ASSESSING THE EU MEMBER STATES' PROSPECTS ON ENERGY AND CLIMATE POLICY STRATEGIES AND TARGETS: AN ENERGY TRILEMMA APPROACH

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ÖZET

AB ÜYE ÜLKELERİNİN ENERJİ İLE İKLİM POLİTİKA STRATEJİLERİ VE HEDEFLERİYLE İLGİLİ DEĞERLENDİRİLMESİ: ENERJİ ÜÇLEMESİ YAKLAŞIMI

TURAN, UĞUR

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Avrupa Birliği 28 üyesi ile birlikte enerji konusunda ciddi yatırımlar yapmaktadır. Dünya da yaşanan enerji krizleri yüzünden, enerjinin önemi önce ki yıllarda katlanarak artmıştır. Avrupa birliğinin ortak politikası gereği enerji hedefleri belirlenmiştir. Bu hedefler Enerji ve İklim Politikaları stratejisi adı altında 2020, 2030 ve 2050 kısa ve uzun vadeli olarak belirlenmiştir. Adeta bir yol haritası olan bu süreçte temel amaçlar, yenilenebilir enerji'nin kullanımını arttırmak, enerji verimliliğini arttırmak ve sera gazı salınımını düşürmektir. Birliğin asıl amacı Avrupa Birliği ülkeleri için güvenilir bir enerji tedariki sağlamak, kömürün payını azaltmak, yenilenebilir enerjiye teşviki sağlamak ve çevreyi korumaktır. Bu tezin amacı Avrupa Birliği enerji politikalarını detaylı şekilde inceleyip, karşılaştırmalı politika analizi kullanarak üye ülkelerin enerji politikalarını, projelerini ve hedeflerini Dünya Enerji Konseyinin Enerji Üçlemesi Listesine göre incelemektir

ve analiz etmektir. Enerji üçlemesinde ki 3 ölçü şunlardır; enerji güvenliği, enerji eşitliği ve sürdürülebilir çevre'dir. Bu 3 ana başlık altında bir çerçeve geliştirilmiştir. Bu çerçeve, üye ülkelerin profillerini daha iyi analiz etmeyi hedeflemiştir. Ülkeler karşılaştırılırken 3 ana grupta incelenmiştir. Bu gruplar Dünya Enerji Konseyinin belirlediği enerji üçlemesi listesinde ki performanslarına göre sınıflandırılmıştır. İlk grup yüksek ulaşılabilir üyeler, diğeri orta derece ulaşılabilir üyeler ve son olarak düşük derece ulaşabilir olarak sınıflandırılmıştır. Geliştirilen çerçeve'de analiz edilen önemli noktalar ülkelerin politikalarını analiz ederken kullanılmıştır. Sonuç olarak performanslarına göre öne çıkan ülkeler İsveç, Avusturya ve Danimarka olmuştur. Gruplar arası enerji politikalarının başarılı olmasına göre yakın gelecekte İtalya'nın yüksek ihtimalle bir üst gruba geçmesi ön görülmüştür. Özetle enerji güvenliği, enerji eşitliği ve sürdürülebilir çevre başlıkları altında ülkeler kendi politikalarını geliştirmiş ve 2020, 2030 ve 2050 için hedeflerini belirlemiştir.

Anahtar Kelimeler: Avrupa Birliği enerji hedefleri, enerji güvenliği, enerji eşitliği ve sürdürülebilir çevre.

ABSTRACT

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TURAN, UĞUR

Sustainable Energy Master Programme, Graduate School of Social Sciences

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European Union with its 28 member states has been making significant investments on the field of energy. As a result of the energy crises which have broke out all around the world, the importance of the energy has gradually increased for the last few years. Some goals have been set for energy within the framework of European Union's common policy. These goals are defined as 2020, 2030, and 2050 targets in the short and long term under the name of Energy and Climate Change Strategies. The main aims of this process which serves as a Roadmap are to promote the use of renewable energy, increase the energy efficiency, and decrease the use of greenhouse gases. The basic goals of the EU is to provide a reliable energy supple for the European Union members, decrease the share of the coal, promote the use of the renewable, and protect the environment. This thesis aims to analyze the policies of the EU in details, study the energy policies, energy projects and goals of the member states in the context of energy trilemma index created by World Energy Council by employing the method of comparative policy analysis. Three dimensions within energy trilemma index are energy security, energy equity, and environmental sustainability. With the

framework outlined by these three dimensions, a better analysis of the member states is aimed. When a comparison is being made among the countries, they are basically studied in three main groups. These groups were determined by the performances of the countries based on the energy trilemma index proposed by World Energy Council. The first group includes the high achieving members; the second group includes the medium achieving members, and the last group includes the low achieving members of the Union. Main points in the framework are used in analyzing the policies of the countries. As a result of this classification, Sweden, Austria, and Denmark are determined as the leading countries in terms of their performances. Italia is expected to shift to the upper group in the near future if the energy policies will be successful. To sum up, countries have developed policies under the dimensions of energy security, energy equity and sustainable environment, and also set their specific goals for the years 2020, 2030, and 2050.

Keywords: EU Energy targets, energy trilemma, energy security, energy equity and environmental sustainability.

To my Father...

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CHAPTER 1- Introduction

Energy is one of the most significant issues today and it has always been crucial priority for the European Union, as well as other countries in the world. Especially, as a result of the enlargement, energy consumption has rapidly increased day by day within the Union. The European Union has been facing many energy challenges due to the climate change, global competition for energy supplies and energy import dependency since the beginning of the 21st century. As a response to these challenges, a widespread European approach to handle energy has become mandatory for the Union. The main scope of this thesis is to evaluate European Union member states' energy targets on the basis of the EU Commission targets which are defined as "2020-2030-2050" (EC, 2009).

The European Commission (2008) establishes conditions and limits for the energy targets in general, however Union member states have to integrate those targets in accordance with their potentials and policies. By doing this, countries are facing many challenges regarding the energy security, economic availability and affordability, infrastructures and so on. For example, Maros Sefcovic who is a Vice-President of European Commission and EU Climate & Energy Commissioner Miguel Arias Canete presented in 2015 that affordability of energy to all citizens is a mile-stone of the Euro zone and they are going to reform wholesale and retail markets for decreasing the consumer prices. According to Canete (2015), the Union needs solidarity. As in history it is known that one of Robert Schuman's favorite speech (1950) says "Europe will not be made all at once or according to a single plan. It will be built through concrete achievements which first creation of solidarity." He is the founder of European Union and he also mentioned solidarity issue. At last, the EU support energy market that "speak with one voice" and Mr. Sefrovic emphasized the importance of negotiating with their partners from one voice.

This thesis is utilizing energy trilemma index of World Energy Council to compare the EU-28 states' positions and policies, regarding these targets. The main aim of this thesis is to determine the member states' potential to achieve these targets.

While doing that, this study also scrutinizes a framework to classify the member states from the perspective of Energy Trilemma.

In order to achieve these goals, the EU is establishing Energy Union which adopted a strategy for climate change policy for common energy in the Europe. At this point, renewable policies are vital for the EU. There is no doubt that growing share of renewable energy helps the mix of energy in states. Moreover, it may help the economical development because of increasing demand in energy (EC, 2013). In addition to economic perspective of the importance of the renewable, the EC states that renewable energy sources might enlarge diversity plus security of energy as it is vital in long term availability, moreover it may also support the development of the states and by growing economy, it could help decrease the cost of climate change challenge. Briefly, there is no direct relation between growth and energy consumption regarding the renewable but with European Union's energy targets, in the long-term economic returns are expected (Pirlogea&Cicea, 2012).

Although the importance of energy had been recognized in early days, the 21st century has become a turning point on the EU's agenda addressing to energy issue. Since Jose Manuel Barroso (2004-2014) became the President of the European Union Commission , he put emphasis on energy chapter in Euro zone, moreover during his presidency period he followed very significant issues in agenda of the Commission, which are Lisbon Strategy and an EU climate change package and Treaty of Lisbon (EC, 2010).

In 2007, European Commission (EC) put an energy plan into action for Europe. The Commission expressed this policy as: delivering sustainable, secure, and competitive energy is fundamental for Europe and thus, acting together is a necessity because the EU was established as the Coal and Steel Treaty in 1952 as a result of the founding members of the EU was considered as a common advance to energy needs (EC, 2007). Becoming successful in other issues such as development and employment which were stated in the Lisbon Strategy and the Millennium Development Goals are extra complicated and challenging without the EU's widespread action and a fresh energy policy that is determined,

competitive and long-standing is needed (EC, 2007). This policy emphasizes the need that the member states should act together to be able to deliver a sustainable, secure, and competitive energy and to handle the challenges faced due to changed energy markets and geopolitics. The European Commission (2008) issued a new plan named "An EU Energy Security and Solidarity Action Plan, Second Strategic Energy" in November 2008. This five-point plan has been presented by the Commission and on the points of focus was as follows: (1) Diversification of the energy supply and requirement for infrastructure, (2) to improve relations for external energy supply, (3) Oil and gas stocks and to improve mechanisms to energy crisis, (4) Energy efficiency, (5) To make local energy resources in the EU efficient. European Union's energy security and solidarity action plan mostly emphasizes the energy security moreover aims to reduce the energy dependency as much as possible. The focus points of this plan are external energy relations and the use of indigenous energy resources and responding to challenges from outside energy resources.

The EU member states buy oil from Organization of Oil Exporting Countries (OPEC) and Russia, and demand gas from Russia, Norway, and Algeria (BP, 2015). The Union seeks some options to diversify energy sources and channels of supply. Jong and Linde (2008, p.1) point out to challenges and state that some issues in the energy is the results of the new EU after the fall down of the Berlin Wall as well as geo-economical and geopolitical plan because associate states are dependent on Russian oil and gas due to the extension. As a reaction to these developments as stated above by Jong and Linde, the member states of the EU supported common energy guidelines within the Union. The main concern of the European energy policy is to achieve a stable energy policy prices, sustainable energy supply, and secure energy (Jong, 2008; Linde,2008). Energy policies of the European Union have been shaped by the 20-20-20 targets.

The EU set long-term energy goals which were adopted in 2007 with the aim of maintaining security of supply and competitiveness, reducing greenhouse gas emissions by 80-95 percent below the 1990 level by 2050 (EC, 2007). There is a road map for energy policy and renewable energy usage and it is observed that

EU's energy profile has been changing by these policies. On the other hand, the member states have different energy mixes, different suppliers and their priorities in energy issue are different from each other. Thus, the member states pursue national energy strategies although they also have similar challenges. In other words, they concern about their own national strategies that send them away from the common energy policy.

This thesis is divided into eight parts which are started with Introduction and followed by Methodology and Literature review. The methodology of thesis is comparative analysis and while doing comparative analysis, policy analysis is used as a tool to determine the positions of EU-28 member states. According to Lijphart (2007), comparative methodology is a tool for various studies for analyzing resemblances and differences. In the first 2 chapters, the concepts such as comparative analysis and policy analysis will be defined within the literature part, in addition energy trilemma index and Union's energy targets will be explained in these chapters.

The third part of the study, reviews the history of the European Union's energy policy, energy dependence and consumptions of the EU-28. And also by using the statistical data from Eurostat, the energy market is analyzed briefly.

The following chapter explains the main aims of energy targets of "2020 – 2030 – 2050" in the framework of European Commission purposes. According to 2020 headlines, the Commission mentions "Smart growth, Sustainable Growth, and Inclusive Growth", moreover these headlines will be a project for 2030 and 2050 targets as well.

The fifth part of the thesis explains the energy trilemma. According to World Energy Council, the sub-titles of energy trilemma are Energy security, energy equity, and environmental sustainability. All three dimensions of the trilemma were explained respectively.

The sixth part of the thesis created a framework for analyzing the EU-28 countries energy dimension specifically. The EU member states have different characteristic of energy profiles, the selected criteria's are scored by referencing

the average points of EU-28 countries. This framework helps to understand following chapter which is energy trilemma performances of the EU member states.

The seventh part of the thesis explains European Union's member states' energy profiles, according to energy trilemma index explained, the countries are divided into three groups according to their performance. Global CCS Institute (2013) suggests that it is not possible to mention only one method for achieving a balance of trilemma. However, grouping countries according to their energy trilemma performances could be helpful for analyzing them. The first group of countries has the best rankings of three dimensions of the trilemma, the following group performances are average when compared with the first group and the last group has the worst performances according to the index. Lastly, in this chapter comparative analysis of the groups will be mentioned in the results part.

The last part of the thesis is conclusion. A revision of the topic and comparative analysis of the countries' performance results will be included in this part. Following questions will be answered according to the framework;

- What is the importance of European Union's energy targets?
- Why is the Energy Trilemma a significant tool?
- Which countries could reach the energy targets in 2020, 2030 and 2050?
- Is there any connection between the economic development and the energy trilemma regarding the countries' performances?
- Could European Union be successful at the end of the road map in the years 2020, 2030, and 2050?

Briefly, European Union goals for energy are binding for countries and each country has their own targets according to their energy needs. In this chapter introduction of the thesis and the following chapters are explained, and the following chapter will focus on methodological framework of the study and literature review.

CHAPTER 2- Methodological Framework and Literature Review

Today, energy is essential for all countries because economic growth highly depends on the availability of energy sources. The rapid population increase and the changed geopolitics in the World lead to challenges and threats to supply in energy sector. Energy security has always been one of the trendiest topics of the government's policies. Moreover, as it is known energy security is significant for a sustainable economy. In BP's Statistical Review of World Energy 2015, data has demonstrated that Europe is already dependent on external imports of energy resources such as gas and oil, and mostly from Russia. Because of this dependency, understanding the factors in energy security is vital, as well as its consequences. In order to identify and analyze the EU's energy reliance, it is important to understand and assess the EU's energy policy. Briefly, energy security is defined by International Energy Agency (IEA, 2007), "the uninterrupted availability of energy sources at an affordable price". However, it has also challenges such as power struggles, terrorist attacks, economic developments, geopolitical changes and environmental concerns (Biresselioglu, 2012).

In this thesis, main methodology is comparative analysis. It will be used to analyze the European Union's member states' energy policy making, their strategies towards 2050 and review these policies and strategies, considering the aspects of energy trilemma of World Energy Council. The analysis will allow this study to, compare and contrast member states' positions. This study will implement policy analysis together with the comparative analysis in order to achieve more accurate results. In summary, the following section will elaborate these issues, discussing its role in existing literature.

Comparative method is a main analysis of comparison which supports influence of description and plays a huge role in focusing similarities and dissimilarities of cases Lijphart's (1971). Comparative analysis is a method which is used in social science disciplines but mostly used in political science and international relations (Caramani, 2008, p.2). It is a comprehensive method which can be used in the research. This method usually analyzes the major points of the comparison and

dissimilarities of the countries. The model of this method is descriptive, explanatory, and predictor that makes use of collective data, individual data, and text data (Caramani, 2008, p.19). Also, Carmani states in his book that the main point of comparative method in literature was clearly seen in the late 1960's and early 1970's. Comparison is usually making use of hypotheses and it serves as a predictor for the new hypotheses and for building theories (Lijphart, 1971, p.682). Additionally, Lijphart explains that comparative method includes several comparison forms such as statistical analysis, experimental research, and historical studies. Moreover, all forms are employed under the discipline of political science generally. The father of comparative analysis is Lijphart's (1971) article Comparative Politics and Comparative Method. The Dutch political scientist Lijphart explains the comparative method as the small number of cases. Here have important publications of Lijphart, his most important work is The Politics of Accommodation (1968) which is about Netherland's political system, in Democracy in Plural Societies (1977) he analyzed comparative analysis of society from the mirror of democracy. In his another work named Patterns of Democracy which is not less important than the other ones (1999, 2012), Lijphart classified 36 different views of democracies. His article Comparative Politics and the Comparative Method (1971) is a leading publication which has been used in many existing research and this publication is the inspiring element of this thesis. He imposes the method that needs at least two observations for direct statistical analysis and his article claims that there must be two main criterions for the estimation of unlike approaches which are experimental, statistical and case-study; how these approaches achieve the goal of testing theory and data which is found, are obtain or not for each method. In literature, comparative methodology has a meaning which is shaped in the social sciences roughly. Lijphart mentions that comparative method does not have specific focus, but as a methodology, it studies "the how but does not specify the what on the analysis" (Lijphart, 1971, p.682). The most common methodology is empirical data analyzing and it uses ceteris paribus while studies two or more data. Varying methods are demonstrated in Table 1. Below there is a table that Lijphart mentioned briefly.

Case Study Method	Comparative Method
Emphasis: Permits serious test of cases even with limited resources Problems: Contributes a smaller amount to building theory than studies with additional cases	Explanation: Investigation of minor number of cases "n" Emphases: "Given certain scarcity of time, energy and financial resources, the intensive analysis of a few cases may be more promising than the superficial statistical analysis of many cases." (Lijphart, 1971, p.685)
Experimental Method	Statistical Method
Emphases: Eliminates related explanations throughout experimental control Problems: Experimental control is not possible for the majority of the cases of field in comparative politics.	Emphases: Explanations of statistical organize Problems: Hard to collect fitted information in a important number of cases, because of both scarcity of time and resources

Table 1. Lijphart's Schema of Methods (1971)

Source: (Collier, 1993)

In other point of view, John Stuart Mill (1994) stated that comparative research has two types which are The Method of Agreement and The Method of Difference. As it is understood, the method of agreement analyzes similar cases; on the other hand the Method of Difference studies dissimilar cases. The following table shows that there are two (2) different ways of analyzing simply which are similar and which are different views.

