with a population of 82 million, is the most populated EU country and also the largest European energy market. Being located in the middle of the European energy markets, Germany is an important transit country. Germany is also the third-largest economy among the OECD countries.

By the reunification in 1990, five new federal states acceded to the Federal Republic and now Germany consists of 16 federal states. Reunification was supported by massive efforts to restructure the economy of the new federal states, which brought many changes to the energy sector. Major efforts have been made at both the federal and local levels to integrate and increase energy efficiency measures and policies and this led to a reduction of energy consumption in new federal states.

German energy policy is increasingly influenced by environmental concerns. Since the beginning of the 1990s, the federal government's environmental policy has given increased emphasis to global warming issues. In this context, energy efficiency policies have been given more and more importance because increases in energy efficiency contribute to the reduction of CO_2 emissions, therefore government has established ambitious targets to reduce greenhouse gas emissions. In addition, the German government decided to phase out nuclear power plants. Therefore, energy efficiency and conservation, CHP and renewable energy sources have become more important elements of the German energy policy than before.

After a sharp reduction in the early 1990s, energy intensity continued to decrease in the second half of the decade. During the 1990s, energy intensity decreased faster in Germany than in the EU, Canada, Japan and the United States. According to the latest forecasts of IEA (2002c), energy intensity will continue to decrease faster in Germany than the Europe

average. Energy efficiency has improved due to the reduction in energy consumption in the new federal states in the early 1990s after the restructuring of industry and strict energy efficiency measures.

For the implementation of energy efficiency measures, responsibility is at the federal level. The Federal Ministry of Economics and Technology is in charge of energy efficiency policy. The federal government is responsible for proposing legislation governing energy efficiency, but the federal states have an important role in implementing and enforcing it. They can also introduce their own measures to promote energy efficiency (IEA, 2004c: 1). In addition to Ministry, the German Energy Agency - Dena[95] was founded in 2000 for supporting measures related to energy efficiency, climate protection and promotion of renewable energies. Dena, which coordinates the various players within the energy sector, is not a subordinate agency of a ministry; it was set up as a company.[96] The most typical activities of Dena are running energy efficiency pilot projects using new technologies together with the industry, information campaigns on promoting energy efficiency and demand side managements.

Energy and energy efficiency policies have been shaped by strategies and reports adopted by the government. Since 2000, the Federal Ministry of Economics and Technology has adopted important strategies, which highlight energy efficiency as an important priority. The most comprehensive strategy[97] contains estimates and scenarios on a sustainable energy policy for the future. According to the Strategy the improvement of energy efficiency plays a key role within the framework of a modernisation strategy for

[95] Dena: Deutsche Energie Agentur.

[96] The stakeholders are presently the KfW (Kreditanstalt für Wiederaufbau) (50%) and the Federal Republic of Germany (50%) represented by the Federal Ministry of Economics and Technology, the Federal Ministry of Transport, Building and Housing and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

[97] “Strategy for Sustainable Development” was adopted in April 2002.

sustainable development. Based on an analysis of some key energy efficiency indicators of the entire economy, some suggestions for pilot projects for the further improvement of energy efficiency are also included.

Another important regulatory measure for improving energy efficiency is the Ecological Tax Reform Act[98]. Act foresees some tax reductions for manufacturing industry and agriculture for taking measures for CO_2 reduction. In 2003, the Act was updated and contained further reductions on taxes. In addition to this Act, an ecological financial reform was also initiated.

In the following sub-sections, firstly, energy efficiency in the transmission/distribution systems of Germany is evaluated. Secondly, the end-use sectors of Germany are examined for determining instruments and measures concerning promotion of energy efficiency. In addition, bearing in mind the fact that German energy policy is highly influenced by environmental concerns, environmental policies and measures are also taken into consideration in the last section.

4.2.2.1 Energy Efficiency in Transmission/Distribution Stages of Energy

Germany, with a surface area of 357.000 km^2, is the largest European electricity market. The liberalization of German electricity markets is based on the EU Electricity Directive of 1996, like in Denmark. The electricity market has a decentralized structure with about 900 companies, which are privately and municipally owned utilities. There are six transmission companies and about 56 regional utilities that are responsible for distribution of electricity (IEA, 2002c: 99). The supra-regional electricity networks are mainly in private ownership. On the local and regional level active participation of municipalities can be observed. Germany is a member of UCTE.

[98] Ecological Tax Reform was adopted in 1999.

Germany has developed both infrastructural and demand side measures for increasing efficiency of transmission and distribution lines. According to the study of ICF Consulting (2003), about 5.1% of total production is lost during transmission and distribution of electricity. This is an evidence of high efficiency in transmission/distribution phases of energy despite its geographic land area.

As it is pinpointed in Section 4.2.1.1, efficiency in transmission and distribution systems is related with economic wealth of the country. According to IEA (2005b) statistics per capita GDP was nearly 25.000 US dollars in 2003. As a wealthy country, Germany is not facing significant electricity thefts, like Denmark. In addition, the electricity infrastructure is well developed and quality of transmission and distribution lines is high when compared to Turkey due to economic wealth of the country.

The prosperity of the country is reflected to the length of underground cables for both transmission and distribution. The length of overhead lines and underground cables of Germany is given in Table 4.6.

Table 4.6 The Length of Transmission/Distribution Lines of Germany (km)

High Voltage		Medium Voltage		Low Voltage	
Overhead	Underground	Overhead	Underground	Overhead	Underground
71.609	4.740	190.000	285.000	231.500	694.000

Source: ICF Consulting, 2003: 36.

As it is seen in Table 4.6, Germany has considerably great length of underground cables in particular in medium and low voltage. Bearing in mind the fact that losses generally occur in medium and low voltage lines, these figures confirm the higher efficiency of distribution lines.

In addition to infrastructural measures, Germany has been implementing demand side measures. Germany has been implementing demand side management by studies on load management, implementing multi-timing tariffs and promoting consumer awareness for reducing demand (Ergen and Yıldırım, 1997: 29). According to Ergen and Yıldırım, like Denmark, Germany is one of the best performing countries concerning demand side management. Dena inter alia organises demand side management together with the 12 local agencies for the promotion of energy efficiency and especially for reducing electricity demand in peak times. It also operates an "energy hotline", a free telephone service for advising both companies and individuals on the rational use of energy. Moreover, being a member of UCTE also has a contribution to meeting demand especially in peak times.

To sum up, Germany has ensured high efficiency in transmission and distribution systems of electricity, like Denmark. This high efficiency is attributable to high level of GDP, well-developed infrastructure and demand side management. Within this perspective, attention is paid to consumption stage of energy in end-use sectors.

4.2.2.2 Energy Efficiency in End-Use Sectors

This section gives a brief review on German end-use sectors for determining instruments and measures that contribute to the promotion of energy efficiency.

4.2.2.2.1 Industry Sector

In the industry sector, the dominating instrument to improve energy efficiency is voluntary agreements. In 2000, a new voluntary agreement[99] on climate protection between the government and German business was committed.

[99] Former voluntary agreements on climate protection were made in 1995 and 1996.

With a view to the objectives of the Kyoto Protocol, German business committed itself to reduce greenhouse gases. Chidiak (1999) notes that negotiations between government and industry involved nearly all policy parameters, objectives and timetables jointly set by industry and included detailed branch-by-branch commitments and provisions for monitoring.

In 2001, the government and German business have agreed on a voluntary agreement for the promotion of CHP plants, which is an addition to the voluntary agreement on climate protection. The voluntary agreement, which aims at building CHP in industry, is accompanied by a new CHP Law[100]. The law aims to achieve ongoing operation and modernization of existing plants. The law foresees industries, which operate CHP plants, to receive bonus payments for construction of new plants and modernization of existing plants.

In addition to voluntary agreements, third-party financing for energy efficiency investments has increased considerably in recent years in German industry. IEA figures (2004c) show that about 480 companies had invested 6.6 million euros for a total of 39.000 projects in 1999. The companies providing third-party financing can receive financing from special programmes established by KfW.

As a result, Germany exhibited substantial energy efficiency since the beginning of 1990s, which can partially be attributed to some voluntary agreements with the industry. Improvements in energy efficiency are observed especially in the chemical industry, and for cement, textiles and equipment goods.

[100] CHP Law came into force in April 2002 and will be in effect until end of 2010.

