CHALLENGES OF THE EU EMISSON TRADING SCHEME:

THE CARBON FAT CATS CASE AND PROSPECTS FOR TURKEY

BURAK CAN BAYRAM

BOĞAZİÇİ UNIVERSITY

2015

CHALLENGES OF THE EU EMISSON TRADING SCHEME:

THE CARBON FAT CATS CASE AND PROSPECTS FOR TURKEY

Thesis submitted to the

Institute for Graduate Studies in Social Sciences

in partial fulfillment of the requirements for the degree of

Master of Arts

in

International Trade Management

by

Burak Can Bayram

Boğaziçi University

2015

Challenges of EU Emission Trading Scheme: Carbon Fat Cats Case and Prospects for Turkey

The thesis of Burak Can Bayram

has been approved by:

Assoc. Prof. Aslı Deniz Helvacıoğlu _____
(Thesis Advisor)

Assist. Prof. Osman Sabri Kıratlı _____

Assoc. Prof. Dilek Ünalan _____

June 2015

DECLARATION OF ORIGINALITY

I, Burak Can Bayram, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

Signature…….....

Date …….....

ABSTRACT

Challenges of the EU Emission Trading Scheme:

The Carbon Fat Cats Case and Prospects for Turkey

The European Union Emission Trading System (EU ETS) is accepted as the largest and the most advanced system among other emission trading systems. Increasing discussions about effectiveness of the EU ETS shows that even the most advanced emission trading system has major challenges. Therefore, main principles, characteristics and especially major challenges of the EU ETS is analyzed in the light of the carbon fat cats case to be able to make recommendations to establish Turkish Emission Trading System.

ÖZET

AB Emisyon Ticaret Sistemi'nde Yaşanan Sorunlar:

"Carbon Fat Cats" Örneği ve Türkiye'nin Görünümü

Avrupa Birliği Emisyon Ticaret Sistemi (AB ETS) dünyanın en gelişmiş ve büyük emisyon ticaret sistemi olarak kabul edilir. Ancak, sistemin etkinliğine yönelik her geçen gün artan eleştiriler dünyanın en gelişmiş emisyon ticaret sisteminin bile bazı temel zorlukları aşamadığını gösteriyor. Bu yüzden, Türkiye Emisyon Ticaret Sistemi'nin kurulmasına yönelik öneriler "Carbon Fat Cats" örneği üzerinden Avrupa Birliği Ticaret Sistemi'nin ana ilkeleri, özellikleri ve en önemlisi zorlukları analiz edilerek oluşturulmuştur.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Climate change is a major environmental challenge which the earth has been facing for a longer time than it became popular. The earth's climate change is due to human influence for over 100 years which has always varied naturally until that time (Nussbaumer, 2007, pp. 1-2). The research made by chemist Svante Arrhenius showed that the concentration of CO_2 into the atmosphere had increased significantly since the beginning of the Industrial Revolution (Brohe, Eyre, & Howarth, 2009). In this frame, greenhouse gas (GHG) mitigation became one of the most important political tools over the past 20 years in many countries.

Earth's climate has been affected by anthropogenic greenhouse gas emissions (GHG) which has the major contribution to global warming since the since the mid-20th century. Cumulative anthropogenic Co2 emissions to the atmosphere were about 2000 GtCo2 between mid-18th century and 2011. However, almost half of the anthropogenic Co2 emissions have occurred in the last 40 years in this period. Intense emissions in last 40 years are derived mainly from population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy (IPCC, 2014, pp. 5-9).

Under the given circumstances, raising public concern on climate change is inevitable. It may originate from different factors; environmental, political and economic. Climate change is so significant that it causes so many predicaments all over the world which results in rising environmental awareness globally. Climate change affects shareholder value due to higher energy prices, constraining GHG mitigation

targets and increased losses due to severe and adverse weather events (Labatt & White, 2007). It should be noted that these directly affect economy. Therefore, governments and international organizations cannot remain unaware of climate change and foresee CO_2 mitigation steps in many policy agendas.

Historical development of climate change and mitigation policies shows the importance of international conventions and supranational organizations as the major initiatives. This may be linked to the supranational nature of the environmental issues. The process starts with the Conference of the Human Environment in Stockholm in 1972. United Nations Environment Program (UNEP), which adopted the framework convention and protocol for international treaty negotiations, was formed as a result of the conference on September 2, 1973 (Kutney, 2014). United Nations Framework Convention on Climate Change (UNFCCC) has been appeared as a result of the international awareness after UNEP. It has been constituted to other international, regional, national and local formations, signed by 165 parties[1] on 21 March, 1994 (UNFCCC, 2015a). UNFCCC has outlined main definitions, objectives, principles, commitments, actions, etc. which are constituted basis for later negotiations such as Kyoto, Copenhagen, Cajun and Doha. Objectives, commitments, principles and actions have been detailed in later negotiations in relation with the main objective stated in UNFCCC; "The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with

[1] UNFCCC has currently 196 parties including all UN members as well as Niue, Cook Islands and EU.

the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." (UNFCCC, 2015a).

First climate change mitigation efforts were basically targeted foretasting. However, it has been developed since the establishment of carbon markets which contribute to wide range of mitigation projects that involve more actors. Carbon markets constitute of different mechanisms, namely Kyoto mechanisms - the intergovernmental emissions trading scheme (ETS), the Joint Implementation (JI), Clean Development Mechanisms (CDM) - and EU ETS the main climate policy of European Union. Beyond that, there has been the development of voluntary carbon market which is a useful tool for reducing GHG emissions in the absence of compliance market.

Kyoto Protocol came into existence as a result of these efforts to reduce or limit greenhouse gas emissions. Countries committed to reduce their greenhouse gas emissions in accordance with identified targets under Kyoto Protocol. As a way of meeting these targets, the Kyoto Protocol introduced three market-based mechanisms: ETS, JI and CDM (UNFCCC, 2015d). Afterwards, European Union member states decided to establish their own emission trading system to meet these targets and to take even more severe actions against climate change.

European Union Emission Trading System (EU ETS) is the first and largest intergovernmental market based emission trading scheme. It bears a model role for Turkey with regard to Turkey's candidate status to the EU. However, it bears

considerable challenges as well. This thesis develops a conceptual model based on the challenges of the EU ETS and uses this model as an instrument of analysis of one of the leading cases of EU ETS; so called EU Carbon Fat Cats Case which is developed by Sandbag[2]. In line with the findings, the thesis offers a scenario for Turkey and provides policy recommendations to overcome possible and very similar challenges that EU faces.

The main features of emission trading are analyzed in the next chapter. Chapter 3 provides information on the EU ETS and focuses on the challenges of the EU ETS in detail. Chapter 4 analyzes "carbon fat cats" case by using the conceptual model developed for the challenges of the EU ETS. The case is being analyzed by using the conceptual model developed for the construct of challenges in third chapter. Chapter 5 offers a scenario for the challenges of a possible Turkish Emission Trading System by utilizing the same conceptual model. Considering the accession process of Turkey to the EU, it is likely that Turkey would be harmonizing its ETS with that of the EU. In this situation, this may result in similar challenges. Discussions and policy recommendations derive from the "Turkish Fat Cats" scenario. The case is again analyzed by using the model developed for the construct of challenges.

[2] A non-profit organizaton campaigning to increase public awareness of emissions trading. The organization was established in 2008 by Bryony Worthington in London and was the first (and founding) member of *The Guardian's* Environment Network.

CHAPTER 2

EMISSION TRADING SCHEME

2.1 Definition

Emission trading is defined in Kyoto Protocol as a scheme that allows countries that have spare emission units to sell this unused capacity to other countries that exceeded given targets (UNFCCC, 2015c). On the other hand, European Union defines its own emission trading system (EU ETS) over "cap and trade" principle: Companies receive or buy emission allowances which they can trade with one another as needed within the cap which is set on the total amount of certain greenhouse gases that can be emitted by the installations in the system (European Commission, 2013). Main target of the system is to reduce emissions by reducing the cap over time in the EU ETS. International Emissions Trading Association (IETA)[3] defines this system as a powerful policy instrument for managing industrial greenhouse gas emissions (IETA, 2015a). Sandbag highlights the difference of emission trading from traditional environmental regulation based solely on the threat of penalties. Sandbag defines emission trading as a market-based approach to control pollution by creating tradable pollution permits to create a profit chance as an incentive for higher performance (Sandbag, 2011c).