	Method of Difference	Method of Agreement
Most similar system research design	Deals with differences in Similar Cases	Deals with similarities in Similar Cases
Most different system research design	Deals with differences in Different Cases	Deals with similarities in Different Cases

Table 2. John Stuart Mill's definition of strategy for Comparative Method

Source: (Andrew, 1997, pp.310-318)

In this thesis, this study will focus on the policies of more than two countries, reviewing from energy trilemma perspective. The main aim of this thesis is to determine the member states' potential to achieve these targets. By using comparative analysis, this study uses both similar cases and different cases since

a number of member states have almost the same strategies and also the same problems regarding the energy issue. Because all factors including energy security of supply, countries' infrastructure gaps, difficulty to reach grids and etc. affect status of member states when they face world energy council indexes. Therefore this thesis studies comparative analysis by using policies of EU member states within the context of their targets.

According to Peters (1998), it is vital that there are five examples of literature which are made with comparative politics. Moreover, in the existing literature suggestively some of these studies are fully "comparative", and even some of them only focus on performance of a country alone rather than focusing on the performance of more than one country. In the existing literature, there are a number of studies focusing on the comparative method, including the description politics of single states in a issue, whatever A is (Rose, 1991; Anderson 1991). The second one is the analysis of similar processes in more than one country, analytic studies (Bendix, 1964; Moore, 1966; Skocpol, 1979). The third one that will also be employed in this thesis is the classification of schemes for multi countries or sub nationwide units by using typologies both to evaluate groups of countries and to disclose something about the inner politics of all political schemes (Lijphart, 1990). In addition, it must be emphasized that this thesis is going to use classification method of energy trilemma of World Energy Council, and thesis will analyze European members in 3 groups which are Pack Leader countries (the best-performed ones), the second group which are moderate according to their performance of energy trilemma and the last group of members that showed low level of performance in energy trilemma index. The fourth study of comparative politics is statistical or evocative analysis of data from a division of every country, especially on geological or developmental grounds, testing a number of hypotheses about connection of variables inside to "sample" of countries (Lange and Garrett, 1985). And the last one is statistical analyses of all the countries in the world challenging to enlarge patterns and/or test dealings across the whole variety of political systems (Banks and Textor, 1963; Sullivan, 1996: Pratt, 1966).

The last but not least point is about major approaches to comparative politics, it is obvious that in international relations theory there are several theories which deal with comparative method and some of them are explained by Caramani (2008). Those approaches are described briefly as followed. The purpose of structural functionalism is to discover the essential activities of all political systems and then to compare the methods wherein these functions were performed. Marxism's aim is to analyze and compare the existence history of human development until modern period (Burchil, 2013, p.154). Marxism also assumes a growth model that would guide through revolution throughout a "dictatorship of the proletariat" (Caramani, 2008, p.47). Corporatism's approach stresses the inner role of state and society connections in leading, and especially the legitimate role of public interests in influencing policy, moreover this criteria serves as a means for understanding the policies of both sides. The last approach is Governance that comparative politics governance has various similarities with structural functional analysis. It argues that definite tasks have to be performed so as to govern a society and then assumes that these can be accomplished in several ways (Caramani, 2008, p.48).

In the energy-related literature, there are a number of studies which have employed comparative methodology. In the following paragraph, some examples of studies that use comparative methodology are discussed.

Konstantinaviciute and Bobinaite (2015), analyzed EU member states' carbon dioxide emission factors on manufacturing sector and they used comparative analysis as a methodology. The most important aim of the research is to observe the comparisons of carbon emissions between EU member states for energy manufacturing. Moreover, it indented to observe if countries emission targets are in line with the international agreements on quality criteria of clearness, comparison, correctness and reliability. Another study in literature is about energy qualifications of the buildings among EU states (Andaloro, 2015; Salomone, 2015; Loppolo, 2015; Andaloro, 2015). According to them, energy certification of the buildings has a key role in EU states' common policy. In addition, they used comparative analysis to determine best performer country

among EU states. However they observed 27 EU members in their studies, but in this thesis it is going to be 28 EU states including Croatia which has become the last member.

As it is known, there is energy collaboration between Russia and EU, but they have disagreements about policy and economic influence of their neighbor countries (Sierra, 2011). Sierra used comparative analysis to study EU and Russia's influence on Southern Caucasus. The article observes that two different mechanisms are influencing and they have projections on Caucasus both in economy and energy sector. Briefly, article uses comparative analysis for policy advances of EU and Russia.

The next main point while doing comparative methodology is policy analysis. First of all it is thoroughly an altered concept but in this thesis there will be a comparative analysis of countries' policies, therefore it is better to explain what policy analysis is and how could this study combine both of them. The concept of policy analysis is a function of a regulation, moreover policy analysis is a method which defines the problems and goals of countries' policies, and it examines the influence and observes the acts of government.

In the existing literature, there are two types of policy analysis which are *"of"* and *"for"* (Taskoh, 2014). Briefly, he explained the framework *"of"* for that explains states' policies and how they developed. He also mentioned that *"for"* framework is an analytical way and using expressive method. Additionally, he also studied bureaucratic situations. Considering the *"of"* policy, it has a more academic perspective than the *"for"*. Moreover, it looks into how a particular policy developed in a certain period. Shortly, of policy is a kind of academic analysis whereas for policy deals with development more deeply. Among the two main frameworks which are background of policy analysis, thesis is going to use comparative policy analysis and the aim of the study shapes *"of"* analysis rather than *"for"* policy structure.

In energy related literature, there are many studies which have used policy analysis. Greenhouse gas emission reductions in different member states of EU

are compared due to measurement of car transportation (Ajanovic, 2016; Haas, 2016). The methodology of the study developed as a policy analysis that how states manage their energy consumption and the study researched taxation system on the energy market. They also compared forecasted energy project policies until 2030. Another research in literature which used policy analysis is about scenarios of waste policy in EU-27. This research analyzes the finest recycling ways with a decline of consumption in EU-27 countries. It also compares the policies of the states on waste management (Andreoni, 2015; Saveyn, 2015; Eder, 2015). The research builds a scenario until 2020 about how policies are going to change. The last example from the literature is about EU and China. Both European Union and China have different characteristics in terms of region, population, financial market, community, politics, and history. However they are fighting agains similar issues such as local inequality and unbalanced local enlargement (Minarcikova, 2015). The study looks into different policies of the regions and compares EU and China in some aspects.

Most of the studies in the literature focus on the availability of energy resources, accessibility to energy, competition over supplies and the threat of climate change. In energy trilemma chapter, the concepts of availability and accessibility will be explained. As it is explained, this study is going to use World Energy Council's data about the energy trilemma. In literature there are various studies about energy trilemma. It will be explained in the following chapters but to mention briefly, energy trilemma is a significant concept in energy market because it examines the performance scores of the countries based on three variables which are security, sustainability, and affordability. In addition, this is a tool of identification for countries or large organizations policies or corporate strategies. Moreover, they could benchmark their current positions for checking their influence on market (ARUP, 2016). Here is several examples in literature, Heffron, McCauley and Sovacool (2015) discuss energy trilemma differently due to the original concepts of energy trilemma. They define energy equity as an economic concept and energy security is described by political concepts. However this study refers to original WEC index.

The study claims that energy justice issue is significant for comparing countries and their infrastructures. The methodology of the study is the energy justice metric (EJM), which analyzes the energy trilemma index based on justice. Lastly, authors aimed to observe that the increase in carbon dioxide emission negatively effects society. Another study which is written by Gunningham (2012), analyzes how the Indonesian government manages its energy trilemma performance. This study is mainly focuses on strains among energy security, poverty and environmental change, moreover analyzes government policies by referring to energy trilemma index. As it is seen that energy trilemma is the issue which helps countries while making policies.

According to 20/20/20 targets, different technologies are analyzed in EU-27 countries in terms of efficiency, energy savings and fuel switching (Blesl, 2010; Kober, 2010; Kuder, 2010). This study also criticizes climate policies of the countries. Moreover the effects of increase in efficiency are observed regarding the energy security due to the increasing use of renewables. In addition, this study also creates five scenarios about EU-27 targets and these scenarios are looking into carbon emissions in industry, agriculture, transport, sequestration and storage and conversion.

Another interesting study in literature identifies England's waste targets until 2020. Study suggests that EU member states will recycle 50% of their household waste. Moreover, possible solutions of recycle are discussed in study (Waite, 2015; Cox, 2015; Tudor, 2015). In literature there are many studies about 2030 targets of EU for example Knopf, Nahmmacher and Schmid (2015) analyzed EU's energy targets for 2030 and study focused on electricity sector. The EU put targets about the decreasing of carbon emissions and the renewables, furthermore they will continue to follow this strategy till 2030. The study analyzes targets binding effect on electricity sector regarding the economic expenses and regional investments. Energy targets of EU are discussed in the following chapters.

Roadmap 2050- A Practical Guide to a Prosperous, Low-Carbon Europe analyzes the consumption of accessible technologies to decrease greenhouse gas

emissions in Europe by 80% by 2050. This report argues the necessity and benefits of decarbonization in the long term to improve development and security. Implementation is regarded as the biggest challenge. To achieve this performance, this report offers some milestones between now and 2050 for a decarbonized economy. Innovation, technology knowledge rates and the cost of capital are the main arguments of this study. This study explains short-term necessities to reach the 2050 goals and emphasizes advisor decisions that maximize the variety of zero-carbon supply options.

There is a road map for energy policy and renewable energy usage and it is observed that the EU's energy profile has been changing according to these policies. Carvalho (2012) suggests that it is vital to describe measures on the way of reaching the targets which projected by the European Union for a 20% diminution in greenhouse among the well-developed members by 2020. Investment of research plus innovation through awareness in the Europe energy sector makes it possible to achieve these targets. Jong and Linde (2008) argues that the challenges and several issues in the energy is the outcome of the EU after the collapse of Berlin Wall as well as geo-economic and geopolitical outline since members are dependent on Russian oil and gas while growing. The Union buys oil from OPEC countries as well as Russia, and demands gas from Russia, Norway and Algeria. It is obvious that the variety of energy supplier proves the importance of energy diversity; moreover member states should follow up EU's common approach of energy policy to become a unique market.

Methodological framework and literature review part of the study explained the term of comparative analysis and mentioned its importance with references from various literature reviews. In addition, policy analysis was explained briefly according to comparative politics issue and several research examples were given from the literature. Moreover, European Union's energy targets were explained with existing studies. The following chapter is going to analyze the EU's energy policies and their profiles diligently.

CHAPTER 3- Analyzing the European Energy Policy Making and the Profile

3.1 Development of the EU's Energy Policy Making

The European Coal and Steel Community is considered as the heart of the European Union. *The European Coal and Steel Community* (ECSC) was established in 1951 with the intention of creating a regular market for coal and steel among its members. After six years in 1957, *The European Atomic Energy Community (EAEC or Euratom*) was founded. The principle of the organization was to build an expert market for the nuclear power in Europe. The 1973 oil crisis was a turning point for Europe's energy policies and posed the weaknesses of Europe (Moussis, 2011).

During the 1970s and 1980s, the Union had an oil based energy outline. The first directive was adopted in 1968 to avoid supply reduction and interruption within economic activities. Jegen (2014, p.6) explains that according to the instruction, members should stockpile crude oil products at a minimum level for 65 days. For fossil fuels, comparable measures have been taken to secure stocks after the oil crisis in 1973. The crisis also led to a growing intergovernmental cooperation that was later institutionalized with the foundation of the International Energy Agency (IEA) in 1974.

Although, *The European Coal and Steel Community* was founded, a real policy towards energy has been made in the late 1980s as a result of the new energy challenges Europe faced since market-oriented approach of the EU had been ineffective to address those challenges (EU, 2010).

According to Langsdorf (2011, p.2) Consolidation of Europe hardly developed despite these approaches and attempts for the energy policy. The reason was increased demand and dependency of oil as the vital energy. Additionally, transport routes and existing markets made the members to show dissimilar interests leading the lack of support in the field of energy policy.

Yorkan (2009, p.27) claimed that EU took its first and real step toward energy policy with *Energy White Paper an Energy Policy for the EU- COM (682)* issued in 1995. The Union explained their first three priorities as follows: (1) to ensure

energy policy, (2) settle competitiveness, (3) protection of the environment. Those three priorities were also mentioned in *Green Papers* that was issued in the following years.

At the beginning of the 21st century the conditions changed radically. Umbach (2009) explains that EU's oil and gas assets decreased on one hand, investment in energy infrastructure were declining and energy use was increasing on the other hand, creation of EU more and more dependent on energy imports. According to Larsson (2007, p.45), aftermath of 9/11 attacks and political conditions in supplier countries caused handicaps in the market. Jong and Linde (2008, p.4) also pointed out the newly emerged economies such as China and India and suggested that these new economies caused an increase in energy demand clearly.

The natural gas crisis which broke out in 2006 between Ukraine and Russia caused to be recognized a new strategy by the Union. EU tried to describe the energy policy once more by focusing several information after the crisis. It is understood that supply security as under threat and they immediately focused on expanding resolution though, it is observed that acting together against such crisis has already been embraced amongst the members (Stern, 2006).

As a response to these challenges, Lisbon Treaty agreed by member states to secure energy supply, to pick up the market, to connect the networks all the way through Europe, and to enlarge the energy efficiency at all levels. Lisbon Treaty entered into force in 2009 and has become a communal duty for the members as a widespread policy.

Carvalho (2012, p.19) suggests that such policies provide a basis for *Europe 2020* initiative and are the determiners of the period of ten years of EU's enlargement strategy. The aim of Europe 2020 is to make EU's economy ready by means of intelligent and sustainable growth and to fight against the climate change explained in Treaty of Lisbon.

In 2011, the European Union aimed a further decline in greenhouse gas emissions by 2050 compared to the levels in 1990. The rate of decrease has been

aimed as 80-95% gradually. This is known as 20-20-20 targets. EU's long term targets will be examined in Chapter Four in details.

The European Energy Union ensures Europe to become a secure, affordable and climate-friendly. They subsides EU-28 countries for fighting climate change, create new jobs and economical growth and plans to investments for future. Since the Energy Union Framework Strategy was established, the targets of the Union have shown improving, for instance low-carbon usage, security and competitive economy (EU, 2015).

3.2 European Energy Profile

Although most of the energy within the European Union area is imported from other countries, energy dependencies of the members are different from one another. The countries which are producer and exporter of oil and natural gas within EU are only Denmark and the United Kingdom. Langsdorf (2011, p.2) explains some differences and challenges among member states. For example, Italy and Malta have a huge energy dependency which is around 80 and even sometimes 100 percent, while Denmark is self-sufficient and also exports energy to other countries. The United Kingdom is one of the countries which has the lowest dependence ratio and imports 26% of its energy (Eurostat, 2015).

Baumann and Simmerl (2011, p.2) state that in order to handle the high dependency on imported energy resources, increasing competition, and the climate changes, there is an encouragement for deeper management of external policies within the EU. *Figure 1* shows the energy dependence data of EU-28 in total energy consumption.

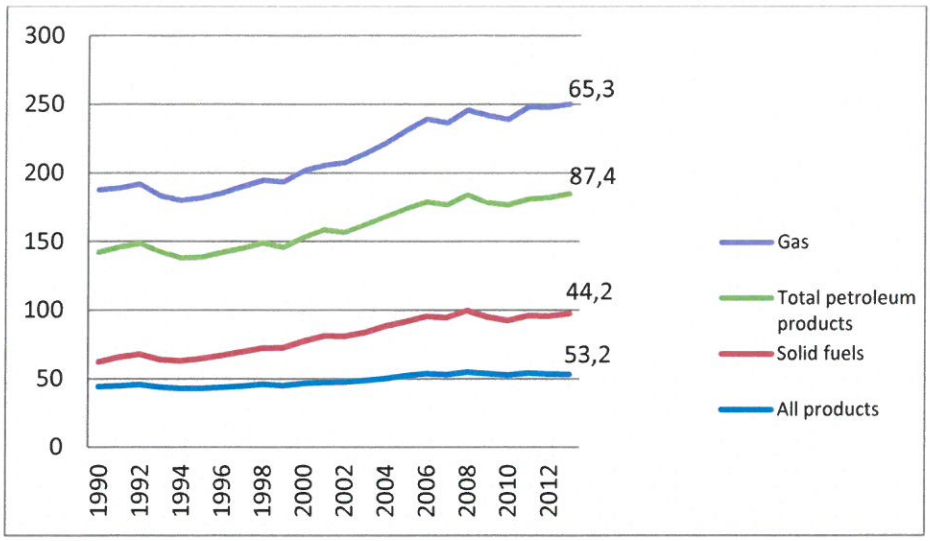

Figure 1. Energy Dependence of EU-28 (% of Imports in Total Energy Consumption)

Source: Eurostat

The dependence of the Union is clearly observed in the Figure 1. Especially the dependence on gas and petroleum products had been high since the early 2000s, while the dependence on solid fuels is lower. This growing dependence points to a shortfall between production and consumption.

During the 1990s, the use of electricity as an energy source also increased considerably within the EU. According to the Eurostat, Electricity and Heat Statistics (2016), housing and services sectors are the main responsible for the growth in electricity consumption. Use of electricity in the manufacturing sector is rotating the economic cycle. The highest share of heat is produced from solid fuels and natural gas.

Figure 2 and *Figure 3* demonstrates the Energy Dependence on Solid Fuels and Energy Dependence on Gas between 1990 and 2013.