4.2.2.2.2 Building Sector and Households

The buildings in new federal states had large energy saving potential due to old energy building methods. It was necessary to tackle considerable deficiencies in energy efficiency in the new federal states following German reunification. Therefore focus is directed to building sector. In this respect, since 1991, all new buildings in the new federal states have had to meet the latest standards applied in Western Germany.

For reducing energy requirements of residential and industrial buildings an Ordinance[101] was adopted by the government. The target of the Ordinance is to reduce the energy requirements of new buildings by an average of 25-30%. Eichhamer et al. (2004) note that the importance of this Ordinance is the prescription of the energy-profile certificate, which includes energy characteristics of the building for ensuring transparency and strengthening the efforts to save energy for all new buildings. In addition to new buildings, the Ordinance also encourages energy efficiency improvements in existing buildings.

In order to improve the energy efficiency of existing buildings in Germany, a financial measure has been developed by the KfW. The Housing Modernisation Programme, which was only valid for the new federal states up to 2002, was renewed in 2003 and is now valid across Germany. Support is given by low-interest loans for investments in the modernization and repairs of residential buildings. This programme is of crucial importance for consumers who have financial difficulties.

Concerning appliances, since 1998, energy consumption labelling has been mandatory in Germany. Thus, related EU Directives have been transposed

[101] Energy Conservation Ordinance was adopted in February 2002.

into national law. Labelling Act[102], which created a legal framework to implement the EU Directives on labelling of household electrical appliances, was amended in 2002. Furthermore, voluntary labelling programmes are being carried, including the labelling of the group of efficient appliances for electrical appliances and the Energy Star[103] designation for office devices. Dena is preparing special activities to organise and promote the Energy Star as a voluntary label for office equipment.

In 2002, the Associations of the Electricity Industry and Dena have launched a demand side measure, a nationwide information campaign[104], aiming at raising energy efficiency in private households. The public awareness campaign has been organized as a private/public partnership project. The campaign covers three topics “reducing standby consumption of electrical appliances”, “raising energy efficiency of household appliances” and “supporting efficient lighting with high comfort”. According to IEA data (2004c), more than 300 reports were published by the media including 164 articles in newspapers and magazines in the scope of campaign. The public awareness campaign has been successful throughout Germany. Many initiatives including information for the media, opinion polls, exhibitions and other public events have been launched for increasing public awareness.

To sum up, Germany has established regulatory, voluntary, financial and demand side measures for promoting energy efficiency in buildings. Energy Conservation Ordinance has contributed to the promotion of energy efficiency in existing buildings and as well as new buildings. Also labelling systems for both household and office equipments have worked successfully and IEA (2004c) declared that Germany has taken a leading position in the sale of energy efficient appliances of class A. In addition, the financial

[102] Energy Consumption Labelling Act was adopted in 1997. (BGB1. Ip. 2616)

[103] For detailed information on Energy Star see page 66.

[104] Initiative EnergieEffizienz

measure, the Housing Modernisation Programme, supports consumers for taking energy efficiency measures for their houses. Lastly but not least, the nationwide information campaign also has contributed to raising awareness.

4.2.2.2.3 Transportation Sector

Energy consumption in transportation sector in Germany increased since the mid 1990's. The government and oil industries explain this increase by a greater number of sales of diesel cars. Diesel cars, which consume less energy, are attractive for consumers. Thus, greater number of diesel cars has caused an overall increase in energy consumption in the transportation sector.

The increase in energy consumption and in the face of the rise in CO_2 emissions in the transportation sector, the federal government considered it particularly important to achieve substantial progress in this area. Like in industry sector, a voluntary agreement has been made committing the automobile industry to a 25% reduction in fuel consumption of new cars between 1990 and 2005. O'Neill and Warren (2001) emphasize that the achievement of this agreement should be supported with measures undertaken by the federal government such as improving traffic flows or tax cuts. Koch (2001) considers the 25% reduction as an achievable target and he adds by more advanced technologies much greater fuel economy improvements would be possible in 2020 in Germany. In addition, Germany supports voluntary agreements to reduce fuel consumption and emissions of cars and trucks.

For encouraging usage of low pollutant emission cars, the German Parliament adopted Motor Vehicle Tax Act[105]. The Act allows for temporary exemptions of the annual motor-vehicle tax for low pollutant emissions cars

[105] Motor Vehicle Tax Act was adopted in July 1997.

and higher taxes for some high emissions cars. The tax rate was also reduced for cars that have a very low level of consumption. These tax initiatives have contributed both to reducing emissions and to increasing energy efficiency simultaneously.

To sum up, like in industry sector, the dominating instrument is the voluntary agreements, which are focusing on reduction of fuel consumption and emissions. In addition, the regulatory measure, Motor Vehicle Tax Act, has also influenced people for buying more efficient cars.

4.2.2.3 Energy Efficiency in Relation to Environment

As it is underlined before, ambitious reduction targets for CO_2 and other greenhouse gas emissions are the important driving forces for climate policy in Germany. Like Denmark, Germany has two ambitious targets for decreasing emissions. First one is a national commitment; the German government set the target of reducing CO_2 emissions by 25% of the 1987 levels by the end of 2005. Second one is an international commitment under 1997 Kyoto Protocol[106] and by the European Union's internal Burden-Sharing Agreement of 1998, Germany is committed to reducing its greenhouse gas emissions by 21% of the 1990 level for the period 2008-2012.

In 2000, the German government adopted a Climate Protection Programme[107], which contains a package of measures to reach the national goal of 25%. Programme contains measures for CO_2 reduction in the fields of energy supply, transport, buildings, new technologies, and agriculture and forestry.

[106] Germany has ratified Kyoto Protocol on 26 April 2002.

[107] Climate Protection Programme was approved in October 2000.

According to IEA figures (2002c) CO_2 emissions have decreased in Germany since 1990. In the old federal states, CO_2 emissions increased by 2% between 1990 and 1995, whereas in the new federal states they decreased by 44%, mainly due to economic restructuring and significant energy efficiency improvements. Total CO_2 emissions fell by 12% between 1990 and 1995. By the end of 1995, per capita emissions in the new federal states were very close to those in the old federal states. After 1995, CO_2 emissions reduction slowed down. In 2000, CO_2 emissions were 13.6% and total greenhouse gas emissions were 19.1% lower than the 1990 level.

By 2000, Germany was already very close to the Kyoto target, greenhouse gas emissions being only 1.9% points above the target for 2008-2012. It should be pinpointed that the energy efficiency measures that are introduced before 2000 play a crucial role in reducing emissions.

4.2.2.4 Overall Evaluation of Energy Efficiency in Germany

Germany has managed to reduce its energy intensity since 1990. At present, Germany uses a wide range of measures to improve energy efficiency. All findings of the Section 4.2.2 are summarised in Table 4.7.

Table 4.7 Energy Efficiency Measures of Germany

Sectors	Measures
All	- Strategy for Sustainable Development of 2002 - Ecological Tax Reform of
Electricity Transmission/Distribution Systems	-Underground cabling -DSM
Industry	- Voluntary Agreements (Climate change + CHP) - Third-party Financing
Buildings and Households	- Energy Conservation Ordinance of 2002 - Housing Modernization Programme of 1995 - Labelling Act of 1997 - Energy Efficiency Campaign of 2002
Transportation	- Voluntary Agreements - Motor Vehicle Tax Act of 1997
Environment	- Kyoto Protocol - National Commitment of 1990 - Climate Protection Programme

Source: Derived from the findings of Section 4.2.2.

These energy efficiency measures have all contributed to the promotion of energy efficiency in Germany. Within this perspective, Table 4.8 illustrates the improvement of energy efficiency in end-use sectors.

Table 4.8 Energy Efficiency Change in End-Use Sectors in Germany

	1990			2002			Change in Energy Intensity 1990-2002 (%)
	TFC* (Mtoe)	GDP (billion US $ in 2000 prices)	Energy Intensity (TFC/GDP)	TFC* (Mtoe)	GDP (billion US $ in 2000 prices)	Energy Intensity (TFC/GDP)	
Industry	88.7	1545.84	0.0573	73.22	1887.47	0.0388	-32.4
Transport	60.63	1545.84	0.0392	67.07	1887.47	0.0355	-9.4
Buildings	69.44	1545.84	0.0449	65.56	1887.47	0.0347	-22.7

* Total Final Consumption
Source: Derived from IEA (2005b) and IEA (2002c).