[3]A non-profit trade organization that is focused on establishment of effective market-based trading systems for emissions of greenhouse gases based on the UNFCCC. IETA has about 170 member companies from OECD including BP, Shell, Gazprom, Eon, BNP Paribas and Goldman Sachs.

2.2 Principles

2.2.1 Cap and Trade Principle

"Cap and trade" has various definitions in literature. It may appear as an approach, principle, system, policy or a tool. "Cap and trade" terminology has numerous propositions. However the function of the system remains stable. It is accepted as primary principle of the EU ETS.

"Cap and trade" is the main form of emission trading as it is the primary principle of the largest emission trading system: EU ETS. An emission cap is set and then permits, each one is for one tone of Co2e pollution, are created up to the level of this cap. Allowing a trade in these permits puts a price on every Co2e pollution (Sandbag, 2011c). In an ideal system, cap has to be lowered in selected periods. Otherwise, emission reduction – the main aim of the system- would be excluded. Lowering the cap provides direct limitation to emitters. This feature makes it one of the most efficient tools for sustainable environment policies. United States Environmental Protection Agency (EPA)[4] put forward its controlling power by defining it as a policy approach for controlling large amounts of emissions from various sources (US Environmental Protection Agency, 2015a). Dirix, Peeters, & Sterckx (2015) explain the system over its purpose as an incentivizing mechanism to reduce emissions in the most cost-effective manner by allocating tradable permits (Dirix et. al., 2015, p. 5). Brohe et al. (2009) identifies it as a system which firms receive emission quotas to comply with

[4]An agency of the US federal government which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.

either by reducing emissions or buying additional quotas. He, Wang and Wang (2012) uses ETS and "Cap and trade" as the equivalent concepts while defining "Cap and trade" as a market-based policy to control pollutant emissions.

2.2.2 Polluter Pays Principle

Besides the "cap and trade" principle, emission trading systems also have an intellectual base: "Polluter pays" principle. It showed up from the necessity of pricing the damages for environmental resources. It was first defined by the Organization for Economic Cooperation and Development (OECD) in 1972 (Barde, 1994, p. 5). OECD offered that the polluter should bear the expenses of carrying out the pollution prevention and control measures that reflect the cost of goods and services which cause pollution, decided by public authorities to ensure that the environment is in an acceptable state (Barde, 1994, p. 5). The importance and effect of the principle is highlighted when it is included in the United Nations Rio Declaration on Environment and Development: "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment." (United Nations, 1992). United Nations put forward the polluter pays principle in sustainable environmental policy making process in the 16^{th} principle of the declaration.

Various definitions and approaches of the polluter pays principle shows that the main idea behind the principle is that companies must bear the cost of polluting just like they bear the cost of production or distribution. Therefore, polluter pays principle aims to internalize the so called “external environmental pollution costs” in polluter level (Barde, 1994, p.6). In this point, the principle is directly integrated to emission trading schemes. In theory, the cap is set for emitter installations. If these installations emit more than the given cap, they have to buy emission allowances inside the trade mechanism. In other words, polluter has to pay for the acquisition of the right to emit more. Thus, polluter pays principle is implemented through market-based instruments.

2.3 Characteristics

Major characteristics of emission trading systems are addressed in various definitions of emission trading system. These characteristics may be outlined under 3 main topics Emission reduction orientation, cost-effectiveness and flexibility.

2.3.1 Emission reduction orientation

The purpose of emission trading systems is to deliver an environmental outcome (IETA, 2015b). Cap and trade principle adds this crucial characteristic to emission trading systems. Since cap must be met, an emission trading system is more than a regulatory or reimbursing mechanism, it is mainly emission reduction oriented. In an ideal ETS, emitters’ obligations are not limited with their payments for emission allowances. They have to consider the environmental outcome. It is expected that the system encourages

but also forces emitters to reduce emission levels via green investments, innovation and fuel shifting.

2.3.2 Cost-effectiveness

Emission trading systems protect emitters' commercial and economic benefits. The main reason behind this is the goal of advanced integration to ETS by many industries and countries. Cost-effective character creates the opportunity in the system. According to EPA, successful cap and trade programs provide strict environmental accountability without restraining economic growth (US Environmental Protection Agency, 2015b). The G8 Heads of States and Governments mentioned that "market mechanisms, such as emissions-trading within and between countries (…) can provide pricing signals and have the potential to deliver economic incentives to the private sector." at their Heiligendamm meeting in Germany in 2007 (Reinaud & Philibert, 2007, p. 7). This approach has an important contribution to the efficiency of ETS. The interests of private emitters' automatically requires being cost-effective. Cost effective characteristic provides ETS an increasing popularity as a sustainable environmental policy tool among countries. Kyoto Protocol and successful establishment of European Union Emission Trading System pioneer other national and regional emission trading schemes. Currently, there are a lot of active and proposed emission trading schemes in such countries other than EU, namely in USA, UK, Switzerland, New Zealand, Australia, South Korea, Canada, Kazakhstan, Japan and China. However, the most advanced sample system is in the European Union. According to the 2015 status report of The

International Carbon Action Partnership (ICAP)[5], 40% of the world's GDP is now subject to emissions trading (IETA, 2015c) (see Figure 1).

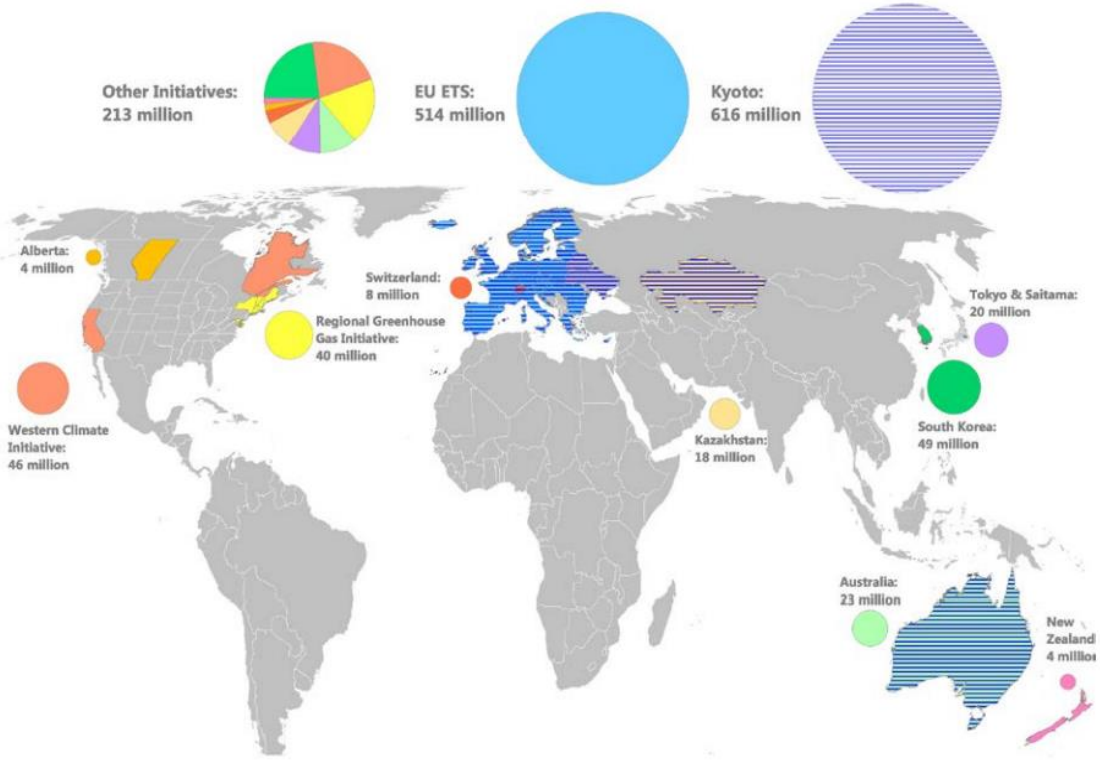

Figure 1. Countries with an ETS and their populations (Talberg & Swoboda, 2013, p. 24)

2.3.3 Flexibility

Emission trading system, which is also defined as a flexible mechanism in Kyoto Protocol, offers both compliance and policy flexibility which makes system easily applicable. Fundamentally, system offers emitters to reduce emissions and/or buy

[5]An international forum for governments and public authorities that have implemented or are planning to implement emissions trading systems. ICAP partnership counts 30 full members and 4 observers.

allowances by choosing one of the flexible mechanisms given by the authority. Along with some environmental associations like IETA and EPA, Goulder and Schein (2013) and Zakeri et al. (2015) mentioned advantages of flexibility provided to industries, and emitters through emission trading mechanism. Newell et al. (2012) underline each emitter has the flexibility to select how to meet the cap. Moreover, they attract attention to business needs for maximum flexibility in environmental mechanisms to open up more opportunities at lower cost (Newell et al., 2012). Tradable allowances can decrease long and short term costs by providing flexibility and incentives for the adoption and mitigation. Each emitter has the flexibility to select the methodology to meet the cap. However, an ideal system is expected to encourage emitters to choose one of the flexible mechanisms to decrease their emission levels while doing it at the lowest possible cost. Therefore, flexibility should voluntarily be limited by reducing cap and increasing targets each year. So, an ideal system is expected to use flexibility as a source of encouragement to decrease emissions by innovating, researching for green business models and green investments.