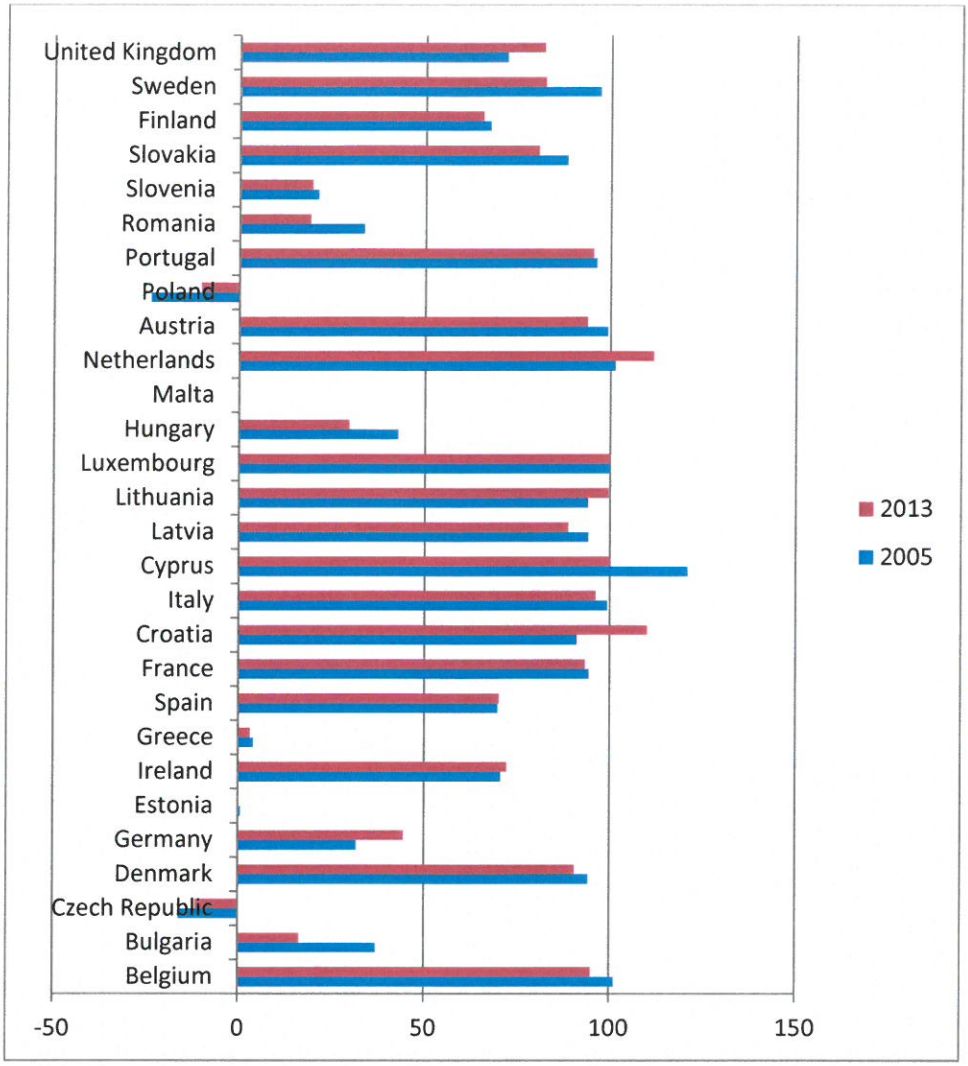

Figure 2. Share of Energy Dependence on Solid Fuels

Source: Eurostat

The share of energy dependence on solid fuels in the EU is still high when compared to 2005, and even higher in some countries, such as United Kingdom, Netherlands, and Croatia. The Czech Republic and Poland do not use solid fuels, while Greece's dependency has the lowest level among other countries. The EU has remarkable reserves of coal and consumption of solid fuels is still high although the use of natural gas has increased lately.

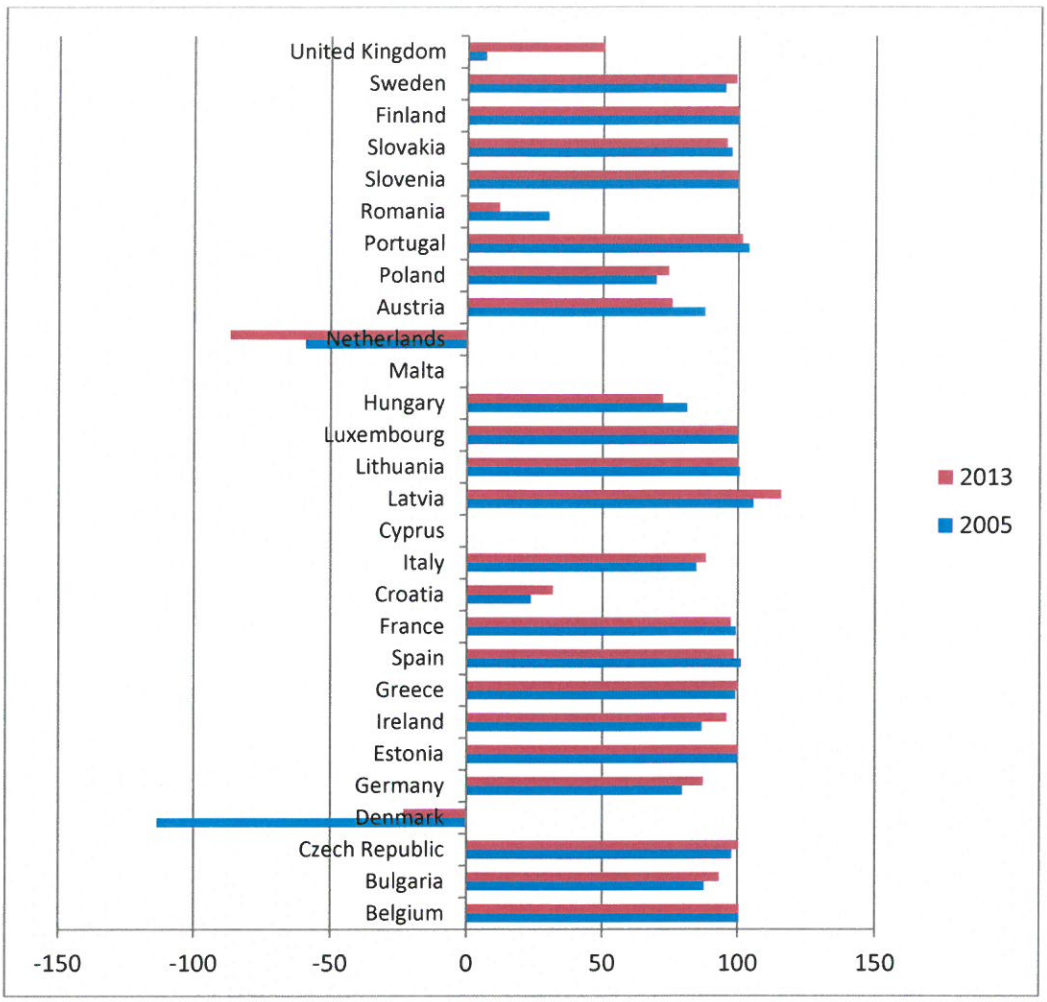

Figure 3. Share of Energy Dependence on Gas

Source: Eurostat

Energy Dependence on Gas in the EU has a big share in its energy consumption and the dependence on Russian gas has increased since the end of 1990s. Except for Denmark and Netherlands, all member states of the EU are heavily dependent on gas. Guney (2014) states that Russia imports about 80-100% of their gas supply to 6 members of the EU. Especially, Finland, Slovenia, Hungary and Bulgaria are extremely reliant on Russian gas.

Europe's electricity markets and networks are considered extremely important for EU energy coordination and to meet the innovative challenges. A supply which is reliable and cost-effective is the main purpose of the EU by utilizing both of the great centralized generators and small spread sources everywhere in Europe. The European Commission supports an idea known as The Smart Grids that is a courageous program of research, expansion and expression. This vision

aims a route to an electricity supply network with the aim of meeting the supplies of Europe in the future. The Europe's electricity network explains as follows (EC, 2006):

• Flexible: It means responding to customers' needs and changes as well as the challenges possible in the future;

• Accessible: Being reachable to all links for network users, especially for renewable power sources and powerful regional generation as less as possible carbon emissions;

• Reliable: Developing secure and quality supply channels in order to respond to changes and ambiguities resulting from the changing demands of the new age;

• Economic: This implies offering the best price to the customers by means of a successful administration, modernization, and 'level playing field' rivalry and regulation. *Figure 4* demonstrates the supply, transformation and consumption of the electricity in the EU-28 in 2005, 2010, 2015.

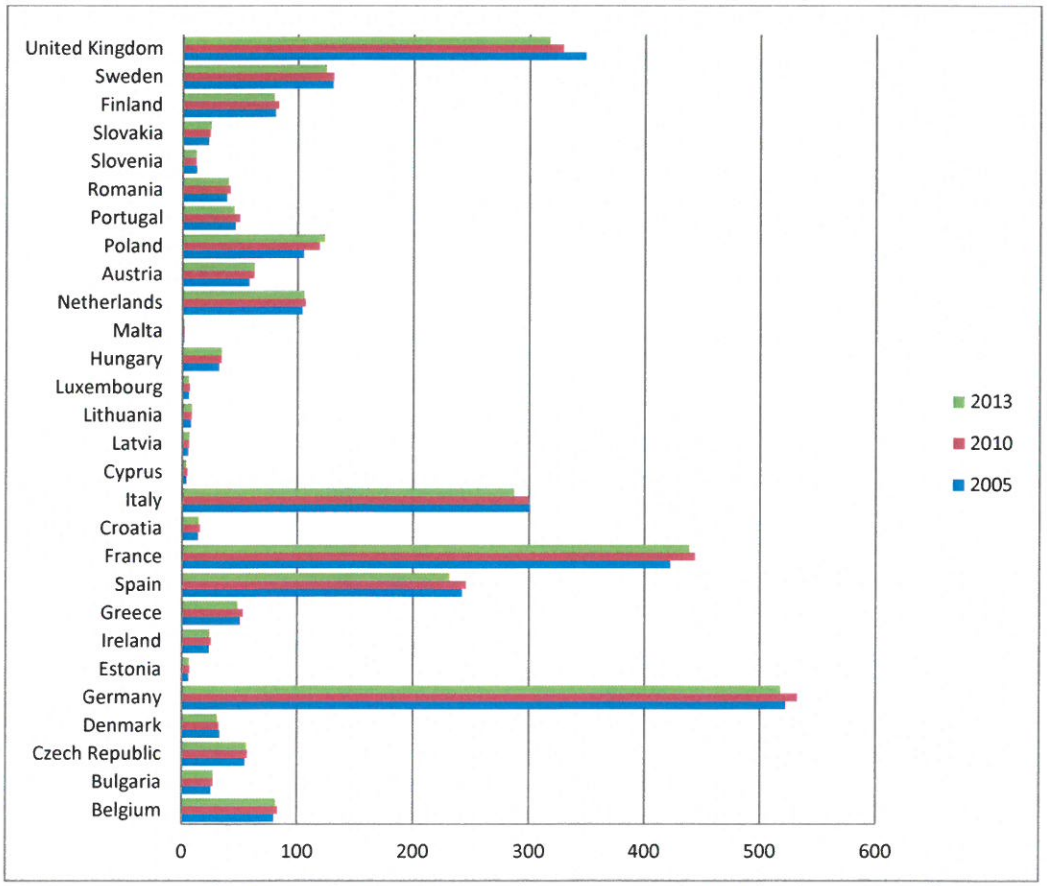

Figure 4. Supply, Transformation and Consumption of electricity (Gigawatt hours)

Source: Eurostat

The European transport industry is an important sector in economy and the growth of the European transport has been an important issue for the Union due to the increased fuel consumption. The growing number of the cars concerns the EU; moreover policies on renewable energy have resulted in the implementation of the commands that promote the use of electricity created from renewable energy sources.

JRC-Science and Energy Report by the EC (2014) states that the Renewable Energy Directive of the EU determines a common target for renewable with the share of 20% in all energy consumptions and the share of 10% renewable in the transport sector is the sub-target for all members, in addition these are binding targets. *Figure 5* shows the share of renewable energy in total fuel consumption of transport in the EU-28 between the years 2005-2013.

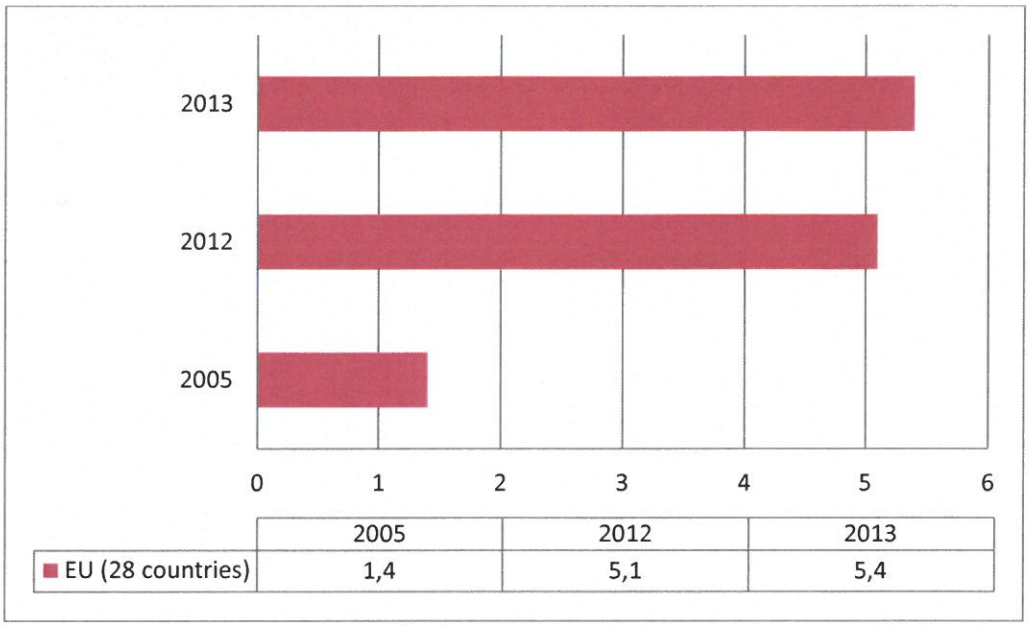

Figure 5. Share of Renewable Energy in Fuel Consumption of Transport

Source: Eurostat

The share of energy from renewable sources in transport increased from 1.4% in 2004 to 5.4% in 2013 and 5.1% in 2014 according to the Figure 5. The share of energy from renewable sources in transport still remains at low levels and the objective of the EU in respect to its 2020 target are focusing on renewable energy consumption share.

According to the Eurostat (2016), in the EU-28, renewable sources in gross final consumption share in energy observed that an increase from 8.5% in 2004 to 16.0% in 2014. This is regarded as a proof of a progress towards the Europe 2020 target of 20%. *Figure 6* shows the share of renewable energy in gross final energy consumption in 2013 and compared to the target by the EU.

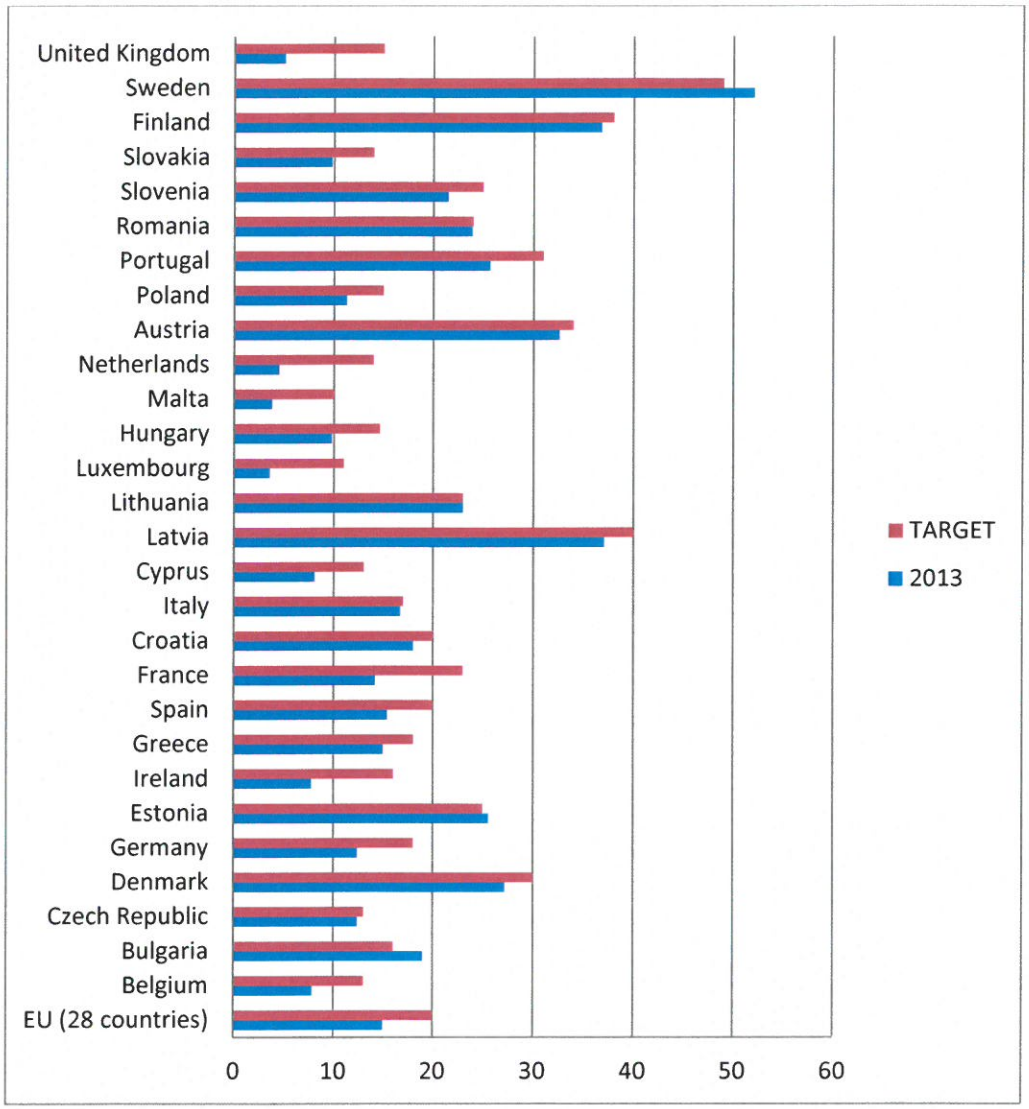

Figure 6. Share of Renewable Energy in Gross Final Energy Consumption

Source: Eurostat

The renewable share in Estonia, Sweden and Bulgaria is above the 2020 target value according to the Figure 6. In 2013, Czech Republic, Romania, Italy and Finland is almost reaching the 2020 target, while the United Kingdom, Netherlands, Malta and Luxembourg fall behind too much of the EU target. In

2013 the highest share was observed in Sweden among member states and the lowest share was in Luxembourg.