Table 4.8 indicates that the highest improvement in energy efficiency has been achieved in industry sector. As Eichhammer et al. (2004) also emphasize the decrease in energy intensity and consumption is mainly due to the voluntary measures taken by the government. Concerning buildings, regulatory measures and information dissemination are used to reduce energy consumption. One of the key challenges in this sector is to reduce energy consumption in existing buildings. Energy intensity in building sector is reduced between 1990-2002 period due to high energy saving potential in buildings in East Germany. It is worthwhile to point to the fact that energy consumption has decreased both in industry and buildings sectors while GDP has increased. In the transportation sector, although voluntary agreements with the automobile industry and tax exemptions for less pollutant cars have contributed to efficient use of energy, the efficiency improvement remains limited when compared to industry and building sector.

Major efforts are under way to improve energy efficiency at the federal, state and municipal levels with the main objective of reducing CO_2 emissions, a priority of overall energy policy in Germany. O'Neill and Warren (2001) underline the fact that without the Kyoto Protocol, many energy efficiency programmes would not exist and policy development for promoting energy

efficiency would be minimal. Germany places great emphasis on improving its monitoring and assessment efforts on energy efficiency measures in order to meet national and international commitments on climate change. In addition to environmental concerns, Germany plans to phase out nuclear power; thus, it needs to generate electricity otherwise or to reduce electricity demand. The government considers energy efficiency to be one of the key measures to compensate for nuclear power in this respect.

4.3 General Evaluation of Energy Efficiency Measures of the EU, Denmark and Germany

As it is shown throughout Chapter 4, energy efficiency concept was first gained importance during the oil crises of 1970's. Since energy is not adopted as a common policy within the EU, taking measures at the EU level has always been a difficult task. Therefore, promoting energy efficiency throughout the EU remains mainly limited with Member States. At the Union level, attention is generally paid to issuing legislation related to energy efficiency.

However due to recent high oil and gas prices and Kyoto Protocol, which became legally binding at the beginning of 2005, energy efficiency has recently gained more importance by taking into consideration the considerable potential for improving energy efficiency on reducing external dependence and protecting environment. Within this perspective, in 2005, the European Commission identified energy efficiency as a core objective of the Union's energy policy and stated that energy efficiency would be a key priority from 2005 onwards. In this regard, as they are briefly explained in Section 4.1.2.2, comprehensive measures to be taken at the EU level are identified in the scope of the European Energy Efficiency Initiative. As it is a new initiative, which is started in mid 2005, only near future will show their impact on promotion of energy efficiency.

However as it is pinpointed in preceding sections, in addition to EU's legislation on energy efficiency, Member States have been implementing extra energy efficiency measures since the first oil crisis. Among all Member States, Denmark and Germany have accomplished well-developed measures for the promotion of energy efficiency. These measures are briefly explained throughout Section 4.2.

As a result of all measures, policies, strategies and systematic efforts, energy efficiency is well promoted in these countries. Within this perspective, Table 4.9 illustrates the promotion of energy efficiency levels in end-use sectors for the EU-15, Denmark and Germany.

Table 4.9 Promotion of Energy Efficiency in End-Use Sectors in the EU, Denmark and Germany

	Reduction in Energy Intensity 1990-2002 (%)		
	Industry	**Buildings**	**Transport**
Denmark	24.3	9.3	18.2
Germany	32.4	22.7	9.4
EU-15 Average	13	9	7

Source: Derived from IEA (2005b), IEA (2002b), IEA (2002c) and ODYSSEE (2004)

Table 4.9 indicates that the development rate of energy efficiency in end-use sectors both in Denmark and Germany are higher than EU-15 average. As it is seen in Table 4.9 the greatest energy efficiency improvement is ensured in industry sector. The improvement in building sector remains relatively low when compared to industry owing to the difficulties in promotion of energy efficiency of existing buildings that require substantial investment. Energy efficiency in buildings is well promoted in Germany mainly due to the large saving potential of buildings in East Germany. Energy efficiency in transportation sector is well promoted in Denmark by contributions of adopted action plans.

All measures that have been examined throughout Chapter 4 have more or less contributed to the promotion of energy efficiency. Although it is extremely difficult to calculate the contributions of each measure to the promotion of energy efficiency Table 4.10 attempts to demonstrate the contribution of specific measures to the promotion of energy efficiency that are implemented in Denmark, Germany and the EU.

When Table 4.10 is examined, the greatest contribution is gained from the voluntary agreements. As it is seen in Table 4.10, Green Tax Package, a voluntary agreement with the Danish industry, German voluntary agreements on climate protection and CHP development in industry sector and on reducing fuel consumption of private cars in transport industry have significant contributions on energy saving. Within this perspective, it could be concluded that measures concerning industry sector have more impact on promoting energy efficiency. Concerning building sector, although measures are contributed to the promotion of energy efficiency, their contribution is relatively limited, except in Germany. As it is previously highlighted, there is a significant saving potential in buildings in East Germany and therefore focus is directed to building sector after the unification. As regards transportation sector, Denmark is reduced energy intensity by 18.2% mainly by the contributions of action plans, however the data for energy reduction is not available. Car Labelling Directive of the EU has a significant contribution to the reduction of energy consumption particularly when compared to the Labelling Directives on Electrical Appliances.

As a conclusion, as Table 4.9 and Table 4.10 also illustrate, it can be generalized that efficiency measures that are designed for industry sector have contributed comparatively more to the promotion of energy efficiency.

Table 4.10 Contributions of Specific Measures to the Promotion of Energy Efficiency

	Industry		Buildings		Transport	
	Measure	**Contribution**	**Measure**	**Contribution**	**Measure**	**Contribution**
Denmark	Green Tax Package	For the period 1996-2000, energy consumption reduced by 10%.	Energy Labels	For the 1990-2002 period, energy consumption reduced by 22.8%	n.a	n.a
	CHP	For the period 1980-2004, energy consumption reduced by 15%.				
Germany	Voluntary Agreements	For the period 2000-2004, energy consumption reduced by 2.7 Mtoe.	Energy Conservation Ordinance	For the 2000-2005 period, energy consumption reduced by 1.6 Mtoe.	Voluntary Agreements	For the 2005-2010* period, it is envisaged that energy consumption will reduced by 3.5 Mtoe
			Energy Labels	For the 2005-2010* period, it is envisaged that energy consumption will reduce by 0.48 Mtoe.		
			Housing Modernisation Programme	For the 1995-2002 period, energy consumption reduced by 1.2 Mtoe.		
EU-15	n.a	n.a	Labelling Directive	For the 1992-2000 period energy consumption reduced by 1 Mtoe.	Car Labelling Directive	For the 1999-2002 period, energy consumption reduced by 7 Mtoe.
			Buildings Directive	For the 2002-2010* period, it is envisaged that energy consumption will reduce by 3 Mtoe		

*Projections.
n.a: not available
Source: Derived from ODYSSEE (2004a, 2004b, 2004c), Eichhammer (2004), Bjonner and Jensen (2002).

CHAPTER 5

RECOMMENDATIONS FOR THE PROMOTION OF ENERGY EFFICIENCY IN TURKEY

As it has been shown in preceding chapters, energy intensity in Turkey is far above the EU average and Turkey has some weaknesses and problems preventing the promotion of energy efficiency especially when the most energy efficient EU Member States are taken into consideration. After having examined Turkish energy efficiency situation, major problems preventing the promotion of energy efficiency in Turkey were specified in Chapter 3. These specific problems can be grouped into four categories:

- General problems like financial, institutional and managerial barriers concerning all sectors,
- Problems regarding electricity transmission/distribution systems,
- Problems regarding end-use sectors,
- Problems regarding environmental protection.

These problems constitute important barriers to promoting energy efficiency in Turkey. This chapter tries to develop possible solutions and recommendations concerning the problems and bottlenecks of Turkey concerning energy efficiency by taking into consideration lessons learnt from best practices of the EU, Denmark and Germany.

5.1 General Measures

Turkey has significant financial, institutional and managerial barriers to promoting energy efficiency concerning all sectors. Lack of targeted and integrated energy efficiency policies, inadequate legislation and ineffective implementation, insufficient administrative capacity and low level of coordination, lack of finance and non-cost reflecting energy prices can be identified as general problems.

Energy efficiency has horizontal aspects in variety of sectors, e.g. industry, building, transport and environment. In order to promote energy efficiency of a country, effective implementation of targeted and integrated measures and programmes on energy efficiency comprising all sectors is of paramount importance. Hepbaşlı and Özalp (2003) note that there are no standardized approaches towards energy efficiency in Turkey. In this context for determining an integrated energy efficiency policy, getting full support from all related players, including private sector is necessary.