2.4 Emission trading and carbon tax

Carbon taxes and emissions trading schemes are the two globally practiced, popular environmental regulatory policy schemes. Emission trading systems mainly aim to mitigate emissions in a cost-effective way. Thus, emission trade becomes applicable as it affects emitters' profits at the least level. In this framework, emission trading system is obviously more advantageous than carbon tax.

He et al. (2012) compares efficiency of the various tax policies with cap and trade in terms of some important criterions including economic welfare, total profit and generation. Their quantitative study clarifies that there is no certain advantage between cap and trade and tax since it depends on the implementation of policies. Keohane (2009) underlines the advantages of cap and trade such as controlling the cumulative quantity of emissions, cost effectiveness, broad participation and equity in the international context. Luo and Tang (2014) highlight the overall negative effect of carbon tax on the market participants through their analysis on proposed carbon tax in Australia. In this framework, being a market-based system makes emission trading more efficient than the carbon tax. IETA supports this argument by pointing that cap and trade seeks out the most efficient reduction projects within the market by considering the lowest cost outcome (IETA, 2015b). Environmental Defense Fund (EDF)[6]compares the options over practicality while underlying tightening a cap is more practical than increasing a tax (Dudek, Margolis, Xiaolu, Hanling, & Hu, 2014, p. 5). Zakeri, Dehghanian,Fahimnia and Sarkis (2015) find that companies have better performance under an emission trading mechanism, compared to carbon tax in terms of supply chain performance, emissions generation, costs and service levels. A survey made by Dijkstra (1999) shows that environmentalist groups prefer emission trading systems and auctioning permits over carbon tax since emission trading system is more applicable for industries.

[6]EDF is one of the world's largest environmental organizations, with more than one million members and a staff of 500 scientists, economists, policy experts, and other professionals around the world. Organizaton has offices in the USA, Mexico and China. Organization works mainly on oceans, ecosystems, health, climate and energy since 1967.

2.5 Emission trading and innovation

OECD identifies the most important benefit of the tradable permit system as its contribution to facilitating the development and implementation of innovation to control climate change (Tietenberg, Grubb, Michaelowa, Swift, & Zhang, p. 19). Environmental innovation can be also attractive for firms due to its potential to generate not only environmental but also economic benefits (Christmann, 2000; Eiadat, Kelly, Roche& Eyadat, 2008; Rennings, Ziegler, Ankele& Hoffmann, 2006). Innovative method is applicable for ensuring lower cost and higher efficiency in long terms. Besides that, trading of surplus emissions provide extra profit chance for low-carbon companies. In Kyoto Protocol, emission trading concept is accepted under the circumstances of which Annex B countries are allowed to purchase the emission rights from Annex B countries which are able to reduce emissions below the assigned levels (UNFCCC, 2015d). This feature is common and base characteristic of any cap and trade scheme. In this frame, companies can make extra profit by selling their emission allowances which they can excess allowances by investing in green technologies.

Despite emission reduction is one of major targets and innovation is in the major tool of this target, there are very limited research about direct linkage between emission trading schemes and innovation. There are a few studies about this issue and mainly concentrated on the interaction between innovation/mitigation technologies and EU ETS. Rogge and Hoffman (2010) focus on German -power sector on their studies as Germany has the largest share of planned power generation capacity in the EU and power sector has the largest share of GHG emissions covered by EU ETS. Their findings show that EU ETS is accelerating innovation process and increased sector-based

innovation of power generation technologies in Germany. One of the most significant points of their findings is carbon capture and storage (CCS). CCS has experienced a very dynamic development over the last 5 years with the EU ETS as the main driver. However, they also attract attention to the dependency of environmental innovative technologies' diffusion on efficient carbon price (Rogge & Volker, 2010). Borghesi et al. (2015) investigates the impact of EU ETS on innovation by analyzing Italian manufacturing industry. For the EU ETS, the empirical evidence provides positive results Italian ETS firms were associated with a more widespread adoption of environmental innovation especially in energy efficiency and CO2 abatement. However, their deeper analysis shows that the decision making process is negatively related to innovation diffusion. Their interviews with experts, managers and sector associations show that leading emitters waited during phase one for allowance market to become advantageous for profitable trade instead of investing in green innovation on the contrary with the most innovative firms that are already invest in green innovation before EU ETS (Borghesi, Cainelli, & Mazzanti, 2015). Similarly, Löfgren, Wrake, Hagberg and Roth (2013) find that EU-ETS does not have a significant effect as it was expected on firm investment decisions in emission reduction based technologies. Their analyses cover some small and large firms operating in Sweden. These firms do not seem to invest in innovative green technologies because of non-encouraging scheme. Schmidt et al. (2012) empirically analyze the effects of climate policy on the rate and direction of research and development by distinguishing between emitting and non-emitting technologies. And, they find that the first two phases of the EU ETS has caused increasing adoption of emitting technologies instead of non-emitting technologies which was created because of imperfect design of the scheme.

These studies reveal that innovative investments are not encouraged by EU ETS as expected. Ironically, flexible characteristics of ETS may hamper the development of innovative technologies to reduce emissions. Another major problem is general environmental policy instruments which aim at increasing sustainability without determining exact technology (Sanden & Azar, 2005). Therefore, environmental policies should be more technology-intensive to provide sustainable and cost-effective solutions in longer term.

CHAPTER 3

THE EUROPEAN UNION EMISSION TRADING SYSTEM (EU ETS)

3.1 Historical Development of EU ETS

European Union Emission Trading System (EU ETS) covers half of the EU's Co2 emissions and 45% of the EU's GHG emissions in the all EU member states plus Iceland, Liechtenstein and Norway by limiting GHG emissions in more than 11.000 installations mainly in power generators, energy-intensive sectors[7] and civil aviation (European Commission, 2013). These statistics made EU ETS the most comprehensive and largest emission trading scheme over the world. This success is mostly based on know-how sourcing from being the world's first international company-level 'cap-and trade' system for reducing emissions of carbon dioxide (CO2) cost-effectively (European Commission, 2013).

European Union has developed its own emissions trading scheme even without and before Kyoto Protocol was in effect. After the ratification of the Kyoto Protocol on 31 May 2002, the 15 EU member states redistributed their collective Kyoto reduction target among themselves in order to achieve these targets cost effectively and flexibly by establishing an emission trading system which is one of the major mechanisms suggested by the Kyoto Protocol (De Jong & Walet, 2004, p. 261). EU ETS was launched on 9 December 2002 and became operational on 1 January 2005 to reduce its emissions of greenhouse gases by putting a limit on overall emissions from high-emitting industry sectors which is reduced each year (European Commission, 2013).

[7] EU Commission defined these sectors as: "oil refineries, steel works and production of iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals".

The first phase of the EU ETS which started on January 2005 lasted three years. Phase one was a pilot period of "learning by doing" to prepare for phase two which is conditional and coinciding with the first commitment period of the Kyoto Protocol. The EU ETS covered only CO2 emissions from power generators and energy-intensive industrial sectors during the Phase one (European Commission, 2011a). Almost all allowances were given to businesses free of charge to encourage actors to use the mechanism. The penalty for non-compliance was only 40 Euro per ton (European Commission, 2011a). EU has covered enough data for establishing a price for carbon, free trade in emission allowances across the EU and the necessary infrastructure for monitoring, reporting and verifying actual emissions from the businesses covered (European Commission, 2011a).