The EC's Working Paper on the European Energy and Transport (2006) promotes the use of electricity from renewable energy sources. There is a framework to achieve this and the aim is to supply an important amount of electricity from renewable energy in medium-term and to speed up its usage in the European electricity market. The aim of the encouragement of renewable established by the Directive is explained as below:

- To present correct and confidential certification of renewable energy sources,
- To secure priority entrée for renewable electricity to the electric network,
- To control whether administrative procedures is valid for the set up of the plants for green power,
- To make sure transparency and non-discriminatory actions in the costings for involving fresh producers of green power to electricity network.

According to the Eurostat (2015), renewable energy had a 11.8% share of the gross domestic energy use in 2013. The share of renewable in gross domestic consumption was comparatively higher in Portugal (23.5%), Denmark (24.2%) and Austria (29.6%). On the other hand, Sweden (34.8%), Latvia (36.1%) and Norway (37.4%) surpassed the EU target.

The benefit of use of renewable energy includes a decrease in greenhouse gas emissions, diversification in energy supplies and decrease in reliance on oil and gas. Therefore, usage of renewable energy is the fundamental objective of the EU's forecasted energy policy. *Figure 7* shows the consumption of renewable energies in EU-28 between 2004-2013 as tones of oil equivalent.

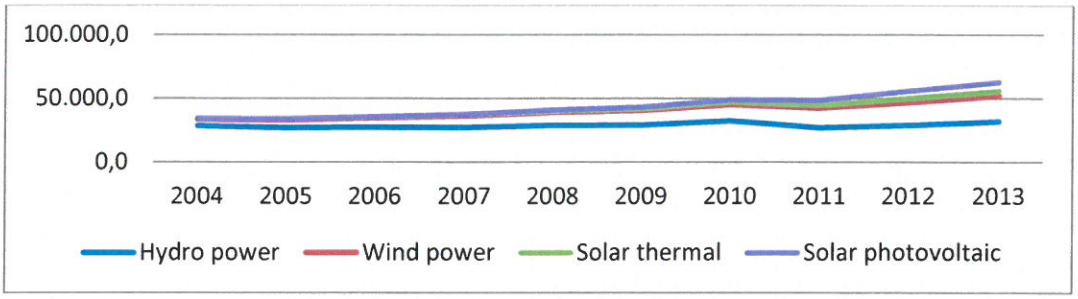

Figure 7. Consumption of renewable energies in the EU-28 (Tonnes of oil equivalent)

Source: Eurostat

Consumption of renewable energies between 2004-2013 shows an increasing trend, except for hydro power. However, usage of renewable energies in 2011 is at its lowest level. When compared to five years ago, solar photovoltaic, solar thermal and wind power demonstrates a significant increase, while the consumption of hydro power is less than the others.

Kantor and Mohr (2015) states that the EU achieved a significant increase in the wind power generation. For the last two decades, the numbers of annual facilities have increased regularly. Expensive fuel prices and developments in wind turbines have made the wind power to be seen as well-liked from the economic competitiveness viewpoint thanks to the conservative forms of power production.

According to the European Photovoltaic Industry Association as cited by Kantor and Mohr (2015), Europe's Photovoltaic market is the most powerful market and also the leader in the World with a capacity more than 70 GW which is the 70% of the World's cumulative Photovoltaic capacity. Germany and Italy are the leading countries in PV energy within the EU and followed by France, Belgium, Greece, the UK, and Bulgaria.

Photovoltaic technology, power plants of solar thermal requires a direct line of sun light for efficiency, while power plants of photovoltaic's can operate using both direct and indirect sun light. Thus, the consumption of solar thermal is less than photovoltaic's, although it represents significant increase in Figure 7.

According to the Eurostat, Energy Production and Import Statistics (2016), the EU-28's imports of major energy exceeded exports by some 909 mt in 2013. Primary energy refers to the energy consumed in order to produce energy. The member states which have the most population are the largest importers of the primary energy, exception for Poland.

The Eurostat Statistic notes that as 2004, Denmark was the just net exporter of primary energy in Europe. In 2013 Denmark saw over jumped in its imports. In EU, Luxembourg, Malta, and Belgium were the largest importers in 2013. Malta, Cyprus, and Luxembourg are totally dependent on the imported energy (97-100%). Ireland, Italy, Portugal and Spain follow them respectively with import dependence ratios between 80% and 90%. *Figure 8* shows the Primary and Final energy consumptions of EU-28.

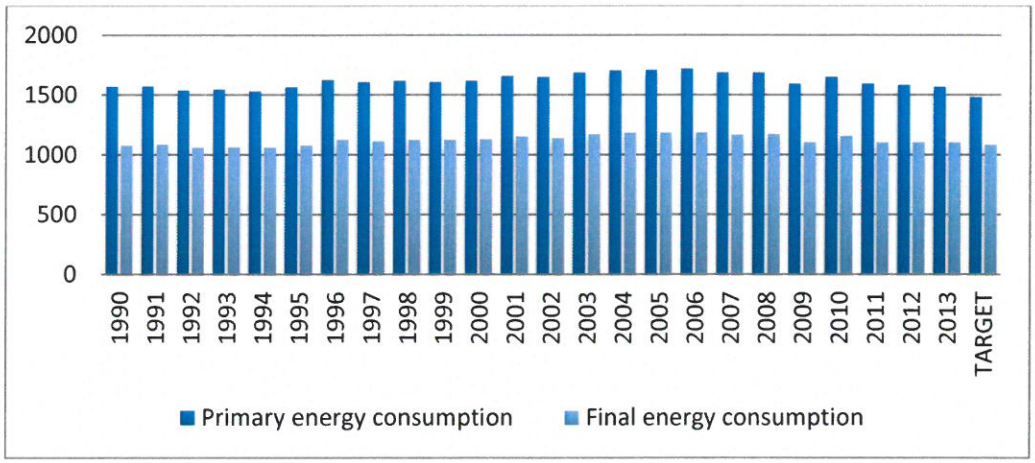

Figure 8. The Primary and Final Energy Consumption of EU-28 (Million TOE)

Source: Eurostat

Figure 8 shows that the primary energy consumption in the EU decreases between 2008-2013. This implies to a major progress in falling energy consumption in the EU. Final energy consumption also shows a decrease between 2005-2013.

According to the EC (2015), the little increase in 2013 in final energy consumption is mostly due to enlargements in Belgium, Czech Republic, Germany, Ireland, France, Hungary, Netherlands, Austria, Slovakia, and United Kingdom. Each country within the European Union follows a different national

strategy about the energy due to their domestic parameters and energy resource.

Baumann and Simmerl (2011, p.8) call attention to members from Central and South Eastern Europe that require local reserves of fossil fuels conventionally focusing on the domestic production of nuclear power and renewable energy.

While this chapter analyzed European energy policy making with references to the literature and Eurostat and member states' energy profiles, the following chapter will be examining the EU energy targets for 2020, 2030 and 2050.

CHAPTER 4- Examining the EU's Energy and Climate Policy Strategies and Targets

The EU sets a target for countries in specific years for climate change, as it is mentioned previews chapters 2020, 2030, and 2050 are the main years respectively. All these years have their own significant targets for greenhouse gas emission. This chapter is going to highlights what are all these targets. Here are the brief goals for countries according to target years. The European Council accepted a fresh energy and environment policy in March 2007 which set an outline with the aim of enabling the sustainability, competitiveness, and security of supply as the energy objectives and known as the "20-20-20" (WEC, 2007). The aim of this policy is to decrease greenhouse gas emissions by 20%, enlarge the share of renewable in total energy consumption to 20% compared to the current figures and increase the energy efficiency by 20% until 2020. The World Energy Council (WEC) demands from countries that after 2020 target, 2030 is a fresh framework for climate change and energy market. One of the main points of 2030 targets is achieving a 40% decrease in greenhouse gas emissions when compared to 1990. Moreover, the share of renewable energy in total consumption must be at least 27% and also 27% of energy saving are demanded by EU Council (EC, 2014, 15). Council demands from countries that by 2050 around 80-95% reduction will be fulfilled in greenhouse gas emissions (EC, 2011). In following sections all target years are explained and some examples from literature are given.

4.1. The EU's Energy and Climate Policy Strategy for 2020

The international energy market experienced a structural change at the beginning of 1990s. Eriksson (2011) suggests that the change in international energy market resulted in an increase in energy prices and energy dependence of the EU, especially in third countries.

As a response to these developments, the European Commission adopted a strategy in November of 2010 that promotes a market with competitive prices and security of supply by means of technological advancements and being a leader, and partnerships at international level. The EU concerns the relations

with its suppliers and countries which have the transit energy roads in order to minimize the possible risks relevant to the EU's energy dependency.

Europe 2020 determines reinforcing priorities and headline targets:

– Smart growth: making investment on research and development (R&D) areas.

–Sustainable growth: encouraging the renewable energy sources and competitiveness in economy.

– Inclusive growth: helping to increase the rate of employment and reduce poverty.

Table 3 shows the targets and flagship initiatives under different growth modules.

Headline Targets and Flagship Initiatives	Targets	Flagship Initiatives
Smart Growth	3% of GDP to be invested in the research and development (R&D) sector. Reduce the rates of early school leaving to below 10% and at least 40% of 30 to 34 year olds to have completed tertiary or equivalent education.	Innovation Union Youth on the move A digital agenda for Europe
Sustainable Growth	Reduce greenhouse gas emissions by 20% compared to 1990 levels. Increase the share of renewables in final energy consumption to 20%. 20% increase in energy efficiency	Resource efficient Europe An industrial policy for the globalisation era
Inclusive Growth	75% of 20 to 64 year old men and women to be employed Reduce poverty by lifting at least 20 million people out of the risk of poverty and social exclusion.	An agenda for new skills and jobs European platform against poverty and social exclusion

Table 3. EU's Headline Targets and Flagship Initiatives

Source: European Commission

These targets represent the three priorities of smart, sustainable and comprehensive development at national, EU and international level and are regarded as critical to be successful. It is known that each member must adopt the Europe 2020 strategy.

The Commission Paper (2013) states that with the intention of the EU's 2020 target in order to control demand for energy 20% is equal to 1,000 coal power plan or 500,000 wind turbines. Energy efficiency also creates a decrease in

energy import and air pollution. The Commission analyzes the particulars of seven flagship initiatives:

– "Innovation Union": To constitute suitable circumstance and reachable to capital in order to make research and development with the aim of economic development and jobs as a result of innovation.
– "Youth on the move": To improve the quality of education system and to create job opportunities for the young population in the market.
– "A digital agenda for Europe": To accelerate the speed of internet and to ensure the advantages of a digital on its own market for companies and devices at homes.
– "Resource efficient Europe": To disconnect economic development from the utilization of resources; encourage the low carbon economy and the use of renewable energy sources, modernization of the transport sector and promotion of the energy effectiveness.
– "An industrial policy for the globalization era": Particularly for small and medium enterprises, improving the business environment by creating a sustainable industrial policy to compete within global business environment.
– "An agenda for new skills and jobs": To improve labor markets and help people to develop their capacities with the aim of increasing the labor participation and the mobility of labor regarding the employer supply and demand in the EU.
– "European platform against poverty": To design a platform to help people who lives in EU countries and suffers from poverty and social exclusion.

In this context, a sustainable future is the main priority of the Union. The Union concerns about looking beyond the short term goals and maintain the current status. The purpose of Europe 2020 is to create employment opportunities and improved welfare by delivering smart, sustainable, and inclusive growth.

The flagships imply the necessity of focusing on research and development to be able to address the challenges including the climate change, supply efficiency, health and demographic change. To achieve above flagships, the EU calls the member states for an improvement in national research and development (R&D) systems.

4.2. The EU's Energy and Climate Policy Strategy for 2030

In 2014, 2030 Energy and Climate Targets was introduced by the European Commission with the purpose of decreasing the greenhouse gas emissions at a 40% level compared to 1990 levels and increasing the share of renewable energy in final consumption at a 27% level. The aim of the Commission is to create a low-carbon economy to reduce the energy dependence of the EU.

De Vos et al. (2014) point out the importance of the EU Emissions Trading System (EU ETS) used by the sectors to achieve the required reduction in greenhouse gas emissions. Sectors outside the System are also responsible for a cut of 30%, while others within the System are responsible for a cut of 40%.

The EU ETS launched by the European Union in 2005 is regarded as one of the leading cost-efficient systems in the attempt of decreasing greenhouse gas emissions. The European Commission (2016) states that the EU ETS is an important tool in struggling with the climate change. There are 11,000 power stations along with industrialized plants in member states using these systems. According to this system, there is a limit on overall emissions, especially for high-emitting sectors. The EU ETS limits around 45% of total emissions in Europe. On the other hand, transport, lighter industry, buildings and agriculture sectors are the non-ETS sectors and they are responsible for 58% of the total emissions. It is also emphasizes that these systems creates a more healthy environment for the citizens by reducing the occurrence the illnesses resulting from air pollution (Euractive, 2013).

Following *Figure 9* exhibits the Greenhouse gas emissions in non-ETS sectors.

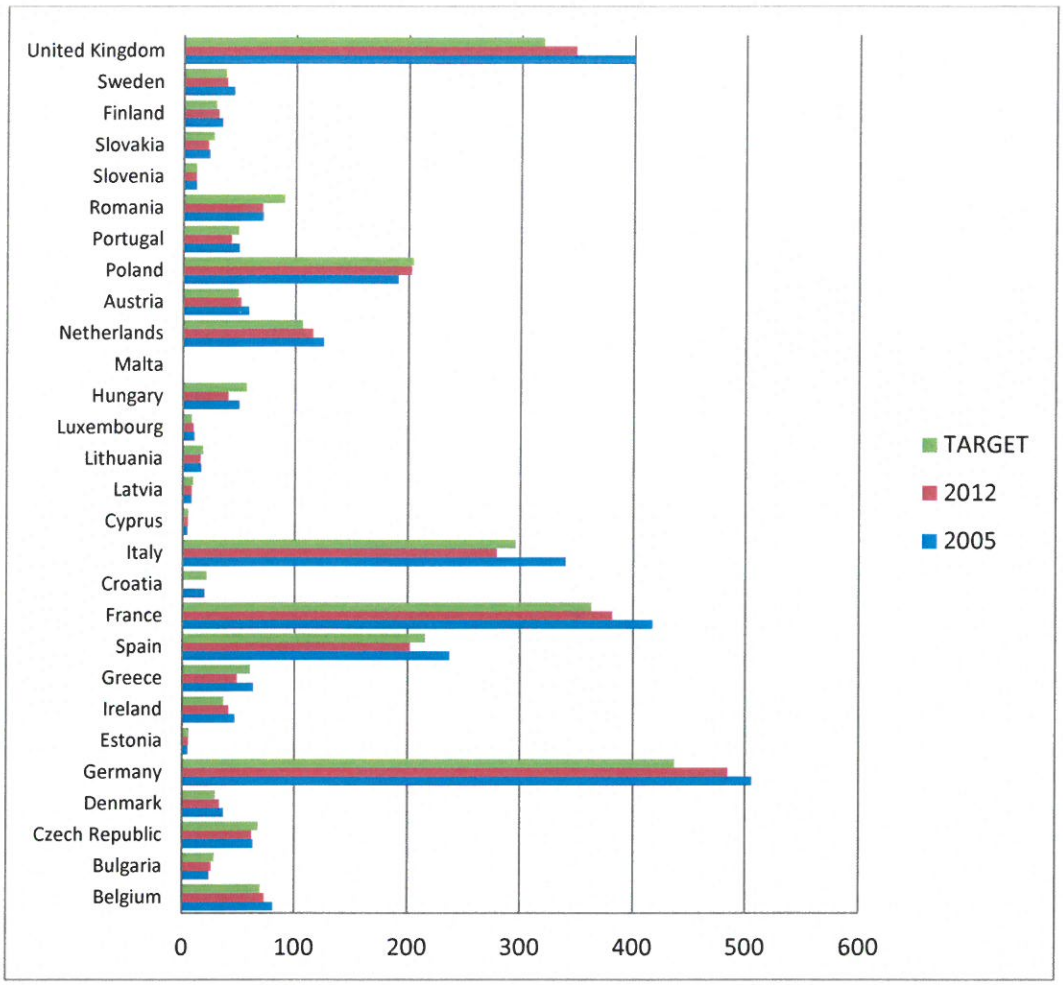

Figure 9. Greenhouse Gas Emissions in non-ETS sectors (Million tones CO2 equivalent)

Source: Eurostat

2030 policy framework for climate and energy which was introduced in January of 2014 by the European Commission was including the following key proposals (De Vos et. al., 2014):

-By 2030, minimizing the greenhouse gas emissions by 40% which is also below the 1990 levels. The sectors using of this system should decrease their emissions by 43% compared to 2005 levels, while others cut by 30% and below.

-Maximizing the share of renewable to at least 27% in total EU consumption by 2030. In contrast to 2020 target, 2030 target is only stringent at the EU-level. Additionally, a new governance organization based on nationwide plans is planned by the Commission for competitive, secure, and sustainable energy.