In addition to determining integrated energy efficiency policy, determining quantitative targets at the national or sectoral levels is of crucial importance. For example, in the EU both at the Union and Member State level, nearly all programmes and measures regarding promoting of energy efficiency include specific targets for certain time periods. Such targets would help in monitoring and evaluating the effectiveness of the policies and measures. In this context, determining targets for certain time periods is important for Turkey for implementing effective policies and measures.

Inadequate legislation and ineffective implementation of the legislation in the energy efficiency field is one of the important barriers to undermine the promotion of energy efficiency in Turkey, especially in the past. Before the declaration of candidacy for the EU membership, Turkey has had few regulations issued by MENR for promoting energy efficiency. Following the

adoption of Accession Partnership of 2003, which defines promotion of energy efficiency as a short-term priority, Turkey attaches due importance for adopting energy efficiency legislation. In this perspective, Revised National Programme issued in July 2003 encompasses detailed and targeted time schedule for harmonization of the related EU acquis.

In the scope of Revised National Programme, most of the relevant EU acquis for energy efficiency in the residential and services sectors (energy standards and labelling for electrical appliances, standards for boilers, building codes for new buildings, etc.) have been transposed to the national legislation. The EU's legislation on car efficiency labels and fuel economy targets in transportation sector and on air-conditions remain to be adopted.

Apart from adopting relevant EU acquis, for further promoting energy efficiency in all sectors of economy, a National Energy Efficiency Strategy for Turkey has been endorsed by MENR on 24 June 2004. After that, for ensuring the effective implementation of the Strategy, a Draft Energy Efficiency Law has been prepared by MENR. Draft Energy Efficiency Law constitutes a strong framework for the development and implementation of energy efficiency measures in order to increase the efficient use of energy to reduce the burden of energy costs on the economy and to protect the environment. Bearing in mind the components of the Draft Law, increasing energy efficiency awareness, improving administrative structures for energy efficiency services and tax incentives, subsidies, soft loans for energy efficiency improvements, Draft Law will have substantial positive impact on promotion of energy efficiency if it is enacted. In this perspective, enactment of Draft Law as soon as possible is of crucial importance. After the enactment of Draft Law, adoption of overall energy strategies like "Energy 2000" and "Energy 21" of Denmark or "Strategy for Sustainable Development" of Germany is needed for the promotion of energy efficiency. Developing such

an overall energy strategy is also indicated as a short-term priority in the Accession Partnership[108] of 2005.

Turkey coped with problems concerning the adoption of energy efficiency legislation. There are only few regulations left as mentioned above. The main problem for Turkey is the effective implementation of adopted legislation. Ensuring the effective implementation of all EU energy efficiency legislation, implementation of the identified measures in National Energy Efficiency Strategy by the government and carefully monitoring and evaluating their impacts are expected to have substantial contribution to enhancing energy efficiency throughout Turkey.

Insufficient administrative capacity, both in quality and quantity, is a major deterring factor in achieving effective implementation of energy efficiency programmes and projects. NECC, which is the responsible public institution for enhancing the activities on improving energy efficiency in all end-use sectors, is not sufficient enough dealing with energy efficiency policies and measures. NECC has no regional branches; moreover there are no regional or local administrations that are responsible for promoting energy efficiency. Establishment of regional offices is of crucial importance in particular in a large country like Turkey. Being a relatively new institution, NECC has lack of expertise in this area especially limited experiences in energy efficiency project development, implementation and evaluation. Therefore, in Accession Partnership of 2005, strengthening administrative capacity in the field of energy efficiency is indicated as a short-term priority.

To improve quality of administrative capacity, establishing international cooperation, for example increasing know-how transfer from the EU and efficient Member States, would be beneficial. In this perspective, EU's

[108] Proposal for a Council Decision on the Principles, Priorities, and Conditions contained in the Accession Partnership with Turkey [SEC (2005) 1426].

European Sustainable Energy Forum would be an opportunity for Turkey for stimulating debate and creating effective input for promoting energy efficiency. In addition, creating an energy efficiency network at national and international level for ensuring the flow of information contributes to increasing expertise. Organising international conferences, seminars or training courses would be helpful for strengthening administrative capacity of the related institutions that are active in energy efficiency policies.

There are a number of institutions active in energy efficiency policies and programmes. As Laponche (2004) also stresses, due to their decentralised characteristics, energy efficiency programmes will be successful only if they are designed and executed with the full agreement and cooperation of all the parties concerned. However, in Turkey, cooperation and coordination between the main stakeholders (public and private sectors) and institutions (e.g. the Ministry of Environment, the Ministry of Reconstruction and Resettlements, the Ministry of Industry and Trade, Turkish Standards Institute and the Scientific and Technical Research Council of Turkey) is not very intensive. In order to increase energy efficiency throughout all sectors of economy, enhancing coordination between various ministries and institutions in the area of energy efficiency and related environmental aspects plays an important role. It should be needed to determine responsible experts and contact points in each institution in order to form a platform for exchanging of views.

Lack of finance is probably the important barrier to the promotion of energy efficiency. Currently there are no specific financial or fiscal incentives to promote energy efficiency. The Draft Energy Efficiency Law does include tax incentives, subsidies and soft loans for industry for energy efficiency investment, VAT exemptions for energy efficient household appliances and equipments used in buildings and subsidies for biomass-based CHP.

Getting foreign assistance, mainly through appropriate EU funds is of utmost importance, bearing in mind the fact that as compared to the new EU Member States (particularly the Central and Eastern European states) and the other accession states, Turkey has received very limited financial assistance from EU funding instruments. The effective participation of Turkey to the related EU programme, Intelligent Energy for Europe, is also necessary for getting support for energy efficiency projects. Turkey has been eligible to participate into the afore-mentioned EU programme in 2002. However, Turkey does not participate in this programme due to high amount of national financial contribution to the budget of the programme.

One of the important barriers for fully exploiting Turkey's energy saving potential is the energy prices, which have not been based on cost for all consumer groups. Cost-reflective pricing is a prerequisite for ensuring energy efficiency. Determining energy prices at levels below costs encourages the inefficient use of energy and makes energy efficiency investments less profitable. It is important to eliminate the cross-subsidies in electricity and gas sectors.

5.2 Measures Regarding Electricity Transmission and Distribution Systems

Losses in transmission/distribution systems constitute an important problem in the energy sector. As it is mentioned in Section 3.2.1, nearly 22% of total electricity production is lost in transmission (3%) and distribution systems (18.6%) due to both technical and non-technical reasons. Especially high level of distribution losses is an important concern and has adverse effects on Turkish economy.

Concerning technical losses, rehabilitation of the existing distribution network and investment in network operation tools are necessary to reduce technical losses. Underground cables that are used all across Europe would help to

reduce losses, particularly in distribution network. TEDAŞ has very recently started to bury distribution lines in big cities. It would be beneficial to extend the underground cabling, in particular in rural areas, for reducing losses. For covering the expense of high-cost underground cables, using related EU funds, e.g. Intelligent Energy for Europe or Financial Cooperation Programme, may constitute a solution.

It is envisaged by the government that privatisation of distribution networks would contribute to facilitating further investment and efficiency improvements. Bearing in mind the fact that financial and human resources of TEDAŞ are not adequate enough for repairing and controlling the lines, privatisation could contribute to the promotion of efficiency of distribution lines. It is worthwhile to point to the fact that private distribution companies would also prevent electricity thefts by increasing controls as a result of better management. Therefore, implementing the privatisation schedule for distribution networks that is determined by Electricity Sector Reform and Privatisation Strategy Paper of 2004 on time is of crucial importance.

Monitoring the performance of distribution companies also contributes to cope with technical losses. Therefore, it is needed to ensure widespread implementation of SCADA/DMS, which is an online data and control system. According to Çetinkaya (2003) establishment of SCADA/DMS on the distribution grids can decrease the losses to 5%.

Strict implementations concerning demand side management, like Danish and German cases, would reduce excessive load in peak times. Thus, multi-timing electricity tariffs would be beneficial for shifting demand from peak times to off-peak times. In addition, connection with European electricity transmission grid, namely UCTE connection, would reduce transmission losses due to its potential for meeting excessive demand from other countries automatically in peak periods owing to the time differences between countries. However, it should be noted that the impact of UCTE connection

on reducing technical transmission losses would be low since transmission losses in Turkey are already not very high and closer to world standards.

