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YÜKSEK LİSANS TEZİ

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ONAY SAYFASI

Enstitümüz AB Siyaseti ve Uluslararası İlişkiler Anabilim Dalı Yüksek Lisans öğrencisi Selma ŞEKERCİOĞLU'nun ***"RENEWABLE ENERGY: IN THE CONTEXT OF TURKEY'S ENERGY POLICY WITH SPECIAL REFERENCE TO THE EU POLICIES"*** konulu tez çalışması 25.08.2011... tarihinde yapılan tez savunma sınavında aşağıda isimleri yazılı jüri üyeleri tarafından oybirliği / oyçokluğu ile başarılı / ~~başarısız~~ bulunmuştur.

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ONAY
DAKTALI Y.
Prof. Dr.

23/08/2011 tarih ve 2011/VIII Sayılı Enstitü Yönetim Kurulu kararı ile onaylanmıştır.

ACKNOWLEDGEMENTS

Foremost, I would like to thank my supervisor Assist. Prof. Dr. Mustafa Yılmaz who gave me an opportunity to search on this thesis subject. Then, I would also thank Assoc. Prof. Dr. Mehmet Alkan for his lasting supports and Assist. Prof. Dr. Armağan Emre Çakır for his guidance and supports throughout this thesis.

Specially, I want to express my gratitude towards Prof. Dr. Tanay Sıdkı Uyar, Mustafa Çetin and Zeki Aybar Eriş for accepting to make interviews with me and for contributing to my thesis.

I would also thank my sincere friend Gizem Genç for her significant contribution to my English expressions and to my sister Seda Şekercioğlu for her helps during the writing process of this thesis.

Finally, I would like to thank my family and my close friends that I cannot count here for their endless support and encouragements during my studies. Especially I want to express my gratitude to my father Özalp Şekercioğlu and my mother Şerafet Şekercioğlu for their great patience.

ABSTRACT

Renewable energy has started to gain importance after the 1970's in parallel with the developments in the World system. But the construction of renewable energy policies both in the EU and Turkey has accelerated after the millennium. In order to examine Turkey's renewable energy policy in comparison with the EU policies, it is necessary to look at their historical processes. In this historical process it has been seen that there were some problems about decision making styles. For Turkey the difficulties arise from the fiscal and technical problems whilst in the EU the problems were related with the Union structure. After 2000's there was a good progress in renewable energy policies but for Turkey the existing policies are not sufficient enough to have an efficient strategy. Moreover the existing support mechanisms are not enough to urge the renewable energy investments. There is a need for constructing a well designed and comprehensive energy policy with the involvement of different actors from different categories. From this framework, it is a necessity to assess Turkey's renewable energy policy with its future projection perspective.

Keywords: Renewable energy policy, the EU, Turkey

ÖZET

Yenilenebilir enerji, Dünya sistemindeki gelişmelere paralel olarak 1970'lerden sonra önem kazanmaya başlamıştır. Fakat hem AB'de hem de Türkiye'de yenilenebilir enerji politikalarının inşası milenyum sonrasında hızlanmıştır. Yenilenebilir enerji politikasını AB ile karşılaştırmalı olarak inceleyebilmek için tarihsel süreçlere bakmak gerekmektedir. Bu tarihsel süreçte karar alma stilleri ile ilgili bir takım sorunların mevcut olduğu görülmektedir. Bu sorunlar AB için Birlik yapısıyla ilgiliyken, Türkiye'nin yaşadığı güçlükler mali ve teknik problemlerden kaynaklanmaktadır. 2000'lerden sonra yenilenebilir enerji politikalarında iyi bir ilerleme gözükse de Türkiye için mevcut politikalar etkili bir strateji oluşturmak için yeterli değildir. Dahası mevcut destek mekanizmaları yenilenebilir enerji yatırımlarını desteklemek için yeterli değildir. Farklı kategorilerden farklı aktörlerin katılımıyla gerçekleşecek iyi tasarlanmış ve kapsamlı enerji politikasının inşa edilmesine gerek vardır. Bu çerçevede Türkiye'nin yenilenebilir enerji politikasının gelecek kestirimi perspektifi ile değerlendirilmesi gerekmektedir.

Anahtar Kelimeler: Yenilenebilir enerji politikası, AB, Türkiye

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ABBREVIATIONS

BO	:	Built-Operate
BOREN	:	National Boron Research Institute
BOT	:	Built-Operate-Transfer
BOTAŞ	:	Petroleum Pipeline Corporation
CBCC	:	Coordination Board on Climate Change
CCS	:	carbon Capture Storage
CIP	:	Competitiveness and Innovation Framework Programme
DG	:	Director General
DLR	:	German Aerospace Centre
EC	:	European Commission
ECSC	:	European Coal and Steel Community
EEPR	:	European Energy Programme for Recovery
EIA	:	Environmental Impact Assessment
EIB	:	European Investment Bank
EIEI	:	Electrical Power Resources Survey and Development Administration
EMO	:	The Chamber of Electrical Engineers
EMRA	:	Energy Market Regulatory Authority
ETİ MADEN	:	Eti Mine Works General Management
ETS	:	Emission Trading System
EU	:	The European Union
EURATOM	:	European Atomic Energy Community
EUROSTAT	:	European Statistics Office
EÜAŞ	:	General Directorate of Electricity Generation Cooperation
ETSAP	:	Energy Technology System Analysis Programme
EWEA	:	European Wind Energy Association
FiT	:	Feed in Tariffs
FP7	:	7^{TH} Framework Programme
GDP	:	Gross Domestic Product

GHG	**:**	Green House Gas
GWEC	**:**	Global Wind Energy Council
IEA	**:**	International Energy Agency
IEE	**:**	Intelligent Energy Europe
IKV	**:**	Economic Development Foundation
INOGATE	**:**	The Energy Cooperation Between the EU, Eastern Europe, the Caucasus and Central Asia
IPCC	**:**	International Panel on Climate Change
MAED	**:**	Model for Analysis Energy Demand
MENR	**:**	Ministry of Environment and Natural Resources
MFA	**:**	Ministry of Foreign Affairs
MoEF	**:**	Ministry of Environment and Forestry
MTA	**:**	General Directorate of Mineral Research and Exploration
NREAPs	**:**	National Renewable Energy Action Plans
NSE	**:**	Non-sustainable Energy
PİGM	**:**	General Directorate of Petroleum Affairs
PV	**:**	Photovoltaic
RE	**:**	Renewable Energy
RES-E	**:**	Renewable Electricity Market
SAVE	**:**	Specific Actions for Vigorous Energy Efficiency
SEE	**:**	State Economic Enterprises
SET	**:**	Sustainable Energy Technologies
SPO	**:**	State Planning Organization
TAEK	**:**	Turkish Atomic Energy Authority
TEIAŞ	**:**	Turkish Electricity Transmission Co. Inc.
TEK	**:**	Turkish Electricity Enterprise
TEMSAN	**:**	Turkish Electromechanics Industry
TEN-E	**:**	Trans European Networks
TETAŞ	**:**	Turkish Electricity Trading and Contracting Company Inc.
TGC	**:**	Tradable Green Certificates
TIAM	**:**	TIMES Integrated Assessment Model
TKİ	**:**	General Directorate of Turkish Coal Enterprises

TOR	**:**	Transfer of Operating Rights
TUBITAK	**:**	The Turkish Specific and Technological Research Institution
TPAO	**:**	Turkish Petroleum Cooperation
TTK	**:**	General Directorate of the Turkish Hard Coal Enterprises
TUIK	**:**	Turkish Statistical Institute
UNDP	**:**	United Nations Development Programme
UNFCC	**:**	United Nations Framework Convention on Climate Change
USA	**:**	United States of America
UK	**:**	United Kingdom
VAT	**:**	Value Added Tax
WCED	**:**	The World Commission on Environment and Development
WEC	**:**	World Energy Council

INTRODUCTION

Energy as one of the crucial policy area has been protecting its importance over a century. It is also the core element of the establishment of the EU. But with the changing World order, climate change, the finite characteristics of the fuel sources caused new researches on finding new, alternative and sustainable ways for meeting energy demand. Although renewable energy sources has been used for a long time for different purposes, people realized their benefits after the mid of the 20th century.

In the global level the environment problematic began with 1972 Stockholm Conference and has been continuing until now. Relatedly, the awakening in the energy policy has started in those times. Moreover, the other driving force behind this awakening was the 1973 and 1979 Oil Shocks.

In the EU after the Oil Shocks, there were some struggles creating a common energy policy in order to decrease energy dependence. But it could not be possible to set common goals until 21st century because the States have showed the energy issue under their rights of independence.

The changing dynamics in the World order and the increasing consumption rates in the EU urged the States to consider the situation and activate. Besides having a common energy policy, having a renewable energy policy started to gain importance. Germany's successful transition to renewable energy production since 1990's has also constituted an important reason behind this mobilization.

On the other side in Turkey, it is not possible to mention an energy policy until 1990's. Before that day, the planning was tried to be realised with the Development Programs and with transition to liberalization in 1980 the State has determined a liberalization aim for the energy sector. The lack of political will or fiscal and technical impossibilities were blocking the development of the sector. Because of that reason today the country still faces with the liberalization problems and tries to complete it.

In terms of renewable energy after the enactment of Electricity Market Law in 2001, the private sector started to make investment on the renewable energy sources. To the point the inadequacy of support mechanism have slowed this progress.

After considering the motives behind current policies it is possible to say that the main developments both in the EU and Turkey started after 2000. The process has begun before 2000, but the system became effective after the millennium. In this sense there is a parallelism between the EU and Turkey.

On the other hand Turkey's candidate status necessitates to study on the EU and Turkey's renewable energy policies comparatively to contribute the literature. Moreover, to make rational determination for Turkey's energy policy, it is crucial to take the EU as an important contributor.

The aim of the thesis is to contribute the literature examining Turkey's renewable energy potential, general energy policy and the EU policies in order to show the connection that they have and to show why Turkey needs to encourage renewable energy investments.

From this perspective the EU has some legal arrangements for encouraging renewable energy in the EU level. One of the important arrangements was Directive 2009/28/EC which determined obligatory targets for the member states in order to have 20% renewable share in the gross final consumption until 2020. Its importance also related with its obligatory nature.

As a turning point in Turkey's energy policy, the 2001 Electricity Market Law and the additional legal arrangements were aimed to organize the energy investments. So they do not have any future dimensions like the EU's Directive.

In the case of the energy potentials, both the EU and Turkey do not have a big potential on fuel based sources. But relatively they have good renewable energy potentials. It is a fact that the energy consumption rates have been increasing in two of them. Turkey with her development aims do not have intention to slow down its development progress. But the energy efficiency aim can stabilize the consumption

rates while the industry is growing up. It is also possible for the EU which has started to implement its energy efficiency aims and waiting a visible outcome in the consumption rates.

Within this study it has been preferred to look at the EU and Turkey's renewable energy policies comparatively and make a possible outcome for Turkey's future planning with referencing projections. Before starting to chapters there are some points that have to be mentioned. In this work in order to narrow the issue, some EU programs and legal arrangements will be overlooked. Only the most related ones with the issue will be examined. On the other hand in the case of renewable energy potential, there is not a comprehensive study made by the international agencies or the European Commission. So that, it has been preferred to use German Aerospace Centre's data and relatedly the Schreyer and Mez's feasibility study. In the case of consumption the Eurostat data will be used. Further, the sectors that have the proportion in the consumption rates will not be investigated in order not to make a complexity with indicators.

There are some studies on Turkey's renewable energy potential which strengths Turkey's chapter. The existing literature is enough in terms of determining energy potentials, installed capacities and consumption rates. For Turkey, in the case of legal arrangements again the related ones will be selected to be examined.

The array of the dissertation was arranged in an order that shows the EU and Turkey's distinctive situations. There are four main chapters. The first chapter namely, 'The European Union and Renewable Energy' aims to investigate the EU policy in a detailed way. After considering the historical policy background the current situations of renewable and non-renewable energy sources will be examined. Importantly, it will focus on the existing legal arrangements, support programs and tools. Finally it will mention the future planning.

The second chapter 'Turkey and Renewable Energy Policy' was designed as the same way with the first chapter and studies Turkey's renewable energy policy under the same headlines. The third chapter 'The comparison of Turkey and the EU's

Renewable Energy Policies' aims to compare the existing situations and argues the social cost analysis and the importance of support mechanisms. Firstly although it is difficult for that kind of technical work a theoretical background related with the politic will be tried to be given to the reader. Afterwards the physical structures of non-renewable and renewable energy sources will be compared. Then the support mechanisms like FiT and TGC's will be studied in detail. Additionally, in order to make a contribution to the literature and pave the way for more studies the case of social cost calculation will be mentioned within the bounds of possibility.

The fourth chapter 'The Future Projection of Turkey's Energy Policy' will consist of political aspects in their historical perspective. Moreover the liberalization and privatization processes will be mentioned. The role of domestic sources will also be an important part of the last chapter. Additionally, energy demand projection, support mechanisms and the structure of public corporations will be studied. Under the future projection the variables related with the energy consumption, TEAŞ's electricity capacity projection and suggestions for future planning will be examined.

Importantly for the last section some interviews will be made with different persons related with the issue. So, the last part besides the existing literature is leading on the interviews that help to understand the issue in a more proper way.

CHAPTER I: THE EUROPEAN UNION AND RENEWABLE ENERGY

1.1) THE GENERAL ENERGY POLICY OF THE EU

From general perspective, energy policy of the EU constitutes the main motivation of the Community in terms of struggling with negative effects of the new World order and Climate Change. Basically the concerns on security of supply, finite characteristics of fossil fuels and the climate change urge the Community to arrange new technologies in order to create more independent and moreover political community. This situation also changed the direction of the conventional policies.

There is a strong relation between the energy and climate change and basically they cannot be assessed apart from each other. Indeed, the preparation of the Climate and Energy Legislative Package in 2008 was a step for the further policies consist two of them. A functional energy policy has to consist an environment outlook.

Under this headline energy policy of the EU will be examined in a very detailed way. To start the section with the historical perspective of the EU Energy policy emphasizes the importance of energy for the sustainability of the Union. Then it focuses on current EU energy policy and the situation of the renewable energy sources. It also criticises the legislation, their implementation. As a final part it argues the future of renewable energy policy within the whole energy policy.

1.1.1) Historical Background of the EU Energy Policy

Since the first agreement which established European Coal and Steel Community (ECSC) the European Countries have been trying to construct an energy policy. The first steps were the establishment of ECSC in 1951 and European Atomic Energy Community in 1957. Those agreements paved the way for more integration. But importantly those two first agreements were not aimed to construct a common energy policy, on the other side they were ‘adopted primarily to ensure regular and equitable supplies of coal and nuclear energy in the Community’ (European Commission, 2000, online).

The needs to construct a common energy policy aroused after the 1973 and 1979 Oil Shocks in order to decrease oil dependence of the Community and led the construction of nuclear plants (Oktay and Çamkıran, 2006, p.161). Besides as stated in the Green paper there were attempts to have an energy chapter within the context of the Maastricht and Amsterdam Treaties which has failed. Preamble of the Amsterdam Treaty was the only part of the text that mentions energy (European Commission, 2000, online).

On the other side White Paper 1995 An Energy Policy for the EU and Green Paper 2000 on Security of Energy Supply were firstly claimed that there was a strong need to encourage a comprehensive policy for energy. In the 2000 Green paper it was argued that the EU use more energy than it produce and energy needs of the Union is increasing day by day (European Commission, 2000, online).

So there was a need to have more common strategy. But it was difficult to reach a consensus on the energy issue because of the national security concerns. In the 2006 Green Paper A European Strategy for Sustainable, Competitive and Secure Energy summarizes the six key areas for energy policy which are: 1)Competitiveness and the Internal Energy Market 2)Diversification of the Energy Mix 3)Solidarity 4)Sustainable Development 5)Innovation and Technology 6)External Policy (European Commission, 2006a, p.4-5). Those of the key areas constitute the main principles for the next strategies.

In 2007 the Commission prepared another report namely An Energy Policy for Europe. It was mentioned the challenges determined in the previous reports. Additionally it created a new strategic plan for the Community's energy future (European Commission, 2007b, p.3-5)

After 2007 there were several attempts for developing energy policy. SET Plan, Third Legislative Energy and Gas Package, Climate Action, Strategic Energy Reviews and lots of arrangements were set out to reach more comprehensive strategy.

In the 2010 the Commission prepared a new strategy for competitive, sustainable and secure energy (European Commission, 2010b, p.2). This strategy also

can be seen as a product of the 2009 Renewable energy Directive which will be examined later. In this section it is preferred to look energy issue from the overall perspective. To avoid the complexity the legislation on renewable energy has not been investigated under this headline. What is more the last Strategy prepared by the Commission will be examine as a final part of this section to create a holistic point of view.

1.1.2) The Objectives of the EU Energy Policy

Mainly there are three objectives which are security of supply, sustainability and competitiveness. These three objectives constitute the main background of the energy policy and were determined in the Green Paper 2006 which aimed to build new strategies in order to challenge with new era. With emphasizing the role of the energy in the EU citizens' life it warns the policy makers:

> Europe must act urgently: it takes many years to bring innovation on stream in the energy sector. It must also continue to promote diversity – of energy type, country of origin and transit. In this way it will create the conditions for growth, jobs, greater security and a better environment (European Commission, 2006a, p.4).

After 2006 Green Paper in the March 2007 European Council, the objectives of the energy policy was accepted by the Council and objectives became valid in the EU level. Besides three main objectives the Commission added to the next report that there are three points for the European energy policy in the beginning which are: 'combating climate change, limiting the EU's external vulnerability to imported hydrocarbons, and promoting growth and jobs' (European Commission, 2007b, p.5).

1.1.2.1) Security of Supply

It is vital for all countries to reach energy sources without any problem. According to UNDP World Energy Assessment, energy security means 'the continuous availability of energy in varied forms, in sufficient quantities, and at reasonable prices' (Khatib, 2000, p.113). So the first condition to have a secure energy is to reach the source easily.

For the EU there would be some problems. Disagreements with Russia and decreasing rates of the fuel sources threat the energy security and also security of supply. The EU realised that: 'With both energy consumption and dependency on oil and gas imports growing and supplies becoming scarcer, the risk of supply failure is rising' (European Commission, 2011a, online). Because of this fact they try to encourage new technologies for renewable energy and diversify suppliers.

The Union meets 54% of its energy needs from imports and if the EU would meet 2020 target its net import rates will remain at today's levels (European Council, 2011, p.2). On the other hand the EU meets its 34% of crude oil and 40, 8% of gas needs from Russia (European Commission, 2010a, p.21). (See figure 2 and 3). These rates constitute the 90% of Russian gas and 60% of Russian crude oil which increases interdependence between Russia and the EU (Paillard, 2010, p.70).

European Commission underlined the importance of having one voice in the energy policy in order to decrease its dependence of imports and also to diversify the suppliers not to confront any surprises like experienced in 2006 and 2009 gas crisis between Russia and Ukraine; 2007 and 2010 crises between Russia and Belarus:

> Today the EU has Memoranda of Understanding on energy with a large number of third countries. Europe should develop a new generation of "**energy interdependence**" provisions in broad-based agreements with **producer countries** outside Europe. Energy interdependence provisions should aim at a balance between security of demand and security of supply (European Commission, 2008a, p.8).

1.1.2.2) Sustainability

Sustainability is a term 'explicitly entails the right of future generations to the same opportunity of access to a healthy ecological future and the finite endowment of the Earth's resources as that of the present generation' (Matson and Carosso, 1999, p.1200). From the EU energy perspective the main idea behind the concept of sustainability is to encourage the Union to use renewable energy sources producing low carbon energy and to urge the states and citizens to use energy efficiently. From this point of view Energy policy consists of three main characteristics: '

> 1) developing competitive renewable sources of energy and other low carbon energy sources and carriers, particularly alternative transport fuels, 2) curbing energy demand within Europe, and 3) leading global efforts to halt climate change and improve local air quality' (European Commission, 2006a, p.17).

To the point, climate change can be assessed as one of the main elements of sustainability. To hold climate change can be realize with the improvements of renewable energy technologies which lead sustainable future. To the point Zamfir while explaining renewable energy support mechanisms says that:

> European Union is applying a range of policy instruments to encourage electricity from renewable energy sources and to bring nature closer to an environment friendly consumption (2009b, p.526).

So as the EU, energy policy has strong ties with environment in terms of negative outcomes of energy production processes like air or land pollution. Energy efficiency is also another dimension for sustainability. If energy is used efficiently there would be some decreases in the final energy consumption. Buildings in the EU are as one of the important energy consumers 'responsible for about 40% of the EU's total final energy consumption and CO_2 emissions' (European Commission, 2008b, p.2). It has planned that technological developments on building sector and energy certificate system will decrease total energy consumption. So the share of renewable energy sources in the final energy consumption will automatically increase. Additionally, energy efficiency affects climate change and CO_2 emissions in a positive way.

1.1.2.3) Competitiveness

Competitiveness is another tool of energy policy and it has three dimensions like sustainability which were determined in the 2006 Green Paper:

> 1) ensuring that energy market opening brings benefits to consumers and to the economy as a whole, while stimulating investment in clean energy production and energy efficiency, 2) mitigating the impact of higher international energy prices on the EU economy and its citizens and 3) keeping Europe at the cutting edge of energy technologies (European Commission, 2006a, p.17-18).

Supporting new technological mechanisms within the internal market requires having more competitive industry and on the other hand 'industrial competitiveness

requires a well-designed, stable and predictable regulatory framework, respectful of market mechanisms' (European Commission, 2006a, p.7). So, if there is a need to encourage competitiveness, the EU has to develop new arrangements in order to regulate the market mechanisms. The only way to reach the objective is that governments and industry have to act together.

The issue also has low carbon economy perspective. Yuan et all identifies that there are three stages that low carbon development has and finally after the developments in order of the economy and society it is possible to reach low carbon world which assumes less CO_2 emissions and more economic development (2011, p.1706-1707). According to the European Commission within the twenty years period there were 16% decrease in the GHG emissions and 40% growth in the economy (European Commission, 2011p, online).

From this perspective the EU has created a road map for moving to a competitive low carbon economy in 2050 and expressed their will to take action (European Commission, 2011r, online). This will supports the competitiveness target of the general energy policy.

Besides new arrangements, the role of European Investment Bank (EIB) is also important. To reach the objectives European Investment Bank promote 'competitiveness in energy supply – a key consideration for the economic development of the European Union given the central role played by energy in the modern economy' (European Investment Bank, 2007, p.1).

1.1.3) The Current Situation of the EU Energy Policy

Today, the EU has rather developed energy policy than 1990's. Especially the effects of the global warming and global movements for the climate change affected the EU and its policy making. There were struggles in order to establish a link between environment and energy. Climate is mostly affected by the traditional energy production methods. The EU underlined that nearly 80% of the greenhouse gas emissions in the EU countries are energy related emissions (European Commission, 2010b, p.3). On the

other hand the finite characteristic of the non-renewable sources paved the way to establish more common and effective energy policy.

In the European Council of March 2007 besides the objectives of the EU Energy Policy, the reduction targets for the greenhouse gas emissions were set out. In comparison with 1990 greenhouse gas emission rates, 20% reduction until 2020 was planned. Reduction rate could increase to 30% if other develop countries have similar progress. On the other hand they targeted 20% share of renewables, 20% improvements in energy efficiency and 10% share of renewables in the transportation until 2020.

The EU Climate and Energy Legislative Package prepared by the Commission and became law in June 2009. According to the Commission there are four points constitute the core of the package: the first one a more developed Emission Trading Systems (ETS) organizing the allowances for the business sector, the second one is Effort Sharing Decision covers the areas out of the ETS, the third one is related with the national targets for the share of renewable energy and the last one is related with Carbon Capture and Storage (CCS) (European Commission, 2011c, online).

It is obvious that energy policy is mostly depends on environmental facts and dependence rates of the fossil sources. The latest enlargements of the Union also affect the previous policies. As Inotai stated that 'the EU is aggravated by the fact that the specific energy consumption of the new members of 2004 and 2007 is generally higher than the average of the EU-15' (Inotai, 2008, p.6).

Besides all these developments Directive 2009/28/EC is in force and has big influence on the energy policy. It covers reduction rates for greenhouse gas emissions, increasing share of renewable energy sources and additionally binding National Renewable Energy Action Plans (NREAPs). In order to reach the targets collaboration and transparency in adopting law is crucial. Because of that reason the contribution of member states is vital. So creation of NREAP is a big step for the further developments. In the next chapters for the comparison of planning systems NREAP will be studied more detail.

1.1.3.1) The Role of Non-renewable Energy Sources

The EU is one of the important energy consumers in the World and its dependency of imported fuels increased from 45.0% to 53.1 % within ten years period between the years 1997-2007 (Eurostat European Commission, 2009, p.18). It is a fact that 78, 6% of the 2007 Gross inland consumption comes from solid fuels, oil and natural gas. While 13, 4% of the consumption is meeting from nuclear energy and 7, 8% from renewable energy (European Commission, 2010a, p. 27). (See figure 4).