Second phase was valid between 1 January 2008 and 31 December 2012. During Phase two, EU ETS became the biggest source of carbon credits by allowing businesses to buy CDM and JI credits[8] around 1.4 billion tons CO2-eq (European Commission, 2011a). By doing this, EU ETS enlarged the range of cost-effective emission mitigation options available to businesses and became the main driver of the emission trading systems globally (European Commission, 2011a).

European Commission specified the emission reduction target on average by 6.5% compared with the 2005 verified emissions during phase two (Brohe, Eyre, & Howarth, 2009, p. 113). On the other hand, Kyoto Protocol obliged Annex I countries[9]

[8] Credits from nuclear facilities and agricultural and forestry activities were excluded.
[9]See the list: http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php

to reduce their overall emissions of gases indicated in Annex B by at least 5% below 1990 levels in the commitment period 2008 to 2012 (United Nations, 1998, p. 4).

In the end of 2012, EU-28 Member States overachieved their targets by a total of 4.2 Gt CO2-eq over the first commitment period of Kyoto Protocol (European Commission, 2014b, p. 6). However, the 2008 economic crisis decreased economic and industrial dynamism, and thus emissions. Falling emissions resulted in decreasing demand for allowances by an even greater margin. This led to a surplus of unused allowances and credits which weighed heavily on the carbon price throughout the second trading period. Moreover, permission of international offset credits dropped the carbon price as well.

The EU ETS is currently in its third phase which was started in 2013 and will be ended in the end of 2020. The most important regulation in this period is a single EU-wide cap on emissions applies in place of the previous system of national caps (European Commission, 2013). Therefore, there would not be any national allocation program in operation. Also, some additional regulations such as including more sectors (part of the chemical industry, aluminum) and gases (nitrous oxide and per fluorocarbons) will be applied in line with the important aim of yearly linear decrease of the emissions cap of 1.74% per year (European Commission, 2014a).

3.2 Political and Economic Aspect

European Commission formulates efficient policies to meet EU's climate targets. Policies mainly based on following aim: Reducing EU's vulnerability to the impacts of

climate change with adaptation and mitigation policies. The Commission creates important short-medium and long term targets such as 202020 packages, 2030 GHG reduction target and 2050 roadmap. ETS, protection of ozone layer, European Climate Change Programs and promoting low carbon technologies are only a few tools defined to meet these targets.

Since taking actions against the unwanted effects of climate change is a key priority for the Union, emission reduction targets and policies are crucial. Leaders set EU's 2020 climate and energy package, the 20-20-20 targets, to fight climate change, increase the EU's energy security and strengthen its competitiveness in 2007. The package constitutes of three major targets: 20% reduction in EU GHG emissions compared to 1990 levels, raising the share of renewable energy and energy efficiency by 20% (European Commission, 2015b).

The most important complementary legislation of the package is about strengthening current ETS system by cutting the cap each year and progressively replacement of free allocation with auctioning (European Commission, 2015b). Free allocation was a key method for acceptance of the EU ETS in the first phase. However, it is resulted in efficiency loss.

There appeared a need to enact a complementary legislation due to the fact that almost 60% of the EU's total emissions were coming from sectors outside the EU ETS. Under the Effort Sharing Decision[10], member states are expected to bear national

[10]The Effort Sharing Decision establishes binding annual greenhouse gas emission targets, that concern emissions from most emitting sectors not included in the EU ETS, for Member States for the period 2013–2020.

reduction targets for the sectors that are not covered by EU ETS (European Commission, 2011b). These targets are set relative to their wealth. Enabling national renewable energy targets to raise the share of renewable energy in the consumption is the goal of the third complementary legislation. The final legal move of is directly connected with green innovation technologies. A directive which focuses on the environmentally safe use of carbon capture and storage (CCS) technologies by covering all CO2 storage in geological formations in the EU has been enacted (European Commission, 2011a). Also, New Entrants Reserve (NER 300) is established with 300 million allowances to fund the deployment of innovative renewable energy technologies (mainly carbon capture and storage) through NER 300 program (European Commission, 2011a). The programme is designed as a catalyst for the demonstration of environmentally safe CCS and innovative renewable energy (RES) technologies on a commercial scale within the European Union (European Commission, 2011a).

These legislations were formulated to serve to decrease emissions 21% below the 2005 level by 2020 (European Commission, 2015b). Commission expanded targets by introducing 2030 framework for climate and energy policies in 2014. 2030 policy framework is built on the 20-20-20 package and increased emission reduction target to 40 percent compared to 1990 levels while increasing share of renewable usage in energy consumption and energy intensity targets to 27% (European Commission, 2014a). Reform of the ETS is still the major complimentary legislation in 2030 policy framework. In parallel with increased GHG reduction target, cap declining rate increased to 2.2% annually from 2021 onwards, instead of the rate of 1.74% up to 2020 (European Commission, 2014a). In this frame, the Commission went into action to address the

surplus of emission allowances by proposing back-loading 900 million allowances until 2019-2020 as a short-term precaution to postpone the current oversupply problem of allowances in the EU ETS (European Commission, 2013). Afterwards, The Commission proposed the establishment of Market Stability Reserve (MSR) as a continuation of temporary back-loading starting in the beginning of 2021 (CDC Climat Research, 2014). MSR proposal is designed to adjust auction volumes are in an "automatic manner" to reduce the amount of EU allowance units which constitutes an important “surplus problem”.

Under 2030 policy framework, a new governance system based on national plans is established (European Commission, 2014a). This step is expected after the national targets in 20-20-20 package such as reducing GHG emission from non-ETS sectors and national target to increase the share of renewable usage (European Commission, 2014a). As a result, the Commission enabled national plans to meet its energy goals (European Commission, 2014a).

The Commission created its long-term policy framework by introducing 2050 roadmap for moving a competitive low-carbon economy in 2015. The Roadmap aims to reduce EU’s GHG emissions to 40% by 2030, 60% by 2040 and 80% by 2050 below 1990 levels through domestic reductions (European Commission, 2015a). Europe’s final target is to provide a successful low-carbon economy by 2050. In this way, the Commission aims to save energy, provide cleaner air and create new job opportunities by investing in green growth and innovation (European Commission, 2015a).

It is predicted that transition to a low-carbon society will be triggered by green growth and innovation. Since power sector has the biggest share in Co2 emissions and potential in cutting them, the share of clean technologies aimed to increase almost to 100% in 2050 (European Commission, 2015a). Besides power sector, more than half of the Co2 emissions sourced from other high emitter sectors are aimed to decrease by 2050 (European Commission, 2015a) (see Table 1).

Table 1. GHG Reductions and Targets Compared to 1990 Levels, by sectors

GHG reductions compared to 1990	**2005**	**2030**	**2050**
Total	**-7%**	**-40% to -44%**	**-93% to -99%**
Sectors			
Power (CO2)	-7%	-54% to -68%	-83% to -87%
Industry (CO2)	-20%	-34% to -40%	-54% to -67%
Transport	30%	20% to -9%	-54% to -67%
Residential and services (CO2)	-12%	-37% to -53%	-88% to -91%
Agriculture (Non-CO2)	-20%	-36% to -37%	-42% to -49%
Other non-CO2 emissions	-30%	-72% to -73%	-70% to -78%

Source: European Commission Climate Action Official Webpage: http://ec.europa.eu/clima/policies/roadmap/perspective/index_en.htm

The Commission estimated the EU would need to invest 270 billion Euros to make the transition until 2050. In case of a successful transition, it is predicted that EU could save 175-320 billion Euros in fuel costs and 88 billion Euros in health costs until 2050 (European Commission, 2015a).

3.3 Challenges

Cap and trade system allows companies both to buy and sell emission allowances and to cut their emissions for achieving the emission reduction targets. These emission levels are agreed upon, at regional, national, or international level. An actor emitting more than its allowance, must compensate the difference. The actual emissions and the cap are agreed upon and negotiated on a market by buying emission certificates which are put on the market by an actor which would emit less than allowed in the cap-and-trade framework (Nussbaumer, 2007, p. 3082). This system needs to provide cost effective and flexible achievement of the emission abatement target. However, EU ETS is not working properly as it should be.