Concerning non-technical losses, which arise from thefts, the implementation of ABONE-NET system would contribute for preventing non-technical losses. Under the monitoring system of subscribers, illegal usage of electricity and unpaid bills would be determined easily.

Increased state control and implementing incentives and penalties that aim to prevent theft are necessary. In Turkish Criminal Code it is stated “electricity thefts shall be punished with imprisonment between 2 and 5 years” [109]. Adoption of heavier punishment is needed in this respect. Also, targeted social aid for consumers in need may contribute to cope with theft. People who use electricity illegally generally consume a lot due to free charge. Within this perspective, Kavak (2005) pinpoints that free delivery of electricity to a certain limit (for example, up to 75 KWh) to consumers in need, and billing the whole consumption in case of exceeding the determined limit would be a proper measure. In this case, people who consume electricity illegally would be drawn to the system and excessive consumption would be prevented.

5.3 Sectoral Measures

Turkey has some bottlenecks and deficiencies concerning end-use sectors, namely industry, buildings and transport on development and implementation of energy efficiency policies and measures.

Regarding industrial sector, up to date, programmes for enhancing energy efficiency in the industrial sector have very much focused on raising awareness and training of energy managers. Bearing in mind that there is

[109] Turkish Criminal Code, No: 5237, (OG 25611, 12.10.2004) (Article No: 142-1-f).

high-energy intensity in industry, further strong policies are needed in order to enhance energy efficiency of the sector. In order to promote energy efficiency of the industry sector, implementing an industrial energy efficiency strategy, reducing energy intensity and providing and improving financial capabilities for industry for energy efficiency investments are considered as important instruments. Implementing an effective industrial strategy needs analyzing the energy efficiency potential for rational use of energy and identifying measures. Also, sufficient monitoring and evaluation of energy consumption contributes to the effective implementation of such a strategy.

As it is highlighted in Section 4.2.1 and 4.2.2, greatest energy efficiency improvement is achieved in industry sector both in Denmark and Germany. These countries developed voluntary measures by taking into consideration the fact that industry would implement the most cost-effective measures for being competitiveness. However, there are no voluntary energy efficiency measures in Turkish industry. Voluntary agreements with the industry sector are important instruments for the promotion of efficiency of the sector. For example, in German industrial sector the dominating instrument to improve energy efficiency are voluntary agreements. As Table 4.10 in Chapter 4, illustrates German voluntary agreements have contributed to nearly 2.7 Mtoe energy savings for the period 2000-2004. Voluntary agreements with Turkish business on reducing energy consumption or greenhouse gases would contribute to promotion of energy efficiency. In addition, voluntary agreement for the promotion of CHP with German business forms a good model for Turkish industry.

In order to reduce energy intensity of the sector, particularly in energy intensive industries, further usage of industrial CHP would definitely contribute to the sector's efficiency. As it is highlighted in Section 3.2.2.1, CHP plants can improve energy efficiency up to 55% when compared to 30-40% efficiency of conventional generation of electricity. Denmark is the best performing country in CHP operation, thus, reflected to the energy intensity of

the sector. As it is emphasized in Section 3.2.2.1, CHP has developed fast due to governmental support in industry sector in Turkey. At this point, further promoting the usage of CHP in industry is an important instrument as Denmark provides a good example.

Scarce financial resources for energy efficiency measures in industry prevent the promotion of energy efficiency in industry. Improving legal framework to enable financing of energy efficiency projects by third party financing and supporting the establishment of ESCO in order to provide financial and fiscal incentives, are good instruments for alleviating financial strains. Developing financial support mechanism, e.g. tax deduction, is of crucial importance. Bearing in mind the positive effects of Danish Green Tax Package on promoting energy efficiency of Danish industry, implementation of a similar tax package would have positive impacts on efficiency and as well as competitiveness of the business.

Energy efficiency is directly linked to research and development (R&D) policy. Projects that would be developed for the promotion of energy efficiency would also affect industrial competitiveness. Energy efficient technologies are essential for promoting energy efficiency especially in industry sector. However, there has been no specific national R&D programme related to energy in Turkey. Lack of an R&D policy is an important barrier for increasing competitiveness of the industry. Allocating a budget for an energy R&D programme would both improve end-use energy efficiency in industry and encourage manufacturers to produce more energy efficient products. At this point, effective collaboration with the EU in the context of 7th Framework Programme offers a helpful opportunity for Turkey.

Lastly, it is important to update the 1995 Regulation on the measures to be taken to increase energy efficiency in industrial establishments, for ensuring better alignment with the related EU legislation. Supporting demonstration projects for increasing energy efficiency in small and medium sized

enterprises, extension of the existing energy management training programmes and wide scale dissemination of related training documents are also important instruments for enhancing energy efficiency of industry sector.

Concerning buildings, the main goal is to increase living comfort and to reduce costs for heating and lighting. Heat losses of buildings are high due to insufficient insulation of existing buildings and heating systems. Despite the low level of income of consumers, rehabilitation of existing buildings and heating systems through more effective implementation of the thermal insulation regulation standards is important for saving energy without loss of amenity. At this point, financial mechanisms, like low-interest loans to improve energy efficiency in existing buildings, gain importance. Housing Modernisation Programme, which supports consumer to invest in energy efficiency improvements, accounted for additional 1.2 Mtoe energy savings between the period 1995-2005 in Germany. In this regard, developing a similar financial mechanism like Housing Modernisation Programme would support the consumers in financial difficulties.

Introducing energy efficient technologies, e.g. small scale CHP for heating in buildings, contributes promotion of energy efficiency in the buildings. As it is seen in Danish case, using CHP plants in buildings has contributed both to increase efficiency and reduce CO_2 emissions. In addition to industrial usage, support may be given by the government for the usage of CHP plants, particularly in new buildings.

As a general barrier to energy efficiency, energy consumers in Turkey have limited information about energy efficiency issues. They have scarce or no knowledge about energy consumption of home appliances or office equipment they use. In this point of view, widespread use of product labelling is needed to bring performance and energy consumption of the equipment to the attention of the consumers. Energy labelling has proved to be a substantially effective measure in increasing the choice and sales of the most

energy efficient appliances on the market. Increasing demand for the most energy efficient products is also an important factor motivating manufacturers to develop more energy efficient technologies. Labelling systems for both household and office equipments have worked successfully in Germany and IEA (2004c) declared that Germany has taken a leading position in the sale of energy efficient appliances of class A. According to Eichhammer et al. (2004), an addition electricity savings of 0.48 Mtoe is expected for the period 2005-2010 by the labelling systems. As a result, further implementation of energy labels is of crucial importance for Turkey for facilitating comparisons between different competing products.

In addition to labelling of products, application of mandatory energy labels for houses and apartments is beneficial for informing potential buyers of a property's annual energy consumption and its environmental impact. At this point, energy labels for buildings would demonstrate the energy saving potential and would encourage people for taking energy efficiency measures. For example, according to IEA data (2004b), Danish Labelling Scheme has resulted in labelling of buildings from 40.000 to 50.000 every year and 45% of the owners of labelled houses actually invested in saving measures. Within this perspective, a similar application for Turkey would obviously have positive impacts for energy saving, especially in new buildings.

Similarly, consumers have insufficient awareness on the rationale of energy efficiency measures that could be implemented for reducing the energy consumption. Information on the performance of energy efficiency investments is often difficult to acquire in Turkey. Energy efficiency is not perceived as an investment and usually consumers undervalue energy efficiency in comparison with other investments. In fact, apart from limited awareness, lack of financial resources also plays an important role in this perspective. Low level of income prevents consumers from taking energy efficiency measures. People in Turkey have other priorities rather than energy efficiency investments due to financial strains.

Moreover, training people who are working in the energy sector or related sectors, constitutes an important instrument for promoting energy efficiency. When constructing buildings, architects, engineers or heating system installers need to have enough knowledge about the latest technologies to make energy-savings possible.