This section aims to investigate the existing energy sources in detail and to show the rates of import dependency, consumption, and electricity production. In order to make a rational illation in the next sections the necessary graphics will be examined.

1.1.3.1.1) Coal

In the 1950's after the Second World War there were two problems in Europe. Bache and George explained that the first problem was related with German-French conflict and the second one was about guaranteeing supply of coal for the Steel industry (Bache and George, 2006, p.94). For this reason coal can be called as a first energy source that the ECSC established for. With the establishment of ECSC as an important element the usage of coal was regulated.

The use of different energy sources have varied in the following years with the effects of new technological developments. Nevertheless coal is still used by the EU. In the Gross Inland Consumption statistics coal is used under the name of solid fuels which covers hard coal and lignite. The usages of solid fuels are affected by the usage of natural gas for 1990s. Particularly after 1990, there were some increases but consumption rates of solid fuels have decreased. The 2007 rates show that solid fuels are constitute 18, 3% of the Gross Inland Consumption (European Commission & DG for Energy, 2010, p.8)

Moreover the dependency of hard coal and derivatives is increasing for years. It increased from 34, 8% to 58, 5% within ten years period between 1997 and 2007 (Eurostat European Commission, 2009, p.20). (See figure 5). There are six countries

that the EU imported its coal. Russia is the biggest importer of coal with 26, 2% and it is followed by South Africa with 21, 5%, by Australia with 13, 6%, by Columbia with 13, 5%, by USA with 9, 7%, by Indonesia with 8, 2%. Additionally import dependency of solid fuels is 41, 2% in 2007. (European Commission, 2010a, p.30-32). (See figure 6). And coal is sharing 29, 4% of the Gross electricity generation with 988 TWh of electricity (European Commission, 2010a, p.43).

1.1.3.1.2) Oil

DG for Energy emphasize that 'oil remained the most used energy source in the EU in 2007' (European Commission & DG for Energy, 2010, p.7). Although it stands such an important position, the EU has not enough oil reserves in order to meet the demand. Oil reserves in the North Sea are only account for 4, 4% of the World reserves and it is far from meet the EU's demand. Moreover the oil extracted in the North Sea has very high prices in contrast with the Middle East (Oktay and Çamkıran, 2006, p.159).

Because of that reason the EU imports oil from the other countries. On 2007 its import dependency on oil raised to 82, 6% (European Commission, 2010a, p.30). (See figure 7). There are eight exporter countries that meet the EU's oil demand. These are Russia (34, 0%), Norway (15, 5%), Libya (10, 2%), Saudi Arabia (7, 2%), Other Middle East Countries (6, 3%), Iran (6, 2%), Kazakhstan (3, 4%) and Nigeria (2, 8%) follow Russia (European Commission, 2010a, p.31). (See figure 2). Russia is the biggest oil supplier for the EU and this situation creates concerns related with security of supply.

From another perspective 36, 4% of the EU Gross Inland Consumption is met by crude oil and it nearly doubled solid fuel rates (European Commission, 2010a, p.29). (See figure 4). The contribution of such an important source to the electricity generation is not so much. Only 3, 3% of the Gross electricity generation met by oil with 112 TWh of electricity (European Commission, 2010a, p.43).

1.1.3.1.3) Natural Gas

Natural Gas constitutes 23, 9% of the EU Gross Inland Consumption and it is mostly used for heating with coal. (See figure 4). On the other hand, with 760TWh of electricity natural gas constitutes 22, 6% of the Gross electricity generation (European Commission, 2010a, 27, p.43). (See figure 8).

Import dependency rates of coal is 60, 3% and it constitutes the second imported energy source. (See figure 7). There are several countries that import their gas to the EU. As same as the other non renewable energy sources the biggest gas supplier for the EU is Russia. The 40, 8% of the imported gas comes from Russia according to the 2007 rates. Norway (26, 7%), Algeria (16, 9%), Nigeria (5, 1%), Libya (3, 3%), Libya (3, 3%), Qatar (2, 4%), Egypt (1, 9%), Trinidad and Tobago (0, 9%) follow Russia (European Commission, 2010a, p.31). (See Figure 3).

1.1.3.2) The Role of Renewable Energy Sources

Renewable energy sources especially after innovation of new technologies in order to struggle with climate change and its negative effects started to use more frequently. 2007 rates show that 7, 8% of the Gross Inland Consumption comes from Renewable energy sources (European Commission, 2010a, p.29). (See figure 4). This rate increased 2% since 2000. Gross inland consumption by renewables shared by biomass with 69, 8%, hydro with 18, 9%, wind with 6, 4%, solar with 0, 9% and geothermal with 4, 1% (European Commission, 2010a, p.27-28). (See figure 9).

The European Commission also expressed that in 2007 5, 5% of the final energy consumption comes from renewables with exclusion of electricity and derived heat (European Commission, 2010a, p.34). (See figure 10).

On the other hand renewables share 15, 6% of the Gross Electricity Generation which covers 526 TWh electricity (European Commission, 2010a, p.45). (See figure 8). The 59,0% of this generation comes from hydraulic energy, 19,8% from wind, 19,4% from biomass, 0,7 from solar energy, 1,1% from geothermal energy (European Commission, 2010a, p.41). (See figure 11). Particularly, hydraulic energy has been used

by the countries to produce electricity for several years. Its electricity generation rate is not a coincidence.

1.1.3.3) The Role of Nuclear Energy Sources

Nuclear energy is an important type of energy source for the EU. In 1957 the establishment of European Atomic Energy Community (EURATOM) was a step for the further developments. Ganova states in her dissertation that 'The EURATOM Treaty was rather an expression of EU's will to use nuclear power for peaceful purposes, than an economic project' (Ganova, 2007, p.5). It is also important for the peaceable uses of nuclear energy. However there are so many debates misuse of nuclear energy and also safety of nuclear energy plants, the EU is still using nuclear energy for energy production. European Commission underlined that, 13, 4% of its Gross inland consumption is formed by nuclear energy in the 2007 (European Commission, 2010a, p.27). (See figure 4). Despite protests on safety, nuclear energy still plays important role in the total energy production and consumption.

DG for Energy explained in its 2009 reports that there was a fall between 2006 and 2007 levels. The rates of the nuclear energy in the Electricity generation decreased 5, 5% and constitutes the 27, 8% of the total with 935TWh production (European Commission & DG for Energy, 2010, p.17). On the other hand nuclear energy has 132 829 MW electricity production capacity and this constitutes the 17, 0% of the EU total capacity for electricity production (European Commission, 2010a, p.39). (See figure 12).

1.2) RENEWABLE ENERGY POTENTIAL OF THE EU AND THE SHARE OF RENEWABLES AT THE ENERGY PRODUCTION

The potential calculation is a difficult attempt. In the literature there are some classifications about the potentials. Generally potentials divide into theoretical, technical and economic parts. Most of the works explain them in this array from comprehensive to narrow one. In their very recent article Verbruggen et all argued this issue from different perspectives. They state that the determination about the potentials is an outcome of the climate policies (2010, p.851). Moreover in their work they try to

look the concepts from linguistic perspective by investigating the term potential. Interestingly in the absence of a comprehensive article on the calculation of renewable energy potentials this work is situated in an important position.

In this article the authors underlined that the Fourth Assessment Report of the International Panel on Climate Change (IPCC) include new definitions about the potentials aiming to create a more recognized uses. There are mainly four potential fragmentations which are market, economic, technical, physical potentials. Market potentials assessed as the GHG mitigation under the expected market conditions, policies and precautions. Economic potential adds the social cost perspective to the market potential and narrows its context. For the technical potential the technological development dimension was underlined. Physical potential also is used as the theoretical potential without calculation of any economic and technical dimensions (Verbruggen et all, 2010, p.854).

Verbruggen et all after considering several works on potentials claim that potentials have to be investigated from 'bottom up' perspective (2010, p.858). They criticises the baseline scenarios about the uncertainty on future. In their research there are four fragments on potentials which are market potential, economic potential, sustainable development potential and technical potential. With their words market potential is:

> the amount of RE output expected to occur under forecast market conditions that are shaped by private economic agents and are regulated by public authorities. Private economic agents realize private objectives within given, perceived and expected conditions. Market potentials are based on expected private revenues and expenditures, calculated at private prices (incorporating subsidies, levies, and rents) and with private discount rates. In reality, the private context is partly shaped by public authority policies (2010, p.858).

Economic potential is also considered as:

> the amount of RE output projected when all – social and private – costs and benefits related to that output are included. in realizing the economic potential, negative externalities and co-benefits of all energy uses and of other economic activities are priced, while social discount rates are used to balance the interests of consecutive human generations (2010, p.858).

Sustainable development potential with the effect of environment and social policies can be identified:

> the amount of RE output that would be obtained when all four sustainability dimensions of WCED are taken into account in an integrated holistic manner. This contrasts with the market and economic potentials, which take only partial account of social and environmental issues in working towards sustainable development, issues of governance need to be addressed explicitly (2010, p.859).

The last one is technical potential which references 'the amount of RE output obtainable by full implementation of demonstrated and likely to develop technologies or practices' (2010, p. 859).

Under this section the economic potentials of these sources will be studied. But firstly it is necessary to mention that the German Aerospace Center's (DLR) projections data will be the main source for this part. Because any of the related institutions do not have a study on the renewable energy potentials of the EU countries. Besides DLR's data the reports of WEC, GWEC, EWEA and feasibility work of Schreyer and Mez are also used in order to support the section.

1.2.1) Wind Energy

The creation of wind under the World Energy Assessment 2000 by Rogner et all is defined that:

> Winds develop when solar radiation reaches the Earth's highly varied surface unevenly, creating temperature, density, and pressure differences. Tropical regions have a net gain of heat due to solar radiation, while Polar Regions are subject to a net loss. This means that the Earth's atmosphere has to circulate to transport heat from the tropics towards the poles (Rogner et all, 2000, p.163).

In the last two decades the capacity of wind energy has been increasing in Worldwide. World Energy Council (WEC)'s 2010 Survey on Energy Sources indicates that 'World wind energy capacity has been doubling about every three and a half years since 1990' (2010, p.501). According to the Global Wind Energy Council (GWEC) the cumulative installed wind capacity for 2010 is 194, 390 MW (2011, p.14). (See figure

13). In the EU side the installed wind capacity for 2010 is 84, 278 MW (2011, p. 4). (See figure 14)

On the other hand the economic potential of the wind energy within the EU calculated as 1331, 8 TWh (DLR, 2006, p. 43, Schreyer& Mez, 2008, 32). In the DLR's projection the countries Estonia, Leetonia and Lithuania are not included. But in Schreyer and Mez's feasibility work they added these countries to the calculation. (See table 1)

1.2.2) Solar Energy

Solar energy is the primary energy source and most of the other renewable energy sources are indirectly emerge from sun like wind, biomass, hydro and ocean. Flux density of solar energy changes in the different land of the World. So, utilization from solar energy is different in evey place (WEC, 2010, p.408-410). World can utilize from sun in two ways. First one is photovoltaic system which is working without any additional mechanisms and solar power thermal plants system which is working with a thermodynamic power cycles (WEC, 2010, p.415). In general terms solar energy is using both for heating and electricity needs. Under this headline the term solar energy covers both of the sun related energy production systems.

The European Commission expressed that:

> the photovoltaic research field is primarily focused on reducing the cost of electricity generation. The total installed capacity of PV systems in the EU at the end of 2009 was approximately 2.2 % of total electrical capacity. Out of the 27.5 GW of total new power capacity constructed in the EU in 2009, PV accounted for about 21% (5.8 GW, up from 5.1 GW in 2008) (European Commission, 2011d, online).

For the solar-thermal systems:

> the total installed capacity of solar-thermal systems in Europe in 2006 was 13 GWth. Three countries capture 72% of the market in the EU, as a result of long-term financial incentive schemes: Germany (with 49% of the installed capacity), Austria (12%) and Greece (11%); followed by France, Spain and Italy, albeit with much smaller markets (European Commission, 2011e, online).

Within the EU countries the economic potential of the solar energy for long term period was counted as 1583,8 TWh by the German Aerospace Center (DLR, 2006, p.43). With the 1291 TWh capacity Spain has the biggest solar energy potential within the EU countries. (See table 1).

Table 1:

Long-term economic potential for renewable energy in the EU, Norway, Iceland, Switzerland, Candidate States and western Balkans (in TWh)

	Hydro	Geo	Biomass	Solar	Wind	Photo-voltaic	Wave and tidal	Total
Belgium	0.5	no entry	7.3	no entry	13.0	2.1	0.2	23.2
Bulgaria	12.0	0.8	7.7	no entry	8.9	2.0	no entry	31.4
Czech Republic	3.0	no entry	20	no entry	5.8	1.1	no entry	29.9
Denmark	0.0	no entry	6.6	no entry	55.0	1.3	2.2	65.1
Germany	26.0	28.2	87	no entry	262.0	23.4	7.0	433.6
Estonia	0.4	no entry	10.5	no entry	3.0	no entry	no entry	13.9
Ireland	1.3	no entry	6.2	no entry	55.0	1.1	4.0	67.9
Greece	12.0	9.4	7.2	4	49.0	3.9	4.0	89.5
Spain	41.0	28.2	40.4	1278	93.0	19.5	13.0	1531.1
France	72.0	14.1	79.1	no entry	129.0	23.4	12.0	329.7
Italy	65.0	19.6	46.1	7	79.0	17.6	3.0	237.2
Cyprus	1.0	no entry	0.6	20	6.0	0.1	0.2	27.9
Latvia	4.0	no entry	4.6	no entry	1.3	no entry	no entry	8.6
Lithuania	1.5	0.8	12.5	no entry	0.9	no entry	no entry	15.7
Luxembourg	1.0	no entry	0.4	no entry	0.0	0.8	no entry	2.2
Hungary	4.0	51.9	11.3	no entry	1.3	2.0	no entry	70.5
Malta	no entry	no entry	0.1	2	0.2	0.1	0.1	2.3
Netherlands	0.1	1.3	9.6	no entry	40.0	4.3	1.0	56.3
Austria	56.0	4.1	30.6	no entry	3.0	2.9	...[1]	96.6
Poland	7.0	1.7	52.1	no entry	65.0	3.1	1.0	129.9
Portugal	20.0	14.1	15.2	142	18.0	3.9	7.0	220.1
Romania	18.0	1	40.9	no entry	7.9	2.0	no entry	69.8
Slovenia	8.0	0.4	6.3	no entry	0.3	1.0	no entry	16.0
Slovakia	6.0	3.1	10.7	no entry	0.7	2.0	no entry	22.5
Finland	20.0	no entry	53.7	no entry	27.0	1.7	2.0	104.4
Sweden	90.0	1.3	80.4	no entry	63.5	3.7	2.0	240.9
United Kingdom	8.0	0.3	30.7	no entry	344.0	7.8	60.0	450.8
EU Countries	477.8	180.3	677.8	1453.0	1331.8	130.8	118.7	4370.2
Switzerland	38.3	no entry	8.0	no entry	0.0	3.7	no entry	50.0
Turkey	122.0	300.1	44.7	131	110.0	15.6	no entry	723.4
Macedonia	4.0	no entry	2.6	no entry	0.1	0.6	no entry	7.3
Croatia	8.0	1.1	8.9	no entry	2.6	0.8	3.0	24.4
Serbia & Montenegro	27.0	4.1	14.3	no entry	0.3	1.0	2.0	48.7
Bosnia-Herzegovina	19.0	no entry	9.5	no entry	0.1	0.6	no entry	29.2
Iceland	40.0	182.4	0.1	no entry	1.0	0.3	10.0	233.8
Norway	178.0	no entry	25.8	no entry	76.0	1.0	10.0	290.7
Total	914.1	668.0	791.7	1584.0	1521.9	154.4	143.7	5777.8

Source: Schreyer. M. and L. Mez. (2008). ERENE *European Community for Renewable Energy*. Volume 3. Berlin: Heinrich Böll Stiftung. p. 32.

1.2.3) Hydro Energy

According to WEC's statistics installed capacity reached 874 GW in 2008 (2010, p.287). With this capacity Hydro energy is the most used renewable enegy sources in the World context. For the EU countries installed capacity is nearly 102 GW (European Commission, online). Moreover hydo power is one of the most important electricity sources in the EU. The European Commission underline that:

> In 2008 about 63% of the electricity generated from renewable energy sources, or roughly 10% of the total electricity production in the EU-27, came from hydropower. European countries with the largest capacity of hydropower are France, Italy, Norway and Spain (European Commission, 2011f, online).

From another perspective according to Schreyer and Mez with DLC's data the economic potential of hydro energy in the EU is 477,8 TWh (2008, p.32) (see table 1). Comparison of the economic potential and utilization rates shows that there are more potential than using.

1.2.4) Geothermal Energy

Geothermal energy is a kind of energy arising as an outcome of the earth's heat. It is not possible to utilize this energy source in everywhere and 'utilisation of this energy has been limited to areas in which geological conditions permit a carrier (water in the liquid or vapour phases) to 'transfer' the heat from deep hot zones to or near the surface, thus giving rise to geothermal resources' (WEC, 2010, p.453).

In case of utilization within the EU while the installed capacity for the electricity sector counted as 671 MW, it is 12 GWth for heat sector (European Commission, online). Moreover the EU has 280,3 TWh economic potential according to researches (Schreyer& Mez, 2008, p.32) (See table 1).

1.2.5) Bioenergy

Bioenergy has two subfields biomass and biogas. From forestry, agricultural residues, municipal residues, wastes and municipal solid wastes etc. are constituting the

sources of biomass (WEC, 2010, p. 360). Bioenergy is producing from these sources. In the EU according to the European Commission data :

> Bioenergy production reached 86.6 million tonnes of oil equivalent (Mtoe) in 2007: 66.4 Mtoe from solid biomass, 6 Mtoe from biogas, 6.1 Mtoe from municipal solid waste (MSW) and 8.1 Mtoe from biofuels. Solid biomass use for energy had increased from 44.8 Mtoe in 1995, an increase of 21.6 Mtoe (48 %) (European Commission, 2011g, online).

In the DLR's report and Schreyer & Mez's study only economic potential of the EU was calculated. In these works economic biomass potential of the EU was found as 677,8 TWh(2008, p.32) (see table 1).

1.3) LEGAL ARRANGEMENTS ON RENEWABLE ENERGY

The EU as an organization including twenty seven countries has lots of legal arrangements on several issues. There are also some legal arrangements on renewable energy. Before listing the important arrangements it is crucial to mention that there are many other documents related with renewable energy. One of the first was 1988 Council recommendation on developing renewable energy sources (88/349/EEC), Because of the lack of political will as stated in the previous sections; legal arrangements focusing on renewable energy could have been prepared a few years later.

Before 2001 there were some White and Green papers on the energy policy in general, but they all include renewable energy perspective. Mainly there are four Directives for the renewable energy policy which were published after 2000. The other published documents can be assessed as official documents. In this part of the chapter after explaining the official documents, Directives, Commission Decision on NREAPs and Renewable Energy Road Map will be investigated under different titles. But it is necessary to mention that the documents studied under this part of chapter include mostly electricity perspective, but also energy performance of buildings and promotion of the use of biofuels will be mentioned.

The process for renewable energy policy began with Green Paper: For a European Union Energy Policy. After a consultation process White Paper: An Energy Policy for the EU established in 1995 (COM (95) 682) by the European Commission.

This document was the first document that aimed to construct common renewable energy policy (Cansino et all, 2010, p.6001). In the 1997 a Green paper namely Energy for the future: Renewable Sources of Energy was published (COM (96) 576) and afterwards the European Commission published another White paper related with the issues in the Green paper. White Paper for a community Strategy and Action Plan (COM (97) 599) was firstly determined %12 targets for the usage of renewable energy sources (Fouquet et all, 2008, p.4080). Because of the characteristic of the document the target did not binding for the nation states.

There are also two other Green papers published in 2005 and 2006. One of them is Green paper on Energy Efficiency (COM (2005) 265) and the other one is Green paper A European Strategy for Sustainable, Competitive and Secure Energy (COM (2006) 105).

From a broad perspective it is suitable to say that all these papers aimed to encourage the energy policy interaction with the all interested public levels. Especially Green papers prepared a template for the nation states, agencies, business sector in order to explain their ideas. From the beginning the main motives behind these document is to decrease dependence on imported energy, liberalize the internal market and make renewable energy preferable. In addition to these legal documents, as a primary legislation Lisbon Treaty also mentions energy issue and it includes three objectives of the EU Energy Policy (European Union, 2007, p.90). So objectives of the energy policy settle in the primary sources.

1.3.1) Directive 2001/77/EC

Hanreich states that approval of this directive 'sets a legal framework for the future development of the renewable electricity (RES-E) markets in the EU' (Hanreich, online, p.3). This was an important step for the further arrangements. On the other side this document was the first document that obliges the member states in order to reach the 12% share of electricity in the total consumption target which determined in the White paper.

In the preamble of the Directive it is strongly claimed that production of electricity from renewable energy sources is one of the priority areas for the EU (European Parliament and of the Council, 2001, p.1). Moreover it mentions guarantee of origin and safety of electricity grid. In the article 6 it makes the member states to reduce barriers in front of the renewable energy production and to have more transparent, objective, arrangements (2001, p.4).

As a result of this Directive member states firstly started to publish their national progress reports. This was crucial for reaching the objectives determined for the renewable energy. Furthermore after that Directive, there have been developments in the renewable energy sector in terms of technology and employment. But these developments are still not enough.

1.3.2) Directive 2002/91/EC and Directive 2003/30/EC

In the Directive 2002/91/EC on the Energy Performance of Buildings it is highlighted that buildings are responsible nearly 40% of the total energy consumption (European Parliament and of the Council, 4/1/2003, p.1). Arising from this fact there was a need to have a legal framework in order to draw up an arrangement on energy performance of buildings. They underlined that new and efficient policies have positive impact on long term energy consumption. This Directive determines basically minimum requirements for the energy certificates of the buildings, boiler and air conditioning systems.

Directive 2003/30/EC on the Promotion of the Use of Biofuels or Other Renewable Fuels for Transport was targeted to decrease the CO_2 emissions from transportation. It also determines two targets for the share of fuel. In the 2005, 2% and in the 2010, 5, 75% share of renewable fuels in the national markets have to be ensured by the member states (European Parliament and of the Council, 17/5/2003, p.1-3).

1.3.3) Renewable Energy Road Map

Renewable Energy Road Map was prepared in 2006 for the evaluation of the last ten years and expressing of the new plans for the next years. In the first part of the

Road Map the need for establishing 20% share of renewable energy in the final energy consumption target was discussed. The Commission expressed that National policies had not been effective in order to reach %12 objective and it was necessary to create a mandatory target for the EU. New target covered electricity, transport, heating and cooling sectors. So it became crucial to expand the usage of the RES in different sectors. Additionally, it is said that: 'Reaching the target will generate major greenhouse gas emissions savings, reduce annual fossil fuel consumption by over 250 Mtoe by 2020 (European Commission, 2006a, p.4).

1.3.4) Directive 2009/28/EC and Commission Decision 2009/548/EC

Directive 2009/28/EC on the promotion of the use of energy from renewable sources was very comprehensive document. All types of renewable energy sources, grid connections, guarantee of origin, necessity for establishing a transparency platform, necessity to establish national mandatory targets were mentioned within the context of this Directive. (European Parliament and of the Council, 5/6/2009, p.20-26), It can be considered as the most important document for the renewable energy arrangements. Besides the other arrangements on specific parts of the issue like electricity it had a comprehensive outlook. This also made the arrangement effective especially in terms of obliging member states to determine National Renewable Energy Action Plans.

From general perspective in the preamble of the Directive all issues related with renewable energy were mentioned. Especially the urgency about decreasing GHG emissions and necessity to increase energy efficiency standards stand as the main motive behind this Directive. Firstly in the Road Map and then in the March 2007 European Council urgency to have a comprehensive Directive on renewable energy was set out. Moreover transparency and efficient rules for the implementation of the targets counted as necessary.

Mandatory targets for the member states were determined in this document. In the EU level the share of renewable energy sources in the gross final consumption would be reach 20% and additionally in the transportation sector renewable energy sources would be reached 10% shares in the final energy consumption. For biofuels and

bioliquids a sustainability criteria was mentioned. The biofuels issue was examined in detail because of its connection with the environmental outcomes (5/6/2009, p.26).

For every member state a target was determined and a list was added to the Directive as Annex I (5/6/2009, p.46). Member states were free to combine their energy mix. The Union also supported strategic cooperation between member states and more transparent policies in the national, regional and local levels. Furthermore, in the article 5 of the Directive Commission called to prepare a template for the NREAP's until 30 June 2009. On the other hand member states were obliged to prepare their NREAP's until 30 June 2010(5/6/2009, p.28). The commission prepared a template for the NREAP's and it was published in 2009 under the name Commission decision of 2009/548/EC. This decision could be counted as an outcome of the Directive 2009/28/EC.