Since the establishment of carbon market mechanisms, there were ongoing discussions about challenges in carbon markets. These discussions mostly focus on the functionality of methods and tools of mitigation policies. European Commission claims that the EU ETS is the cornerstone of the EU's strategy for fighting climate change. As a part of its "Climate Action" the aim of the EU Emissions Trading System (EU ETS) is explained as "to help EU Member States achieve their commitments to limit or reduce greenhouse gas emissions in a cost-effective way. Allowing participating companies to buy or sell emission allowances means that emission cuts can be achieved at least cost." (European Commission, 2011a). EU member states are doing well in terms of achieving their commitments for lower costs. However, it is not "effective" in current system which is influenced by emission allowance surplus problem. Allowance surplus is resulted from weak targeting, usage of international offset credits and economic crisis. In the end, system itself creates a low carbon price problem. The price is so low that is

insufficient to trigger companies to implement emission reduction policies/investing in green technologies.

3.3.1 Low carbon price

Carbon price is the most popular issue of the discussion of challenges. The main logic behind putting a price on carbon emissions is to encourage companies to invest on green technologies like usage of renewable energy sources, intense research and development activities on green technologies. In this system, carbon price must be a disincentive factor against heavily polluting movements and make green investments more feasible than buying emission rights over time. If system works as required, companies that produce more efficiently gain a competitive advantage because they do not need to buy as many allowances as before and hence would have lower costs than their more polluting competitors (Carbon Market Watch, 2014, p. 3). Michael Wara[11] (2007) stated that it can be achieved in a system that the price paid for carbon credit must be several times the price that it actually cost to reduce emissions. However the price of carbon is far too low to encourage investments into efficient technologies or the use of renewable energy.

In theory, it is predicted that the allowance price should reflect market fundamentals related to the marginal costs of emissions reduction (Koch, Fuss, Grosjean, & Edenhofer, 2014). Fuel switching is the most important method in the EU ETS, therefore prices for input fuels are expected to determine European Union

[11] Environmental law scholar at Stanford University. Wara is an expert on energy and environmental law.

Allowances (EUA) prices in an efficient market (Hintermann, 2010). However, current system is not working properly due to extremely low carbon price. It is shown in the Figure 2 that the carbon price plunged from almost 30 Euros per ton of CO2 in 2008 to as low as 5 Euros in EU while it is almost zero in CDM projects. Both Kyoto mechanisms and EU ETS mechanisms currently resulted in an incredibly low carbon price.

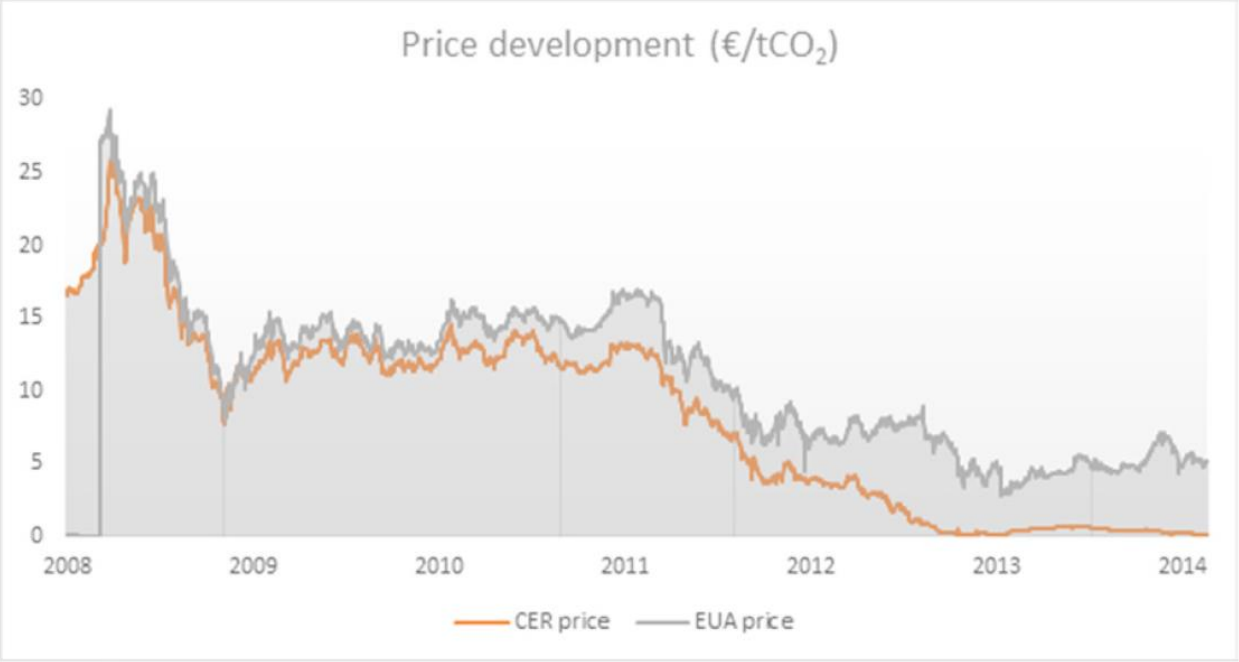

Figure 2. The price development of CDM offsets (CER price) and EU ETS credits (EUA price), 2008-2014 *(Carbon Market Watch, 2014, p. 3)*

The scheme is too far away to give a strong price signal. The most common view among market participants, academicians and policy-makers (Grosjean, Acworth, Flachsland & Marschinski, 2014; de Perthuis & Trotignon, 2013) is that three main causes can be put forward to explain the weak EUA price signal: (a) the economic crisis in the European Union (Aldy & Stavins, 2012; Neuhoff, Schopp, Boyd, Stelmakh, & Vasa, 2012) (b)

weak environmental policy making/ weak targeting (Fankhauser, Hepburn, & Park, 2010; Van den Bergh, Delarue & D'haeseleer, 2013; Weigt, Ellerman, & Delarue, 2013) and (c) usage of international offsetting credits - the large influx of Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) in the EU ETS during Phase II (Neuhoff, Schopp, Boyd, Stelmakh & Vasa, 2012; Newell, W.A.& Raimi, 2012).

3.3.2 Allowance surplus

Low carbon price grows out of increasing allowance surplus. European Commission submits that a growing surplus of allowances and international credits has been available on the carbon market since 2009, because of the economic crisis started in late 2008 (European Commission, 2015c). Surplus may be in an increasing tendency with the 2008 financial crisis, however the problem is beyond that and deeper. Obviously, 2008 financial crisis have an important impact of increasing surpluses.

However, surplus problem cannot be reckoned without regulatory problems: 2008 is the first year in the ETS from which spare allowances could be banked forward for future use, and therefore contribute to the surplus (Sandbag, 2014b, p. 15). Therefore, allowance surplus has to be seen as a major problem which is becoming even more serious with effects of regulatory and structural problems, financial crisis and international offset credits usage. Namely, all these factors have contributed currently over 2 billion EUA surplus (see Table 2).

Table 2. ETS Allowances, Emissions and Offsets Surrendered (Stationary Installations, 2008-2013, in millions)

	Total allowances issued	Verified emissions	Spare EUAs	Offsets surrendered	Surplus
2008	2,011	2,120	-109	84	-25
2009	2,049	1,880	170	81	250
2010	2,081	1,939	142	137	279
2011	2,101	1,905	197	254	450
2012	2,260	1,867	393	504	896
2013	2,057	1,904	153	133	286
Total	**12,559**	**11,614**	**945**	**1,192**	**2,137**

Source: Sandbag. (2014b). *Slaying the dragon: Vanquish the surplus and rescue the ETS.* Sandbag. p.15

Allowance surpluses have always been accumulating and the the total surplus reached 2,137 million at the end of 2013 (See table 2). The Sandbag (2011) underlines the scale of total surplus of allowances, sourced from economic recession and over allocation, and states that 77% of EU ETS installations held surplus allowances (Sandbag, 2011b).