In this respect, training people on energy efficiency measures and raising public awareness on energy efficiency issues are of paramount importance. In order to promote public awareness, professional associations, chambers, unions, schools and media are crucial instruments for preparing coherent and targeted information and awareness campaigns. Like German public awareness campaign, Initiative EnergieEffizienz, which aims to raising energy efficiency in private households, a similar large nationwide information campaign launched by NECC and private companies would be beneficial for raising the awareness of the public. Publishing reports and articles in newspaper and magazines and television and radio broadcasting would be beneficial for raising energy efficiency awareness. Similarly, taking active role in EU's recent public awareness campaign, "Sustainable Energy Europe 2005-2008", which aims to raise public awareness and disseminate know-how for promoting sustainable energy production and use among individuals and organisations, private companies and public authorities, professional and energy agencies, industry associations and NGOs across Europe, would be useful in this regard. Besides, providing technical and financial assistance to consumers through effective instruments, information, consulting, loans, is necessary for implementing proper measures to achieve better energy efficiency.

Concerning transportation sector, there have been no comprehensive and coordinated policies and programmes to encourage energy efficiency except for limited applications in big municipalities for developing public transportation. Extending and increasing the quality of subway, light rail and

tram network is of paramount importance for reducing usage of private cars and thus fuel consumption. Moreover, in order to reduce fuel consumption, Kavak (2005) pinpoints the fact that slow flow of traffic should be prevented by regulating traffic congestion and increasing traffic controls.

Moreover, adopting action plans including targets for reducing CO_2 emissions, like Danish transport action plans, which impose ambitious CO_2 reduction targets for Denmark, make pressures on promoting the efficiency of vehicles. It is important that energy efficiency become a guiding principle in the development of transport policy. Better statistics could help in developing appropriate policies and measures and in monitoring their effectiveness. The improvement of coordination among the different ministries responsible for transport, private cars, taxation and energy policy is also of crucial importance.

For increasing efficiency in transportation sector, encouraging the use of alternative transport fuels is needed. Bio-fuels as well as fuel cells and hydrogen technologies are among the priorities of R&D in Turkey. In parallel, one of the priorities of 7^{th} R&D Framework Programme of EU is fuel production from renewable energy sources. In this perspective, establishing close cooperation with the EU in the context of 7^{th} Framework Programme would be an opportunity for Turkey for developing new technologies on alternative transport fuels.

It is also important that new cars must be as fuel-efficient as possible. In this context, voluntary measures could be introduced in transportation sector. Voluntary agreements with automobile industry on reduction of fuel consumption would contribute to both increasing efficiency and protection of environment. Support could be given by the government for voluntary agreements to reduce consumption and emissions of cars and trucks, like in Germany. Germany envisages reducing energy consumption by 3.5 Mtoe for the period 2005-2010 by the contribution of voluntary agreements.

Encouraging usage of low pollutant emissions cars, introducing new regulatory measures, particularly purchase tax based on vehicle fuel economy or CO_2 emissions and circulation tax incentives, like the ones foreseen Motor Vehicle Tax Act of Germany, can contribute to the promotion of energy efficiency in the transport sector.

5.4 Environmental Measures

Concerning environmental protection, Turkey neither has any international or national commitments for reducing emissions nor any strategy or programme for climate change. As it is pinpointed in preceding sections, defining strict targets for reduction of emissions, makes pressure for the efficient use of energy.

Denmark and Germany have national and international commitments in the context of Kyoto Protocol and Burden-Sharing Agreement of 1998 for reducing emissions. Adopting a legally binding international commitment for reducing greenhouse gas emissions would definitely contribute to promotion of energy efficiency as it is shown both in Danish and German cases. However, Turkey has not signed the Kyoto Protocol and has not defined a specific target for reduction of greenhouse gasses yet. Bearing in mind the fact that Kyoto Protocol is a part of the EU environment acquis, determining targets for reducing emissions as soon as possible is of crucial importance. However, currently Turkish government strongly rejects signing the Kyoto Protocol and adopting a binding emission reduction target in near term due to relatively low level of economic development and low level of per capita emission compared to other OECD countries. IEA (2005a: 48) recommends to the government the adoption of a national non-binding target for reduction of greenhouse gas emissions. It seems a rational recommendation for the efficient use of energy; however, it should be pinpointed that the impact of such a target would be low due to its non-binding nature.

A comprehensive climate change strategy including set of measures in the fields of energy efficiency, renewable energy sources and CHP is necessary for reducing emissions. In this perspective, German Climate Protection Programme, which contains several sectors like transportation, buildings, agriculture or forestry, is a good example. Turkey could adopt such programmes or strategies in environment sector and a more proactive stance in environmental issues.

5.5 General Evaluation of Measures

In preceding sections, recommendations have been made regarding promotion of energy efficiency in Turkey by also taking into consideration the best practises of the EU, Denmark and Germany. This section attempts to evaluate the viability of each of these recommendations by taking all analyses into consideration, which are made throughout this study. However, it should be highlighted that the evaluations are not based on deep feasibility cost analyses. In this respect, Table 5.1 attempts to indicate a general evaluation of proposed measures.

Table 5.1 General Evaluation of Proposed Energy Efficiency Measures for Turkey

Sectors	Proposed Measures	Term*	Viability**
All	Draft EE Law	Short	High
All	Cooperation/Coordination	Short	High
All	Strategies	Medium	Medium
All	Administrative Capacity	Medium	Medium
All	Financial Incentives	Medium	Medium

Table 5.1 continued			
All	Cost-Reflected Energy Prices	Medium	Medium
Transmission/ Distribution	Privatisation of Distribution Assets	Short	High
Transmission/ Distribution	Heavier Punishment	Short	Low
Transmission/ Distribution	Control Systems	Medium	Medium
Transmission/ Distribution	UCTE Connection	Medium	High
Transmission/ Distribution	DSM	Long	Low
Transmission/ Distribution	Underground Cabling	Long	Low
Industry	Voluntary Agreements	Short	High
Industry	Training Courses	Short	High
Industry	CHP	Medium	Medium
Buildings	Public Awareness	Short	High
Buildings	Energy Labels for Equipments	Medium	High
Buildings	Financial Measures	Medium	Medium
Buildings	Energy Labels for Buildings	Long	Low
Buildings	Small Scale of CHP	Long	Low

Table 5.1 continued			
Transportation	Voluntary Agreements	Short	High
Transportation	Tax Incentives	Medium	High
Transportation	Action Plans	Medium	Medium
Transportation	Traffic Congestion and Traffic Controls	Medium	Medium
Transportation	Alternative Transportation Modes	Long	Low
Transportation	Alternative Transportation Fuel	Long	Low
Environment	Comprehensive Climate Change Strategy	Medium	Medium
Environment	National Non-Binding Emission Reduction Target	Medium	Low
Environment	Signing Kyoto Protocol	Long	Low

Source: Own Evaluation.

* "Term" refers to a time period that is needed for the implementation of proposed measure. In this respect, "short term" refers to 1-2 years, "medium term" refers to 2-5 years and "long term" refers to 5-10 years and above.

** "Viability" refers to the possibility of taking proposed measure by taking into consideration the required financial and human resources of the proposed measure. In this regard, "high" refers to lowest costs and/or lowest human resources, "medium" refers to medium costs and/or medium human resources, "low" refers to highest costs and/or highest human resources.

Concerning general measures, two short-term priorities can be identified. Priority should be given to the enactment of Draft Energy Efficiency Law, which is envisaged to be in force by mid 2006. Also strengthening cooperation and coordination between the main stakeholders in the field of energy efficiency can be considered as a short-term priority. It should be easy to determine responsible experts and contact points in each institution in order to form a platform for exchanging of views. Within this perspective,

these two priorities are achievable in the short-term and they would have less financial burden on the government budget.

Adoption of integrated and targeted strategies can be identified as a medium term priority, since developing an effective strategy necessitates assessment of needs. In addition, developing strategies needs significant human resources. Another medium-term priority would be strengthening administrative capacities of NECC and related institutions. Improving administrative capacity by means of increasing the quantity of personnel is easy since it requires less cost. However, it is relatively difficult to promote the quality of existing administrative capacity. Developing financial or fiscal incentives is possible in medium term since the Draft Law on Energy Efficiency will create the necessary legal base for these incentives, however they oblige costs. Lastly, determining cost reflective energy prices can be considered as a medium-term priority. When privatisation takes place, cross subsidies will be abolished since private companies will reflect their costs to their prices. Therefore, it seems possible to ensure cost reflective energy prices in the medium-term.