-Energy efficiency in the 2030 framework and its function will also be regarded as a re-examination of the Energy Efficiency Directive because it was revised later in 2014.

The Commission states that the 2030 policy structure should be based on full completion of the 20/20/20 targets and the following (EC, 2014):

- In the same direction with the 2050 roadmaps, a determined commitment to reduce greenhouse gas emissions by following a low-cost approach to handle the challenges under the existing economic and political conditions.
- Simplify the European policy framework, and also improve to be supplementary and create a harmony between goals and instruments.
- Since specific conditions of each member state are different from each other, it is important to ensure flexibility among them to designate a transition for low-carbon.
- Reinforcement of regional cooperation is important in addressing the common energy and climate challenges, as well as preventing distortion in the market.
- By a cost-efficient approach, accelerating the development of renewables.
- A well perception of the factors which determine energy costs is significant because the policy should be based on facts and proofs. While determining the purposes of the framework and the instruments to be applied, it is important to focus on the competitiveness in the market and affordability of the energy for citizens.
- To achieve the desired improvement in energy security along with low-carbon and competitive energy system, diversification of imported energy, improving the infrastructure by investing, energy saving in end-use, common action within integrated market place, research and innovation are the key factors.
- To attract to investors about EU's policy framework after 2020, by assuring that important changes to current purposes do not come into force earlier than date.
- Reasonable contribution of the member states that reflects their specific situation and capacity.

Wyns, Khatchadourian and Oberthür (2014) suggest that the EU's post-2020 renewable energy and energy efficiency policy structure will change remarkably

with the European Commission's 2030 climate and energy policy framework. The elimination of nationally obligatory renewable energy targets after 2020 would be a major difference.

The Structure of the climate and energy targets for 2030 has been accepted with a broad consensus by the member states of the Union. On the other hand, increasing the share of renewable energy to the smallest amount of 27% by 2030 will be the only obligation at the EU-level without nationwide obligatory. In addition, for reducing greenhouse gas emissions, member states' current obligations will continue after 2020 as proposed by the Commission. When the suggested target would be fully implemented, it's projected that a decrease of 32% will be achieved when compared to the figures in 1990s.

4.3. The EU's Energy and Climate Policy Strategy for 2050

Climate change is regarded as the most important ecological challenge for the humanity. Not only the EU but all the nations in the world are required to take a common and coherent action to cope with this challenge. As a response to this problem, the European Institutions prepared a plan and some objectives beyond the 2020 and 2030 with the aim of achieving the long-term goal of diminishing emissions by 80-95% until 2050.

Carvalho (2012, p.19) dictates that there should be a remarkable re-arrangement in social activities such as transportation, city planning, residence sector and electricity production in order to achieve to the goal of reducing the gas emissions globally by 2050.

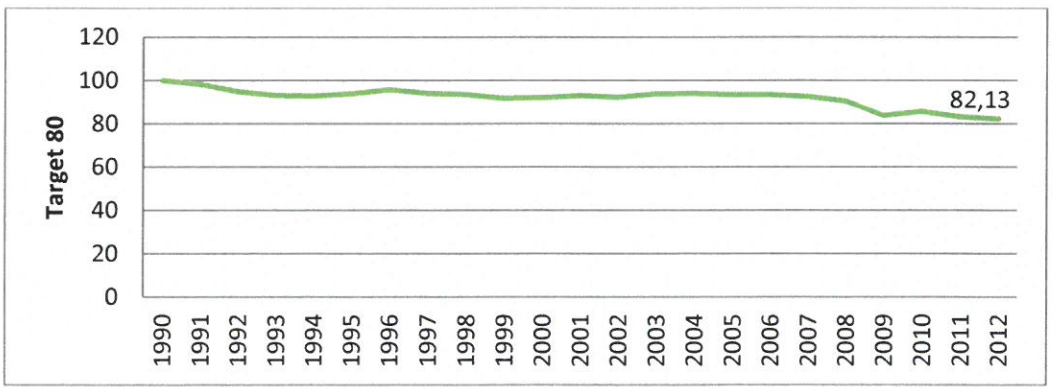

Figure 10. Greenhouse Gas Emissions, EU-28

Source: Eurostat

In 1997, 15 EU Member States signed the Kyoto Protocol and agreed to fulfill their commitments for the first commitment period of 2008-2012 and to reduce the GHG emissions by 2008–2012. *Figure 10* shows the total GHG emissions between 1990-2012 among the EU-28. As of 2009, a sharp decline is observed in GHG emissions in Figure 10.

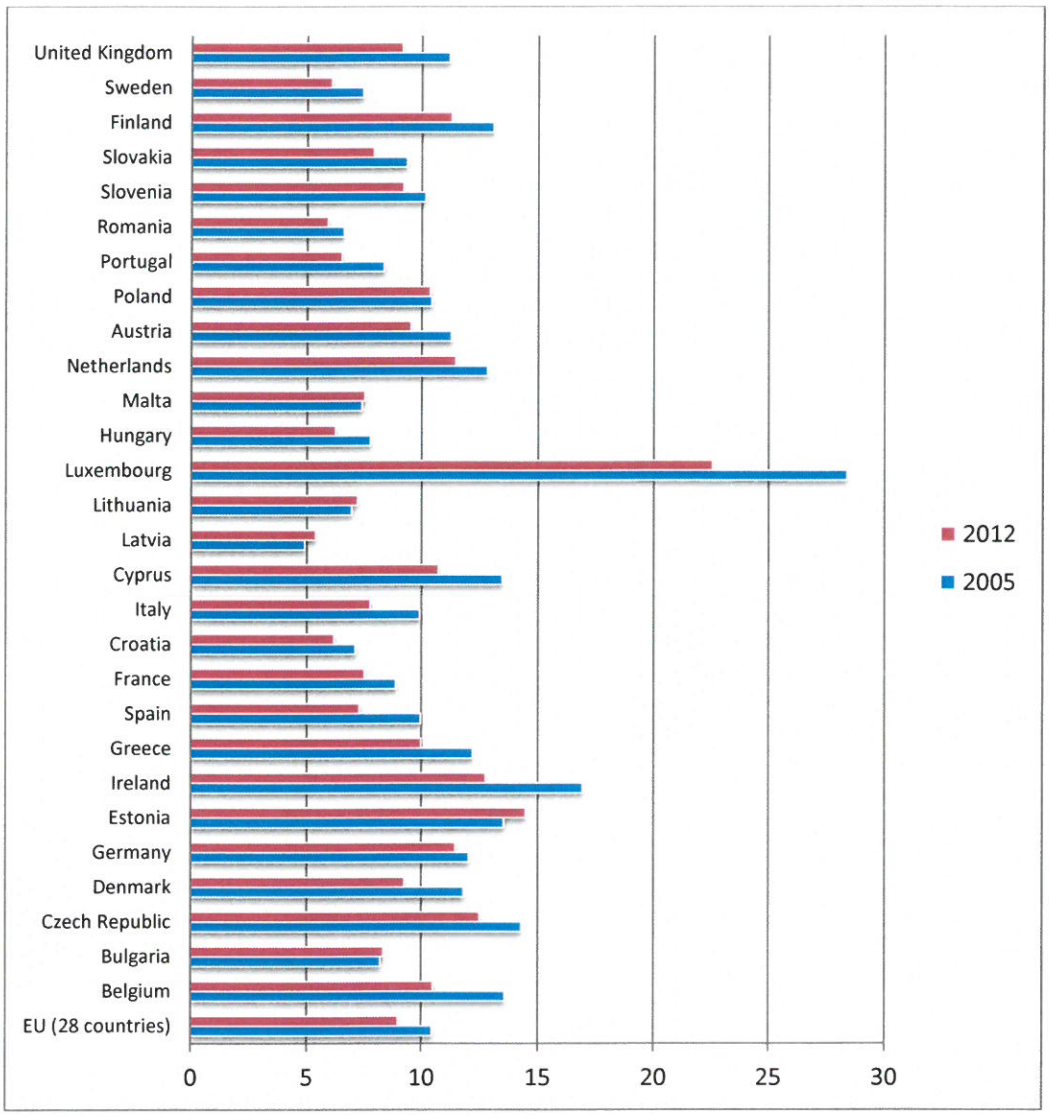

Figure 11. Greenhouse Gas Emissions Per Capita (Tonnes of CO2 equilavent)

Source: Eurostat

Figure 11 shows that among the EU members in 2012, greenhouse gas emissions per capita are the peak in Estonia, Germany, Latvia, Lithuania, and Poland. The biggest decrease in 2012 compared to 2005 is in Belgium, Ireland, and Spain. Luxemburg has the maximum share in greenhouse emissions among other member countries while Sweden is the state which is the closest to its target.

Member states would be trying to reduce their emissions and also fulfilling their national targets in the following year.

In order to address greenhouse emissions, Langsdorf (2011, p.7) states that "Energy 2020" is a long-standing energy policy based on the "energy action plan" of 2007. On the other hand, "Energy Roadmap 2050" is also a strategy paper that takes longer time to response to investment in continuing for energy infrastructure by giving a route for following 2020.

The purpose of the Commission with the Energy Roadmap 2050 is explained as; to achieve a largely decarbonized society in the EU and higher energy security, lower import dependency, lower energy prices and CO2 reductions as a result, as well as a better air quality and favorable health conditions (EC, 2011).

According to the Commission's 2050 low carbon and energy roadmaps, the evolution needs technological investment and infrastructure and the cost of such an investment is estimated as equal to 1.5% of the GDP on annual basis in the meantime.

In this chapter, the European Union's energy targets are explained. Each target has different goals for energy and climate change challenges. The nearest target which is binding is in 2020. Countries energy policies were shaped to according to these energy purposes and until 2050 the aim of the carbon emissions are projected to decrease 80-95 % level. The next chapter explains, what are energy trilemma and its three dimensions.

CHAPTER 5- Introducing Energy Trilemma Approach of World Energy Council

5.1. Dimensions of the Energy Trilemma

The energy sustainability is explained in three main dimensions by the World Energy Council that is energy security, energy equity, and environmental sustainability. Additionally the Council generates a concept called "energy trilemma" which ranks nations based on their performance of sustainability of energy policies with measuring three dimensions (Wyman, 2015). In literature, trilemma means choosing the best two instead of three options. In economics that is known "impossible trinity" which means a trade-off among three targets. However, Energy trilemma is about achieving all of the three targets (Carbon Brief, 2013). World population is growing steadily and it is observed that as the world becomes more urbanized, the GDP of the countries is growing as well. Moreover energy demand is increasing rapidly on annual base and in global energy market supply security plays a vital role, in addition it has a potential to double by 2050. Therefore, the World Energy Council examines the performances of the countries, organizations projects (ARUP, 2016). For climate targets energy trilemma is a main reference of the countries. In 2015, the World Energy Council published five action areas which have the priority for decreasing greenhouse gas emission. The first one is the "Trade and transfer of technology" which includes logically shaped protections without any tariff on environmental supplies and services. The second issue is "Carbon pricing", that refers to redirect investments as a stop for low-carbon solutions. The third one is the "Financing Mechanisms" and it represents the innovative financing mechanisms to enlarge the investments on energy infrastructure. The fourth issue that trilemma takes into consideration is the "Demand management and energy efficiency" which covers increasing the management and efficiency in all sectors. And the last one is the "Priorities Innovation and R&D" that means investment on area of research and growing with using state of the art technology and tools.

Shortly, The World Energy Council (2015) explains the energy trilemma's dimensions as follows:

Energy security: The efficient management and use of the primary energy to meet the demand, by focusing on both domestic and external energy sources. Energy supply security is the main issue of this dimension.

Energy equity: It means that the energy supply is convenience and affordable meeting the demands, in other words everyone in the population has the access to energy at the same level.

Environmental sustainability: Getting energy supply from renewable sources.

5.1.1. Energy Security

Energy is critical in maintaining and promoting the economic growth. Dreyer and Stang (2014, p.11-12) define energy security as 'the uninterrupted availability of energy sources at an affordable price'. They state that managing the energy security requires some efforts to diminish the risks in energy systems, both inside and outside of the market. Tools for the achievement include: ensuring markets' role with get together demand and supply at the finest level.

Energy security implies the availability of the energy. Papanikos (2015) states that it is important to utilize different suppliers and energy sources, diversity of energy mix, diversity in transport routes and spatial diversity of distribution.

Labandeira and Manzano (2012) remarks that energy is necessary in any case although energy-efficient strategies are being succeeded due to production process for basic benefits of human beings.

In this sense, energy security is vital for economic expansion and progress of the societies because the stability of the energy supply is not easy due to geopolitics in the world. In the last decade, energy consumption in the world has seen a significant growth because of the emergence of developing countries such as India or China.

As stated before, energy has become an important issue in many countries. In the European Union, energy security, as one of the three dimensions of energy policy, has been a key priority.

The European Commission's green paper in 2000 identifies several sources of risk relevant to energy:

• Physical risks: This implies to the lack of energy or energy production as well as geopolitical conflicts or unusual disasters.

• Economic risks: This implies to the unsteadiness between demand and supply which leads to volatility in energy prices.

• Political risks: This means that energy exporting countries may use energy as a political weapon against importing countries.

• Regulatory risks: Insufficient rules in the local markets and the changeability of the regulations in the exporting countries.

• Social risks: Conflicts may result in radical increases in prices.

• Environmental risks: Significant damages to environment may occur as a result of the nuclear accidents, etc.

In this context, political, economic, social, environmental risks, and geopolitical crises affect the countries and also they might differ from one country to another.

5.1.2. Energy Equity

Energy has to be accessible and affordable to all classes of the society. According to ARUP (2016), energy must be measured like a public good, moreover it should be guaranteed by the government and provided to their citizens who could easily access and afford energy. Energy supports economic growth obviously and without it, industrial enlargement and communal goods like health and education may collapse. Most of the energy policies are shaped by affordability which is based on the political influence. Moreover, to be able to sustain the reasonable prices for the citizens, energy market is enforced to involve in a competition (ARUP, 2016). Indeed, consumption of the energy is the binding point of a country in corresponding the demand at an uninterrupted level.

Papanikos (2015, p.6) points out to the importance of government policies that policy-makers should make strategies responding to energy needs of the society in the outlook by the best plan of taxes and state-aids which address to sustainability and to lift up government incomes in case of a need.

A DFID Report (2002) state that as the economy of country grows, problems occurs in energy market due to the scale of demand. The Report advises to use these from first to last huge investment, such as new technologies for renewable energy, to discover fossil fuels, and to produce and distribute electricity. At this point, to attract the nations to their own capital is significant for developing countries.

In this context, the capital is important for countries while meeting the energy requirements of their people. Many developing countries try to make their energy sectors smart for foreign investors or private local investors.

It can conclude that investing and sustaining infrastructure might be the main task of the government because they are vital for the constant supply of energy and stability. However, building an energy infrastructure is costly as stated above.

5.1.3. Environmental Sustainability

Environment is a vital issue considering the global warming and the climate change. Papanikos (2015, p.6) mentions that this situation would lead to a shift from fossil fuel to solar and wind energy to avoid global warming and decrease air pollution.

Production and the use of energy is a main effector of the environment. Environmental sustainability takes the third place in the trilemma. World Energy Council accepts "sustainable energy" as a main way of decreasing carbon footprints and increasing volume of the economy of the nations.

DFID Report (2002) explains that energy and environment is existing together because many energy sources are obtained from the environment. For example, using clean technologies are environment friendly but like fossil fuels extraction, some directly effects climate during the process. Renewable energy resources combined with efficient use of fossil fuels is the solution advised in developing countries in order to help reduce negative effects of the energy use.

The Energy Trilemma Index which is proposed by the World Energy Council and its consultant Oliver Wynman, provides the level of energy security, energy

equity (affordability) and environmental sustainability of the countries. The index examines the comparative ranking among all 130 countries in the world and this thesis analyzes only EU-28 member states. Moreover, selected criteria in the Table 5 also analyses the EU-28 countries' performances. The selected criteria are chosen under four main issues and ten sub-topics, which are related to energy trilemma index as well. The four main topics are Economic Growth and Development, Environmental Sustainability, Energy Sources and Energy Access and Security, while the sub-criteria are energy intensity, energy affordability, GDP/per capita, CO2 emissions, oil, gas, coal, nuclear, renewable energy and diversity of energy mixes, respectively. Briefly, ranking highlights how states run the trade-off among three dimensions of energy trilemma and the best performance is shown with an AAA score (WEC, 2015). The order of AAA score is energy security, energy equity and environmental sustainability. The countries have the opportunity to develop their energy performance, whether they are ranked as first or last. Moreover, policy makers in sectors are emboldened to look at performances over decades and they could compare themselves against regional or GDP group peers (WEC, 2015). Development is an important issue for countries and it is confirmed by WEC (2015) that trade-offs in trilemma index helps the development level to improve. It is obvious that the countries face some challenges while going through the stages of economical development. The index shows that developed countries have a higher rank. However WEC mentioned a vital point that countries should invest more on low carbon emission forms such as renewable for their energy mix. Because of the old infrastructures, countries may face some challenges in the future. The index points out that for developing countries renewable energy will become more accessible and cost-effective. Moreover, countries should invest on new technologies to reach EU's targets and for the affordability of the energy both by citizens and industry for which it has a huge importance. It is observed from the index that top 10 countries are developed countries and their GDP per capita is around more than 33,500 US dollar (WEC, 2015).

In the following section, framework of selected criteria's and performance indicators of the each EU member state will be examined.

CHAPTER 6- Examining the EU Member States from Energy Trilemma Concept

Countries have different energy mix of resources and supply, but their main aims are to focus on increasing the renewable, efficiency and decreasing CO2 emissions in line with the 2020, 2030 and 2050 targets. The countries' process of energy trilemma ranking is mostly visible. The following figure 12 shows the changes countries overall scores in time.