1.4) PROGRAMS AND POLICY INSTRUMENTS FOR RENEWABLE ENERGY

There are some programmes and policy instruments that adopted by the EU to reach the objectives guaranteeing security of supply, increase the energy efficiency and increase the use of renewable energy sources. This section is designed to investigate those programmes and some policy instruments like green certificates or subsidies. It is necessary to give information about these subjects to compare the EU and Turkey's policies in the next chapters.

1.4.1) Programmes for Renewable Energy

1.4.1.1) Predecessor Programmes

The EU realised the need to have programs in order to increase the use of renewable energy, to inform people about energy efficiency and the rational use of energy. That reason urges the policy makers to create programmes. The first programmes SAVE (Specific Actions for Vigorous Energy Efficiency) and ALTENER started to work in 1991 and 1992. Those programmes were designed within the context of energy policy. While ALTENER were supporting the use of renewable energy

sources, SAVE aimed to improve energy efficiency. Importantly those two programmes supported non-technological actions (Verhoef et al., 2004, p.29 and European Commission, 2005b, p.18).

It is a fact that White Paper 'An Energy Policy or the European Union' constituted the turning point for the future programmes. It determined the target 12% share of renewable energy sources in 2010 consumption rates.

ALTENER II programme also sustained predecessor's role. Verhoef et al. state that 'ALTENER aims to make a major contribution to the Community Strategy and Action Plan outlined in the White Paper "Energy for Future: Renewable Sources of Energy"'(2004, p.29). They also mention that there are three main sectors for ALTENER II: local authorities, the energy sector and building sector. The programme supported many studies, actions in order to increase the use of renewable energy sources in these sectors. Additionally it aimed to develop the coordination in the levels of international, regional, national, local levels and support the development of energy networks namely TEN-E which started in 1995 (IKV, 2003, p.8-9).

1.4.1.2) Second Generation Programmes

There are six programmes between the years 2002-2006. These are COOPENER, STEER, CONCERTO, Sustainable Energy Europe, Intelligent Energy Europe I (IEE I) and ManagEnergy.

Intelligent Energy Europe I Programme could be considered as a comprehensive programme. It follows the first period's programmes and sustains their role. Its main objective was to support the energy policy determined by the Green Paper on Security of Supply (European Commission, 2003, p.3). This programme worked between the years 2003-2006 and afterwards there was aroused a need to sustain this programme under the umbrella of more general framework programme. For the technical support mechanisms of this programme Managenergy initiative was launched in 2002. Managenergy initiative still preserves its role after IEE I programme (European Commission, 2011n, online).

COOPENER, programme remained at work between 2003-2006 and its budget was € 17 million under the IEE I (IKV, 2003, p.10). The programme aimed to support the movements in order to promote renewable energy sources in developing countries of Africa, Asia, Latin America and the Pacific (European Commission, 2011h, online).

STEER programme also covered the years between 2003-2006 and it nearly doubled COOPENER's budget with €32 million (IKV, 2003, p.10). Steer Programme was designed to support the new energy approaches in the transport sector and to promote energy efficiency with renewable fuels.

CONCERTO programme is an ongoing initiative. Its first period was held within 6th Framework Programme between the years 2002-2006. The aim of the programme explained in their web site that:

> the initiative as a whole, focuses on the integration of renewable energy sources and energy efficiency measures, involves eco-buildings integrating onsite renewable energy sources with energy efficient building design and management, poly-generation, combined heat and power and district heating (ideally using biomass) (European Commission, 2006b, online)

In general terms it focuses on rational use of energy in the buildings to reach the targets. It helps to speed up the process of having more renewable energy share rather than the conventional ones. On the other hand all of these programs help to achieve the targets for renewable energy share and providing security of supply and energy efficiency.

Sustainable Energy Europe campaign was launched in 2005 and it will end in 2011. It was designed to support sustainable energy with some organizations like exhibitions, conferences or Energy Day activities. It aims to include all layers of the society into the action to reach the energy and environment targets as soon as possible.

1.4.1.3) The Current Programmes

Mainly in the current situation IEE II, INOGATE, Build Up, Covenant of Mayors, Eco- innovation, European Energy Programme for Recovery and 7th Framework programme (FP7) sustain their works. Additionally TEN-E is also in effect.

It has three objectives and one of them could be counted as a tool of the renewable energy policy. It is the objective of 'reinforcing security of energy supply' (European Commission & DG Energy and Transport, 2004, p.7) to serve renewable energy targets.

IEE II programme is working under the CIP (Competitiveness and Innovation Framework Programme). CIP established to encourage services for innovation and it supports the information technologies as well as its support for RE and EE. It has three programmes in its framework. IEE II is the only programme related with our work within the CIP. The budget for IEE II determined € 730 million and its duty is to help the EU to reach the determined targets for 2020. Within the context of this programme there are annual calls for projects and initiatives. The elected ones take monetary help (European Commission, 2011i, online)

INOGATE programme was actually constructed for oil and gas transport purposes in 1995 but with the Astana Energy Ministerial Declaration it enlarged its sphere. It established between the EU and Belarus, Ukraine, Turkey, Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, Moldova, Georgia, Armenia and Azerbaijan. Besides increasing security of supply it also supports sustainable development, energy efficiency and renewable energy. These countries also try to close their policies with giving support to regional investments (INOGATE, 2011, online)

Build Up Programme was launched in 2009 for promoting smarter buildings in the EU (The European Portal for Energy Efficiency in Buildings, 2011, online). European Energy Programme for Recovery (EEPR) has been in effect until 2010. EEPR constitutes financial instrument for supporting technology in infrastructure areas (European Commission, 2011j, online). Their common point is to support technological developments in the energy sector. Additionally 7th Framework Programme covers energy research. It is in force between the years 2007 to 2013 and it provides a fund for energy researches (European Commission, 2011k, online). Mainly, since 1984 all Framework programmes support research and development projects in the EU.

Covenant of Mayors and Eco-Innovation programmes were designed to provide les greenhouse gas emissions. Eco Innovation Programme is a funding

programme which aims to reduce ecological footprint of Europe (European Commission, 2011l, online). Covenant of Mayors also aims to create more sustainable cities with more energy efficiency and clean energy (Covenant of Mayors Web Site, 2011, online).

1.4.2) Policy Instruments for Renewable Energy

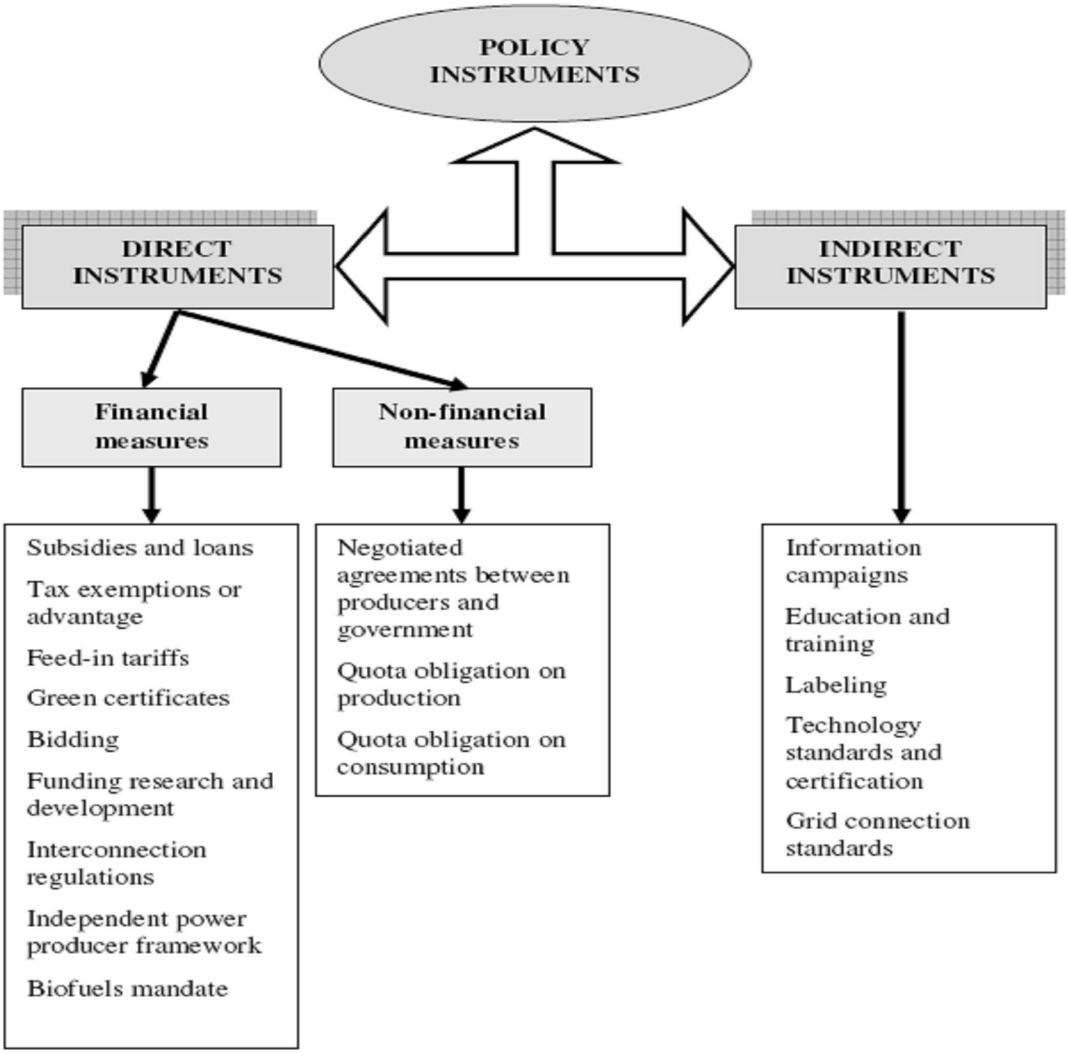
Most of the EU countries have been using different policy instruments to support producing electricity from the renewable energy sources. In general terms Zamfir categorizes policy instrument into two major sub units which are direct instruments and indirect instruments. Direct instruments are also divided into categories financial measures and non-financial instruments. (See the table 2).

It is possible to look the policy instruments from this perspective. Indirect instruments are generally supported by the EU –wide programs which had explained in the first part of this section. Direct instruments constitute the main driving force behind the development of renewable energy technologies. The support level of the countries to the renewable energy technologies is one of the debatable issues the EU. Especially financial instruments are the most criticizing ones.

Although it is a political issue, support for the renewable energy sources need to be investigated in order to reach more comprehensive outlook. But it is crucial that one model cannot fit for all the countries and Zamfir added that: 'each country choose any instruments or mix of instruments to promote renewable energy sources, taking into consideration the local condition of renewable energy technologies, the costs and the target for market penetration' (2009a, p.162).

The main motive behind the government support is the protection of environment with increasing Greenhouse gas (GHG) emission rates. Arising from this fact taxes have two sided benefits. While one is serving as a protector for the environment, the other provides increases in the employment (Cansino et al., 2010, p.6001).

Table 2:



Source: Zamfir. A. (2009a). The Promotion of Renewable Energy Sources: European Experiences and Steps Forward. *Economia Seria Management.* Vol. 12. No. 1. p. 155.

In the national levels Feed in Tariff (FiT) and Tradable Green Certificates (TGC) are the most using instruments. While Denmark, Spain and Germany are using FiT system, TGC system is used in the Belgium, Italy, Poland, Romania, Sweden and UK. In FiT systems tariff and their time period determined by the government and suppliers have to pay the determined amount for their production in the determined period. In the TGC system the government defines a need for a place and set certificates for the electricity. Consumers, generators and suppliers are all have to purchase certificates. This system allows minimum share for any of them (Ragwitz et al., 2005, p.5; Fouquet et al., 2008, p.4080; Zamfir, 2009a, p.154).

In the EU level, European Commission supports the TGC system although the countries using FiT system is more successful in renewable energy. Fouquet et al. underlined the Commission's approach with referencing a working document SEC (1999) 470 Final (not published) that the FiT system is not competitive and not suitable for the EU level (Fouquet et al., 2008, p.4081).

1.5) THE FUTURE PLANNING

The European Commission has been working to create a more effective and common energy policy. In the EU level creating effective and sustainable policies is difficult. But considering the facts about the 21th century, the need to prepare a more environment friendly policies plays an important role behind the EU decisions.

For the future planning the year 2007 was important. Because the Council considered the Commission's studies and decided to move for creating compulsory targets for all the member states. 20% share of renewable energy sources, 20% reduction of GHG emissions, improving energy efficiency 20% and 10% share of renewable energy sources in the transportation sector are the main targets for the next ten years.

Documents related with renewable energy were mentioned in the previous sections. But importantly the Commission's struggles on energy are still continuing. In 2010 the Commission prepared a strategy paper for competitive, sustainable and secure energy. This strategy paper was designed explain energy section of Europe 2020 Strategy. From general perspective Europe 2020 Strategy covers 'employment, innovation, education, social inclusion and climate/ energy' related objectives (European Commission, 2011m, online). Within this strategy seven flagship initiatives were created. 'Resource Efficient Europe' is one of them and related with energy policy. It was created to form long term framework for the resource efficient sustainable growth (European Commission, 2011b, online).

The Strategy paper for 'Resource Efficient Europe' was published in the first quarter of the 2011. The main point that it mentions if the resources are used more efficiently to reach the objectives will be easier. It underlined that 'since 1990, we have

reduced greenhouse gas emissions in the EU by more than 10% while our economies have grown by about 40%' (European Commission, 2011b, p.3). Moreover it assumed 80 to 95% reduction of greenhouse gas emissions until 2050 (European Commission, 2011b, p.2). It mentions global dimensions of resource efficiency not only for energy but also for climate change, transport, industry, raw materials, agriculture, fisheries, biodiversity and regional development. This document designed for supporting 2020 Strategy but it can be considered a movement for 2050 Strategy.

Another document published in 2011 is 'Energy Infrastructure'. In this plan for the energy networks it is explained that: 'Adequate, integrated and reliable energy networks are a crucial prerequisite not only for EU energy policy goals, but also for the EU's economic strategy' (European Commission & DG for Energy, 2011, p.7).

In the Energy 2020 Document five priorities that new energy strategy focus on was explained these are: '1) Achieving an energy efficient Europe; 2) Building a truly pan-European integrated energy market; 3) Empowering consumers and achieving the highest level of safety and security; 4) Extending Europe's leadership in every technology and innovation; 5) Strengthening the external dimension of the EU energy market' (European Commission, 2010b, p.5-6).

For the energy efficiency, intensified collaboration in national, regional and local levels and fully implementation of objectives is crucial. Additionally from national to EU level harmonization of rules is necessary for renewal of the infrastructure (European Commission, 2010b, p.10)

For citizens to reach energy securely with affordable prices becomes important. Also proactive movements gain importance. It is a fact that without any technological development the progress cannot be realised. For the renewable energy technology China, Japan, South Korea and USA have industrial strategies. To sustain World Leader claim it is necessary to support technological developments for the EU. Priority four was designed for realising this aim.

In general, after the year 2020 was not planned with mandatory targets. In the first quarter of 2011 'European Energy Efficiency Plan 2020' and 'Revision of the

Energy Taxation Directive' will be published. In the 4th quarter of 2011 the Commission will present its new strategy namely 'Energy Roadmap 2050' (European Commission, 2011b, p.11).

To sum it is possible to say that the EU has targets for ten years period. But the middle and long term objectives were not determined. Lack of long term targets shows difficulties for taking unanimous decisions. From 1990's to the 2011 the process was not rapid. But with Lisbon Treaty and Directives came into effect after 2007 in the future decision would be taken easier than past. Additionally, transparency procedure will certainly affect the member states' speed in order to enact Directives to their national legal system.

CHAPTER II: TURKEY AND RENEWABLE ENERGY

2.1) THE GENERAL POLICY OF TURKEY

Energy is one of the crucial policy areas for Turkey because of its physical characteristic. Nevertheless decision makers could not prepare an effective and complementary policy document in the past years. Although there is not a sufficient and well designed energy policy, after 2000 there have been some struggles in order to create an energy policy. New Laws on different types of energy and renewable energy sources created a main background for the further developments. Additionally the existences of ninth Development Programme and Strategic plan are also important to construct a new energy strategy.

From this perspective it is preferred to study the issue in the same arrangement with the section one. Because of this reason, first of all, the historical part of the energy issue will be examined. Afterwards the current situation, renewable energy potentials and legal arrangements will be studied.

2.1.1) Historical Background of Turkey's Energy Policy

In Turkey although there have not been a planned energy policy, it is possible to observe Turkish energy planning history by criticizing the development programmes. There are mainly nine development programmes which cover the years 1963 to 2013. Within these forty years period 1978, 1984, 1995, 2006 years were not planned under the framework of development programmes because of the delays on preparing processes. Besides these development programmes in this period there were some important arrangements which need to be mentioned.

As a first step for the electricity planning in 1935, Electricity Research Administration was established with the Law 2819. As Ozturk, Bezir and Ozek underlined, the first Energy Congress was organized in 1953 (2008, p.385). The establishments of Atomic Energy Agency in 1956, Ministry of Energy and Natural Resources in 1963 followed the first step (Hepbaslı& Ozgener, 2004, p.964). The first development programme of Turkey covered the years between 1963 and 1967. In these

years there was a complete State ownership over the energy power plants via State Economic Enterprises (SEE) (SPO, 1962, p.74). Also 54% of the consumption was provided with non-commercial energy sources (wood, dried cow dung and agriculture residues). Only the 30, 5 % of the society was benefited from the electricity (SPO, 1962, p.373, 379). It was planned that 4.956 million Turkish liras (SPO, 1962, p.381) were used for the energy investments in the first period but only 3.335 million TL investments were realised (SPO, 1967, p.13)

In the coverage of the second plan (1968 to 1972) 8.9 billion TL were prepared for the energy investments. In that period it was expected that there were a 3, 2 % increase in the energy production rates (SPO, 1967, p.298). The main electricity objectives of that period were the development of production, transmission, distribution systems, and development of interconnected grids. Moreover it was underlined that hydraulic power plants had priorities over the other sources and importantly the nuclear researches would be started (SPO, 1967, p.558). With the effect of second development programme Ozturk, Bezir and Ozek said that 'in 1970, the Turkish Electricity Enterprise (TEK) were established and so that Turkey could have a central public authority in the energy sector' (2008, p.385).

Within the process of the third programme (1973-1977) if indigenous sources could not meet the demand, there was a possibility to supply it from the outside sources (SPO, 1972, p. 204). As a primary source, lignite was still protecting its importance and its role in energy planning. On the other hand it was outlined that natural gas, nuclear and geothermal energies were firstly started to be used as primary sources of energy (SPO, 1972, p. 565). For the third period 39, 400 billion TL fund was allocated out of the budget (SPO, 1972, p. 576). Additionally with Law No. 1312 the policy makers forced to accelerate the energy investments.

The fourth Development Programme (1979- 1983) could be prepared with one year delay. The political presence of Turkey in that period was not stable. Also oil crises were seen in that period of time. The targeted investment in the electricity sector was 166, 8 billion TL for the fourth one (SPO, 1978, p.241). Energy production, transmission and developments on infrastructure were the main elements behind the

planning. In 1982 with Law No. 2705 (TEIAS, 2011, online) 'electricity distribution was taken from municipalities and was given to TEK' (Ozturk, Bezir, and Ozek, 2008, p.385). Also the need to give an independent status to the General Directorate of Electrical Power Resources Survey and Development Administration (EIEI) was discussed. It was stated at the end of the period that 53% of the energy consumption would be meet by the primary sources (SPO, 1978, p.241). Moreover the need for more works for a long term energy programme was repeated. Additionally, the document urged researches about solar energy for the first time (SPO, 1978, p.401).

In the fifth plan (1985- 1989) the main policy was explained as this:

> The main policy in energy sector is to meet the need of energy on time, efficiently and in a reliable way with supporting and directing the targeted economic extension and social development (SPO, 1984, p.41).

Also it was stated that energy saving would be implemented for the short term but energy efficiency had to be implemented for the long term (SPO, 1984, p. 42). To inform society had gained importance. The priority was given to the development of the natural gas sources. In order to determine absolute presence of the energy sources, long term research programmes were started to set out (SPO, 1984, p. 105). The State was planning to support enterprises about benefited from renewable energy sources. Because of this reason in 1984 Law No. 3096 was established. Hepbaslı and Ozgener say that 'domestic and foreign companies, except for the public Turkish Electricity Administration, were allowed to produce and distribute electricity commercially' (Hepbaslı & Ozgener, 2004, p. 964). If there is a delay in progress, the construction of power plants using imported fuels was discussed in order to use in emergency conditions. It was predicted that the Main Energy Plan would be prepared in a short period (SPO, 1984, p.105).

In the sixth programme (1990- 1994) 16, 9 trillion TL was planned to be used in the energy investments. It was expected that the share of imported sources would be increased in parallel with the consumption rates in the energy sector. A thermal power plant relied on imported coal began to operation. The energy reserve system was planned to put into implementation. Importantly as a first time reconstruction of

electricity sector that public and private sectors can act together was stated (SPO, 1989, p.39). The struggles about the integration to the European Community would sustain. In the electricity sector the need for the long term planning was underlined. The electricity production, transmission and distribution facility investments with an efficient reserve system would be planned and conducted (SPO, 1989, p.259). Additionally in order to benefit from the new energy sources' potential research and development programmes would be supported (SPO, 1989, p.313). In order to support new investments in 1990 The Electric Energy Fund was established (Hepbaslı & Ozgener, 2004, p.964).

Seventh Development Programme contained the years 1996 to 2000. There was 49% dependence to the imported energy sources (SPO, 1995, p.36). At the end of the 1994, the constructed energy capacity of Turkey was 20.857 Mw (SPO, 1995, p.137). There was a failure about integrating the sector that private and state enterprises working together because of the conflict of laws. It was claimed that BOT system made it difficult to establish an open market system (SPO, 1995, p.137). Also the construction of a corporate structure working on regulation of the energy activities, competition, consumer rights, environment etc. was planned (SPO, 1995, p.143).

In the eighth programme (2001-2005) it was stated that the practise of BOT, BO and TOR which were blocking the competition would be solved (SPO, 2000, p.31). Dependence on imported sources increased to 62% (SPO, 2000, p.142). It was underlined that researches on nuclear energy would be sustained. The concepts like sustainable economic and social development, minimum damage to the environment were mentioned in the context of the plan. Additionally the government would take new measures in order to widen new and renewable energy sources. By doing this, they targeted to use the country's energy potential at the highest level (SPO, 2000, p.152).

2.1.2) The Objectives of Turkish Energy Policy

In the Workgroup report on greenhouse gas reduction in energy sector which was prepared by the MENR it is said that 'Turkey's fundamental policy is to provide energy in a timely, adequate, reliable, competitively-priced and environment-friendly

manner' (MENR, 2006, p.4). From this point of view in the Strategic Plan 2010-2014 the MENR determined five strategic aims and targets which are:

1) Energy Supply Security
2) The regional and global influence of our country in the area of energy
3) Environment
4) Natural Resources
5) Corporate (MENR, 2010a, p.12-37).

Under the headlines of these five strategies 11 objectives were determined and additionally their costs were counted. The last two strategies are not related with this thesis subject but the first three strategies can be counted as the strategies of energy policy in this study. The objectives of this plan will be studied under the headline of strategic targets.

2.1.2.1) Energy Supply Security

Energy security has a crucial role in the energy planning of any country. Increasing rate of energy imports causes a security problem. So in the energy strategy, energy security has the major role. In the MENR's Strategic paper under the framework of energy supply security there are five aims:

1) Providing Diversity in Resources by Giving Priority to the Domestic Resources
2) Increasing the share of the renewable energy resources within the energy supply
3) Increasing Energy Efficiency
4) Making the free market conditions operate fully and providing for the improvement of the investment environment
5) Providing the diversity of resources in the area of oil and natural gas and taking the measures for reducing the risks due to importation (MENR, 2010a, p.12-25).

In these conditions a priority giving to the domestic sources is an important asset for reducing dependency on imported energy sources. Toklu et al. conclude their research underlining that 'Turkey is heavily dependent on expensive imported energy resources that place a big burden on the economy and air pollution is becoming a great environmental concern in the country' (2010, p.1185). Besides giving priority to the domestic sources the studies about diversity of resources enables benefited from all domestic sources.

The aim of increasing the share of renewable energy sources and energy efficiency support the usage of domestic sources. From a different viewpoint privatisation process in the energy sector stands as the main element of the policy. Because it has planned that with privatisation of power generation and distribution systems, competition will be fairer in the sector.