Some of surplus holder companies have especially used allowance surplus challenges to make profit over the scheme. There are several special studies focus on estimating a lot of windfall profits created under the EU ETS by taking advantage of the surplus permits and free allowances given by government. These cover different companies that afford opportunities to profit from being in the scheme over allowance surplus and/or free allowances in principal emitter sectors/industries in various European countries. Sijm, Neuhoff and Chen (2006) estimated the windfall profit of power sectors in some of leading countries in Europe. According to them, power sectors in Germany, United Kingdom, France, Belgium and Netherlands gained 5.3-7 billion Euros per year during first phase of the EU ETS. Another research made by Bruyn et. al. (2010) focuses on windfall profits of petrochemical and iron and steel sectors during phase one.

According to this study, iron and steel and petrochemical sectors got emission rights for free. However, they still passes this non-exist cost in the product prices. This has caused windfall profits of up to € 14 billion between 2005 and 2008 in the EU ETS (Bruyn, Markowska, Jong, & Bles, 2010). Martin et al. (2010) anticipate all sectors operating under the EU ETS will make windfall profits over 230 - 300 million surplus allowances and free allowances each year. A recent study made by Sandbag (2014b) - latest research- show that only the net allowance surplus of "Carbon Fat Cats" were over 450 million in the first year of phase 3. Also, there are some more studies focusing on power sector windfall profits in Germany and United Kingdom based on different carbon price assumptions and net surplus level during second phase of the EU ETS. While Maxwell (2011) claims that UK power sector gains around 1 billion pounds as windfall profits, analysis made by Point Carbon and WWF (2008) predicts a 14-34 billion Euros worth windfall profit for German power sector and 6-15 billion Euros for UK power sector. Since, there is a sharp shift away from free allocation towards auctioning in phase 3, free allocations to the power sector dropped from 92% of emissions in Phase 2 to 24% in 2013 (Sandbag, 2014b). However, it is different for non-power sectors: Free allocations to manufacturers fell from 123% of emissions in Phase 2 to 96% in 2013 (Sandbag, 2014b). Windfall profits in non-power sectors will continue to be a problem for the scheme while windfall profits from power sector may sharply decrease.

To remove the increasing surpluses of emissions, European Commission adopted back-loading the auctioning of 900 million allowances from the early years of EU ETS phase 3 of to the end of the trading period by amending the Auctioning Regulation on 25 February 2014 (European Commission, 2014b, p. 20). Back-loading may reduce the

auctioning amounts in 2014, 2015 and 2016 by respectively 400, 300 and 200 million allowances (Carbon Market Watch, 2014). However, these allowances will be returned to the market in 2019 and 2020 by increasing the auctioning amounts over 300 and 600 million allowances in these years (Carbon Market Watch, 2014). Back-loading is a temporary solution and only postponing emissions by auctioning them in near future which transfers emission burden to next years. Therefore, Commission will activate Market Stability Reserve (MSR) by 2021 (the beginning of phase 4). Since back-loading is expected to provide a temporary solution in the following period, MSR is designed on the basis of which the auction volumes are adjusted in an automatic mechanism under pre-determined circumstances applied as of 4th phase of the EU ETS (European Commission, 2014c). Commission aims to establish MSR over two main adjustments: "(a) Adding allowances to the reserve by deducting them from future auction volumes with the aim of mitigating market instability due to a large temporary surplus in the EU ETS if the total surplus is higher than 833 million allowances; (b) Releasing allowances from the reserve and adding them to future auction volumes with the aim of mitigating market instability due to a large temporary deficit in the EU ETS provided the total surplus is below 400 million allowances." (European Commission, 2014c).

Union Members support structural reforms in the EU ETS. However, leading economies showed dignified approach to the proposal. UK Government argues there is an urgent need for a strong reform in the EU ETS. However, the Commission's proposal is unlikely to adequately correct the problem of oversupply in the EU ETS, and as such is insufficient to make the system work properly. Therefore, the UK calls for the proposed MSR to be strengthened and come into force in 2017. (United Kingdom

Government, 2014, p. 2). In the same way, Germany wants the MSR to be implemented even before 2021 with the back loaded allowances returned to the reserve than to the auctioning market (CDC Climat Research, 2014). France suggests the proposed system to be changed technically with regards to setting thresholds at a higher level, to the formula for filling and emptying the reserve and setting up of an independent advisory board for market diagnosis to signal signs of distress (CDC Climat Research, 2014).

In one way, leading members' dignified approach to the MSR is supported by Sandbag (2014) estimates and the Commission's forecast. Even the Commission envisages consistent decline in surplus after the establishment of MSR, they estimate that surplus (Even after back-loading) still be over 2.5 billion by 2020 and over 2 billion (Even after Market Stability Reserve) in 2028 (Sandbag, 2014b, p. 15) (See figure 3).

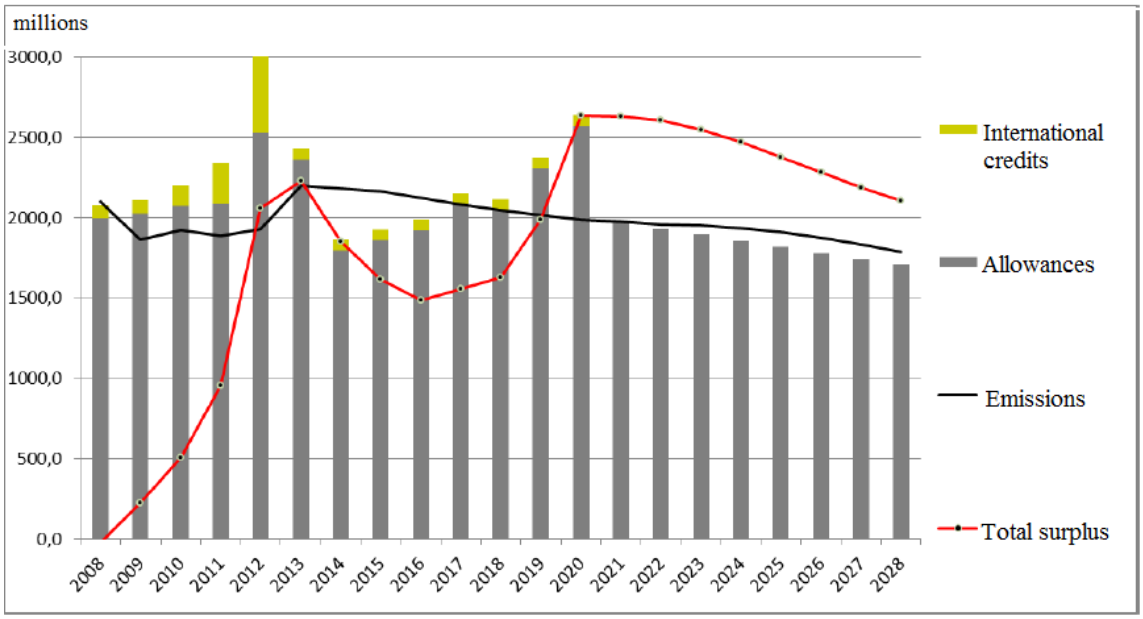

Figure 3. European Commission's forecasts for emissions and surplus (2008-2028 with back-loading decision, aviation excluded) (Sandbag, 2014b, p. 16)

Sandbag (2014) has developed a different and a more pessimistic scenario[12] from the Commission. As their estimation is shown in Figure 4, surpluses might reach over 4.5 billion by 2020 and continue to increase unless essential reforms applied to the ETS (Sandbag, 2014b).