Regarding transmission/distribution stages of energy, attention should be paid to electricity thefts. In this context, privatisation of distribution assets could be the short-term priority and the probability for privatisation seems high since the Electricity Sector Reform and Privatization Strategy Paper envisages the privatisation of the distribution sector until the end of 2006. Secondly, as a short-term priority, implementing heavier punishment would be identified. Despite its substantial impact on preventing thefts, the execution of such a sentence in particular long-term imprisonment punishment is extremely difficult. Therefore, implementing heavier fines would be more sensible even if the possibility of collection of revenues would be low. Therefore the viability of heavier punishment is indicated in Table 5.1 as “low”, although it requires no substantial financial and human resources.

Thirdly, widespread implementation of SCADA/DMS and ABONE-NET systems should be considered as medium-term priorities. Since they need substantial investments, the viability of widespread implementation of these systems is medium. It should be noted that if the privatisation takes place, private sector would finance these required investments. Fourthly, UCTE connection can be considered as a medium-term priority, since studies for interconnection are continuing and are planned to be completed in 2007. Within this perspective, although the connection necessitates substantial investments, the viability of ensuring connection is high.

Lastly, as long-term priorities, demand side management and underground cabling can be identified. Demand side management entails technical studies for reducing demand in peak times, consultancy for consumers on reducing demand and proper metering equipments for multi-timing tariffs. Therefore, as demand side management both obliges substantial human and financial resources, the achievability seems low. Another long-term priority would be underground cabling both for transmission and distribution grids, which would contribute to reduction of technical and non-technical losses. However, since underground cabling requires large investments, as highlighted in Chapter 2, the possibility for burying all grids is extremely low. In this perspective, underground cabling for all transmission and distribution grids can be considered as an ambitious target. Even if privatisation takes place, it is an extremely difficult task for private sector to bury all distribution lines.

Concerning industry sector, since the Draft Energy Efficiency Law will provide the legal basis for voluntary agreements, it would be possible to develop voluntary agreements with industry in short-term. In addition, voluntary agreements require less financial and human resources. Secondly, widely implementation of training courses for industry can be adopted as a short-term priority. As these courses have been continuing since 1997, increasing the quality of these courses and ensuring the widespread implementation throughout the country could be easy. Lastly, as a medium-term priority,

supporting further usage of CHP plants could be identified. It is highlighted in Section 3.2.2.1 that Turkish government gives support to CHP plants. Therefore, although it needs costs, the viability of converting to CHP plants in particular in big industries is medium. To sum up, the industrial measures have financial burden on both government and industrial establishments.

Regarding building sector, as they require small budget from the government, demand side measures, namely promotion of public awareness, can be identified as a short-term priority. Secondly, widespread usage of energy labels for appliances would be a medium-term priority and it requires less financial and human resources from the related industry branches. Thirdly, developing financial measures to cope with financial difficulties would be a medium-term priority. Since Draft Energy Efficiency Law will provide the legal basis for financial measures, it seems possible to develop subsidies and soft loans for buildings, although they need budget from the government.

As long-terms priorities, energy labels and CHP plants for buildings could be recommended. However, in a large country like Turkey, it is extremely difficult to prepare energy labels for all buildings (existing and new) both for consumers and government. Therefore, preparing energy labels in particular for all existing buildings is not very realistic since it calls for substantial human and financial resources. In this regard, attention could be paid to new buildings. It is comparatively easy to prepare an energy label while constructing. Lastly, installing small scale of CHP plants for buildings can be identified as a long-term priority. As large investment is needed for existing buildings, it would be recommended for new buildings, however it seems difficult even for new buildings.

Regarding transportation sector, voluntary agreements with automobile industry on reduction of fuel consumption could be adopted as a short-term priority. Since they would have less financial burden on both for government and automobile industry, voluntary agreements would be achievable.

Secondly, implementation of tax incentives for the reduction of fuel consumption or emissions can be adopted for medium term since they require less cost. Thirdly, as a medium-term priority, action plans or strategies can be recommended. Fourthly, regulating traffic congestion and increasing traffic controls would be adopted as a medium-term term priority. However, as both financial and human resources are needed the possibility for this measure seems medium. Fifthly, extending and increasing the quality of alternative transportation modes would be adopted as a long-term priority. However, as it requires significant investment from the government it seems extremely difficult for realization. Lastly, developing alternative transport fuels would be considered as a long-term priority. Although it will have a substantial impact on energy efficiency, it is a difficult task since it requires new and advanced technologies.

Concerning environmental protection, it is worthwhile to pinpoint the fact that all measures require heavy investment both for government and private sector. It should be underlined that it is an extremely difficult task to promote energy efficiency by taking environmental measures in Turkey. Developing a comprehensive climate change strategy including set of measures for promoting energy efficiency can be adopted as a medium-term priority. Secondly, adopting a national non-binding emission reduction target would be a medium term priority; however adoption of such a target seems difficult particularly when relatively early stage of industrialisation is taken into account. Lastly, signing Kyoto Protocol would be adopted as a long-term priority bearing in mind the fact that Kyoto Protocol constitutes a part of EU environment acquis. It should be pinpointed that if the current ongoing process for EU membership would be stopped or suspended, signing Kyoto Protocol seems an ambitious target even in the long-term period.

CHAPTER 6

CONCLUSION

This thesis aims to determine the barriers to the promotion of energy efficiency in Turkey and attempts to suggest possible solutions for overcoming these barriers by taking into consideration the EU experience at the Union and Member State levels.

The first main Chapter in the thesis gives main information about the energy efficiency concept. Energy efficiency, which is started to develop and gain importance following the first oil crisis in the early 1970s, has again come up to the world agenda recently due to high oil and gas prices and environmental concerns. Considering the existing common valid definitions of energy efficiency that are discussed in Chapter 2, although energy efficiency is the most effective utilisation of energy sources in energy cycle in broadest sense and covers production, transmission, distribution and consumption stages, energy efficiency at the production stage of energy in power plants is not covered within the context of this thesis since it consists of micro level technical engineering issues. In this respect, only transmission/distribution and consumption stages of energy are taken into consideration throughout the thesis.

According to the findings of Chapter 2, energy efficiency has vital economic, environmental and energy security benefits. However, apart from all these benefits, promoting energy efficiency is not an easy task due to major obstacles that prevent the promotion of energy efficiency. These barriers can be grouped into two categories, “common barriers” that exist nearly in all countries, namely lack of information and awareness on positive aspects of

promotion of energy efficiency, lack of capital and rapid payback requirements for energy efficiency investments, and “peculiar barriers” that may not exist in every country, like non-cost reflective energy prices, lack of legislation, low level of coordination between relevant stakeholders and high level of electricity losses.

In case of these aforementioned barriers, it is generally accepted that government’s intervention is needed. For alleviating these barriers, governments designate energy efficiency policies, measures or instruments. These measures and instruments can be classified in six main categories: financial measures, legal or regulatory measures, voluntary measures, demand side measures, infrastructural measures and restructural measures. Finally it is concluded in Chapter 2 that although each of these instruments are designated for overcoming energy efficiency barriers, the degree of effectiveness and overall cost of each policy instrument vary according to country-specific circumstances.

The Third Chapter focuses on energy and energy efficiency policies of Turkey. In the scope of this Chapter, firstly, Turkish energy policy has been explained briefly. The initial finding of this Chapter demonstrates that Turkish government assigns due emphasis to the liberalisation of national energy market in the process of candidacy for EU membership. Secondly, energy efficiency performance is examined. It is seen that energy intensity level is far above from the developed countries. Findings have shown that although efforts for promoting energy efficiency have been accelerated in 2000s, there are crucial problems and deficiencies in transmission/distribution and consumption stages of energy in Turkey.

According to findings of Chapter 3, the most serious problem is high rate of electricity distribution losses concerning transmission/distribution systems. Nearly 18.6% of total electricity production is lost during distribution phase in

2004 in Turkey. These substantial losses have negative impacts on economy and threaten human health and safety.

Concerning consumption stages of energy, Chapter 3 provides an in-depth evaluation of end-use sectors in Turkey. As regards industry sector, findings have shown that in addition to legislative measures, attention is mainly paid to raising awareness and training of energy managers. There are no voluntary measures in industry. Concerning building sector and household equipments, the results have shown that although there is a substantial energy saving potential in buildings, there are only few legislative measures. Transportation sector has received less priority from the government when compared to other end-use sectors, despite its substantial capacity for energy saving. In the scope of energy efficiency studies, there has been no legislation, regulation or standard on efficient use of energy in transportation sector.