2.1.2.2) The Regional and Global Influence of Our Country in the Area of Energy

The sixth aim under the second strategy is: 'Turning our country into an energy hub and terminal by using our geo-strategic position effectively within the framework of the regional cooperation processes' (MENR, 2010a, p.29). Coskun and Carlson argued that there are two reasons behind Turkey's desire. In the one side Turkey wants to constitute 4th corridor after Norway, Algeria and Russia in the gas sector. On the other side as they say 'the second reason is to gain political influence in Europe and in the region due to the ownership of a key infrastructure route' (2010, p.214).

2.1.2.3) Environment

Under the environment strategy the seventh aim is 'minimizing the negative environmental impacts of the activities in the energy and natural resources area' (MENR, 2010a, p.32). Especially after ratifying the United Nations Framework Convention on Climate Change (UNFCC) (24/05/2004) and Kyoto Protocol (26/08/2009) Turkey has to develop a new energy policy in order to decrease GHG emissions. It is outlined in the Strategic plan as this:

> The improvement of energy efficiency, the spreading of the utilization of renewable energy resources and the clean coal combustion technologies, and the integration of the nuclear energy into the electricity energy production options are our main strategies within the framework of the relationship between the energy and environment (MENR, 2010a, p.32).

On the other side the usage of renewable energy sources requires developing new technologies. With a good planning in research areas it is possible to transit more

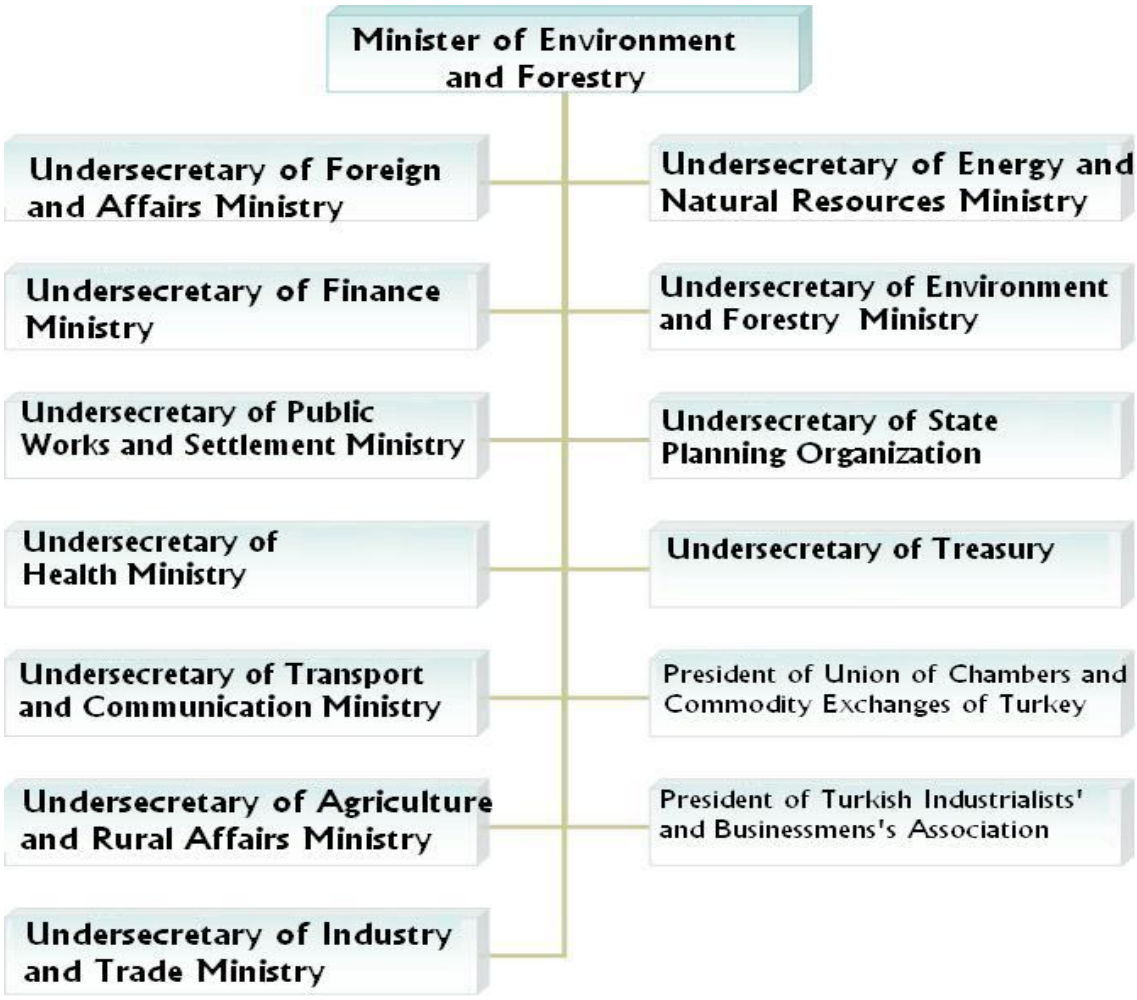
clean technologies. Hence, the usage of domestic sources will increase with environment friendly methods (Kaygusuz & Bilgen, 2008, p.406).

2.1.3) The Current Situation of Turkey's Energy Policy

In the current position there are three sub policies that have to be investigated. The first one is the interactions between energy and environment policy; the second one is 2009-2013 Electric Energy Market and Supply Security Strategy Paper and the third one is 9th Development Program. On the other hand MENR's 2010-2014 Strategic Plan will also be studied under the future planning headline of the chapter two.

Harmony between energy and environment policies has important aspects. There is a requirement for Ministries to act together in order to reduce GHG emissions and realise the National Climate Change Strategy. For the coordination purpose Coordination Board on Climate Change (CBCC) was established in 2001. Under the presidency of Environment and Forestry (MoEF) the related Ministries and Institutions included the Board (MoEF, 2011a, online). (See table 3 below to see the members of the board). Apart from this board, MENR is undertaking two technical work groups' coordinator role which are 'Workgroup for Reduction of Greenhouse Gas Emissions in the Energy Industry' and the other one is 'Workgroup for Reduction of Greenhouse Gas Emissions in Industry, Housing, Waste Management and Service Sectors' (MENR, 2011, online). For the Climate Change especially after signing of UNFCC and Kyoto Protocols it is crucial to have schedule for GHG reductions. For the period between 2008 and 2012 Turkey does not have mandatory targets with reference to the Annex-B of the United Nations Framework Convention on Climate Change (MoEF, 2011b, online). So the planning of the post 2012 is very significant for the future energy policies.

Table 3:



Source: Ministry of Environment and Forestry. (2011a). Coordination Board on Climate Change. [online]. http://www.iklim.cob.gov.tr/iklim/AnaSayfa/IDKK.aspx?sflang=en. (Retrieved May 12, 2011).

Secondly, 2009-2013 Electric Energy Market and Supply Security Strategy Paper is one of the significant Strategy papers that is preparing a background for the 2010-2014 Energy Strategy Plan (With reference to the Interview of Mustafa Çetin). In general terms, the paper determines the objectives for the electric energy sector and making reference to the privatization process and its strategies. Mainly the related objectives with this thesis subject are:

> Toward the target of creating a sustainable electricity energy market, taking into consideration climate change and environmental impacts in activities in all areas of the industry;
>
> Encouraging new technologies, ensuring diversity of resources, and maximum use of domestic and renewable resources in order to reduce external dependency in energy supply (SPO, 2009, p.4).

In the final part of the Plan it is underlined that the planning share of renewable energy sources in the energy mixture is to reach 30% in the 100th year of the Republic (SPO, 2009, p.12).

Finally it is necessary to mention the 9th Development Program (2007-2013). Within this document the full membership process to the EU was examined and the significance of Turkey's membership was underlined. It is expected that Turkey's special Energy Station status would be beneficial for the EU and create a synergy (SPO, 2006, p.11). In the process of the 9th Development Programme it is assumed that Turkey will end the EU harmonization process (SPO, 2006, p10). Finally the significance and priority of the Privatization process and the 2004 Privatization Strategy Plan was mentioned. Under the liberalization target it was planned that the share of the public sector would decrease (SPO, 2006, p.58).

2.1.3.1) The Role of Non-Renewable Energy Sources

In the sum of the energy mix, mostly non-renewable energy sources are used in the energy sector. The motion on using coal as a domestic source, the dependence on natural gas with reference to the Agreement between the Government of the Republic of Turkey and Government of the Russian Federation on Supplies of Russian Natural Gas to the Republic of Turkey via Black Sea Water Area (1998) which assumes Turkey will have to buy 16, 0 billion m^3 Natural Gas per year and finally the dependence on imported fuels creates today's energy mix (MFA, 2011, online).

Apart from Russia Turkey have agreements on natural gas with Turkmenistan, Iran, Azerbaijan, Algeria and Nigeria in order to diversify natural gas suppliers (Hacısalihoglu, 2008, 1870). Turkey's gas imports are expected to increase in the following years (Kiliç, 2006, p.1930). So with a logical deduction it is possible to say that Turkey's energy dependence will increase in the following years and without any effective renewable energy policy this situation cannot be solved. But on the other hand the existence of these agreements and their cheapness in contrast with the renewable energy investments can block the developments on renewable energy for Turkey. To the

point it is necessary to look at the non-renewable energy sources to have a comprehensive outlook about the issue.

2.1.3.1.1) Coal

Coal is the primary domestic energy source of Turkey. The main areas of usage are 'power generation, steel manufacturing and cement production' (Balat, 2009, p.112). For lignite Turkey has a considerable amount of reserve. The 40% of its lignite reserves are in the Afsin-Elbistan basin. The estimated lignite potential in total is 84,400 Mtoe but, only 7,340 Mtoe is seen economic (Pehlivan & Demirbas, 2008, p.28). On the other hand hard coal is another type of coal. But nearly 90% of the hard coal is imported (IEA, 2010, p.85).

According to Enerdata, while the production of solid fuels have been increasing since 2004, the coal imports have also been increased after 2001 (2010, p.13). Coal is sharing 30% of the power generation among the other sources (2010, p.10) (see figure 15). Within the installed electricity capacity coal is sharing 25% (Enerdata, 2010, p.9). (see figure 16). It has been underlined in the IEA's report that '87% of domestic lignite is used for generating electricity' (IEA, 2010, p.86).

2.1.3.1.2) Oil

Balat stated that Turkey has 931 million tons oil reserve (Topçu & Ulengin, 2004 in Balat, 2009, p.114). He also underlined that in the 2005 rates '93% of the oil using in Turkey was imported from the Middle East (Saudi Arabia, Iran, Iraq, Syria) and Russia' (Balat, 2009, p.114). In the Enerdata statistics it is also indicated that:

> Turkey covers just 9% of its oil needs with a production of 2.4 Mt of crude oil. Net oil imports equal 27.7 Mt, 52% of which is crude oil; the share of oil products in total net oil imports has been increasing. Imports mainly come from the CIS (44%), Iran (23%), Iraq (14%) and Saudi Arabia (14%) (2010, p.11).

The share of oil within the power generation is 5%. But it shares 15% of the installed electricity capacity (Enerdata, 2010, p.9-10). (See figure 16). It is a fact that

the globalisation process accelerated the industrialisation and the usage of oil has been increasing for years (Ozturk, Bezir & Ozek, 2009, p.320).

2.1.3.1.3) Natural Gas

The primary energy production from natural gas began in 1976 according to TUIK data (TUİK, 2010, p.226) but natural gas consumption has started in 1987 (Kiliç, 2006, p.1932). Since 1987 the natural gas sector has been developing expeditiously (Ozturk & Hepbaslı, 2004, p.278). In the 4th Development Programme there was a desire to research the usage facilities of natural gas (SPO, 1978, p.393). From 1976 to 2009 State has supported the usage of Natural Gas. IEA underlined the positioning of Natural Gas within Turkey's energy need that:

> From 2000 to 2009, natural gas supply increased by 127%, making Turkey one of the fastest growing gas markets in the Europe...Turkey imports more than 98% of its gas needs. In 2009, 52% of gas imports came from Russia, followed by Azerbaijan (15%), Algeria (14%). Iran (16%) and Nigeria (3%) (IEA, 2010, p.67) (see figure 17).

With the 46% share natural gas has the biggest proportion in the power generation. For the installed electricity capacity it shares 25% and comes second after Hydraulic energy (Enerdata, 2010, p.9-10) (See figure 16).

2.1.3.2) The Role of Renewable Energy Sources

In Turkey hydropower and biomass are the most used renewable energy sources. But Yuksel says here that: 'environmental and scarcity-of-supply concerns have led to a decline in biomass use, mainly for residential heating' (2009, p.1919). The usage of wind, geothermal and solar energies is very limited. In 2004 Hepbaslı and Ozgener stated that approximately 0, 5% of the total production comes from these sources (2004, p.962).

In 2009, 19, 6% of the total electricity generation was provided by the renewable sources. The share of Hydropower was 95%, the share of wind power was 4% and finally biomass and geothermal shares 1% of the total electricity generation comes from renewable energy sources (IEA, 2010,p.97) (see figure 18).

2.1.3.3) The Role of Nuclear Energy Sources

For years there has been a planning to construct nuclear energy power plants. Firstly, in the second Development Programme it was planned to start the use of nuclear power (SPO, 1967, p.559). But for years the aim to construct a nuclear energy power plant has not been realised.

The first studies on nuclear energy were started in 1965. There were some feasibility reports in the 1960's which could not end with construction of a power plant. There were some struggles in order to build a power plant. Respectively they were held in 1973, 1974-1980, 1980, 1995-2000 (Kılıç, 2008, p.1078). Recently there have been some initiatives to built two nuclear power plants in Sinop and Mersin-Akkuyu. The Government shows an effort to realise these investments but it is difficult to guest the future of the initiatives after considering the history.

2.2) RENEWABLE ENERGY POTENTIAL OF TURKEY AND THE SHARE OF RENEWABLES AT THE ENERGY PRODUCTION

In the first section there was an extended explanation about the concept of 'potential'. That discourse is also available in this section. From this perspective within this section the renewable energy potentials and their share in the energy production will be investigated. Apart from the EU, there are some articles written on the Turkey's renewable energy potential. So it is necessary to underline that for Turkey and her renewable energy potentials the literature is richer and this will be reflected within this part of the study.

2.2.1) Wind Energy

For wind energy the most suitable places are Marmara and Southeast regions. According to General Directorate of Electrical Power Resources Survey and Development Administration (EIEI), in 2003 rates the annual average density of wind were 51,91 W/m^2 in Marmara region and 29,33 W/m^2 in Southeast Anatolia (Kaygusuz, 2004, 1138). In the case of the wind energy, installed capacity has achieved 800 MW in late 2009 (MENR, 2010a, p.16). For the share of energy production with 1, 5 TWh, it

has 4% proportion in the total energy production by renewable (IEA, 2010, p.97) (see figure 18).

There are different assumptions on the economic and technical potentials of wind energy sources. On the one hand Schreyer and Mez (2008, p.32) states that Turkey's long term economic potential is 110 TWh and on the other hand Toklu et al. (2010, p.1174) states that Turkey's natural capacity is 400 billion kWh, technical capacity is 290 billion kWh and economical potential is 500 billion kWh. (See table 4). It has also mentioned by the IEA that Turkey has technically 48GW wind energy capacity (IEA, 2010, p.101).

Table 4: Turkey's Renewable Energy Potential

Energy type	Usage purpose	Natural capacity	Technical	Economical
Solar energy	Electric (billion kWh)	977.000	6105	305
	Thermal (Mtoe)	80.000	500	25
Hydropower	Electric (billion kWh)	430	215	124,5
Wind energy (land)	Electric (billion kWh)	400	110	50
Wind energy (off share)	Electric (billion kWh)	0	180	0
Wave energy	Electric (billion kWh)	150	18	0
Geothermal energy	Electric (109 kWh)	0	0	1,4
	Thermal (Mtoe)	31.500	7500	2,843
Biomass energy	Total (Mtoe)	120	50	

Source: Toklu, E., Guney, M. S., Isik, M., Comakli, O., Kaygusuz, K. (2010). Energy Production, Consumption, Policies and Recent Developments in Turkey. *Renewable and Sustainable Energy Reviews.* 14. p.1174.

2.2.2) Solar Energy

Turkey, because of its geographical location, has solar energy potential. Kaygusuz states that: 'Solar energy can technically and economically be harnessed during 10 months over 63% of the land area, whereas 17% of the land area can be used during the entire year' (Kaygusuz, 2004, p.1137).

A stated in the first section that solar energy can be converted to energy with two ways. Akpınar et al. mention it that: 'First, solar photovoltaic (PV) modules convert sunlight directly into electricity. Second, solar thermal power systems use focused solar

radiation to produce steam, which is then used to turn a turbine producing electricity' (2008, p.2026). In Turkey especially in the Western and Southern parts of the country people utilize from solar energy with flat plate collectors for the heating purposes (Yuksel, 2008, p.469).

In the case of potentials, Schreyer and Mez assumed that Turkey has 131 TWh solar energy potential and it is the third country in the Europe that has large solar energy potentials (2008, p.32). On the other hand Toklu et al. suppose that Turkey's natural capacity is 977. 000 billion kWh, technical capacity is 6105 kWh and finally Economical capacity is 305 kWh (2010, p.1174). Additionally in the country report of Turkey IEA states that Turkey has 2 MW total capacities in photovoltaic with referencing the national atlases (IEA, 2010, p.101).

2.2.3) Hydro-electric Energy

Hydro energy has been used for generating electricity since 1902 (Hepbaslı & Ozgener, 2004, p.963). So, before the establishment of republic there were struggles to generate electricity from a hydropower plant. For the current rates within the renewable energy sources it has 95% proportion (IEA, 2010, p.97). Also within the installed electricity capacity it has 33% share and has the biggest proportion (Enerdata, 2010, p.9). Besides, all of the Development Programs have had some plans about constructing new hydropower plants. Therefore the hydro energy is one of the important components of the energy mix. Having said that the construction of micro power plants on the rivers can have negative effects to the nature and their contribution to electricity generation is contested (Demirbaş, 2006, p.787).

As having the biggest installed capacity it is assumed by the Schreyer and Mez Turkey has 122 TWh economic potential and it has the second largest capacity in Europe after Norway (Schreyer & Mez, 2008, p.32). On the other hand according to Toklu et al. Turkey's natural hydro power capacity is 430 billion kWh, technical capacity is 215 billion kWh and economical capacity is also 124, 5 billion kWh (Toklu et al., 2010, p.1174).

2.2.4) Geothermal Energy

Geothermal energy is mainly used for generating electricity and for the heat purposes. The heat of the World causes heating in the groundwater. So it becomes possible to benefit from the sources for electricity and heating purposes (Erdoğdu, 2009, p.2536). For the primary energy production geothermal heat energy has been using since 1963 (TUIK, 2010, p.226)

In 2009 with 0, 5 TWh contributions, it has less than 1% share within the renewable energy sources that produce electricity (IEA, 2010, p.87). The projected long term economic geothermal potential of Turkey is 300, 1 TWh which said by Schreyer and Mez. With these rates Turkey has the biggest geothermal potential in Europe. The projected economical capacity also determined for the electric generation is 1, 4 billion kWh. And for thermal natural capacity is assumed 31.500 Mtoe, technical capacity is 7500 Mtoe and economical capacity is 2.843 Mtoe by Toklu et al. (2010, p.1174).

2.2.5) Biomass Energy

Biomass has different forms like fuel wood and animal wastes which are used in rural areas. Bioenergy also covers agricultural residues, livestock farming wastes, forestry and wood processing residues and municipal wastes (Kaygusuz, 2004, p.1136). In Turkey the usage of biomass has decreased for years with the increasing usage level of natural gas (Saygın & Çetin, 2010, p.112).

The contribution of biomass energy was 0.3 TWh to the electricity generation (IEA, 2010, p.87). For the potentials according to Schreyer and Mez the long term economic potential of biomass energy in Turkey is 44, 7 TWh. On the other hand Toklu et al. assume that natural capacity is 120 Mtoe, technical capacity is 50 Mtoe and economical capacity is 32 Mtoe (2010, p.1174).

2.3) LEGAL ARRANGEMENTS ON RENEWABLE ENERGY

Under this section three Laws which are in force related with renewable energy will be examined. The other existing Law will not be studied in order to prevent confusion. Firstly, Electricity market law, secondly Energy Efficiency Law and finally

Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy will be studied to show the legal arrangements of the renewable energy policy.

2.3.1) Electricity Market Law (Law No. 4628 amended with Law No. 5784)

Electricity Market Law came into force in 2001. But there have been several changes until now. In the article 1 it is stressed that to transmit environment friendly electricity to the consumers is one of the purposes of the Law (2001, p.1). Ozturk, Bezir and Ozek underlined the importance of Law with saying:

> The Electricity Market Law, Law No. 4628, has been enacted on March 3, 2001, for unbundling electricity market activities, to enable progress into a liberalized electricity market, and to provide for fair and transparent market regulation. Law No. 4628 aims at elimination of both the purchase guarantee and Treasury guarantee for future power projects (2008, p.386).

It was stated for the power plants that produce electricity less than 500 kW and micro cogeneration power plants the producers are exempt from obtaining generation licence (2001, p.12). In the 5^{th} and 7^{th} clauses of the Article three there is an arrangement on the construction of wind power plants (2001, p.13).

In the case of security of supply, Turkish Electricity Transmission Co. Inc. (TEIAS) is charged with preparing Long term Electricity Generation Development Program (2001, p.33). Moreover TEIAS is tasked with determining short, medium and long term supply and demand equilibrium according to production capacity projection(2001, p.33).

2.3.2) Energy Efficiency Law (Law No. 5627)

The purpose of this Law was identified in the article 1:

> to increase efficiency in using energy sources and energy in order to use energy effectively, avoid waste, ease the burden of energy costs on the economy and protect environment (2007, p.1).

Moreover a priority is given to The Turkish Scientific and Technological Research Institution (TUBITAK):

> for increasing energy efficiency projects and utilizing new and renewable energy projects; and consult the opinion of the General Directorate for directing and assessing such projects (2007, p.9).

On the other hand it determines the functions of the EIE Administration which is important for determining renewable energy potentials, for raising awareness of the people and for future planning (2007, p.11).

2.3.3) The Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (Law No. 5346 amended with Law No. 6094)

This law is the main arrangement on renewable energy. It determines the rules of investments and purchasing. In the article 1 the purpose of the Law is determined that

> is to expand the utilization of renewable energy resources for generating electrical energy, to benefit from these resources in secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing sector for realizing these objectives (2005, p.1)

Moreover it states the necessity to have 'Renewable Energy Resource Certificate' for purchasing and sale of electrical energy which is given by EMRA (Art 5). With Law No 6094 the support mechanisms and support rates were determined. The State gives a guarantee to the generators to take electricity with a fixed price. The electricity producers (who generate electricity from a renewable energy source) can sell the electricity to the State. The fixed prices for hydro is 7, 3 (USA) dollar cent/kWh, for wind is 7, 3 (USA) dollar cent/kWh, for geothermal is 10, 5 (USA) dollar cent/kWh, for biomass 13, 3 (USA) dollar cent/kWh and finally for solar 13, 3 (USA) dollar cent/kWh. Additionally if the generator takes the components of the power plants like turbine, wings or power electronics from a domestic manufacturer the purchase price will increase. (2010, p.3-4-5).

2.4) PROGRAMMES AND POLICY INSTRUMENTS FOR RENEWABLE ENERGY

Under this section it is not possible to look at the issue as in the first section. Because Turkey does not have programmes or policy instrument for supporting renewable energy like the EU. There is only a program that aimed to increase the level of energy efficiency which will be examined lastly under this headline. Actually it is related with renewable energy in order to raise awareness of the people.

The case of policy instruments, Turkey is using FiT system to support the renewable energy investment. The purchasing prices were explained in the previous part under the related law. So it is not necessary to explain the issue under the different headline. What is more a comparison will be made in the third section of the study.

Herein, it may be significant to point out the role of MENR and the related corporations. Under the umbrella of the Ministry of Natural Resources and Energy there are four attached institutions. Beside these there are nine related institutions and two affiliated institutions working together for the energy purposes. (Table 5) The attached institution with this thesis subject is General Directorate of Electrical Power Resources and Development Administration (EIE). In the case of related institutions Turkish Electricity Transmission Company (TEİAŞ), General Directorate of Electricity Generation Corporation (EÜAŞ), Turkish Electricity Trading and Contracting Company Inc (TETAŞ) can be counted. As affiliated institution EMRA has a very important and determinant factor.

The establishment of EMRA in 2001 was one of the important steps for the renewable energy planning. EMRA has an independent status in the field of energy regulations not only working for renewable energy. The status of EMRA for the energy sector constitutes a main regulatory structure although there are some problems regarding its corporate structure. According to the ENERDATA:

> "Its role is to deliver new licences for the production of electricity, to approve new distribution contracts, to fix the electricity and gas sole tariffs, to implement financial and administrative sanctions and to make sure that the competition rules are being complied with" (Enerdata, 2010, p.4).