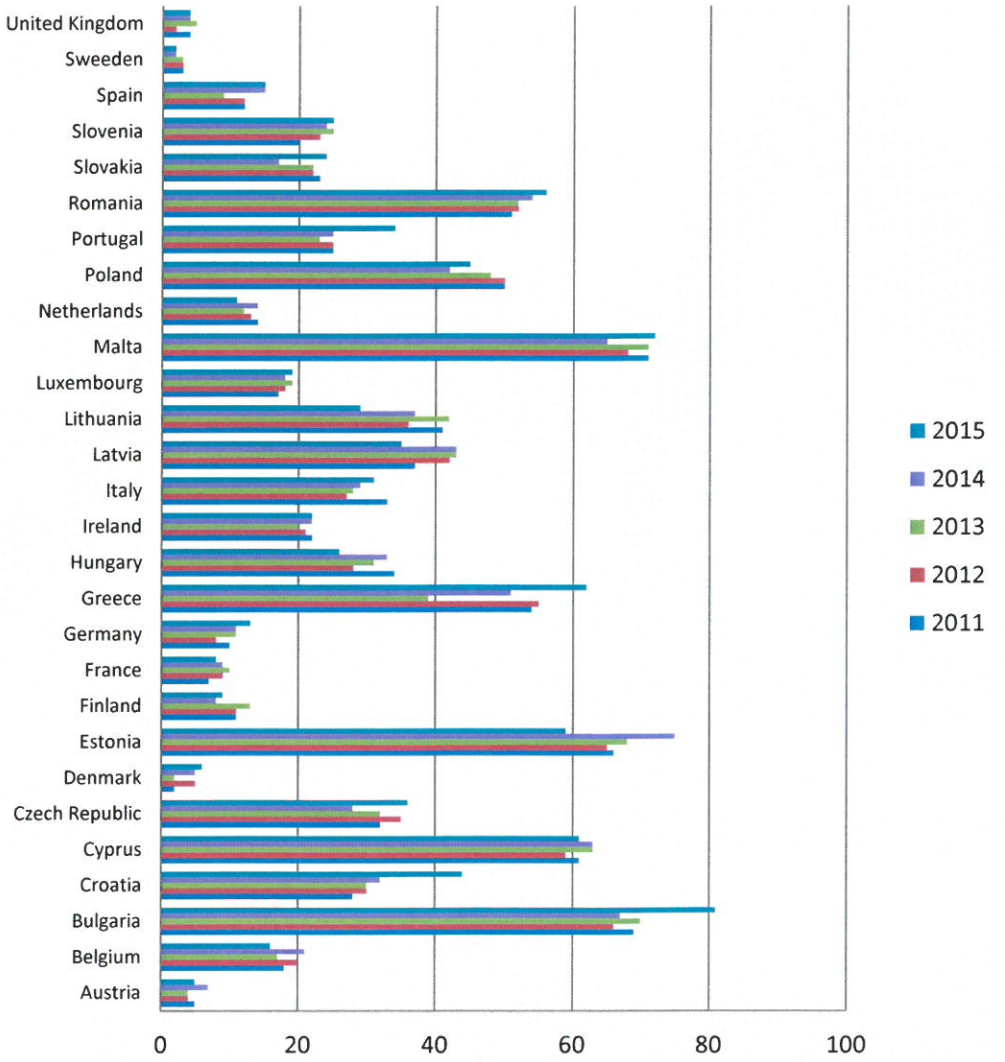

Figure 12. Energy Trilemma Overall Scores Changes in EU-28 (2011-2015)

Source: World Energy Council Energy Trilemma Index

According to Energy Trilemma Index 2015 countries are divided into three main groups including the first one which consists of the best performed ones, the second group which includes the average countries and the last group which

includes the worst performed ones. As it is seen in the Table 4, in the world six of the best countries are from European Union. In Fiqure 12, the countries whose overall scores changed between the years 2011-2015, are given based on their energy trilemma performances.

EU-28	Energy Trilemma 2015 Index Ranks
Sweden	2
United Kingdom	4
Austria	5
Denmark	6
France	8
Finland	9
Netherlands	11
Germany	13
Spain	15
Belgium	16
Luxembourg	19
Ireland	22
Slovakia	24
Slovenia	25
Hungary	26
Lithuania	29
Italy	31
Portugal	34
Czech Republic	36
Latvia	39
Croatia	44
Poland	45
Romania	56
Estonia	59
Cyprus	61
Greece	62
Malta	72
Bulgaria	81

Table 4: Countries' Energy Trilemma Ranking in the World

Source: World Energy Council Energy Trilemma Index

6.1. Scrutinizing a Framework Analysis for the EU Member States

The following Table 5 is the criteria for of the performance of the countries. These criteria are selected due to energy trilemma's three dimensions which are energy security, energy equity and environmental sustainability. Under these dimensions, framework shaped with sub topics as mentioned at the end of the chapter 5. The main point of the framework is to observe and analyze the

countries detailed performances. The table filled with (+ and -) which means, for all criteria there are some average points. For energy intensity criteria, if a country is above the average, it is scored with (-) because energy intensity is the ratio of energy consumption and GDP (EEA, 2013). If a country is below the average, it is scored with (+) which is a good deal. Energy affordability data of the countries are collected from World Energy Council (2015). The GDP of the countries are collected from World Data Bank, and the Energy Sources are from both BP Statistical Review 2015 and World Energy Council (2015). If the score of energy affordability is above the average, the country is scored with (+), and for GDP if the country is above the average, it is scored with (+). The last main criterion is the diversity of energy mix. It is dependent on Energy Sources, if a country has more than 3 energy sources, the criteria is given (+). Some nonexistent data's are given (n/a). The criteria will be examined in the following part of the thesis.

Briefly, countries who has (+) in all sections are classified as developed countries where GDP per capita is high, such as Austria, Germany, Italy and Denmark, on the other hand the countries at the bottom are Czech Republic and Estonia with (-) sign. Average countries according to the criteria are France and Sweden. There is a vital point that although Sweden is the world's second country in terms of performance in the energy trilemma dimensions, it needs to make more investment on energy efficiency and price management in energy market. In the following chapter, Sweden will be analyzed by its policies and the rest of the countries are also analyzed under the 3 groups of energy trilemma performances.

	Economic Growth and Development			Environmental Sustainability	Energy Sources					Energy Access and Security
	Energy Intensity(Million BTU/$)	Energy Affordability($/kwh)	GDP/ per capita ($)	CO2 Emissions (Million Tonnes)	Oil	Gas	Coal	Nuclear	Renewables	Diversity of Energy Mix
Austria	+	+	+	+	+	+	+	-	+	+
Belgium	-	+	+	+	+	+	+	+	+	+
Bulgaria	-	n/a	-	+	+	+	+	+	+	+
Croatia	+	n/a	-	n/a	+	+	+	-	+	+
Cyprus	+	n/a	-	n/a	+	-	-	-	+	-
Czech Republic	-	-	-	+	+	+	+	-	+	-
Denmark	+	+	+	+	+	+	-	-	+	+
Estonia	-	-	-	n/a	+	n/a	n/a	n/a	+	-
Finland	-	-	+	+	+	+	+	+	+	+
France	+	-	+	-	+	+	+	+	+	+
Germany	+	+	+	-	+	+	+	+	+	+
Greece	+	-	-	+	+	+	+	-	+	+
Hungary	+	-	-	+	+	+	+	+	+	+
Ireland	+	+	+	+	+	+	+	-	+	+
Italy	+	+	+	-	+	+	+	-	+	+
Latvia	+	n/a	-	n/a	n/a	n/a	n/a	n/a	+	-
Lithuania	+	n/a	-	+	+	n/a	n/a	-	+	-
Luxembourg	+	-	+	n/a	+	n/a	-	-	+	-
Malta	+	n/a	-	n/a	-	-	-	-	+	-
Netherlands	+	+	+	-	+	+	+	+	+	+
Poland	-	-	-	-	+	+	+	n/a	+	+
Portugal	+	+	-	+	+	+	+	-	+	+
Romania	+	n/a	-	+	+	+	+	+	+	+
Slovakia	-	-	-	+	+	+	+	+	+	+
Slovenia	+	-	-	n/a	-	+	+	+	+	+
Spain	+	n/a	-	-	+	+	+	+	+	+
Sweden	-	-	+	+	+	+	+	+	+	+
United Kingdom	+	+	+	-	+	+	+	+	+	+

Table 5. The Criteria of EU-28 Countries for Analyzing Energy Trilemma Index

Sources: World Energy Council Energy Trilemma Index, World Data Bank, BP Statistical Review 2015

6.1.1. Economic Growth and Development

6.1.1.1. Energy Intensity

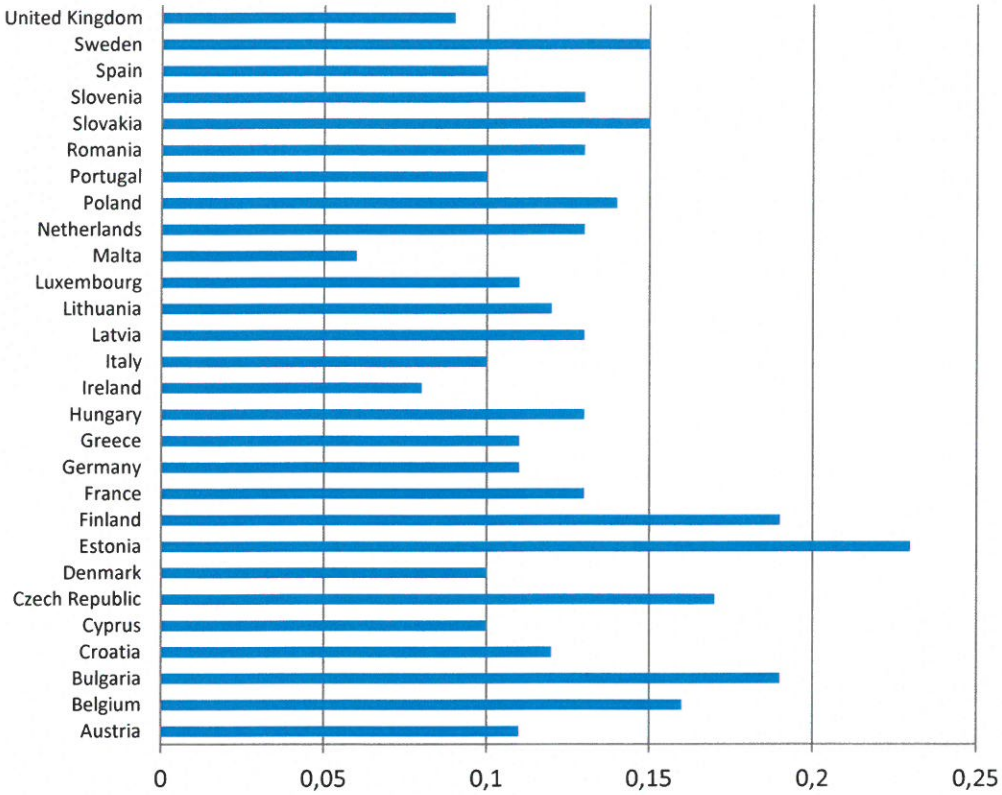

Figure 13. Energy Intensity (Million BTU/$) of EU-28 Countries

Source: World Energy Council Energy Trilemma Index

As it is known that regarding the European targets, energy efficiency is a major indicator for countries, therefore the criterion selected is the energy intensity for analyzing the countries situation. Energy efficiency is inversely proportional to energy intensity. To briefly describe, during the development process of a country, energy intensity rises. However when the peak is reached, the energy intensity at the highest level starts to diminish (EEA, 2015). That means lower intensity is a preferable measurement for countries. Moreover, countries with different volumes of energy consumption and GDP values also have effects on this indicator. The lowest energy intensity is observed in Malta but it doesn't mean that it is the most efficient country but rather means that it has different volumes of energy. But it is observed that some countries such as Austria, France, Denmark, Germany, Italy, Luxembourg, Netherlands and United Kingdom have performed well in intensity however it doesn't mean that Sweden, Finland, Belgium and others have performed badly, the main point is that they are close

to the average point because of their investments regarding the Union targets.

6.1.1.2. Energy Affordability

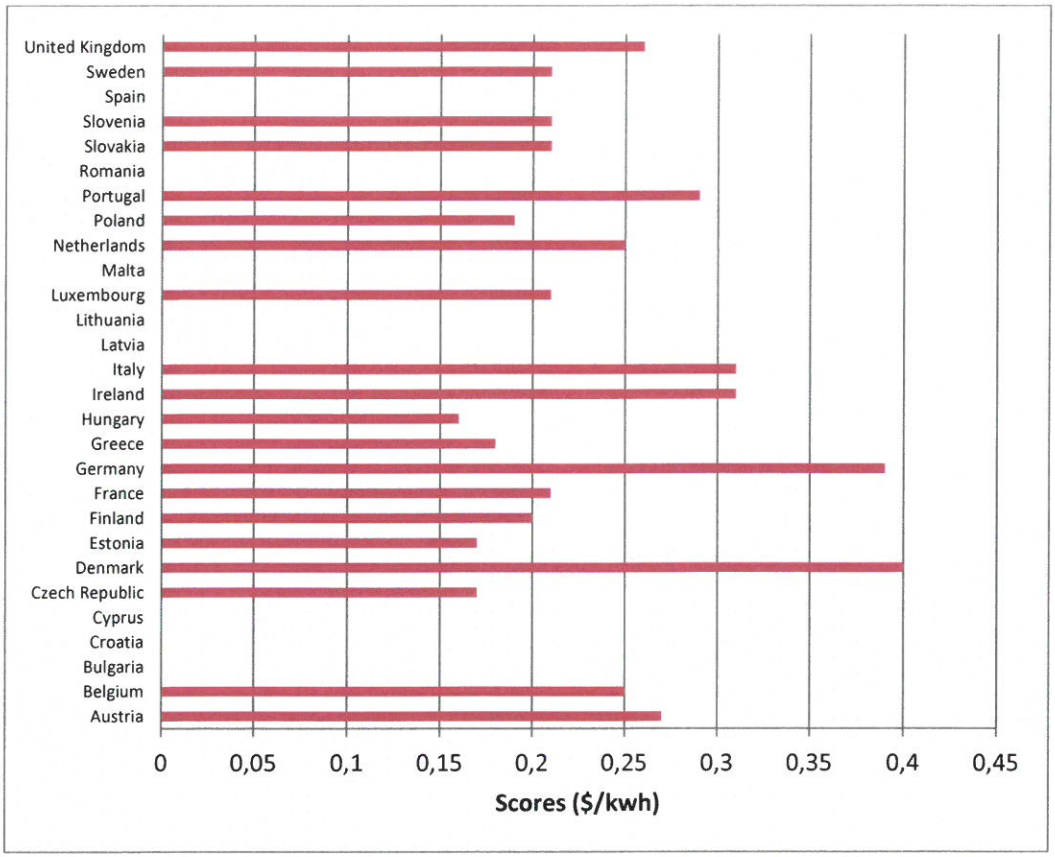

Figure 14. Energy Affordability ($/kwh) of EU-28 Countries

Source: World Energy Council Energy Trilemma Index

Energy equity dimension in energy trilemma is also shown as the affordability of a country. This is a vital point for the economy of the countries. As it is seen in Figure 14, developed countries' energy affordability index is high, for instance most of the countries that have high affordability scores are included in the first group of the energy trilemma. As explained before, their GDP/per capita is higher than 33,500 $ (WEC, 2015) as in Germany or Denmark. The grading system on the Table 5 is made of the total of EU-28 countries' affordability scores divided by 28 countries. There is a significant point that, energy affordability of Luxembourg is under the average point which means energy prices in the country is high. The same scenario is applicable for Sweden and Finland as well. Briefly, according to the energy trilemma index, affordability of the countries is in parallel with their economical development as mentioned in energy trilemma chapter.

6.1.1.3. GDP/ per capita ($)

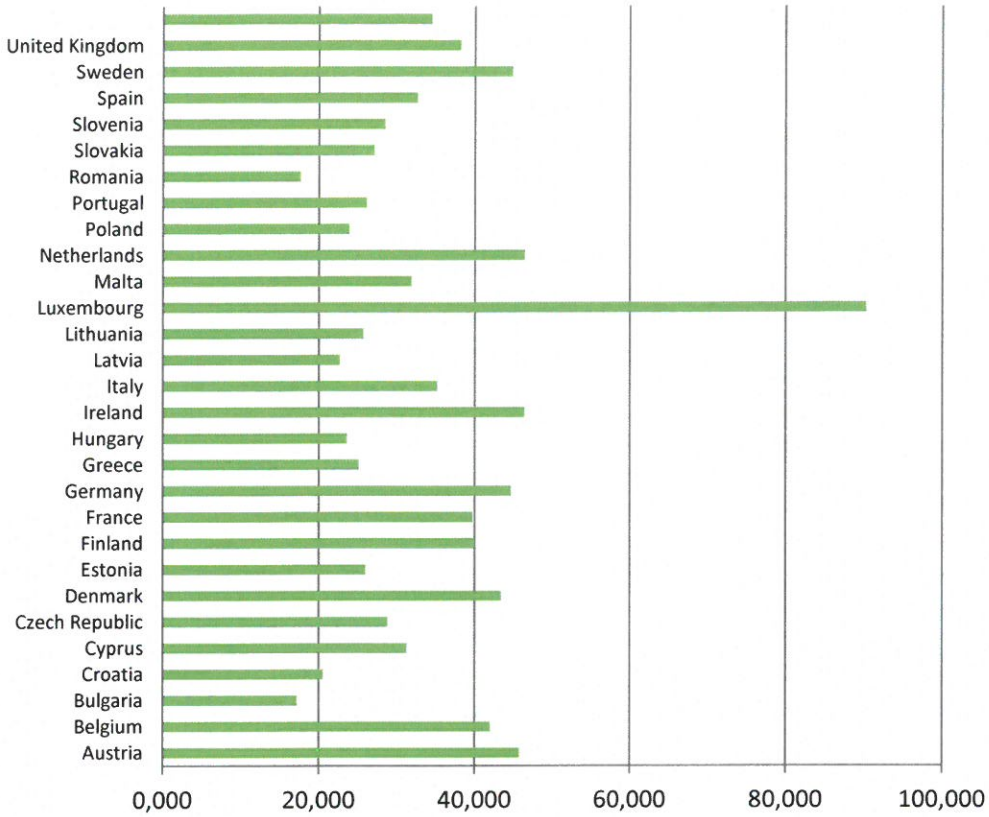

Figure 15. GDP/ per capita (PPP, $) of EU-28 Countries

Sources: World Data Bank, BP Statistical Review 2015

According to World Data Bank, GDP per capita of the countries are analyzed and the countries whose income per capita is above 35,000 $ countries scored with (+) according to average point. It is clear from the figure that, Luxembourg has the highest income score which is 90,000 $ per capita, however as mentioned before, its affordability score is classified as (-). From the figures it can be observed that developed countries and the first group countries such as Austria, Belgium, Denmark, Finland, Germany, Netherlands, Spain, Sweden, and United Kingdom have the highest income rates. Following the leading country, Ireland has the second highest GDP per capita revenue with 47,000 $, followed by Netherlands with 46,000$. Their energy equity levels will be explained in details through the following groups of energy trilemma sections.