[12]For more information: http://www.sandbag.org.uk/site_media/pdfs/reports/Briefing-2020surplusprojection.pdf

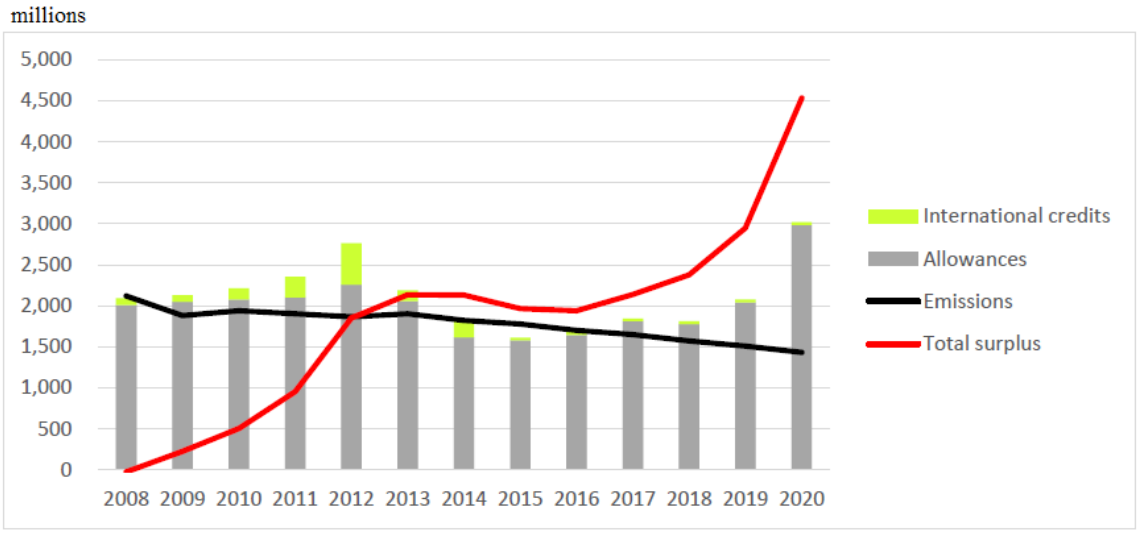

Figure 4. Sandbag's alternative emissions surplus scenario (2008-2020) (Sandbag, 2014b, p. 17)

This large-scaled surpluses would make the EU ETS even more insufficient. Considering incapable precautions of the Commission and skeptical approaches of leading member states, the future scenario of surplus allowance problem may possibly be worse than the Commission's forecasts. Considering current policies, it seems that surplus may continue to be a major challenge for the EU ETS in any case.

3.3.3 Negative effect of international offset credits usage

EU ETS mechanism allowed companies to be able to purchase up to 50% of their emissions reduction obligations through carbon credits from offsetting projects[13] in developing countries (Carbon Market Watch, 2014, p. 4). In other words, current banking rules in EU allow companies to carry over offset credits and convert them into

[13]Of the 132.8 million credits that were exchanged for allowances by 30 April 2014, 50per cent were Certified Emission Reductions (CERs) and 50per cent Emission Reduction Units (ERUs).[2] The origin of these CERs and ERUs was from a limited number of countries, with 80per cent of CERs originating from China and nearly 5per cent from India, and 70per cent of ERUs from Ukraine and 25per cent from Russia. For more detail See.: http://europa.eu/rapid/press-release_IP-14-561_en.htm

EUAs. Companies exploited this option to meet their reduction obligations in a cheaper way comparing to buy EU ETS allowances or bank them to use their post 2020 obligations or making profit over them by selling in the market. Thus, international offsetting became a very important tool of mitigation by providing industrialized nations a lower-cost option for GHG reductions relative to reducing emissions within their own borders (Weyant & Hill, 1999). European companies used international offset credits to reduce their costs and increase cost-efficiency in emission reduction. However, companies bought allowances even redundantly and international offsets constituted a huge burden on emission allowance surplus. According to analysis of Carbon Market Watch Platform (2014), the amount of surplus which is currently around 2,1 billion ton C02-equivalent will be more than 2,5 billion ton CO2-equivalent in the EU ETS up to 2020 (p.4). The build-up of predicted surplus will spring from current and future use of international offsets and recession. (See Figure 5).

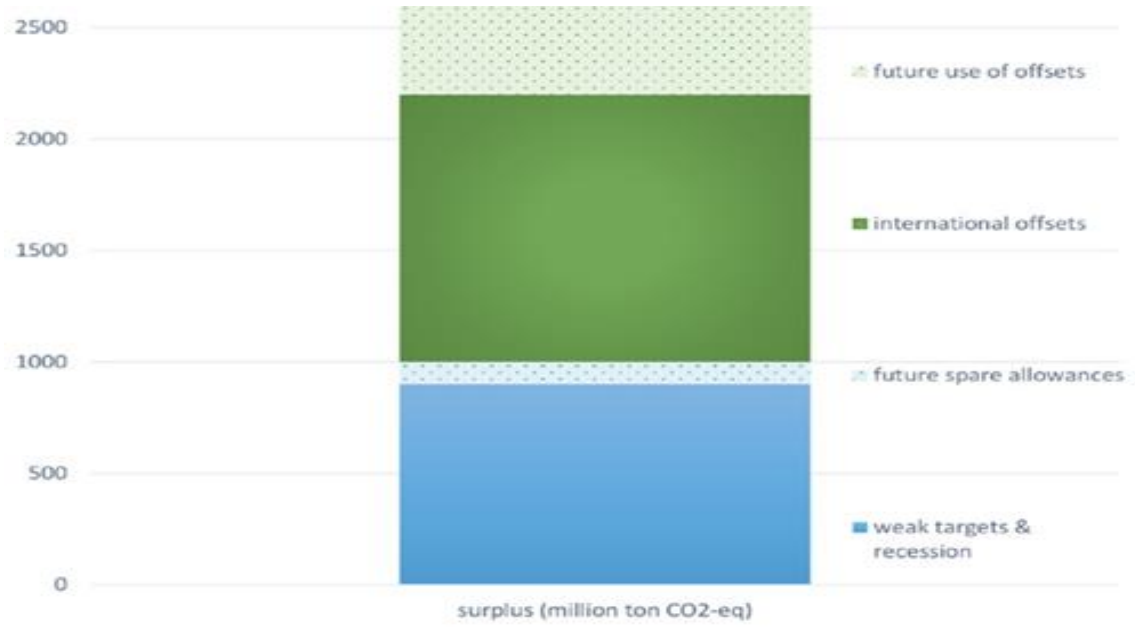

Figure 5. The build-up of allowance surplus in EU-ETS up to 2020 (Carbon Market Watch, 2014, p. 4)

The Commission and the Parliament have banned the use of international offsets to meet the 40% GHG emission reduction target for 2030 (Carbon Market Watch, 2014). However, EU's banking rules threatens this regulation by allowing carry over international offset credits which have been converted into EU ETS allowances (EUAs) (Carbon Market Watch, 2014). Because of the current system, 1.6 billion[14] international offsets that will have accumulated in the system by 2020, can be used towards the 2030 reduction target (Carbon Market Watch, 2014).

Current banking rules in the EU allow companies to carry over offset credits and convert them into EUAs. European Commission took this action to encourage companies (especially biggest emitters that burdens relatively higher emission reduction

[14]The EU set an overall limit at 1.6 billion offset credits (from the CDM and JI) for phase II and III.

costs) to integrate their operations with the EU ETS. Also, European Commission aimed to prevent high EUA allowance price, secure competitiveness of EU companies in international area and prevent carbon leakage. However, projected scenario did not happen. Companies used international offset credits to reduce their costs and increase cost-efficiency in emission reduction. On the other hand, extremely low price of international offset credits (CERs and ERUs) caused EUA allowance price to hit the bottom.

Unfortunately, negative impact of offset credits is not only limited to low carbon price. Constanze Adolf (2012), Vice Director at Green Budget Germany[15], argues that "the EU-ETS will fail to send a clear carbon price signal in order to ensure additional emission reductions and to contribute substantially to the 2020 target." Considering the aim of phase three; reducing the number of allowances issued by 1,74% each year which guarantees a fixed CO2 decrease of 21% within the EU-ETS sector until 2020 compared with 2005 (Adolf, 2012). Adolf's (2012) determination about the failure of the EU ETS on sending a clear carbon price signal is well-directed. However, EU ETS is unlikely to achieve its 40% domestic emission abatement target by 2030 even it takes the risk of failing to send a clear price signal to ensure additional emission reductions(Carbon Market Watch, 2014).The future target will hence fall short of 1.6 billion tons of domestic action, which implies that EU's 40% domestic climate target for the year 2030 could in reality only represent 34% domestic emission reductions (Carbon Market Watch, 2014, p. 4) (see Figure 6).