On the other hand the role of EIE is also important. Because it's main duty as stated below is to make researches on energy sources, to make studies of education and to make surveys for the rational use of energy (EIE, 2011, online). With the Law No: 4628 the enterprises was reregulate and the inclusive corporation TEAS separated three enterprises. Their duties are:

> The Turkish Electricity Transmission Joint Stock Corporation (TEIAS) is responsible for operating the national grid, the Turkish Electricity Generation Joint Stock Corporation (EUAS) is responsible for operating the state-owned power generation facilities, and the Turkish Electricity Trading Joint Stock Corporation (TETAS) is involved in purchasing the electricity from the producers and the sale of such electricity to the distribution companies (Ozturk, Bezir &Ozek, 2008, p.387).

For the energy efficiency issue EIE generate an initiative which calls 'El Ele Enver Hareketi'. Its main aim is to raise awareness of public for the energy efficiency. The EIE established a portal for this purpose and makes campaigns to teach the importance of energy efficiency to the different levels of public (EIE, 2011, online).

Table 5: Related Corporations of the Ministry of Energy and Natural Resources

ATTACHED INSTITUTIONS
General Directorate of Petroleum Affairs (PİGM)
General Directorate of Electrical Power Resources Survey & Development Administration (EİE)
General Directorate of Mineral Research & Exploration (MTA)
Turkish Atomic Energy Authority (TAEK)
RELATED INSTITUTIONS
Turkish Electricity Transmission Company (TEİAŞ)
General Directorate of Electricity Generation Corporation (EÜAŞ)
Turkish Electricity Trading and Contracting Company Inc. (TETAŞ)
General Directorate of Turkish Coal Enterprises (TKİ)
Turkish Petroleum Corporation (TPAO)
Petroleum Pipeline Corporation (BOTAŞ)
Eti Mine Works General Management (ETİ MADEN)
General Directorate of the Turkish Hard Coal Enterprises (TTK)
Turkish Electromechanics Industry (TEMSAN)
AFFILIATED INSTITUTIONS
National Boron Research Institute (BOREN)
Energy Market Regularity Authority (EMRA)

Source: Ministry of Energy and Natural Resources. (2011e). *Related Corporations*. [online]. http://www.enerji.gov.tr/index.php?dil=en&sf=webpages&b=relatedcorporations&bn=1076&hn=&id=4812. (Retrieved March 12, 2011).

2.5) FUTURE PLANNING

In Turkey for the current situation there are three reports as stated in the previous parts. But the main report is 2010-2014 Strategic Plan of the MENR. The extent of the plan covers the all energy and natural resources purposes. So for renewable energy planning there is not any document that focuses on only renewable energy.

Besides there is not any document focusing on renewable energy, the Strategic plan also covers a short term period. It covers the years between 2010 and 2014 although it has aims for 2023, the 100^{th} years of the establishment of Republic of Turkey. But these aims are not imposed sanctions to the MENR and other institutions.

In the plan firstly the need for encouraging the usage of domestic sources and redesigning in the energy mix is being discussed. Under the first aim the works for researching oil and natural gas reserves, construction of domestic coal thermal plants and construction of nuclear power plants are targeted.

For the renewable energy sources, targets were determined. It is expected that until the end of 2013 the hydropower capacity will reach 5000 MW. In the case of wind energy the planned target is to reach 10.000 MW installed capacity until 2015. But importantly it is crucial to observe that in 2009 the installed capacity of wind was only 802, 8 MW. So there is a huge gap about how these investments can be realised. On the other hand the targeted capacities for geothermal is 300 MW which is nearly four times over than the 2009 numbers.

As a third aim the energy efficiency issue was mentioned. The necessity to reduce primary energy density was underlined as an important point. It is planned to reduce it 10% until 2015. Moreover, the harmonization of EU acquis for energy efficiency was seen crucial and settles within the main strategies.

The fourth aim was related with free market conditions. Under this aim it is assumed that the targeted privatization will be completed until 2015. Additionally, the fifth aim is about the oil and gas exploration. In the sixth aim it is about Turkey's special geographic position and the seventh aim is also related with the environment

which focuses on the common but differentiated principles. The following aims are about natural resources and corporate structure which are not related with this thesis.

After considering the order of the Strategic Plan in order to reach the targets determined for renewable energy there is a need for more struggles. Lack of State support and inefficient support mechanisms can easily block the development process.

Finally, this plan was aimed to design a short term perspective for the energy policy. But it also has long term targets. Importantly, there are not any mandatory targets. On the other hand, as mentioned above, the National Climate Change Strategy can also be assessed with energy policy. From this point of view, it is obvious that the energy planning is not sufficient to reach the determined targets. There is a strong necessity for more effective and comprehensive planning that includes all related components. The collaboration of related Ministries like Energy, Environment, Transportation, Industry etc. will make easier to take decision on the energy planning without harming the development of industry as well as decreasing GHG emissions. That is to say the energy policy cannot be evaluated by itself. It has interactions with the other political areas.

CHAPTER III: THE COMPARISON OF TURKEY AND THE EU'S RENEWABLE ENERGY POLICIES

This section is planned to reflect the main connections between the EU and Turkey's energy policies and compares renewable energy politics. In general terms the subject of this thesis is very technical. Because of that reason it is difficult to find a theoretical background and explain the issue with grand theories. This difficulty urges the research to find alternative ways to create an available background.

The order of the headlines designed in a similar way with the first two sections. So it is necessary to discuss how a theoretical background can be given to this thesis. Apart from this the comparison of existing energy sources and their production capacity will be compared. The decision making styles, comparison of support mechanism and finally the social cost and benefit analysis perspectives will be studied under this section.

3.1) THEORETICAL BACKGROUND

Most of the researches related with the energy issues were written by engineers. So it is difficult to emphasize theoretical background with referencing the literature. But, especially renewable energy issue can be seen from different levels. The issue has started to gain importance in global, regional and national levels. Political multilevel system can constitute the main background of this thesis. From the EU perspective multilevel governance is a proper background.

On the other hand Turkey's involvement with the international policies is very limited. So for Turkey actually an analysis arising from the multilevel governance system would not be proper. In other words, energy issue still sustains its national characteristic for Turkey. As a sovereign state Turkey wants to sustain its policy on her own. However, developments in the international environment policy urge the States to link their energy policies with the international environment policy. To the point Turkey is urging by the international system especially by the EU while trying to protect its realistic presence.

In general terms, for Turkey's energy policy a study on the neo-realist outlook is proper. But the liberalisation movements in the energy sector require looking at the principles of neo-liberalism.

3.1.1) Multi-level Governance System in the Energy Policy and the EU

Multi-level governance can be defined as the system that 'characterized by various levels of political space and a problem- or policy- specific functional context' (Hirschl, 2009, p.4408) or 'applied in a variety of policy domains' (Smith, 2007, p.6267). In this context renewable energy can be linked with the global environment and climate policies. Within this process there are many actors that has involved in; like governmental actors, NGOs, interest groups etc.

Interestingly Rosamond, underlined that the states are still protecting their importance within the multi-level governance system. In his words:

> MLG (multi level governance) is consistent with a rather more pluralistic view of the state as an arena in which different agendas, ideas and interests are contested. ...States remain crucially important, but they are melded into the multi-level polity by their leaders and the actions of numerous subnational and supranational actors (Rosamond, 2000, p.111).

In the case of the EU, countries like Germany or Denmark are the main propellant powers with encouraging the development of renewable energy policies. From this perspective their regional and national effects are crucial for the EU to construct a European level policy (Smith, 2007, p.6266). Moreover, the success of the EU about producing policy affects the international or supranational movements. As a two way process the EU is also affected by the international decisions especially related with the climate change.

The implementations of new Directives based on the renewable energy policies create a background for more developments in the EU level which also affects Turkey's policy as a candidate country. The system of the EU is very complex so, the effects of different actors can change from time to time. The attempts for creating a common European energy policy develop the multi-level governance system. It is possible to see

some inconsistencies between the different levels of actors. Smith argues that in the UK there is also some tensions between the actors in different levels (2007, p.6267).

3.1.2) A Neo-realist and Neo-liberal Outlook to Turkey's Energy Policy

The fundamentals of realism and neo-realism are explained by Jervis that:

> Both realism and neoliberalism start from the assumption that the absence of a sovereign authority that can make and enforce binding agreements creates opportunities for states to advance their interests unilaterally and makes it important and difficult for states to cooperate with one another (1999, p.43).

In the case of Turkey, the dependence of imported fuels actually obstructs to take more state based decisions. But the intentions for increasing the use of domestic sources can give the power to Turkey to decide on her own. But importantly the role of the EU and the harmonization process with the EU acquis is on the other hand affects its decisions.

According to Burchill, the main question behind Waltz's neo realist problematic is 'why do states exhibit similar foreign policy behaviour despite their different political systems and constructing ideologies?' (2001b, p.89). As one of the important theorists of neo realist theory Waltz tried to explain the nature of the international system under the balance of power understanding. Based on this question an assumption can be done that Turkey like the other States as a sovereign body has right to plan its own energy policy. Its special geographical position is also an important asset in terms of having power.

Neo-liberalism on the other hand bases on free trade. Burchill says that 'free trade was a more peaceful means of achieving national wealth' (2001a, p.37). The case of economic liberalisation as an ideology of international political economy (Hay, 2009, p.143) constitutes the main motivation behind the liberalisation process in the energy sector of Turkey since 1980's.

All in all apart from these explanations energy policy needs to be studied from more general perspective with referencing all levels of actors. Especially there is a

strong need for more theoretical studies that could not be examined in detail in this study. Additionally the international efforts against climate change would possibly create a theoretical background also for the energy policies in the recent future.

3.2) THE COMPARISON OF PHYSICAL STRUCTURES OF ENERGY SOURCES

In this section it is preferred not only to look at the renewable energy sources but also to look at the non-renewable energy sources in order to give a comprehensive perspective about the current energy situation. Most of the rates were given in the previous sections in detail. That is to say, under this section it is avoided to give all the details about the sources.

3.2.1) Non-renewable Energy Sources

Within the EU 80% of the fossil fuel reserves are solid fuels which are lignite and coal (European Commission and DG for Energy and Transport, 2008, p.27). The proved coal reserves of the EU is 56 148 million tonnes which constitutes 6, 5% of the World total (BP, 2011, p.30). On the other hand Turkey has 2 434 million tonnes proved recoverable reserves at the end of 2008 (WEC, 2010, p.11). According to BP, Turkey has 0, 3% of the World coal reserves (BP, 2011, p.30). In the comparison of their surface areas this difference is natural.

In the case of production, in 2010 17, 4 Mtoe coal was produced in Turkey and the amount of consumption was 34, 4 Mtoe. With this consumption the rates of change 2010 over 2009 was 7, 4% (BP, 2011, p.32-33). On the contrary the EU has 156, 0 Mtoe production and 269, 7 Mtoe consumption. The rate of change 2010 over 2009 was 3, 8% (BP, 2011, p.32-33).

For the oil reserves while the EU has 0,8 thousand million tonnes (6,3 thousand million barrels) oil reserves and share 0,5% of the World's total, Turkey has 44,3 million ton oil reserves according to 2009 rates (BP, 2011, p.6; MENR, 2011a, online). Turkey has very limited oil reserves but there are some struggles to find new reserves in order to decrease the oil dependency of Turkey. In the EU, the countries that have oil

reserves are Norway, Romania and the United Kingdom. After considering these reserves it is not possible to say that neither the EU nor Turkey have satisfactory reserves on oil. Apart from this their consumption rates are very high which will be examined.

Production of oil in 2008 was 2, 4 million tonnes in Turkey and the consumption was also 27, 8 million tonnes (MENR, 2011a, online). For the year 2010 as to the BP, the consumption was 624 thousand barrels per day which decrease -1, 1% from 2009 to 2010 (BP, 2011, p.9). The EU also has 1951 thousand barrels production and 13 890 thousand barrels consumption per day (BP, 2011, p.8-9).

Natural gas is another non-renewable energy sources which has very limited potential both the EU and Turkey. According to BP statistics, total EU reserves are 2, 4 trillion cubic meters and share 1, 3% of the World's total. On the other side Turkey has 6, 2 billion cubic meters oil reserves (BP, 2011, p.20; MENR, 2011b, online).

The current production rates for Turkey is not available but in the web site of the MENR but it is stated that Turkey has 14.576 MW installed capacity for production of electricity from natural gas (MENR, 2011b, online). The consumption rates for 2010 is 39, 0 billion m^3 with 9, 2% increases from 2009 to 2010 (BP, 2011, p.23). Additionally the EU has 174, 9 billion m^3 production and 492, 5 billion m^3 consumption in 2010. The consumption of natural gas has increased 7, 4% from 2009 to 2010 (BP, 2011, p.22-23).

3.2.2) Renewable Energy Sources

The renewable energy potentials and partly consumption rates were given in the previous sections. So within this section the production and consumption rates of renewable energy and installed capacities in the EU and Turkey will be studied. Before starting to examine the issue it is necessary to mention that for this section it is not preferred to use the BP's data. Rather than using their data, the Eurostat's year book 2010 and MENR's data will be used.

Eurostat made a statement that:

> Among renewable energies, the most important source was biomass and waste, accounting for 96.2 million toe of primary production in the EU-27 in 2007. Hydropower was the only other significant contributor to the renewable energy mix (26.7 million toes). Although production still remains small, there has been a particularly rapid expansion in the production of wind energy, reaching 9.0 million toes in the EU-27 in 2007(Eurostat, 2010, p.556).

Within the EU the consumption rates are decreased the level of 2003 in terms of gross inland consumption and final energy consumption. Moreover natural gas and renewable energy sources started to replace oil and solid fuels (Eurostat, 2010, 564-565). For Turkey there is an increase for gross inland consumption and final energy consumption. Turkey increased its gross inland consumption from 79, 4 Mtoe to 101, 5 Mtoe between the years 2003 to 2007 (Eurostat, 2010, p.568) (see figure 19). Apart from the EU the increasing consumption rates of Turkey related with its development process.

In the year 2007, 19, 2% of the electricity was generated from the renewable energy sources. The EU also has 15, 6% share of renewables in the electricity in 2007 (see figure 20). With new policies they increased the renewables share to 21% in 2010 (Eurostat, 2010, 575). The current 2010 rates are not available for Turkey. So it would not be possible to compare the progress within 3 years period.

In the EU generated electricity from hydropower was 344, 6 TWh, from geothermal was 5,6TWh, from wind tribunes was 82, 3 TWh and from biomass was 89, 8 TWh in 2006 (Eurostat, 2010, p.575) (see figure 21). Turkey also in 2009 has generated 35959 GWh, electricity from Hydropower, 340 GWh from biomass, 436 GWh from geothermal and 1495 GWh from wind (MENR, 2011c, online).

In Turkey, at the end of 2009 the installed capacity of wind has reached 802, 8 MW whereas geothermal capacity has reached 77, 2 MW. Additionally in 2009, 420.000 TEP heat energy was generated from sun. Also, 66.000 TEP energy was generated from biomass (MENR, 2011d, online).

In the EU there has been a good progress in the renewable energy investments. Wind energy has reached from 13 GW to 57 GW installed capacity between the years 2000 and 2007. Installed hydro capacity increased 227 MW whilst geothermal increased 857 MW capacities. For the solar energy solar thermal capacity has reached 20, 1 million m^2 while photovoltaic energy has 1731 MW capacity in 2007 (European Commission & DG for Energy, 2010, p.70).

The energy efficiency studies affected the consumption rates of energy in the EU that caused reductions in consumption from 2003. On the contrary Turkey's consumptions have been increasing in direct proportion to the development rates. As a developing country Turkey wants to encourage its industry. From this point of view the energy efficiency studies are also necessary for Turkey. In the case of installed capacities Turkey needs to pay more attention to increase renewable energy investments.

3.3) COMPARISON OF SUPPORT MECHANISMS

As stated in the first section in the EU there are two different financial support mechanisms for electricity sector under the direct instruments. One of them is TGC and the other one is FiT. In Turkey the FiT mechanism has preferred to support the renewable energy investments.

From the EU's side in order to reach 2020 objectives there are a need to have well designed and functional policies to accelerate the renewable energy share within the member countries. The member states have different kinds of support mechanisms and also policy structures. So there is not a common European policy to support renewable energy investments.

Zamfir identifies four points that urge the renewable energy:

> 1) Society relies mainly on fossil fuels, which are limited and non-renewable;
> 2) Fossil fuels will be exhausted in a foreseeable future;
> 3) The use of fossil fuels has generated environmental effects that negatively affect social well-being beyond acceptable limits;
> 4) Renewable energy sources could satisfy the needs of modern society in terms of consumption and environmental impact (Zamfir, 2009a, p.153).

Mainly, driving forces behind the renewable energy need are those points which also led countries to support new investments. The levels of success can vary from country to country but it is necessary to mention that without any State support the renewable energy investments cannot be realised by the private sector. The contribution of the State is the core of the renewable energy planning.

From this point of view, Ragwitz et al. determined two criteria to assess the support instruments. One of them is minimising generation costs and the other one is lower producer profits (Ragwitz et al., 2005, p.3). These are the determinant factors of the success of financial support mechanisms.

There are different kinds of renewable energy support mechanisms or instruments using in the EU apart from FiT and TGC systems. Cansino et al. categorizes them as:

> (i) quota regulations in terms of quota obligations, which are linked to the trade of certificates, (ii) statutory entitlement of RES electricity plants to connection to, and usage of, the grid in many countries, and (iii) price regulation. The third instrument can be implemented in terms of feed-in tariffs, quota obligations/green certificates or bidding systems. Apart from these promotion instruments, subsidies, financial incentives, green funds and tax incentives are also used. (Cansino et al., 2010, p.6001).

From this point of view to support renewable energy investments, the environment taxes (tax incentives that have positive impact on environment) are also necessary and have advantages. Their advantages can be divided into two categories: green dividend and blue dividend. Green dividend is related to protecting environment and on the other hand blue dividend covers more broad perspective. One of the important tools is also its positive effect on employment levels (Cansino et al., 2010, p.6001). In the division of Cansino et al. direct taxes cover personal income tax, corporate tax, property tax and indirect taxes cover VAT (value added tax), excise duty exemptions. There are such a broad support mechanisms that using but in terms of price regulation it is necessary to focus on the FiT and TGC systems.

Generally FiT systems are based on price driven incentives whilst TGC are based on quantity driven instruments. In the FiT systems tariffs are determined by the

governments and the purchasers are obliged to buy electricity from a determined price. On the contrary in TCG systems the investments are realised due to the Government's determination for deployment (Ragwitz et al., 2005, p.5).

As stated in the first section that FiT system is mostly preferred by the member states and TGC system has been used in a very narrow scale. The choice of Turkey to use FiT system necessitates looking at the EU countries using this tool. To narrow the coverage of the issue Germany has chosen to be studied about FiT system. In a sense, Germany and Turkey's FiT mechanisms will be studied. The long experience of Germany was the motive behind the selection of this country. Additionally, the TGC experience of the United Kingdom can be studied in tersely.

3.3.1) FiT System in Germany

The direct support for wind energy was started in 1989 and with 'Electricity Feed in Law' in 1990 the FiT system legally began (Sensfuß, 2007, p.14). Until now there has been a significant development in the renewable energy sector. Additionally the renewable energy mix has been diversified from hydro power and minimum shares of the other renewable types to huge wind, photovoltaic and biomass powerplants. Interestingly the installed capacity increased from 56 MW to 20622 MW between the years 1990 and 2006 (Sensfuß, 2007, p.1). There is a persuasive evidence of the success of a country that realise the renewable energy investments within the 20 years period.

The Renewable Energy Act (2000) can be seen as the accelerator of the Germany's support mechanism. Because Sensfuß underlined that: 'it required public utilities to buy electricity generated by renewables at a given price' (Sensfuß, 2007, p.14). This requirement provides the rapid development substantially. From the EU perspective in the Directive 2009/28/EC and 2009/548/EC the targets has determined for the countries to reach the 2020 objectives. According to the EC there are only seven countries Denmark, Germany, Hungary, Ireland, Belgium, Netherland, Sweden that expected to reach their 2010 electricity targets. For the current rates only Germany, Denmark, Hungary and Ireland has reached their targets, even they went beyond their targets. Germany's target was 12, 5% share of renewable but they reached 17, 4%,

Denmark also reached 34, 3% share which is 5, 3% over the determined targets (European Commission, 2011o, online). Importantly these two countries using FiT system to increase renewables' share in the electricity production.

In the case of Germany and Spain, Ragwitz et al. say about the FiT mechanism's effect on wind energy that:

> The high investment security and low administrative and regulative barriers have stimulated a strong and continuous growth in wind energy during the last decade. It is commonly stated that the high level of the feed-in tariffs would be the main driver for investments in wind energy in these two countries (Ragwitz et al., 2005, p.11).

After considering the importance of the issue it has preferred to say that for Germany not only FiT system but also soft loans and different programmes have also created a proper background (Sensfuß, 2007, p.14). Therefore the FiT system cannot be evaluated by itself but also to increase its effectiveness it requires more supportive struggles.

3.3.2) FiT System in Turkey

As s supportive mechanism FiT is preferred by Turkey. But there is a debate on the effectiveness of the usage of FiT system in Turkey (With reference to the interviews that were done with T.S. Uyar and Z. A. Eriş). The determined fix prices for the electricity produced by the renewable energy sources are not assessed as sufficient.

The Chamber of Electrical Engineers made a statement to the press that with new Law actually there is not any difference between the previous purchase prices and current prices. 7.3 $ cent confronts the previous 5.5 € cent. Moreover, they criticize that this new arrangement allow for the production of powerplants in protected areas and forests which will be harmful for the environment. But this Law also has a positive side which is incentives for domestic production (EMO, 28/02/2011, online).

Further, if all system is considered without any additional support mechanisms or incentives the guarantee of purchase cannot be effective to support renewable energy investment. The recycling period of the investment is very long and not profitable for

the private sector. In fact the nature of the renewable energy investment assumes long period that pay for itself, but without any State contribution the renewable energy investments cannot be considered as rational choice for the investors.

On the other hand the issue of the renewal of the electricity grid is also another important matter. The new renewable energy investments require new and smart grids. The existing presence of electricity grid is not sufficient for the new investments. In the Blue Book it has underlined that TEIAS is the main responsible body for constructing new grids and renew the existing ones (MENR, 2010b, p.126).

3.3.3) TGC System in the United Kingdom

The UK has been using TGC system until 2002 (Ragwitz et al., 2005, p.12). Zamfir identifies that TGC certificates are mainly 'based on the principle of imposing minimum shares of renewable electricity on consumers, suppliers or producers' (2009b, p.528). Besides the UK, Belgium and Sweden are carrying on TGC system successfully. The system is mostly related with level of development. There is success in TGC system but not that much in comparison with FiT system. It has underlined by Ragwitz et al. that 'quota systems as the main support instrument, have a high expected annuity of support (and therefore high costs for consumers) but low growth rates' (2005, p.2).

3.4) THE CASE OF SOCIAL COST AND BENEFIT ANALYSIS

Social costs as Verbruggen et al. 'refer to the residual use of real production factors, not falling on private entities' (Verbruggen et al., 2010, p.853). The importance of the social cost comes from its nature that some costs cannot be quantified. From this point of view the energy investments need to be calculated about their externalities. External cost can be a part of the social cost analysis to determine the negative externalities as far as possible.

From the beginning the costs of renewable energy investments are very high and they have disadvantages over against the traditional fuel based investments. It has discussed that renewable energy technologies cannot compete with traditional ones. But it would become possible after fifty years period (Mirasgedis et al., 2000, 65).

On the one hand the necessity to reduce GHG emissions to supply the World's survival and on the other hand high cost of new investments make the issue very complex. However, with public and State support this transition period can be realised with little chaos. Importantly without efficient and well designed political behaviours the process becomes a labyrinth. The continuity of the solutionlessness creates a vicious circle and it will become difficult to evaluate new solutions.

In the non-sustainable energy supply costs there is a huge gap that could not be calculated about the unpaid social costs. In general terms social costs cover environmental negative outputs, long terms risks and unfair income distribution of energy investments and many others that affect the social circle and cannot be fully calculated with the existing research tools (Verbruggen et al., 2010, p.853).