In scope of Chapter 3, lastly, relationship between environmental protection and energy efficiency is taken into evaluation as environment is directly affected by the level of energy consumption. There is no all-encompassing programme or a comprehensive climate change strategy for reducing greenhouse gas emissions in Turkey. As a matter of fact, Turkey has no binding national or international commitments for decreasing emissions, which would make pressure on promotion of energy efficiency.

According to the findings of Chapter 3, Turkey has some crucial barriers and deficiencies regarding promotion of energy. These problems are grouped into four categories, general problems like financial, institutional and managerial barriers concerning all sectors, problems about electricity transmission/distribution systems, problems concerning end-use sectors and problems concerning environmental protection. In order to overcome these barriers, Chapter 4 has offered energy efficiency instruments and measures that are successful in the EU both at the Union and Member States levels.

In the context of Chapter 4, firstly, energy efficiency policies at the EU level are evaluated. Energy efficiency policies and measures gained great importance since the oil crises in the mid 1970s due to the willingness to reduce import dependency throughout the EU. In this perspective, the findings have shown that focus is mainly directed to energy efficiency legislation. Except for energy efficiency legislation, very limited attempts have been made to tackle energy efficiency issue at the EU level since 2005. Energy efficiency measures have already been taken in the past, but they are mainly limited to Member States initiatives. This is mainly due to the lack of a common energy policy at the EU level. However recent higher oil and gas prices and Kyoto commitments, make the energy efficiency a core objective of the EU energy policy in 2005. It is realized that Member States initiatives are not sufficient for the promotion of energy efficiency, and it is needed to adopt measures at the EU level. In this perspective, the European Commission has launched a new energy efficiency initiative comprised of comprehensive measures to be taken at the EU level as well as all layers of society in order to reinforce energy efficiency. However, with a significant potential on developing competitiveness, sustainable development and security of supply, it is a new initiative, hence, effects and results of these measures are unknown as of today.

In this perspective, to obtain more contribution for Turkey for promoting energy efficiency, two best practises within the EU, namely Denmark and Germany, have also been evaluated in the scope of Chapter 4. At the state level, Denmark and Germany have promoted energy efficiency successfully. After the oil crises, Denmark and Germany had launched a series of action plans and programmes for promoting energy efficiency in all sectors of the economy.

Findings of this section have shown that energy efficiency in Denmark is well developed due to improved efficiency in transmission/distribution phases of

electricity and energy consumption at the end-use sectors. As a wealthy country with 29 thousand US dollars annual per capita GDP, Denmark is not facing with electricity thefts. Moreover, technical electricity losses are at acceptable level due to small geographic surface, underground cables and strong implementations on demand side management.

Concerning en-use sectors, in addition to targeted and integrated policies, many other factors have impacted energy efficiency policies of Denmark. The greatest improvement has been achieved in industry sector. As it is shown in Chapter 4, 24.3% improvement has been achieved between 1990-2002 in industry sector mainly from voluntary agreements with industry and greater usage of CHP plants. Regarding buildings improvement rate is relatively low when compared to industry sector. For the same period Denmark exhibited 9.3% energy efficiency improvement by the contribution of energy labelling systems and CHP like in industry. Concerning transportation sector, action plans have both served to the promotion of energy efficiency and protection of environment. The improvement level for the same period is 18.2%. In addition to end-use sectoral measures, environmental concerns have also put pressure on government for taking further energy efficiency measures.

Like Denmark, Germany has also well promoted energy efficiency when compared to other Member States. German energy policy is highly influenced by environmental concerns. Therefore, energy efficiency policies have been given more priority as increases in energy efficiency contribute to the reduction of CO_2 emissions. Concerning transmission/distribution phases of electricity, it is seen that Germany is very efficient with a total loss of 5.1% of total electricity production in 2000. This is mainly due to underground cabling, the quality of lines, demand side management and high level of GDP, like in Denmark.

Concerning end-use sectors, greatest improvement is achieved in industry sector like in Denmark. German industry exhibited a 32.4% improvement

between 1990-2002. The dominating instrument for promoting energy efficiency is voluntary agreements. Voluntary agreements with German business have contributed to the reduction of nearly 2.7 Mtoe for the period 2000-2004. Building sector demonstrated a 22.7% energy efficiency improvement between 1990-2002, mainly due to substantial saving potential in buildings in East Germany after the reunification. Concerning transportation sector, improvement rate was relatively low, 9.4% for the same period. Voluntary agreements with automobile industry have contributed to this improvement as it is indicated in Chapter 4.

In the light of the findings of Chapter 4, Chapter 5 tried to form a general perspective for Turkey on the basis of determined problems and bottlenecks; and possible solutions are suggested by taking into consideration lessons learnt from best practices of the EU, Denmark and Germany as the main aim of this thesis. Within this context, Chapter 5 has offered measures, which could be taken in short, medium and long terms.

As an overall conclusion, there is a substantial energy saving potential in Turkey. According to forecasts of Ministry of Energy and Natural Resources (2004), total energy conservation potential of Turkey is about 20 Mtoe annually, which is equal to one fourth of the primary energy consumption. The financial value of the potential is 3 billion US dollars annually. These figures highlight the fact that Turkey uses energy inefficiently. In this regard, energy efficiency measures offer advantages for Turkey, in particular in reducing external energy dependence.

There is a significant energy saving potential in every stage of energy cycle, production, transmission/distribution and consumption phases. Energy efficiency measures generally require investment and costs. As promoting energy efficiency is a governmental function, it is necessary to allocate a certain portion of the government's budget to realizing energy efficiency measures. In some cases, private sector's contribution is also needed for

covering these expenses. In this perspective, bearing in mind the limited economic resources of Turkey, priority should be assigned to measures that will yield utmost contribution to the promotion of energy efficiency. Therefore, efforts should be directed to reduce energy losses. Nearly 22% of total electricity production is lost while transmitting electricity from power plants to the consumers. Therefore, especially electricity distribution losses offer a substantial saving potential. However, it is relatively difficult to reduce these losses in the short-term since it requires investment.

As it is highlighted in Chapter 3, there is significant energy conservation potential in Turkish industry. Besides, bearing in mind the fact that Turkish industry is very energy intensive, more attention should be paid to industrial measures for promoting energy efficiency of the sector. As it is pinpointed in Chapter 4, Denmark, Germany and as well as the EU have well promoted energy efficiency in industry sector when compared to other sectors. Measures applied in the industry sector are more productive owing to cost reduction concerns of the business. Among all of the measures, voluntary measures could be the dominating instrument, as they necessitate less cost. In addition, Draft Energy Efficiency Law will provide legal basis for taking energy efficiency measures in the industry sector.

Although other sectors like buildings and transportation offer a significant potential, contributions to promotion of energy efficiency would be relatively limited in the medium-term. It is an extremely difficult task and needs significant budget to promote energy efficiency of buildings in particular already existing ones. Generally people in Turkey have other priorities rather than taking energy efficiency measures due to financial strains. Applying energy efficiency measures to newly constructed buildings is comparatively easy. Therefore, as a first step, attention should be paid to new buildings.

Transportation sector has received less priority from the government and there has been no legislation, regulation, standard or an action plan on

efficient use of energy in transportation sector. Within this perspective, it is fairly difficult to identify measures in short-term since there is no legal basis. In addition, as there is no comprehensive study in transportation sector, assessment of needs is necessary in order to identify proper measures. Nevertheless, by taking the best practises of Denmark and Germany into consideration, it is recommended to assign due importance to adopting action plans and to making voluntary agreements with automobile industry for producing more fuel efficient cars.

Regarding the relationship between environmental protection and energy efficiency, it is worthwhile to point out the fact that it is extremely difficult to promote energy efficiency by taking environmental measures, such as adopting emission reduction target, in Turkey bearing in mind that all measures require heavy investment. Although Denmark, Germany and as well as all developed countries of the EU have adopted environmental measures which make pressure for ensuring promotion of energy efficiency, it seems not possible for Turkey for short and medium terms.

This study attempted to suggest solutions for barriers to promotion of energy efficiency taking into consideration the experiences of the EU, Denmark and Germany. This study tries to draw a general perspective for potential measures that can be taken. Therefore, in addition to this study, for ensuring a full picture, a deep cost analysis can be done in order to determine precise costs of proposed measures. Moreover, for ensuring contributions to Turkey in this area, further studies can be carried out by evaluating other countries practices on promotion of energy efficiency, like new Member States of the EU, which are not energy efficient or like Japan, which is the most energy efficient country in the world.

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