6.1.1.4. CO2 Emissions (MT)

According to the European Union's energy targets, carbon emission policies are mandatory for all of the member states. In the figure it is clear that Germany,

France, United Kingdom and Italy have the highest carbon footprint, since their emission scores are above the average point, they are scored with (-) in the Table 5.

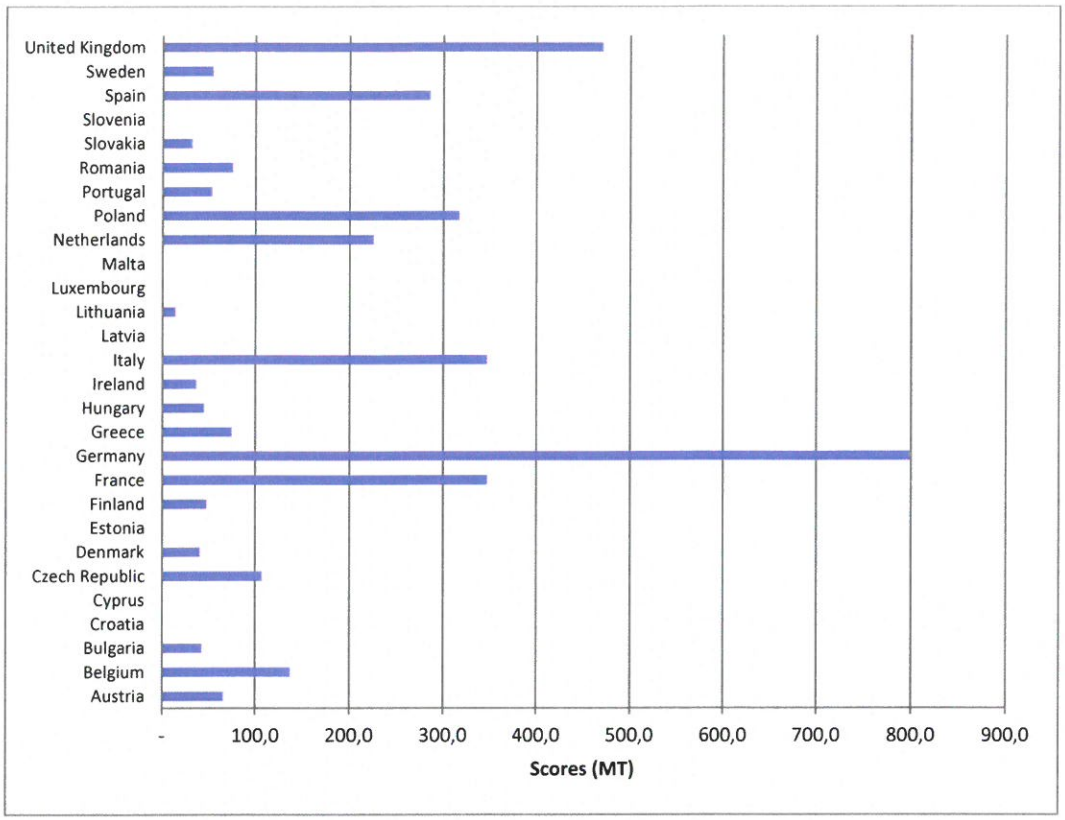

Figure 16. CO2 Emissions (MT) of EU-28 Countries

Sources: BP Statistical Review 2015

For example, Germany aims to decrease its greenhouse gas emission by 40 percent by 2020 and up to 95 percent in 2050 (CEW, 2016). In the following section, policies of the countries will be explained in details. The more clean energy is used, the lower CO2 emission will be. For example, in Austria, Belgium, Denmark, Sweden, the carbon emissions are really low and below the average thanks to the use of clean energy. Their carbon emissions are 65, 138, 40, and 54 million tonnes respectively, however in Germany, France, Netherlands, Poland, and United Kingdom, the greenhouse emissions are 799, 347, 225, 316, and 470 million tonnes respectively. Different energy mixes in consumption directly affects emission scores.

CHAPTER 7- Classifying the EU Member States from the Energy Trilemma Perspective

The European Union countries are classified under three groups in this part of the thesis. They are classified based on their performances of energy trilemma index which is created by World Energy Council. The members' states are analyzed and ordered in this study depending on their high, medium and low achievement potentials. In literature, the identification of the priority of regions and level of Europe are based on common classification of territorial units for statistics which is made by the European Union, furthermore, three groups of regions are defined by the Union as follows; (1) more developed regions where GDP per capita is higher than 90% of the average in EU-28, (2) transition regions, whose GDP per capita is between %75 and %90 of the average and (3) the less developed regions, that GDP per capita is less than 75% of the average GDP of the EU- 28 (EC, 2014).

With this classification, of the EU member states, it is aimed in this study that observing and analyzing how their energy policies are shaped regarding the energy targets and comparing their policies for the EU energy targets. Different potential of energy demand in states, import dependency and different energy policies directly affects the EU's common energy policies, in this sense the aim of the study is to criticize how their policies are shaped, and to analyze member states' current performances based on energy trilemma index.

7.1. The First Group- High Achieving Member States

Sweden, United Kingdom, Austria, Denmark, France, Finland, Netherlands, Germany, and Spain are ranked as the top performers of trilemma Index achieving a well balance. Some of these countries are considered as the "Pack Leaders" (WEC, 2015). Their success is the result of their early act on investment. These countries and the others will be examined separately according to the groups. As it is mentioned before, the first group countries have high levels of GDP per capita, moreover they have well-built political, social and economical systems. Certain energy policy targets have a special importance in reducing the greenhouse gas emissions and increasing the share of the renewable. According to WEC, current infrastructures should be replaced and restructured considering

the innovation, flexibility and reliability. Countries' energy usages are different from each other due to their geographic location and the resources. In this context, the effective usage of the local resources is highly significant for countries. When we look into countries in the first group, it is observed that most of these countries have managed to develop the appropriate national energy policy. As stated in World Energy Council Report (2015), each country has unique challenges and their priority should be developing specific policies for themselves.

Among the European Union countries, the leading country in the ranking is Sweden. Sweden shows a well-organized performance; its score is "AAA" which means its policy makers have diversified the suppliers well. According to the Council (2015), its investments on renewable energy have provided them with a sustainable, secure and an equal energy market with minimum pollution. Sweden is regarded as a 'Pack leader'. Briefly, security of energy in Sweden increases slightly, indeed their production to consumption ratio level is higher. Energy equity performance is also increasing while electricity and oil prices are decreasing. In other words, affordability of energy improves. About environmental sustainability, Sweden is the best performing country in the world considering its low carbon emissions and pollution levels of water and air. Moreover, they are generating their 98% of electricity from low carbon sources. One of the vital projects about taken out of operation of 10 nuclear reactors, moreover they are planning to close their first reactor between 2018 and 2020 (WEC, 2015). According to International Energy Agency (2013), the reason of its success is depending on setting binding rules such as CO2 taxation, moreover the sponsorship of renewable energy and carbon trading under the certificate system of electricity contributes to its success. Lastly, Sweden aims to focus on electric cars and improving the share of bio fuels in transportation (WEC, 2015).

The main aim of the first group countries is to diversify their suppliers and make investments on internal sectors. The United Kingdom is also one of the main stable countries which is called as a 'Pack leader' by the Council. However unlike other countries, UK still relies on fossil fuels for around 69% in its electricity mix

(WEC, 2015). Their balances of dimensions are well built, moreover their performance ranks are "AAB". EC Occasional Paper (2014b) states that United Kingdom's dependency on foreign suppliers is really low since in Scotland they have huge oil and gas reserves. Renewable energy investments are still keep going increasingly including the wave energy from oceans and wind turbines. There is one vital point to consider which is about shale gas extraction. It seems that UK is going to invest more on these sources (WEC, 2015). The United Kingdom aims to cut its greenhouse gas emissions in 2027. Electricity Market Reform proposed by the government is considered as groundbreaking for the future. The UK policies are shaped by demand-side efficiency which means that affordable energy, secure and maintained investments are vital for the reforms (WEC, 2015).

According to World Energy Council Index (2015), Austria balances the trilemma and its score is "AAB". The report states that although the country balanced the environmental sustainability and energy equity, energy security still remains as the weakest point. However, from the figure it is observed that Austria holds the top in the list compared to the other countries. Austria has reasonably low oil product stocks and its dependence on fuel import is high. EC Occasional Paper (2014) explains that dependencies on import resources are really high in Austria. Electricity is cheaper in Austria than its neighboring countries when we look into the well-built sector of renewable. The weak diversification of the gas supply is the only challenge for Austria. Their policies are shaped in line with the 2020 targets which include increasing the share of energy consumption produced from renewable resources up to 34%, reducing its CO2 emissions by 16% compared to 2005 levels in the EU ETS. In addition, Austria's goal is to become self-sufficient in the field of energy by 2050. Austria's list of Sustainable Strategy which includes 20 goals provides their citizens with high quality life, economic growth, sustainable goods and services, as well as optimizing the transportation system.

According to the World Energy Council Index, the country remains as a top performer and a *'Pack leader'*. Denmark met the dimensions of the energy trilemma with "AAB" scores. Energy security remains as the strongest point of

the country, however environmental sustainability falls behind when we compare it to the other dimensions. EC Occasional Paper (2014c) points out that Denmark is one of the net exporter country of oil and gas. According to EC, Denmark may face a danger due to its long-standing strategy to become completely fossil fuel-free thanks to their renewable energy investments till 2050. In March 2012, Denmark put its Energy Agreements into force which contains a wide range of ambitious initiatives; moreover this agreement helps the country to reach %100 usage of renewable energy by 2050.

When it comes to France, Grenelle de l'Environne is a program launched by the French government with the aim of meeting its targets in the energy field. Its balance score in 2015 is "AAB" and its rank in the world according to index is the 8^{th}, which could make it possible to call it a Pack Leader country.

EC Occasional Paper (2014d) explains that the diversifications of the suppliers are an advantage for France. In other words, growth of cross-border infrastructure, reliable trade systems and relations with Spain regarding the electricity and gas interconnectors are essential for its energy system. The French Government put new energy transition law about the reliance on nuclear energy in favor of the renewable energy. This legislation includes increasing the target prices for carbon to about 56 Euro in 2020 and almost doubling it until 2030 with 100 Euro. Moreover, governments also mentioned that social tariffs will decrease the energy prices in the future (WEC, 2015).

The World Energy Council notes that Finland balances the trilemma, but there is a minor weakness regarding the environmental sustainability. In contrast, energy security is mostly determined by oil production. Energy equity performance is more or less well developed however energy sustainability needs further improvement. Its score of the trilemma is "AAB" and according to the Council (2015); performance on relative indicators remains excellent. Government in Finland is focusing on following the energy policies, reforming the wind farms, increasing taxes for fossil fuel consumption in heating generation and increasing the share of biomass, waste, wind and nuclear energy (WEC, 2015).

By the World Energy Council Index, Netherlands achieves to balance the trilemma well. Data of security is almost stable. According to the Index; energy equity remains constant, whereas environmental sustainability diminishes because of the increase in the levels of emissions intensity. Its score is "BBB" but it is still in the first group. The main policies are supporting green deals which means sustainable initiatives are to water energy resources, waste management, biomass and offshore investments, in addition policy makers want to upgrade the current network systems to smart grids (WEC, 2015). EC Occasional Paper (2014) states that as a result of the availability of out-sized domestic gas reserves and infrastructures, they have a positive security of energy supply condition in the short and medium term.

Spain also balanced its dimensions well but because of the diversity of the resources, their energy security rank is quite low when it is compared to other two dimensions. Its score is "BAA" and its ranking in the world order is the 15th. Their energy demand decreased in 2014 because of the economic crisis, however energy consumption is positively growing. Moreover, a reform on electricity was introduced in 2013 by the government which aims to eliminate the tariff deficit. By this elimination, energy sectors expenses and revenues would be in equilibrium again, and the government expected that in next decades these deficits would disappear. Moreover, they mixed their share of renewable energy in 2014 and the new hydrocarbons law will be brought to the market that creating a fresh single well organized gas market and this is very important for EU gas market because Spain is a gas hub market for EU, as it holds the one third of the LNG regasification market within the EU (WEC, 2015).

The last country in the first group is Germany. Its score is "BBB" in the energy trilemma index. Germany has been continuing to balance its trilemma index. Performance of security and equity, they remain stable according to Council however there is a significant point which is environmental sustainability. Since industrial sector plays a huge role in the country, its rank in environment is only "B" which is quite satisfactory for such kind of country. For example, according to the Energiewende (2015), Germany aims a structural reform in the energy

systems to distribute the renewable and improve the energy efficiency and to accelerate the consumption of electricity network expansions. Before 2010, Germany Energy Transition policy was developed whose aim was sustainability, high amount of renewable sources usage in power generation, decreasing the use of fossil fuels and CO2. The government planned to close up its nuclear plant until 2022. The Renewable Energy Law aims to fix prices in both demand and supply sides, furthermore subsidy of renewable energy investments and infrastructures are for increasing volatile renewable energy usage in energy systems (WEC, 2015).

7.2. The Second Group- Medium Achieving Member States

The second group is explained in this chapter in that how countries managed to fulfill the energy trilemma and how they failed. This group includes Belgium, Luxembourg, Ireland, Slovenia, Slovakia, Lithuania, Italy, Portugal, Czech Republic, and Latvia with an energy dependency varying between 80-100% (WEC, 2015). Belgium's score is "BAB" which means energy security is the weakest one among the other dimensions. Energy equity remains in a good level, while environmental sustainability remains above the average. EC Occasional Paper (2014e), states that Belgium is dependent on imports. It import around 74% of its total energy needs; however, this situation is eliminated thanks to the mix of the energy suppliers. The government is working on energy market deeply to find a solution by share of strategic reserves with their neighboring countries and trying to increase its capacity of energy systems because Belgium has about 18 access points for natural gas including both LNG and pipelines, but they are suffering from the lack of economic productivity because of the low prices in the wholesale market in North-West Europe (WEC, 2015).

Slovakia obtains the "ABB" score in energy trilemma. It balanced its three dimensions quite well, because they diversified their energy sources. When it is observed that energy dependence on imports stay high but current internal renewable energy usage is increasing and the waste management is improving (WEC, 2015). Ireland holds "CBA" scores which means that it has some deficits in security. Dependency on imported resources is pretty high in Ireland; however

its performance of dimensions remains mostly stable regarding the environmental sustainability and energy equity. It is trying to build a well secured energy market but because of their location, it seems quite difficult. Energy security is falling behind due to the escalating dependency on fuel supplies; in addition they are challenging the low production rates in the energy. Indeed, high reliance on fossil fuel burning for generation of electricity, their environmental sustainability score is quite good because of fresh air, high quality of water and low energy intensity (WEC, 2015).

"DAB" score is held by Luxembourg. Its position is accepted as stable based on the World Energy Council's Index. Energy trilemma balance displays an imbalance while energy equity and environmental sustainability remains strong. Energy security has some deficits in EU because of its diversity of suppliers were not built well enough. In contrast, energy security is established as a challenge for Luxembourg for its location, but because of its economy, the country stay strong even it is not a country rich in resources. Slovenia's dimensions performance is quite well with "BBB" score. The EC (2015), states that it is using nuclear share in high percentage but they are forecasting to decrease it. And also Slovenia imports their resources, including gas, from Russia (BP, 2015). In 2014, Slovenian government adopted The New Energy Act that includes EU's 3rd Energy Package requirements for climate targets. The government intended to invest on renewable energy for electricity market. Sava River which is passing through Slovenia has an important role for increasing the use of renewable in energy mix (WEC, 2015).

Like Latvia, Lithuania is also in trouble with energy security because the most challenging factor is the diversity of the resources. Its score is "CBA" according to the index. It also imports their resources from Russia as well (BP, 2015). The EC (2015, SWD-231) states that they managed to decrease the use of nuclear from 36% to 0%, therefore they started to be dependent on other resources more than ever, in addition renewable energy share is increased sharply by 18 percent. Increasing share of hydropower made an increasing impact on diversity of generation.