Environmental Impact Assessment (EIA) is also another dimension of the energy planning. It is necessary to find out environmental outcomes of energy investments. But they have to be designed in the most proper way. Ineffective EIA's makes difficult the process (Erdoğan & Ejder, 1997, p.124). Owen argued that there are two broad environment externalities of energy investments:

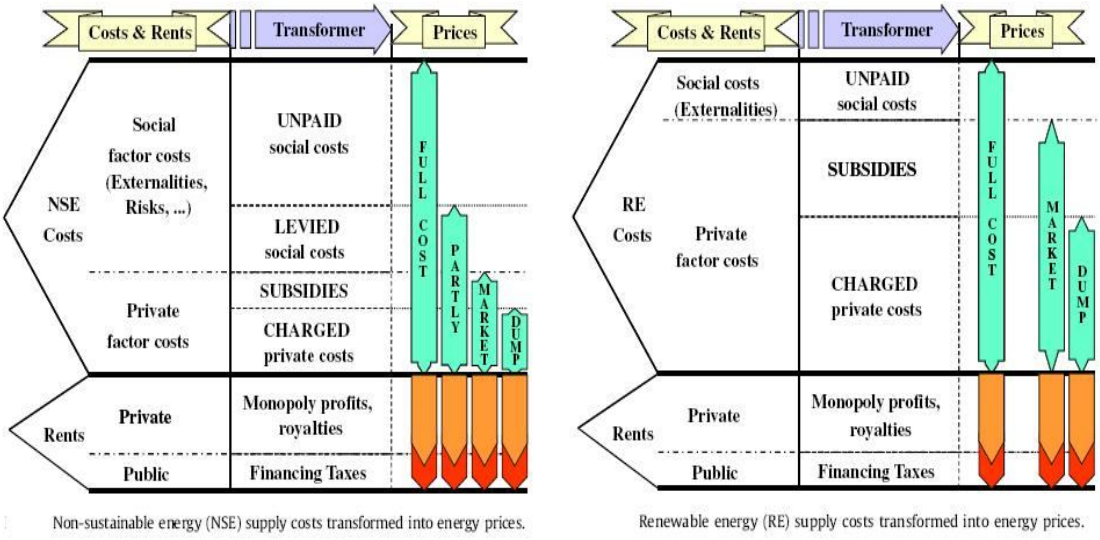
- Costs of the damage caused to health and the environment by emissions of pollutants other than those associated with climate change and
- Costs resulting from the impact of climate change attribute to emissions of greenhouse gases (Owen, 2006, p.636).

So energy, environment and health have strong ties that cannot be separable. Additionally they need to be evaluated jointly. In spite of the superiority of non-fuel sources for the future of the World, renewable energy technologies have to be competitive. That is to say economy is the other aspect of the issue. In general terms all four basic elements like legs of the table. And without any of them to construct a comprehensive policy is impossible.

Monetarisation or pricing the cost of investments necessitates looking at the process from three perspectives. First one is cost and rents, second one is transformer and the third one is prices. In the article of Verbruggen et al. they criticise that from non-sustainable energy (NSE) supply costs to renewable energy costs there are some

changes. Costs are changing whilst rents protect their presence (Rents cover monopoly profits, loyalties and also financing taxes). Table 6 shows their evaluation about the changes on prices (Verbruggen et al., 2010, p.853).

Table 6:



Source: Verbruggen, A., Fischedick, M., Moomaw, W., Weier, T., Nadai, A., Nilsson, L. J., Nyboer, J., Sathaye, J. (2010). Renewable Energy Costs, Potentials, Barriers: Conceptual Issues. *Energy Policy*. 38, p.853.

From this perspective it is possible to see that with renewable energy investments, the unpaid social costs part is decreasing. But to the point it is necessary to mention that the social cost analysis is the core of the investment mechanisms. Without referring to social cost, it is quite out of the question to make rational choices on new investments.

3.4.1) Social Cost Calculation in the EU and Turkey

From the internalisation of external costs perspective the EU has created ExternE (External Costs of Energy) project in 1991 which has involved more than 50 projects in 20 countries. In their terms:

> Internalisation of external costs is intended as a strategy to rebalance the social and environmental dimension with the purely economic one, accordingly leading to greater environmental sustainability (ExternE, 2011, online).

They suggest that in order to consider the cost to the environment or human health there are ways to meet this costs like eco-taxes, subsidise cleaner technologies or external costs estimations. As the project, for the electricity which produced from coal an addition to the bills between 2 and 7 cents per kWh can be a solution for financing social costs(ExternE, 2011, online). Its methodology has six principles:

> 1. The first principle of the ExternE methodology is that this assessment or weighting of impacts is as far as possible carried out using quantitative figures and procedures. The reason is that only quantitative algorithms ensure the necessary transparency and reproducibility of results.
> 2. Secondly, the common unit into which impacts are transformed is a monetary unit. This has a number of advantages: units are conceivable, monetary values are transferable from one application to another and in order to compare costs with benefits, it is necessary to convert benefits into monetary units. For internalising external effects with taxes, it is also obviously necessary to express these effects in monetary units.
> 3. The assessment of impacts is based on the (measured) preferences of the affected well-informed population.
> 4. To be able to get meaningful results, the interviewed persons have to understand the change of utility that occurs due to the impact to be assessed. This implies that it is important to value a damage, not a pressure or effect.
> 5. The methodology should thus be capable of calculating site and time dependent external costs. Only a detailed bottom-up calculation allows a close appreciation of site, time and technology dependence. Thus for most environmental impacts the so-called 'Impact pathway approach' is used.
> 6. Depending on the nature of the policy question, average or aggregated external costs can then be calculated (Externe, 2011, online).

Krewitt argued that:

> In most cases, the ExternE methodology could help to point out the advantages of investments in environmental friendly technologies also from the economic point of view even without considering the more uncertain impact categories (Krewitt, 2002, p.846).

There is also NEEDS project that ended in February 2009 which investigated the issue with three research areas. These are enhancements in energy externalities, development of long term strategies, input to policy making and dissemination (NEEDS, 2011, online). This project created several benefits for further researches with its templates especially on calculating energy related externalities.

The European Commission underlined the importance of internalisation of costs in the 'Community guidelines on State aid for environmental protection' saying

that: ‘internalisation of costs is a priority objective that can be achieved in various ways, including by way of instruments based on market laws or those based on a regulatory approach’ (European Commission, 2001, p.37/5).

For Turkey there is not any study on the social cost analysis of energy. Uyar argued that social costs have to be added to the total costs in Turkey. As Uyar, in the absence of Social cost and benefit calculations developing countries confront the transfer of obsolete technologies (Uyar, 1999, p.2). In these conditions with reference to the EU policies it would be necessary for Turkey to develop new planning perspective for the investments costs.

CHAPTER IV: THE FUTURE PROJECTION OF TURKEY'S ENERGY POLICY

4.1) POLITICAL ASPECTS OF TURKEY'S ENERGY POLICY

Within this chapter energy policy will be discussed from history to the future. Moreover, the existing public corporations and their status will be mentioned. Finally a future projection will be done with reference to the changes in electricity consumption, population and Gross National Product (GNP) rates.

In order to have a broad perspective three interviews were made with different representatives. To learn the academic outlook to the issue, an interview was made with Prof. Dr. Tanay Sıdkı Uyar, to learn the Government's outlook; an interview was also made with Mustafa Çetin. And finally, as a private sector representative, an interview was made with Zeki Aybar Eriş. There was a will to make an interview with a Eurocrat that works on Turkey's energy situation. But it could not be realised because not the reach the related person. So, from Turkey's perspective the issue will be studied in broad sense but it does not have the EU's perspective. In order to fill this gap it has intended to utilise from the Progress reports of Turkey.

4.1.1) The Energy Policy Since the Establishment of the Republic

Is there an efficient energy policy since 1923? This question is the main motivation behind this headline. In general terms as stated in the Chapter II, in order to see the general perspective it is necessary to look at the Development programs. But importantly those programmes were not sufficient to make a general energy policy. All three interviewees' answer to this question is that it is possible to say about Turkey's energy policy after 1980's. Eriş says that 'in Turkey until the 1980 within the 30 years period there has been very serious changes'. Uyar added that 'since 1980s the governments are trying more to get credits from other countries to make investments in energy field'.

On the other side Çetin emphasizes that there has been so many changes for years. He exemplifies that 'in the first years of the Republic in Malatya, Derme

Hydroelectric plant was built and its capacity was approximately 7-8 MW. That powerplant had a capacity to supply all the need of electricity of Malatya'. With the increasing needs for energy in the recent years there has been more need to have a comprehensive energy policy than the past.

From this point of view it is possible to refer energy planning after 1980's. The MENR was established in 1963 but, lack of political will or fiscal difficulties limited its effectiveness. After the enactment of Law No. 4628 Electricity Market Law and sequent Laws like Natural Gas Market Law, and Petroleum Market Law increased their roles. And especially for renewable energy the most important developments were realised after 2000 period. So can 2000 be seen as the turning point? While Uyar and Eriş accepted this assumption, Çetin underlined that:

> Although the enactments of Laws were started in 2002, the works on Law was started in 1990. In the years 1996-1996 and 1997 works were accelerated. So, when we look at the Turkey's energy policy, we cannot see that 2001 and after 2011 as a turning point.

On the other side Eriş argued that:

> Turkey's need for money, the urges of IMF, WB and the EU to leave the investments to the private sector and liberalization of the energy sector led to liberalization process after 2000s. Otherwise long term purchase contracts of BOT and treasury guarantees, so as guarantee of purchase is so important, were block the process.

As a last point, the only thing that can be said whenever it starts, the process accelerated after 2000 with the enactment of the new Laws. But their effectiveness is still questioned.

4.1.2) Liberalization and Privatization Process

Until 1980's there has been vertical integration in the energy sector (Erdoğdu, 2006, p.3). With January 24 1980 Decisions the liberalization movement was started in Turkey. The main objective of that new policy was to transit the market system and this new outlook have revolutionised the traditional policies (Çavdar, 1992, p.227). There were struggles to decrease the State's dominance in the energy sector. Moreover, State wanted to urge the private sector to make energy invest via the Built-Operate (BO),

Built-Operate-Transfer (BOT), and Transfer of Operating Rights (TOR). But, Eriş says that:

> Turkey has constructed its energy policy on short term Governments, immediate straits, advantages and disadvantages. After 1990's lack of serious means and the concerns on possible deficits the State seek a solution with BO, BOT, and TORs. But there was a wrong policy. Because of the lack of tenders, the investments were questioned. Were those expensive or cheap?

Afterwards, the questioning of the BO, BOT and TOR systems urged the State to find new ways for encouraging energy investments. Additionally, the liberalization process could not be realised without any regulations. In 2004, Electricity Sector Reform and Strategy Paper were published for determining the rules of privatization process (MENR, 2004). The liberalization process still continues since that day. Mustafa Çetin underlined that:

> Our main purpose is to provide the market liberalization align with the EU acquis which aimed to supply energy to the consumers in endurable and accessible ways.

In a sense the liberalization process takes so long time for Turkey. To the point the historical opposition for the liberalization movements have been blocking the process. As an outcome of the liberalization process the privatization issue is highly debatable. The nature of the privatization is aiming to restrict the state dominance over the sector which can easily be used for political purposes (Durakoglu, n.d., p.4). Further, Durakoğlu explained the opposite ideas that:

> In addition to the government opportunism, social opposition to privatization is at considerable level. Such opposition may be explained on traditional statist ideology, which underlines the country's economic history (Durakoglu, n.d., p.4).

From this point of view it is possible to say that, this process has been blocked not only by the State but also by the public. The privatization process has started in the early 2000s. In the pre-accession economic program it has underlined that:

> A considerable progress has been achieved in the field of privatization of electricity generation and distribution which is an important component for the establishment of a fully competitive environment in the electricity market. The expected benefits of the electricity privatization

> include the reducing costs by efficient management and reflecting them to consumers, decreasing high energy losses, empowerment of the financial structure of the sector by increasing accrual and collection rates, advancement the contribution of the private sector for supply security, and finally the realization of the renovation and expansion investments by the private sector (Republic of Turkey, 2011, p.65).

But private sector does not find the privatization struggles enough. Eriş states that:

> In order to speak of the free market, there is a need for liberalization of its components. The privatization processes of Electricity distribution companies recently come true. We are experiencing difficulties of its completion with guarantee letters and difficulties on funding. One of the reasons of that situation is the delays of the privatization tenders.

So, the privatization issue is a bit complicated because it has social oppositions arising from the historical ideas. Turkey's liberalization and privatization process on the energy issue is a painful process. However to encourage the renewable energy investments liberalization of the market is the key point. The ineffective regulations of the State and delays in progress obstruct the investments. To the point liberalization is necessary but the State has to guarantee the social side of the issue with well designed energy policy, EIA system and effective Laws.

4.1.3) The Role of Domestic Sources in Energy Planning

Domestic sources are the important contributors to the energy mix of a country. In terms of domestic sources Turkey mainly has renewable energy and coal sources whilst it has a little natural gas and oil potentials. But Turkey's energy policy heavily depends on oil and natural gas. So, Turkey imported most of the energy that is used. It is necessary to change this situation. Eriş says that:

> Politically there is a problem as I see which the usage of domestic sources is. In first period the domestic sources were considered but then with BO, BOT and liberalization they were forgotten. And they left their places to the natural gas sector which has a more powerful and faster financing power behind. In order to put the domestic sources into use there is a need for huge capital investments and credits. So because of the need for capital intensive

> investments, the capital prefers to use imported sources to make money faster.

Interestingly, Eriş mentions about difficulties on the investments. The installation time of a natural gas powerplant is approximately 6 or 8 months. On the other hand this period is 2 or 3 years for a hydropower plant, 1 or 2 years for wind powerplants and 4 years for a coal-fired powerplant (Eriş, 13/06/2011).

Çetin also emphasizes the necessity to use domestic coal sources in the energy mix in order to decrease dependence on imported fuels. On the contrary Uyar sees to support coal, nuclear, petroleum sources as the problem.

There is also nuclear energy case which is very debatable. As stated in the second chapter nearly forty years there have been some struggles to have nuclear powerplants. But is it really necessary for Turkey to have a nuclear powerplant? This also will be mentioned in this part of the work.

4.1.3.1) Coal

The status of coal is debatable. Because of its great GHG emissions, it is not a preferable choice for the energy future. But on the other hand in order to decrease energy imports of Turkey the usage of domestic coals is debated. The calorific value of the domestic coal and ineffective support mechanisms are the main obstacles behind the usage of domestic coal. They require advantage combustion methods. Çetin says that:

> Our coals are low grade fuels and it is difficult to mine. The investment costs are high because they necessitate advantage combustion methods. But both providing supply security and optimum production costs we definitely add them to our economy. Now we are working on it.

Eriş also supports the usage of coal as a domestic source to increase the energy dependency on fossil fuels. Since 1974, the usage of coal has been decreasing despite she has tertiary coal reserves nearly all regions (Baris, 2011, p.1758).

The EU has also established on the coal basis. But in the years especially with the environment policy, the consumption rates of coal have been decreasing. But Baris

underlines that: ‘there is still a significant amount of coal production though it has been decreasing in the EU region’ (Baris, 2011, 1756).

For the USA after the National Energy Policy Report prepared by the National Energy Policy Development Group under the Secretary of Vice President Dick Chaney (2001, online) there have been cancellations in the coal fired power plants. According to the Purdue University in 10 years there have been 150 cancellations in coal plants within the USA (Greenanswers.com, 2011, online). Like the EU, the USA also prefers to decrease coal plants. In order to protect the environment usage of coal is limited.

In the case of alignment of the EU and Turkey’s policies, the situation of coal is complicated. On the one side Turkey wants to increase its domestic sources’ share in the energy generation mostly in electricity. But on the other side in order to comply with the EU acquis Turkey needs to decrease its coal share. The EU only accepts the coal systems compatible with the Carbon Capture and Storage (CCS). In the following years it can be expected that the usage of coal will decline due to the environmental concerns (Baris, 2011, p.1761). Moreover Baris states that:

> Considering that the country ratified the Kyoto Protocol, it is assessed that this issue will create serious problems for Turkey in near future in both complying Kyoto Protocol's and the EU's requirements. This is supported by European Commission in “Turkey 2010 Progress Report” published by the Commission on November 9th, 2010. In this report, European Commission decided that Turkey's aim to limit greenhouse gas emissions growth by 11% from the projected 2020 emissions on the basis of the business as usual scenario cannot be considered to be ambitious

All in all if Turkey wants to be a member of the EU the usage of coal in the energy sector has to be discussed. Because all coal investments would be inactive with the membership. To the point Eriş also says that:

> If the MoEF has to take decisions in parallel with the EU harmonization criteria, Turkey has to shut down some of the powerplants which are Seyitömer, Yatağan and Kemerköy. Moreover lots of factories have to shut down. But Turkey needs to produce incomes.

Development and harmonization with the EU criteria can be seen as the two side of the same coin and requires logical planning without affected by the political

wills. Neither Turkey, nor the World live without considering the environmental outcomes of their behaviours.

4.1.3.2) Nuclear Energy

Nuclear energy is another debatable issue in Turkey. The nuclear studies are conducted by the Turkish Atomic Agency which has been sustaining its role since its establishment in September 4, 1956 (Hepbaşlı & Ozgener, 2004, p.964).

The Turkish Government strongly supports the construction of nuclear powerplants. The Minister of Energy and Natural Resources Taner Yıldız explain their policies in his article that:

> The integration of nuclear energy into Turkey's energy capacity is also going to be one of the main tools in responding to the growing electricity demand, while avoiding increased dependence on imported fuels (Yıldız, 2010, p.36).

In the web page of the MENR it has also stated that:

> For the continuity of electricity generation, nuclear power plants are safer and have higher availability compared to thermal and hydraulic power plants. Based on electricity energy supply and demand projections, it is targeted by 2020 that nuclear power plants will have a minimum of 5% share in electricity production. To that end, Law No. 5710 on Construction and Operation of Nuclear Power Plants and Law on Sale of Energy (2007) were enacted. On May 2010, an intergovernmental agreement was signed between Turkey and Russia regarding the construction of a nuclear power plant in Mersin-Akkuyu (MENR, 2011f, online).

On the other side of the issue Uyar approached the topic from a different standpoint that he argued that even if nuclear powerplants do not have GHG emissions like other fuel based powerplants they have environmental problems. The case of a mechanical breakdown can cause the death of millions of people, radioactive pollution in the environment and billion dollars damage. Moreover their removal costs are very high and considering with their benefits, the energy they produced is actually very expensive (Uyar, 1999, p.3).

Uyar also specified the obstacles in the harmonization process of Turkey's policies to the EU acquis that:

> The desire of the countries managers like Germany, France and Netherlands. They desire to dislocate obsolete energy technologies to Turkey. And the name for this is privileged partnership. That's the name irreversibility of problem.

4.2) ENERGY DEMAND PROJECTION MODEL OF TURKEY

Turkey's Energy Demand projection leans on Model for Analysis Energy Demand (MAED). This model is being used by the MENR with recommends of World Bank in 1984 to calculate the possible future consumptions (SPO, 2011, P.3-1). The MAED considers the medium and long term energy demand of the country. It has a wide entry list like economic, social and technical infrastructure for surveying. In this model demand estimations cover the five years terms (Utlu, 2004, p.181).

Apart from MAED, IEA has created a programme namely Energy Technology System Analysis Program (ETSAP). In its web site there is an explanation on the construction of ETSAP that:

> functions as a consortium of member country teams and invited teams that actively cooperate to establish, maintain, and expand a consistent multi-country energy/economy/environment/engineering (4E) analytical capability. Its backbone consists of individual national teams in nearly 70 countries, and a common, comparable and combinable methodology, mainly based on the MARKAL/TIMES family of models, permitting the compilation of long term energy scenarios and in-depth national, multi-country, and global energy and environmental analyses. (ETSAP, 2011, online).

The TIMES Integrated Assessment Model (TIAM) is used for forecasting the possible future scenarios. It can be also argued that:

> So far no 100% renewable global energy scenarios have been modelled with TIAM, but many analyses focus on keeping the increase in global mean temperature below 2 ^{o}C. As a part of the solution to reduce GHG emissions all these scenarios include non-renewable energy such as nuclear power and fossil fuelled power plants with carbon capture and storage (CCS). To the best of our knowledge, no other global energy system models have been used for analysing a global 100% renewable energy system, but several models have been used on regional and national scale to model such system (Føyn et al., 2011, p.526)

Turkey is not included in this programme. But it can be an important alternative for Turkey in Energy Plans. Because of the technical side of the issue it has

mentioned only a limited perspective. Analysing the issue necessitates engineering background and which is also off topic. There is a need for more studies on this issue.

4.3) THE IMPORTANCE OF SUPPORT MECHANISMS

In the third chapter the importance of support mechanism was discussed and in this section only the ideas of interwees will be studied. Turkey's support mechanism leans on the FiT system. But the purchasing prices of the State are debatable. Uyar says about that:

> The law does not support. The law only makes difficult to get credits for renewable energy investments. Because the state guarantees one third of the real prices electricity generated from renewable energy sources. So it is not really a support. The Law itself is an obstacle.

Eriş also has similar opinion:

> 7.3 $ is not an affordable price for making investments. During the eight years the purchasing price was 5.5 Euro cents. Within this process, in a year there were made investments approximately 300-500MW. So, this is not sufficient. There is no possibility that they can be effective.

On the contrary Çetin emphasizes that:

> this law brought two kinds of incentives. With the Renewable Energy Sources Support Mechanism the generator can sell electricity to the public with a fixed price. Moreover if the generator uses domestic products in his investments he can take more incentives. We are working on the new Directive that we are going to publish it in a near future.

Additionally Eriş offers a Green Certificate method which is based on the certification of generated electricity from renewable energy sources. He says that:

> Although Turkey is exempt from the Kyoto Protocol and EU targets some conscious consumers want to buy green electricity. But a wholesaler if he has a little green electricity in its portfolio, he can sell all of them as green electricity. If the produced electricity is certificated by TEİAŞ, the consumers can buy real green electricity. The consumers have to use their rights.

4.4) THE STRUCTURE OF PUBLIC CORPORATIONS

Especially after 2000 both with the privatization process and with new Laws the position of the Public Energy Corporations were started to be questioned. Durakoğlu calls this situation as a 'regulatory chaos' (2001, p.1). The involvement of EMRA, generation, distribution and transmission companies, Privatization Administration, Turkish Competition Authority and the MENR has created a chaos between all of these corporations (Durakoğlu, 2011, p.2). Uyar states that:

> They just want to go and support the problem. So this is the main problem. For any energy resource to be utilized or to say with meaningful to utilize firstly we need the resource and secondly there is a need for a related technology that converts these resources to useful energy, electricity and proceed. These are two things for renewable energy. The first one is exist, the second one is exist and the ex technologies are available. The only missing thing is political public quality. The public workers or ministers or bureaucrats they are paid by the tax payer's money. So they need to go in the direction of solution. At this moment it is not really so. So as there are many problems then you stay more as a bureaucrat.

Durakoğlu also emphasizes the intricacy of bureaucratic processes in privatization process which caused by the increasing number of authorities. Additionally, as an outcome of the hierarchic situation the right of the MENR to say the final words made it a powerful body on decision making. (2011, p.6). Eriş adds: '

> we know that there are conflicts between the corporations. Because of the politically powerful ministry, the corporations cannot perform their duties. But this is a temporary situation that will change after privatization process'.

On the contrary as a bureaucrat Çetin did not accept that there is a chaotic situation. He underlined that 'we do not have any coordination problem with these institutions. The aim of this classification was related with privatization'. This stands against the other arguments. But from a general perspective considering the difficulties that the private sector have faced and the arguments of the academicians show that there is a problem although the State does not want to accept.

4.5) FUTURE PROJECTION

In this section for the electricity sector TEİAŞ's strategy paper and World Energy Council's 2010 Report can be studied. Additionally, changes in the GDP, population and energy consumption rates can be evaluated with the existing literature.

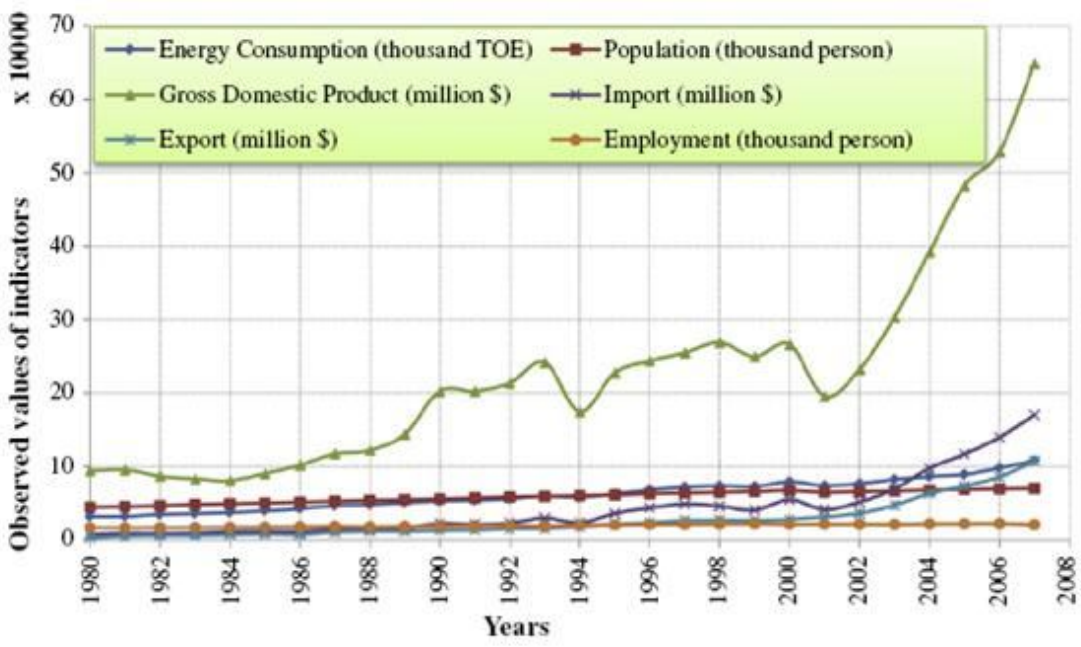
4.5.1) The Variables Related With Energy Consumption

Most of the works that have future projection perspective starts their studies with emphasizing the changes in energy consumption and installed capacities historically. Energy Plans based on the consumption and demand rates. In order to estimate future energy demand and consumption some variables can be used. GDP, population, the amounts of imports and exports, employment can affect the future energy situation. From this point of view, most of studies have reached the same outcome that population and energy consumption directly proportional (WEC, 2010, p.4; Kankal et al, 2011, p.1931). Kankal et al. also underlined the effect of the import and export levels. Moreover, they added that the increases in GDP have effects on the life standards which indirectly increased the energy consumption rates (2011, p.1932). This outlook can be seen in the table 7.

According to WEC, when GDP per capita is 9000 $ levels, per capita consumption of electrical energy is 2700 kWh. From this point of view, when GDP per capita reaches 20000$ it is expected that per capita consumption of electrical energy would reach 5000 kWh (2010, p.4). Energy production processes also have some factors that affect the situation which are technical, economical, social and environmental factors (Talinli et al., 2010, p.4482-4483).

In technical factor it is explained what capacity means. Talinli et al. says that: 'Installed or total capacity is known as maximum capacity of the plant. Unit capacity can also be given as KWh per unit fuel' (2010, p.4482) which helps us to understand how the capacities of a plan can be calculated. Economical factors refer to 'capital cost (initial investment cost), O&M cost, fuel cost and unit price of electricity produced' (2010, p.4482).

Table 7:



Energy consumption and corresponding indicators for Turkey [60–64].

Source: Kankal, M., Akpınar, A., Kömürcü, M. İ., Özşahin, T. Ş. (2011). Modelling and Forecasting of Turkey's Energy Consumption Using Socio-Economic and Demographic Variables. *Applied Energy.* 88: p.1932.

Social factors can also be counted as 'prosperity, community values, and availability of health care' where environmental factors are 'environmental risk, impacts and waste-emissions' (2010, p.4483). In their research they reached an outcome that social factors are the most important factors that need to be taken into consideration (2010, p.4485).

Their technical research is important to show the effectiveness of different factors in energy production processes. These types of researches are necessary to observe the possible outlooks of investments.

4.5.2) Turkey's Electricity Capacity Projection

As stated in the beginning TEİAŞ published a Capacity projection in 2009. Within this projection it has said that in 2008 gross electricity consumption reached 198.1 TWh. From 2007 to 2008 there is a 4.2% increase in consumption rates. But 2009

Economic crises have affected the consumption rates and they assume that the consumption rates could not increase as the past years (TEİAŞ, 2009, p.4-9). The peak load rates and electricity consumption between 1999 and 2008 can be seen in the table 8.

Table 8: Peak Load and Electricity Consumption of Turkish Electricity System Between 1999-2008

	PEAK LOAD (MW)	INCREASE (%)	ELECTRICITY CONSUMPTION (GWh)	INCREASE (%)
1999	18938	6,4	118485	3,9
2000	19390	2,4	128276	8,3
2001	19612	1,1	126871	-1,1
2002	21006	7,1	132553	4,5
2003	21729	3,4	141151	6,5
2004	23485	8,1	150018	6,3
2005	25174	7,2	160794	7,2
2006	27594	9,6	174637	8,6
2007	29249	6,0	190000	8,8
2008	30517	4,3	198085	4,2

Source: TEİAŞ, (2009). Turkish Electrical Energy 10-Year Generation Capacity Projection (2009-2018). [online]. http://www.teias.gov.tr/eng/ApkProjection/CAPACITY%20PROJECTION%202009-2018.pdf. (Retrieved June 5, 2011). p.4.

According to MAED they have two scenarios that convenient with high and low electricity demands. It can be seen in the tables 9, 10.

Table 9: Demand Forecast (High Demand)

	PEAK LOAD		ELECTRICITY DEMAND	
Year	MW	Increase (%)	GWh	Increase (%)
2009	29900		194000	
2010	31246	4,5	202730	4,5
2011	33276	6,5	215907	6,5
2012	35772	7,5	232101	7,5
2013	38455	7,5	249508	7,5
2014	41339	7,5	268221	7,5
2015	44440	7,5	288338	7,5
2016	47728	7,4	309675	7,4
2017	51260	7,4	332591	7,4
2018	55053	7,4	357202	7,4

Source: TEİAŞ, (2009). Turkish Electrical Energy 10-Year Generation Capacity Projection (2009-2018). [online]. http://www.teias.gov.tr/eng/ApkProjection/CAPACITY%20PROJECTION%202009-2018.pdf. (Retrieved June 5, 2011). p.12.

These three tables show that Turkey's electricity demand is increasing every year. Importantly, both in the low and high scenarios the rates of increases in electricity demand exceed the previous period. Even if the lowest development will realise, the rates of change will continue to increase. In these conditions, the planning of the investments gains importance. In order to meet the increasing energy demand there is a need for more investments in a rapid way. That is to say Kücükali emphasizes that: 'currently, the energy demand of Turkey has been growing rapidly than the energy production' (Kucukali, 2010, p.2441).

Table 10: Demand Forecast (Low Demand)

	PEAK LOAD		ELECTRICITY DEMAND	
Year	MW	Increase (%)	GWh	Increase (%)
2009	29900		194000	
2010	31246	4,5	202730	4,5
2011	32964	5,5	213880	5,5
2012	35173	6,7	228210	6,7
2013	37529	6,7	243500	6,7
2014	40044	6,7	259815	6,7
2015	42727	6,7	277222	6,7
2016	45546	6,6	295519	6,6
2017	48553	6,6	315023	6,6
2018	51757	6,6	335815	6,6

Source: TEİAŞ, (2009). Turkish Electrical Energy 10-Year Generation Capacity Projection (2009-2018). [online]. http://www.teias.gov.tr/eng/ApkProjection/CAPACITY%20PROJECTION%202009-2018.pdf. (Retrieved June 5, 2011). p.13.

According to TEAİŞ's first scenario, with the new powerplants that will be constructed at the end of 2016, there will be an addition 14864,5 MW to the existing installed capacities of thermal, hydro, wind and other renewable energy sources. On the other hand according to the second scenario, there will be 12722, 8 MW addition to the existing ones (TEİAŞ, 2009, p.23-16). With the second scenario it would not be possible to meet electricity demand in 2014. Because of that reason the MENR has to take new measures to overcome this deficit (TEİAŞ, 2009, p.78).

4.5.3) Suggestions for Energy Future

Turkey has been making progress for the installed electricity powerplants. In parallel with the consumption rates the investments have increased. Bilgili underlined that Turkey's installed electricity powerplants has increased from 4187 MW to 41813 MW within 33 years (1975-2008) (Bilgili, 2010, p.238).

Uyar emphasized that:

> The directive of 2020 is really putting obligatory targets for the EU countries. But to think these targets should go together with prevention of obsolete technology transfer from one European country to another one which is the case that why we have Greece crisis. We have Ireland, Portugal and Spain is coming. Whatever the problem part of European is the target itself is good and so European Directive or the policies are really driving forces for renewable future.

For the case of Turkey's future energy policy he is expecting normal support and adds that: 'If we consider renewable energy and energy efficiency as a solution not as an enemy and if we just let it happen, in five years we can go 100% renewable energy. That's my hope'.

From the Ministry perspective Çetin says '

> We are about the finish all legislation works in the electricity sector. Market Financial Settlement Centre and Day ahead market started to work. In the near future we will establish 'Power exchange'. The existing arrangements are aimed at liberalization and transparency in the energy market in harmonization with the EU acquis. Until the 100th anniversary of the Republic we have to build new powerplants that have 5000 MW capacity. All our aim is to supply energy as an acceptable cost by the consumers.

As a private sector representative Eriş looks at the issue from a different perspective that from 2005 to 2013 within 8 years only 300MW wind powerplants were made and the target 2000MW wind powerplants for the 2023 seems impossible. He underlined that:

> The reason behind the increases in the construction of powerplants between 2005 and 2011 was the balancing and settlement regulation which causes increases in the electricity prices so that the private sector could make new investments. Now the prices are decreased and also the Renewable Law is not efficient. So, the people do not make investments. If the country

> targeted to reach 15000 or 20000$ per capita income, it is not possible to generate it with national income. If Turkey will be late to put the domestic sources into use she will face with troubles. Turkey will start to face with difficulties with coal, hydraulic and even with wind. We need to support and incentives for the renewable energy and keep the energy prices high in order to solve the problem and reach the target.

In WEC's 2010 Report they questioned how Turkey will reach the determined targets which have low possibility. And also they criticize that there is no struggle for the contribution of domestic sources to the Turkey's energy mix (WEC, 2010, p.159-160).

During the accession negotiations with the EU in December 21, 2009 Environment Chapter was opened (European Commission, 2009, online). The opening of the environment chapter was also important for energy chapter. Because it's main aim is to supply environmental protection and make arrangements on industrial pollution, risk management which are directly related with the energy situation (European Commission, 2011s, online). Although the energy chapter could not open, the alignment policies in the environment chapter are also a propellent power for the energy.

In December 2011 the 17th United Nations Climate Change Conference will meet up in Durban (UN, 2011, online). This meeting is also important for constructing common policies that affect all of the countries. Considering energy and environment link Turkey has to act in harmony with the universal values.

After considering all of the standpoints it has been realised that if Turkey wants to perform its targets, it has to work a lot. The supporting measures have to be increased. On the other hand the share of renewable energy sources has to be increased but the case of coal-generated powerplants is debatable.

From another perspective the social cost analysis of the investments has to be made by the State which will show the rationalization of the renewable energy investments. To the point the plans about constructing nuclear powerplant needs more studies especially on the costs from birth to death.

CONCLUSION

This dissertation has argued that in Turkey there is not an effective renewable energy policy with lack of social cost analysis regarding the EU and Turkey's energy policies in their historical perspectives, there is also more need for supporting the renewable energy investments in the future with reference to the future electricity generation projections and in comparison with the EU, Turkey has to act faster.

At the beginning the energy policies of the EU and Turkey was studied. In this regard, there are some points that need to be mentioned as a last word. Firstly, within the EU it took a long time to construct a common energy targets instead of a policy. This situation arises from the nature of the Union and multi level governance structure. Taking decisions cannot always be easy in the Union level. In Turkey there is also a slow progress in planning. It is possible to see that from Development programs. Their targets and realisation rates do not match up with each other.

Turkey from this perspective while having a wide renewable energy sources has to make more effective planning. The current Strategy Plan is not sufficient for reaching the determined targets. For example targets for wind energy seem impossible to reach after a rational evaluation. On the other hand with a similar mechanism like the Coordination Board on Environment, the planning problematic can be solved because energy actions necessitate more comprehensive involvement of the State actors, private sector representatives and academicians.

After making comparison with the EU and Turkey's energy policy it has been seen that there are differences in support mechanisms and costs calculations. In the EU while social cost analysis of the energy investments have been doing since 1990's, Turkey still does not have a well designed cost calculation system. This is also the main problem that the State can easily make decisions about a nuclear powerplant or a natural gas powerplants. The issue of coal based powerplants is another point of the issue that needs to be analysed more detailed because in the scale decreasing the dependence of imported energy can outweighed. To the point CCS gains importance. The preferred system is having a 100% renewable system. But, as Eriş underlined that such a big

development cannot be realised swiftly. Moreover besides the private sector's will it necessitates a huge State support.

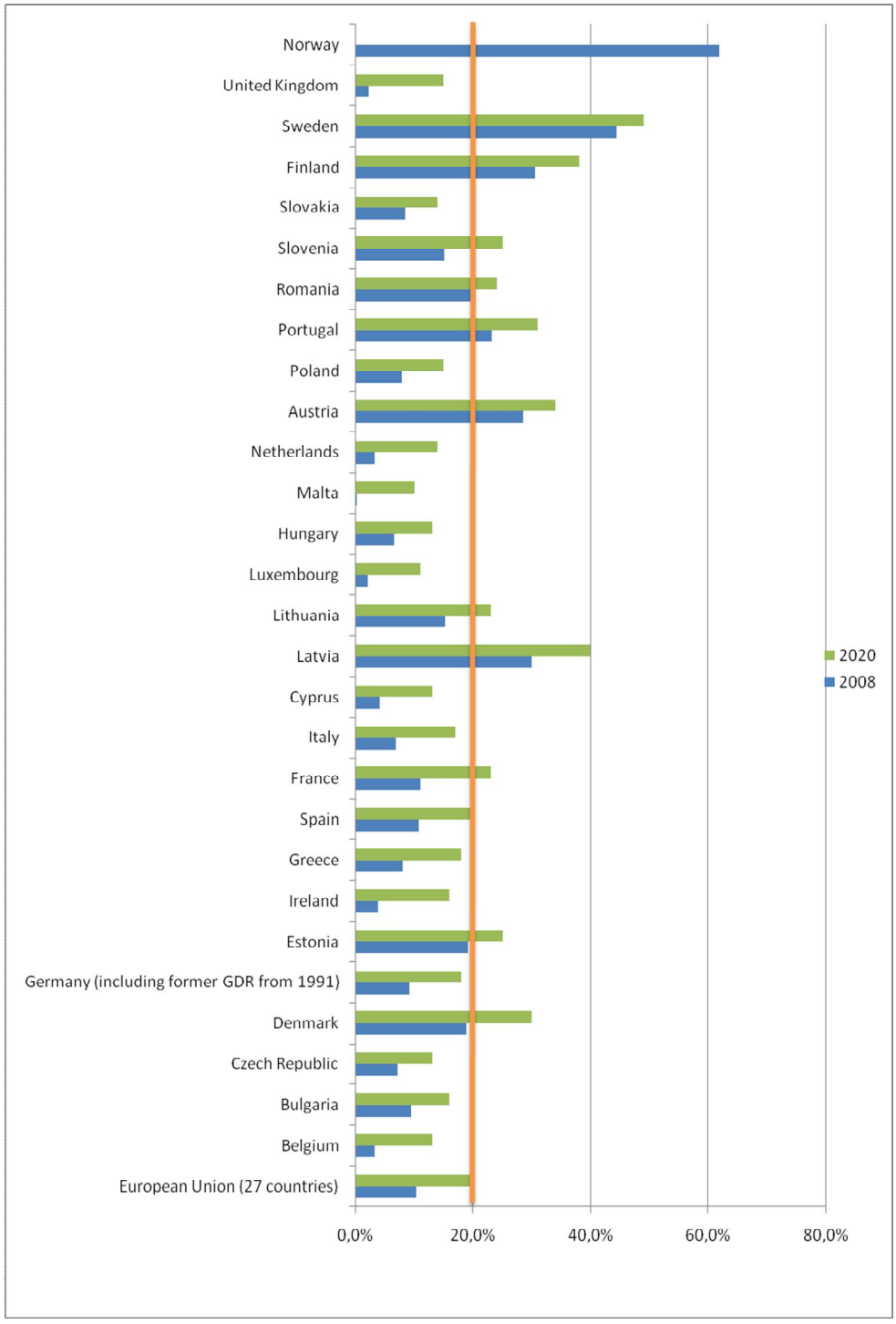
It is seen by the Renewable energy Law that Turkey preferred to use FiT system to support renewable energy investments. But as criticized by many of the actors this rates that guarantee purchasing is very low. In other words they cannot motivate private sector to make more investments. It can be argued that on the one side the State tries to make the energy market liberal and accelerate the privatization but on the other hand does not serve a proper base to encourage them.

From another perspective according to TEİAŞ's projection on future consumption, rates show that with this existing powerplants and the plants under construction there will be energy deficit in a very recent future. So, the State has to review its strategy if she really wants to overcome the energy deficit and decrease energy dependence or this unsolvable situation will continue.

All in all within the context of this dissertation, it has tried to make contributions to the literature with its future perspective. Besides, with the interviews, it has tried to fill the points that the literature cannot explain.

ANNEX

Figure 1: Share of Renewable Energy in Gross Final Energy Consumption



Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 42.

Figure 2:

Crude Oil Imports into the EU-27 (in Mio tonnes)						
ORIGIN	**2000**	**2002**	**2004**	**2006**	**2007**	**SHARE 2007 %**
Russia	112,4	154,7	188,9	189,6	185,3	**34**
Norway	115,9	103,1	108,6	89,1	84,3	**15,5**
Libya	45,5	39,2	50	53,2	55,5	**10,2**
Saudi Arabia	65,1	53,1	64,5	51,1	39,5	**7,2**
Other, Middle East	54,7	43,2	28,5	32,5	34,4	**6,3**
Iran	35,5	25,9	35,9	36,4	34,1	**6,2**
Kazakhstan	9,9	13,4	22,2	26,8	18,3	**3,4**
Nigeria	22,4	18,4	14,9	20,2	15,5	**2,8**
Other Origin	58,3	64,2	56,6	66	78,1	**14,3**
Total Imports	**519,8**	**515,3**	**570,1**	**564,7**	**545**	**100**

Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 31.

Figure 3:

Gas Imports into the EU-27 (in TJ, terajoules)						
ORIGIN	**2000**	**2002**	**2004**	**2006**	**2007**	**SHARE 2007 %**
Russia	4.539.709	4.554.744	4.951.044	4.937.711	4.685.365	**40,8**
Norway	1.985.231	2.601.569	2.801.723	2.844.237	3.061.751	**26,7**
Algeria	2.203.075	2.132.477	2.042.137	2.132.236	1.943.976	**16,9**
Nigeria	172.020	217.882	410.260	563.905	588.317	**5,1**
Libya	33.442	25.536	47.809	321.150	383.615	**3,3**
Qatar	12.443	87.952	160.170	232.721	275.496	**2,4**
Egypt	-	-	-	327.394	221.305	**1,9**
Trinidad and Tobago	36.334	19.120	-	163.233	104.917	**0,9**
Other Origin	112.810	125.425	313.245	227.147	213.995	**1,9**
Total Imports	**9.095.064**	**9.764.705**	**10.726.388**	**11.749.734**	**11.478.737**	**100**

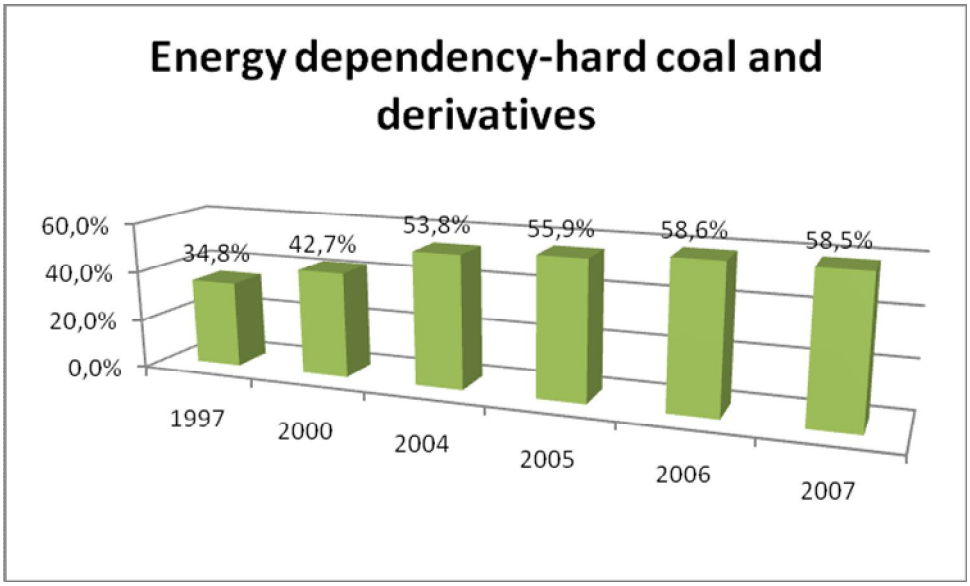
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 31.

Figure 4:

Gross Inland Consumption 2007 (Mtoe)							
	ALL FUELS	**Solid Fuels**	**Oil**	**Natural gas**	**Nuclear**	**Renewables**	**Other**
EU-27	**1806,4**	**331,2**	**656,9**	432,4	**432,4**	**141**	**3,5**
Share	**100,0%**	**18,3%**	**36,4%**	23,9%	**13,4%**	**7,8%**	**0,2%**

Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 28.

Figure 5:



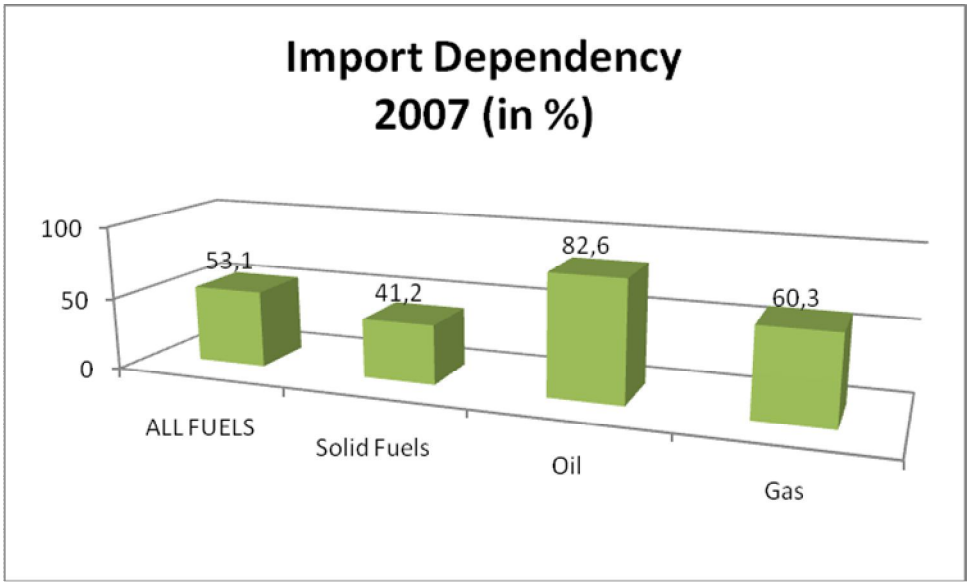
Source: *Eurostat European Commission*. (2009). *Energy, Transport and Environment Indicators. Eurostat Pocketbooks*. Luxembourg: European Union. p. 20.

Figure 6:

Hard Coal Imports Into the EU 27								
(In kilotonnes by origin)								
	Total EU-27	Russia	South Africa	Australia	Colombia	United States	Indonesia	Other
2000	151 575	14 976	40 177	28 600	23 132	20 447	10254	20 437
2002	171 629	23 033	53 961	29 337	21 398	14 082	11 540	18 278
2004	196 062	40 382	54 190	30 838	24 224	15 416	13 980	17 032
2006	213 809	55 544	53 080	27 147	26 068	17 370	21 092	13 508
2007	214 358	56 117	46 121	29 069	29 018	20 833	17 594	15 606
2007 (%)	100,0%	26.2%	21.5%	13.6%	13.5%	9.7%	8.2%	7.3%

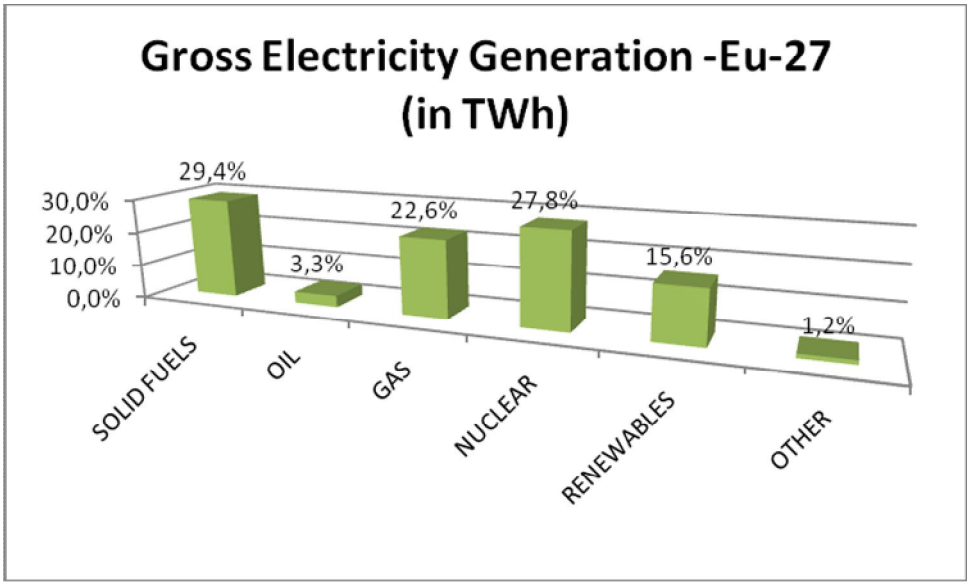
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 32.