Italy shows that the dimension balance is not well-organized. Its score is "CBA". When it is overlooked energy equity holds the stable rank, however environmental sustainability stays with "A" rank thanks to the renewable energy investments. According to the EC (2015, SWD-229), mixture of the energy in Italy is unlike from the rest of the Union members. Italy is dependent on oil and gas products. The government adopted a mitigation policy to transform the thermoelectric fleet and this policy made a positive effect on energy mix. Furthermore, numerous actions were put into effect to increase energy efficiency in transport and industrial sectors. These policies will help to decrease the greenhouse emissions and pollution in the near future (WEC, 2015). Nowadays, most of the policies of the country are focusing on renewable targets such as PV installations, balancing transmission and distribution expenses, and they are planning to develop National Action Plan on Energy Efficiency for 2020 targets, and further. These investments are planned to improve the affordability of the energy and sustainability of the environment (WEC, 2015).

Portugal's score in energy trilemma is "BCA". Its energy security and energy equity demonstrates a fair performance while environmental sustainability shows a very good performance. World Energy Council Report relates this good performance to the settled renewable electricity generation. The EC (2015, SWD-235) notes that dependency on imports are in high levels in Portugal, however they decreased their dependency between the years 2005 and 2013. It is observed that their renewable performance makes environmental sustainability healthy. When we returned to the figure, it can be seen that Czech Republic's score of dimension is "ABC" which means it balances dimensions well in energy security and equity, ion the other hand, environmental sustainability remains poor. According to the Index, high intensity in emission of energy caused its performance in environmental sustainability to become low. In 2015, government proposed several energy policies including updating the Energy Concepts in country, action plan for smart grids, action for energy efficiency plan, and nuclear energy development plan. Moreover, national plan aims mainly at diversification of fuel imports and to increase the transportation routes,

investment on new infrastructure for energy and to implement its energy system into EU's internal market. Additionally, the government is aiming to create their own regional energy markets for oil and gas market (WEC, 2015).

Latvian score of energy trilemma is "CBA", when analyzed energy security and energy equity is low compared to the environmental sustainability performance. According to the Council, Latvian use its energy within the country more than they imports. It brings a security problem. The EC (2015, SWD-230) notes that it spend more than the average of EU in dependency on imports of fossil fuels such as gas. Russia is the only country who supplies it's all gas demands. As a result, the security of energy in Latvia is low with the score of "C".

7.3. The Third Group- Low Achieving Member States

When analyzing the third group countries according to trilemma, it is known that low performed countries are classified under this group. According to Energy Council, as explained before these countries GDP rates are lower when compared to other two groups. These countries are Hungary, Croatia, Poland, Romania, Estonia, Cyprus, Greece, Malta, and Bulgaria, respectively. When it comes to Hungary's performance in energy trilemma, it is seen as "BBB" which is a well-built score. However regarding its economical status, it belongs to the third group. The EC (2015, SWD-227) explains that energy dependence of the country is quite high, in addition it remains above the average of the EU countries. Its share of resources such as gas is higher than the rest of the union. The reason why its score is above the average of the union is that Hungary imports its gas from Russia which is mostly the first supplier of the European gas. The government developed a strategy plan for 2030, which aims to focus on decreasing the dependency on the suppliers. Its energy efficiency is quite low that's why they have a lack of loss while consumption energy for cooling and heating (WEC, 215).

Croatia keeps going on to stable the dimensions, its performance score is "CBB", in contrast energy security is lower than the other states. World Energy Council notes that energy equity in the country is increasing slightly. The rest of the performance remains essentially unchanged. Poland is in trouble with struggling

to get dimensions stable, its performance of trilemma is "BBD". Since it has national sources such as solid fuels, its dependency on imports are not in trouble, as it is observed that the energy security rank of the country is "B". However, because of old settled infrastructures, their environmental sustainability score is "D". They are using coal-fired power plants for generation electricity, so the most challenging factor for them is the sustainability, additionally high level of C02 from generation systems creates another problem (WEC, 2015). In other point of view, Polish government is expecting good results for the future by adopting several policies such as reconstruction of infrastructure, diversification of sources, modernization of generation, increasing supply security and invests efficiently on both conventional and unconventional resources such as gas, increasing usage of biofuels in transport sector and low carbon technologies in coal sector. All of these are planned results by the government for the next two decades (WEC, 2015).

According to the Council, Romania's stability of the trilemma is not well built and its score is "ACC", however its rank of energy security is "A". According to the EC (2015, SWD-236), the mixture of energy in Romania is generally parallel with one of the Union members. Dependency on import is slightly lower in Romania compared to the other members. According to Council (2015), Romania's energy production is getting worse because of consumption ratio. Their current policy on sustainability is shaped by renewable energy law, which offers all green systems certificate packages, but this implementation is postponed and nowadays the country experience uncertainty (WEC, 2015). Estonia is in trouble with balancing the dimensions because of its high industrial areas, where the installed infrastructure are old, make trouble on country's environmental sustainability. Its score of dimensions is "CBD", moreover it is highly dependent on Russian gas. So it can be concluded that because of this dependency, its energy security is ranked as "C", and environmental sustainability is ranked as "D" (WEC, 2015). It encounters with CO2 emissions while production of electricity, in contrast there is a shift to shale oil in generation or energy, furthermore this gas is natural, but it has also positive movements such as

increasing the share of renewable usage in electricity generation, while doing these investments it must focus on energy equity also for its economy (WEC, 2015).

In Cyprus, trilemma score is "DBC", energy security is the main point of weakness as a result of the high dependency on fuel imports. It struggles to balance its energy trilemma. Energy equity remains strong when it is compared to the other dimensions; however the rest of the dimensions shows a poor performance. According to the Index, Greece tries to balance their dimensions of the trilemma with a score of "CAC". Energy equity has a good performance, while energy security and environmental sustainability performances remain poor. Greece's energy security is low because it is mostly dependent on suppliers and it is not a type of country which has itw own resources. The reason why energy equity is high is that the government offers its people reasonably priced energy. Furthermore, its energy security is decreasing slightly because of oil stocks loss and improvement of dependency on suppliers. In addition, Greece is stressed with high stage of CO2 emission intensity, so it causes low sustainability (WEC, 2015).Malta's score of trilemma is "DBC", energy security is the poorest factor among the dimensions. The European Commission (2015-SWD 233) states that Malta makes attempt to diversify its energy mix, however they are highly dependent on oil and gas because of their geographical conditions. Bulgaria's performance is "BCD", balance of the energy trilemma of the country is not accepted well, and however energy security is on average rank and is the strongest one among the dimensions. While the energy equity performs low, environmental sustainability in Bulgaria is the weakest dimension. In 2015, government modified current Energy Act which emphasized that political independency in energy sector is needed, aiming to become stable in the electricity sector, improving the transparency in the energy market. The new acts are planned to increase sustainability of the renewable sources, liberalization and affordability in public (WEC, 2015).

7.4. General Analysis and Results

The targets of European Union mostly focuses on the issue of climate change because global warming emerges rapidly in last decades as a result of the high demand on energy and electric generation techniques which is not clear. Under the framework of the 2020 renewable targets, each member state set its own goal as explained before. These goals were determined in 2008 and shaped in time and until 2050 energy targets are shaped by European Union. Some countries' goals have been reached to 20% for the use of renewable energy. For example, Sweden set its target for 2020 as 49% and today it can be observed that they have already reached its target (Eurostat, 2015). However, although UK's position is close to the top in the energy trilemma index, today it is hard to say that UK is going to reach its targets but it is investing on shale gas extraction and renewable for energy mix and decreasing its 69% share of fossil fuel usage (WEC, 2015; Eurostat, 2015). It is close to the bottom of the pile regarding the renewable share, moreover Netherlands, Luxembourg, and Malta also remains low on the paper (Eurostat, 2015).

The common policy of these countries is that they are upgrading their network systems and making investments on renewable, for instance Netherland's policy is focusing on water and waste management along with offshore investments. Most of the first group countries in the energy trilemma have a policy emphasizing on energy prices and taxation. For example, Germany aims at efficient energy systems in the country and its policy is to build a fixed price on energy market. Like Germany, France also has the same policies, it is trying to build a fixed carbon price by 2030 as mentioned before. Furthermore, Finland has a policy for increasing the taxes. Overall, the first group countries have specific policies for energy targets, in addition like Sweden, most of the countries have been started to put certificate systems for renewable and carbon market which is also binding. This thesis analyzed and compared the policies of the countries as mentioned before. Renewable energy mixes of the EU countries are mostly coming from hydro power and wood for heating (Eurostat, 2015). When we look into the Eurostat data, wind is the second biggest source after hydropower for EU's share of renewable.

The second and third group countries are facing import dependency and old infrastructure problems, however as explained in the energy trilemma country reviews, some of them has quite well performances like Italy who has reasonable amount of GDP per capita. Italy is performing well at national planning. Moreover, its main focus among renewable energies is the solar energy, likewise Portugal, Spain and Greece which are all Mediterranean countries. The lack of security is a serious problem for most of the countries especially Lithuania, Bulgaria, Romania, Poland, and Estonia which are former Soviet countries and highly dependent on Russian gas. The policies of these countries are shaped by supply security. Poland has reasonable acting plans for energy market as mentioned before, but these countries have efficiency problems because of old infrastructure, moreover efficiency is also a major problem for them. For example, Romania had been performing well on green system certification but they stopped their actions. Estonian government on the other hand focused on rebuilding of the old infrastructure in the energy routes. In contrary, Belgium which is one of second group country is suffering from import dependency problem and lack of energy security as in Ireland is shaping its energy policies. Most of the countries in both groups such as Slovenia and Lithuania are trying to manage their nuclear reactors fade. Moreover under Climate Package, Slovenia is forecasting to close its reactors until 2030 (WEC, 2015). To sum up, it is observed from Eurostat data (2015) that, Sweden, Estonia, Lithuania, and Bulgaria have reached their share of renewable source targets for 2020. Additionally, Finland, Austria, Denmark, Romania, Croatia, and Italy are so close to their peak points regarding the share of renewable. However most of the countries still suffering from the lack of specific energy policies while Sweden, Austria, and Denmark appeared to be the best performed countries in energy trilemma index.

CHAPTER 8- Conclusion

The European Union has been facing many energy challenges as a result of the climate change, global competition for energy supplies, and dependency on energy import since the beginning of the 21st century. As a response to these challenges, a widespread European approach towards energy has been set as mandatory for the Union.

The European Union, with its 28 members, is the second largest energy consumer of the World (EC, 2014). Currently, EU has a growing dependency on imports of energy from non-member countries such as Russia. This is a challenge considering the energy supply security. Baumann and Simmerl (2011) suggest that the defining point of the energy challenge is import dependency although the member states have differences in their national volume of parameters. They point out the members' dependency on fossil fuels, except for Denmark including the high import dependency of Cyprus, Malta, Luxembourg and Ireland due to their locations. In this context, energy challenge for each country is varying according to its regional conditions, natural resources, government policies and level of development, as well as its own social and economic requirements and goals. However, as a regional formation, the European Union tries to identify successful approaches toward common challenges within the Union.

Each country should adopt its own national policy and strategy in achieving balance on the energy trilemma because it needs different and specific investment requirements in its energy sector. However, the EU's common policies addressing the challenges are extremely significant in balancing the dimensions of energy trilemma. Eriksson (2011) argues EU's energy approach from a geopolitical and strategic viewpoint and claims that EU's market approach and objectives in energy area have become weak as a result of the reluctance of Russia because of Crimea conflict, and other exporting countries to make cooperation with Europe. In this context, regional agreements between member states and the main suppliers, including the transit countries, seems a more suitable approach for a common EU policy. The EU Commission recommends

trading with countries in the European Economic Area, therefore there is a possibility of a politic crisis that might emerge in the future and influence the trade relations.

As a response to the EU Common Energy Policy and Roadmap to 2050 from 2020 and 2030, the member countries apply national policies and roadmaps to achieve the target of 20% emission reduction and 20% renewable by 2020 and 80% emission reduction in 2050. As it is understood, there are different approaches in countries' energy mix strategies depending on their local resources, geographic locations, political interests, national preference or financial ability. At this point, we can say that the EU Roadmap partly guides member states in meeting the expectation of EU targets on energy transformation in the medium term and long-term. Cooperation and coordination seem as a crucial element between EU level and member states' national policies as a part of low-carbon energy target.

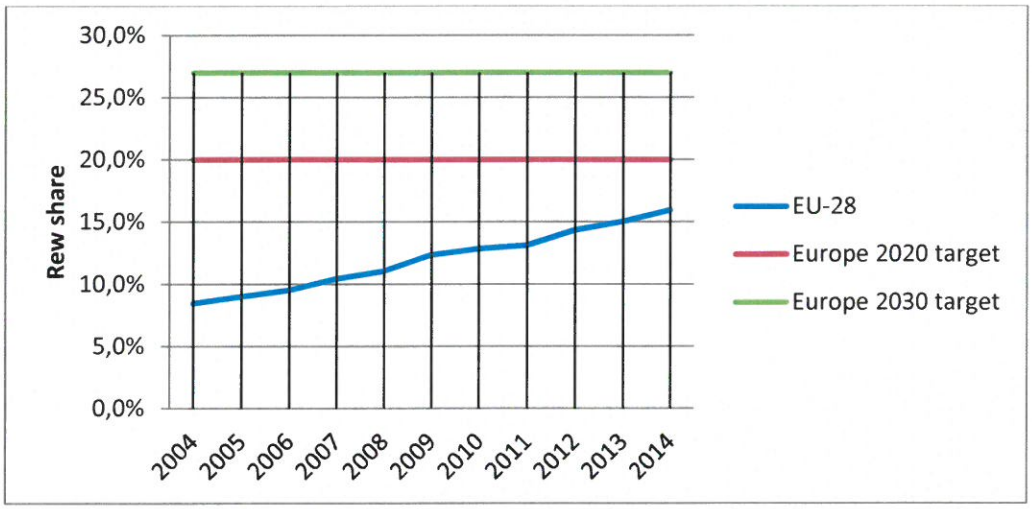

Figure 18. Renewable share of EU-28 and Targets

Source: Eurostat

On above Figure 18, it is clear that European Union targets are so close to be achieved the by member states on the average share of renewable usage, however it is obvious that some of the countries such as third group countries in the energy trilemma, may not reach their targets. Although member states have their own specific goals for renewable usage, energy efficiency and carbon emissions, it is not easy to be successful, because as mentioned in the result part

of the previous chapter, there are different volumes of energy demands, energy security challenge for dependent countries and too aged infrastructure systems for the energy market. It is difficult to exactly estimate the success of European Union's energy goals for 2020, 2030 and 2050, but it is observed from data which shape this thesis that member states are doing their best to achieve their own specific goals. But it is obvious that in the first group according to World Energy Council energy trilemma index, most of the member states are highly close to their goals, for instance Sweden who is ranked in 2nd place in world, is the best performed country among EU-28. Additionally, Austria and Denmark are performing quite well, furthermore, some of the countries from three groups of energy trilemma such as Estonia, Bulgaria and Lithuania have reached their goals. It is a significant point that although Bulgaria is dependent on Russian gas, its performance in terms of environmental sustainability is praiseworthy. However, there is one point that it is very vital for each member state that economical affordability in a country is the factor which shapes the country's energy policies. Affordability is directly related to economic growth, for example the role of energy in economic growth is a significant point for understanding the economy because the role of energy production is mainly affects the growth volume of the countries (Stern, 2011, p.36). One of the European Union's forecasted projects is the Common Energy Union within the European energy market, which is proposed by Maros Sefcovic who is the Vice-President of the European Commission and the Project Leader of the Energy Union, moreover he mentioned that the aim of the Commission is to built a common infrastructure in the EU-28 countries and to connect each country to one another, the main point is that as much as energy security, energy efficiency and sustainability is also a major target for Europe and investing on renewable energy is a vital point (Energy Journal, 2015).

The results of the framework table 5 shows that energy affordability of a country depends on the volume of its GDP per capita however; it is observed that high energy prices could not be afforded by the citizens of the country. For instance in Luxembourg, GDP per capita holds the leading position, however the affordability of the energy is at negative levels scored with (-) which means there

are high prices for energy in the country. On the other hand, in Bulgaria their energy mix is well built, in addition their carbon emissions are under the average with a positive sign, however GDP per capita of the country is under the average with a negative sign. The EU defined classification of countries, as mentioned before, that member states GDP per capita is obligatory, but according to energy trilemma index, it is observed that for example Romania, Italy and Finland are so close to their targets, in addition Austria and Denmark stays strong among these countries. It is observed that shifting between groups is also possible, for example the study shows that Italy is the strongest country in shifting to the first group with its achievement. Belgium's location shapes the country's energy policies and it is so close to move to the first group with its investments and policies as mentioned before. Lastly, according to the study some specific movements are expected from Luxembourg and Hungary. The performances of these two countries in the three dimensions are DAB and BBB, respectively. The main problem for Luxembourg is the energy security issue, if it can handle it well, there will be no doubt that they will shift to the first group.

To sum up, in global market there are no borders when it comes to energy issues, countries' interests are more essential and their energy security problems is shaping their energy policies. Since the economic crisis in 2008, the European economy have gone through many challenges in investing their targets, however the economical amelioration encourage member states to keep energy targets moving. Lastly, it can be seen from the research that the 2020 targets will be achieved by most of the member states. Furthermore, the 2030 targets and the 2050 targets are attempted to be reached by them, however high cost of investments, supply security and energy efficiency are still leading challenges for the EU-28 countries. Lastly, as mentioned before Austria, Denmark, and Sweden are appeared to be the best performed countries among the EU-28 countries; in addition Finland, Romania, Croatia are performing well enough to be so close to their goals; and to sum up Italy, Luxembourg, and Hungary are close to shift their groups considering their policies and performances.

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