Figure 7:



Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 30.

Figure 8:



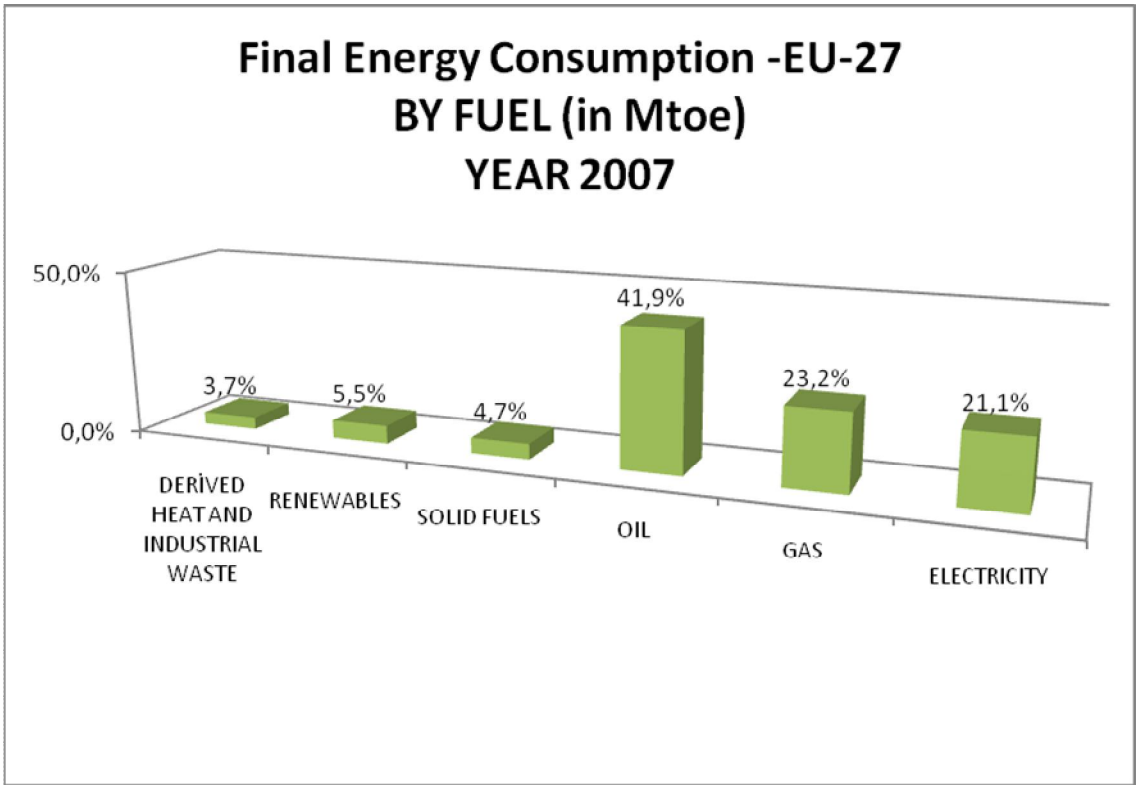
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 43.

Figure 9:

Gross Inland Consumption 2007, RENEWABLES in ktoe						
	RENEWABLES	**Biomass**	**Hydro**	**Wind**	**Solar**	**Geothermal**
EU-27	**141.035**	**98.383**	**26.653**	8.965	**1.263**	**5.771**
Share	**100,0%**	**69,8%**	**18,9%**	6,4%	**0,9%**	**4,1%**

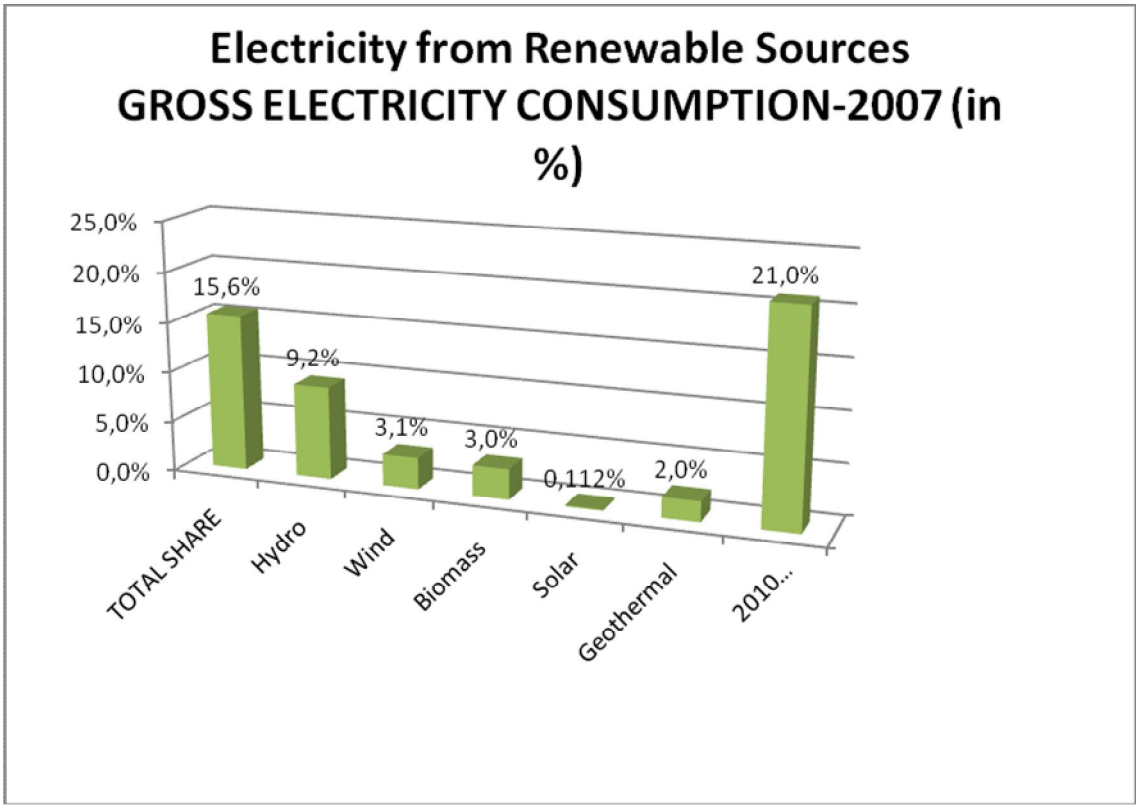
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 28.

Figure 10:



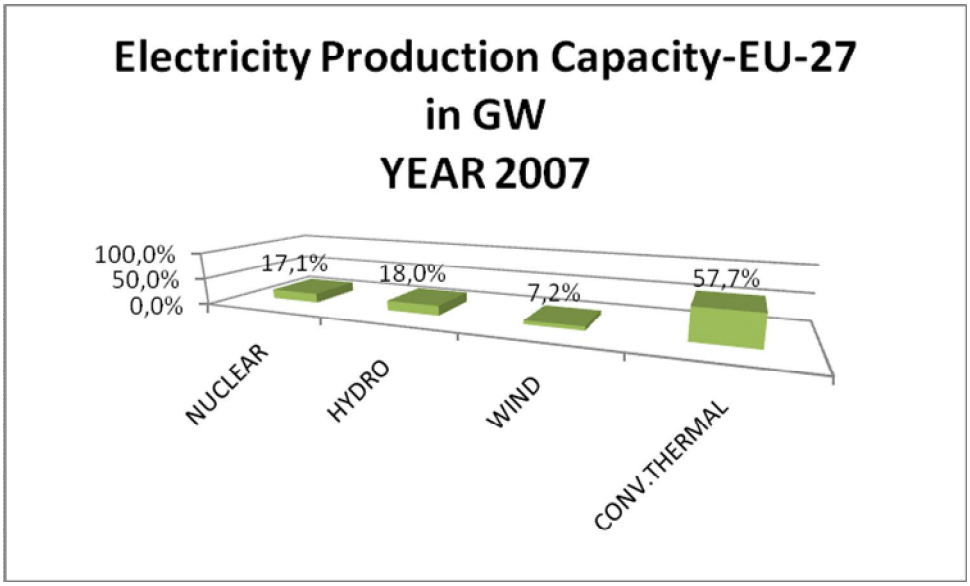
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 34.

Figure 11:



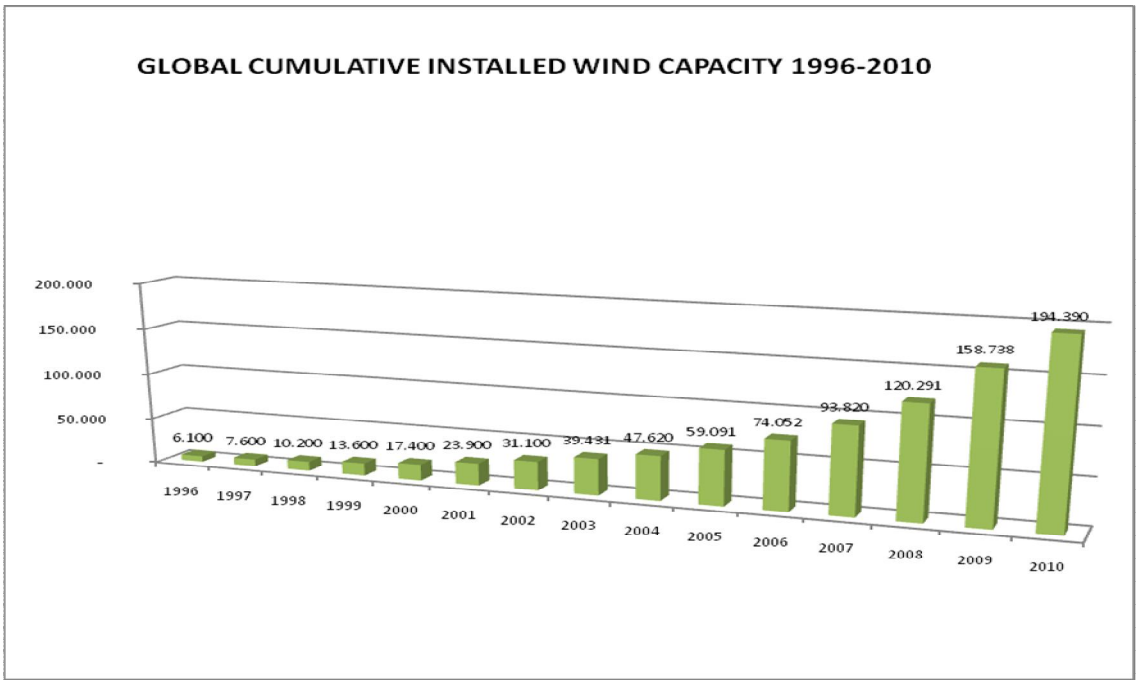
Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 41.

Figure 12:



Source: European Commission. (2010a). *EU Energy and Transport in Figures. Statistical Pocketbook 2010*. Belgium: European Union. p. 40.

Figure 13:



Source: GWEC. (2001). *Global Wind Report.* [online]. http://www.gwec.net/fileadmin/documents/Publications/Global_Wind_2007_report/GWEC%20Global%20Wind%20Report%202010%20low%20res.pdf. (Retrieved March 24, 2011). p. 14.

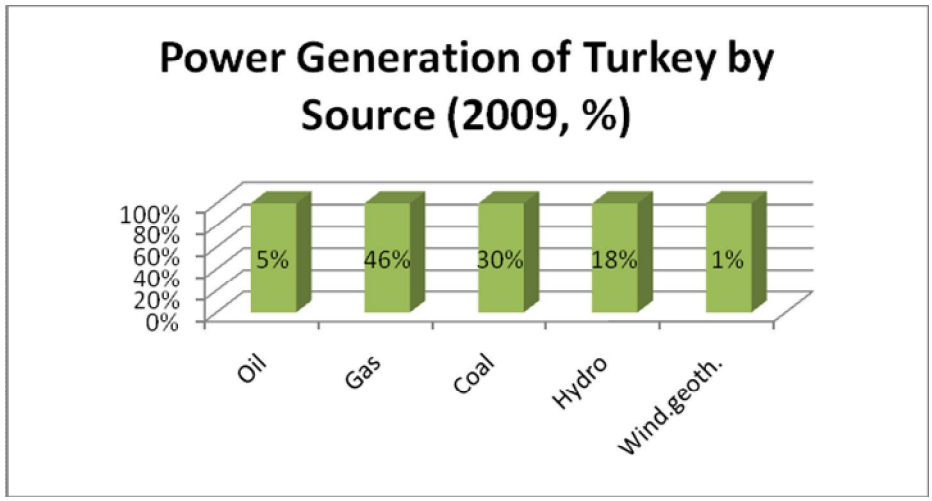
Figure 14:

EU Wind Capacity				
	Installed 2009	End 2009	Installed 2010	End 2010
EU Capacity (MW)				
Austria	-	995	16	1.011
Belgium	149	563	350	911
Bulgaria	57	177	198	375
Cyprus	-	-	82	82
Czech Republic	44	192	23	215
Denmark	334	3.465	327	3.752
Estonia	64	142	7	149
Finland	4	147	52	197
France	1.088	4.574	1.086	5.660
Germany	1.917	25.777	1.493	27.214
Greece	102	1.087	123	1.208
Hungary	74	201	94	295
Ireland	233	1.310	118	1.428
Italy	1.114	4.849	948	5.797
Latvia	2	28	2	31
Lithuania	37	91	63	154
Luxembourg	-	35	7	42
Malta	-	-	-	-
Netherlands	39	2.215	32	2.237

Poland	180	725	382	1.107
Portugal	673	3.535	363	3.898
Romania	3	14	448	462
Slovakia	-	3	-	3
Slovenia	0,02	0,03	-	0,03
Spain	2.459	19.160	1.516	20.676
Sweden	512	1.560	604	2.163
United Kingdom	1.077	4.245	962	5.204
Total EU-27	**10.486**	**75.090**	**9.295**	**84.278**
Total EU-15	**10.025**	**73.516**	**7.997**	**81.406**
Total EU-12	**461**	**1.574**	**1.298**	**2.872**
Of which offshore and near shore	582	2.064	883	2.946

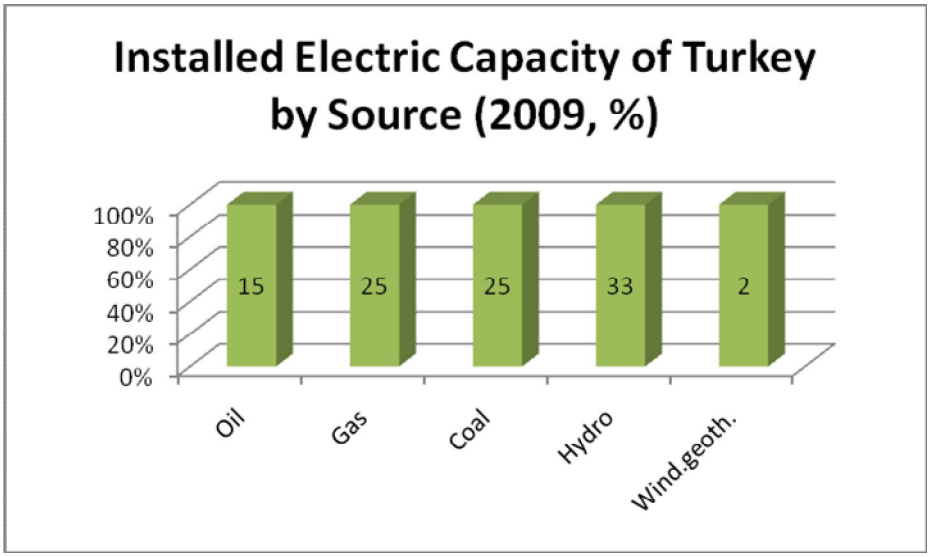
Source: EWEA. (2011). *Wind In Power 2010 European Statistics.* [online]. http://www.ewea.org/fileadmin/ewea_documents/documents/statistics/EWEA_Annual_Statistics_2010.pdf.(Retrieved Mach 25, 2011). p. 4.

Figure 15:



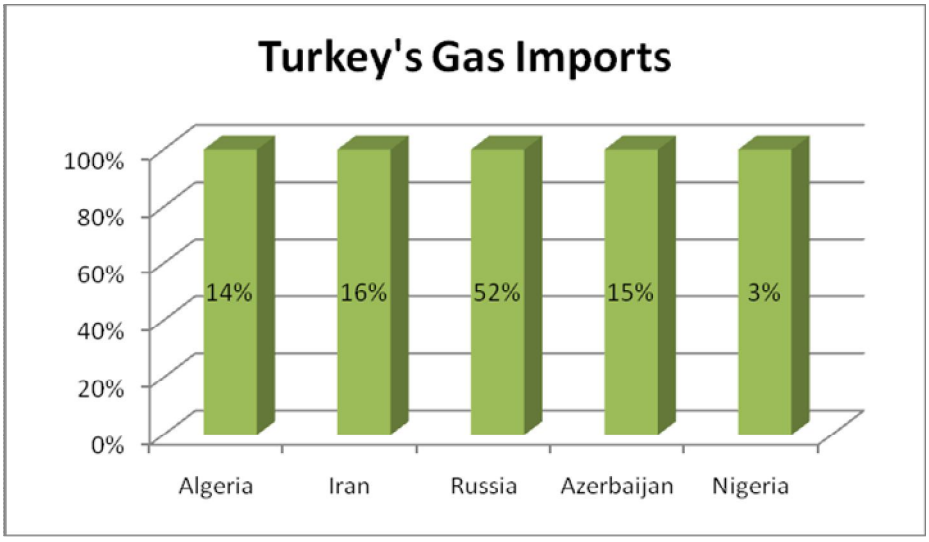
Source: Enerdata. (2010). *Turkey Energy Report.* [online]. www.enerdata.net. (Retrieved March 24, 2011). p.10.

Figure 16:



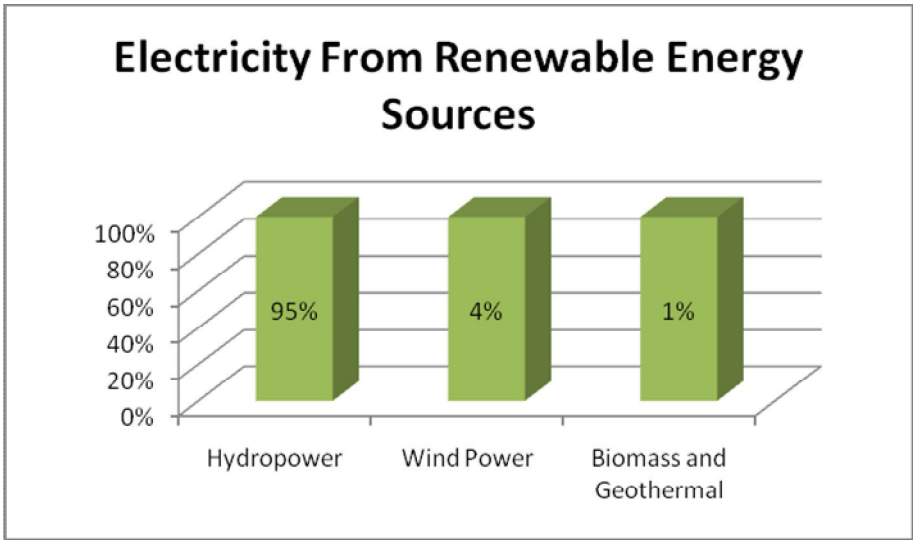
Source: Enerdata. (2010). *Turkey Energy Report.* [online]. www.enerdata.net. (Retrieved March 24, 2011). p.9.

Figure 17:



Source: International Energy Agency. (2010). *Energy Policies of IEA Countries Turkey 2009 Review.* [online]. http://www.iea.org/textbase/nppdf/free/2009/turkey2009.pdf. (Retrieved May 13, 2011). p.67.

Figure 18:



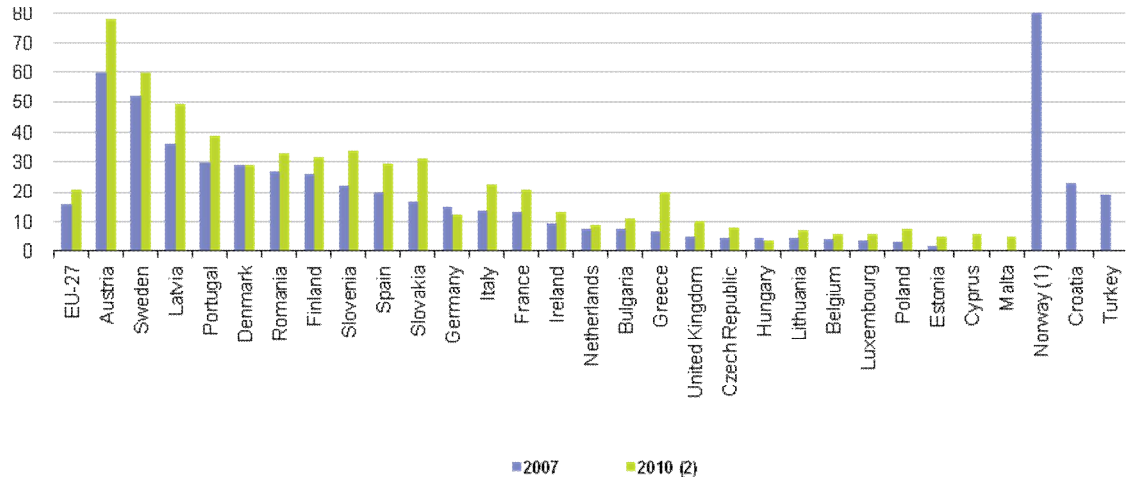
Source: International Energy Agency. (2010). *Energy Policies of IEA Countries Turkey 2009 Review.* [online]. http://www.iea.org/textbase/nppdf/free/2009/turkey2009.pdf. (Retrieved May 13, 2011). p.97.

Figure 19: Final energy Consumption (Million Tonnes of Oil Equivalent)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Share in EU-27, 2007 (%)
EU-27	1.104	1.111	1.109	*1.114*	*1.140*	*1.127*	*1.160*	*1.173*	*1.172*	*1.176*	*1.158*	100,0
Turkey	50,3	49,9	49,2	55,5	50,2	54,7	58,7	60,4	63,2	69,0	72,8	-

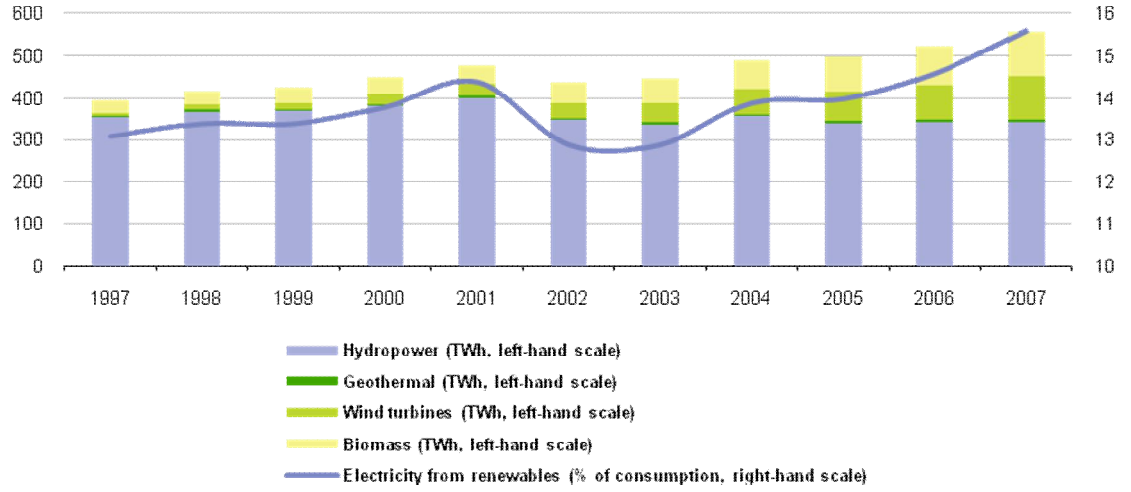
Source: Eurostat European Commission. (2010). *Europe in Figures Eurostat Yearbook 2010*. Belgium: European Union. p.568.

Figure 20: Proportion of electricity Generated from Renewable Energy Sources (% of Gross Electricity Consumption)



Source: Eurostat European Commission. (2010). *Europe in Figures Eurostat Yearbook 2010*. Belgium: European Union. p.575.

Figure 21: Electricity Generated from Renewable Energy Sources, EU-27



Source: Eurostat European Commission. (2010). *Europe in Figures Eurostat Yearbook 2010*. Belgium: European Union. p.575.

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