[15]Green Budget Germany is a non-governmental organization founded in 1994. They work on an Environmental Tax Reform in Germany, a goal which has now been realized to a large extent. They have extended their focus to include all elements of market-oriented eco-fiscal policy: environmental taxation, emission trading, removal of environmentally harmful subsidies, promotion of renewable energies and green growth. (See: http://www.foes.de/ueber-uns/)

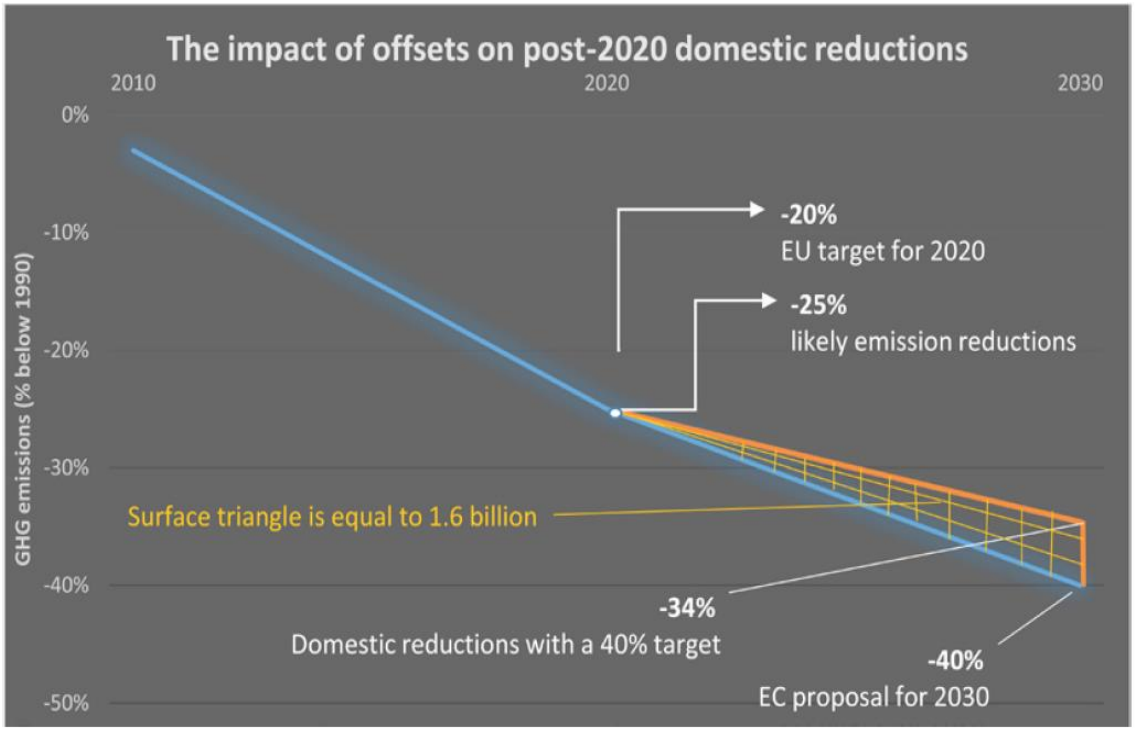

Figure 6. The impact of offsets on post-2020 domestic reductions (Carbon Market Watch, 2014, p. 4)

Even the Commission takes precautions such as back-loading and MSR, a 6% decrement from the current reduction target, which is equal to 1.6 million allowances. This points the critical effect of international offsets.

3.3.4 Weak Policies/Targeting and Economic Crisis

It is a fact that, EU's emissions experienced a decrease after energy consumption and industrial production effected by economic recession. However, even before the economic recession (From 1990 to 2011), emissions decreased by 18.3% while economy grew by 45% in the EU (Carbon Market Watch, 2014, p. 4). Due to this statistics, Carbon Market Watch (2014) propounds that emissions would not increase even without economic recession. On the other hand, The Commission submits that the most

important reason of increasing surplus of allowances is economic crisis (European Commission, 2015c). However, it is claimed that the economic crisis contributed to less than half of the reduction measured between 2008 and 2012 but energy and climate policies have contributed significantly to the emission levels in Europe (European Commission, 2015e). Economic crisis is clearly one of the most important factors for allowance surplus. However, declaring it as the most important factor for weak targeting causes a waste of high potential in terms of reducing greenhouse gas emissions. Even it is already accepted that the earth's climate has been varying because of human influence rather than processing naturally, world leaders may have ran behind the actual effects of climate change. Environmental issues are required to handle the cost of future problems today. However, that "future" is now much closer than it has ever been. Such that; measurements show some crucial changes occurring over a relatively short period of time such as global average temperature increase, snow and ice covers decrease, global average sea level rise, change in precipitation patterns, as well as an increase of the intensity and frequency of extreme weather events (Nussbaumer, 2007, p. 3081). Unfortunately, weak targeting prevents faster progression against global climate change. The yearly emission limits were set higher than the business-as-usual emissions even without economic crisis (Carbon Market Watch, 2014, p. 3). Thereby, current system allows companies even increase their emissions.

Financial crisis exposes even more negative effects of policy makers' weak targeting while creating emission abatement policies. The main reason is changing business as usual conditions. Just like that, economic activities and also emissions were affected by the economic downturn in 2008 financial crisis in Europe (Laing,

Sato,Grubb& Claudia 2013). Declercq et al. (2010) estimated the impact of the 2008 financial crisis on emissions from the EU power sector at approximately 150 MtCO2e, through decreasing fuel prices, lower electricity consumption and offsets. These findings are also supported by UK Climate Change Committee and they indicated that the reductions in overall EU emissions that have occurred since the inception of the EU ETS are more likely due to the result of the impacts of the financial crisis than the EU ETS (Cambridge Econometrics, 2009).

It constitutes an important challenge for EU ETS as policy makers already did not push business to comply very stringent emission abatement rules. The main reason is to put environment-effectiveness behind the eagerness to become cost-effectiveness. Policy makers aim to encourage companies to accept and integrate their activities to the EU ETS while preventing possible carbon leakages by protecting European companies' international competitiveness. Moreover, companies' reducing economic activities during financial crisis times led to automatically decreasing emissions in parallel with their production, trade, transport, etc. activities. Thus, emission abatement targets, which are already weak because of the given reasons, become even more easily reachable. In brief, weak targeting and financial economic crisis are deemed to be the big challenges for EU ETS and affect even more since these two objects can combine very easily.

3.3.5 Insufficient applicability of innovative methods

Main objective of the EU ETS is to cap emissions. However, forming decision-making processes regarding low-carbon technologies is another key objective of the system. In this framework, main intention is to conceive emitters to innovate new low-carbon

technologies, incentivize additional investment in low carbon assets and to reduce investment in carbon-intensive products and processes (Laing, Sato, Grubb, & Claudia, 2013, p. 10).

Green innovation leads emission abatement steps to become a part of sustainable environment policies. However, the speed and scale of applying innovative methods rely on the level of carbon prices. Investment depends on the strength of the price signal created, both in terms of magnitude and long-term credibility (Laing, Sato, Grubb, & Claudia, 2013, p. 10). Since current carbon price is too low both in the EU ETS and international offsetting, the price signal is weak to trigger this kind of investment decision. Even the EU ETS had achieved some degree of capturing the attention of decision-makers, climate policy is generally seen less important than other aspects determining the investment strategy (Neuhoff, Carbon Pricing for Low-Carbon Investment: Executive Summary, 2011). More studies based on surveys and cases about the impact of the EU ETS on innovation activities shows that the EU ETS had moved the climate debate into the boardroom of European companies (Kenber, Haugen, & Cobb, 2009), however had a limited effect on innovation motivation and has lower importance than other context factors (Rogge & Volker, 2010; Hoffman, 2007; Petsonk & Cozijnsen, 2007; Aghion, Veugelers& Serre, 2009). Hoffman's (2007) findings indicated that companies consider carbon costs in small-scale investment decisions or R&D expenses while the EU ETS had very limited effect in large-scale investment decisions. For all that, Rogge and Volker's (2010) findings are promising. Despite the rather low expectations of the innovation impact of the EU ETS in its first two phases (Gagelmann & Frondel, 2005), they find that the EU ETS has influenced the sectoral

innovation system of power generation technologies in Germany in several areas, primarily research and development activities on carbon capture and storage (CCS) technologies. Due to OECD data about patents in technologies specific to climate change mitigation (CCS), patent applications in EU-28 countries increased 110% in 2011 compared to 2005 levels (see Figure 7). In the same period, patent applications in Germany have increased 253% and made Germany the most CCS holding country in the EU.

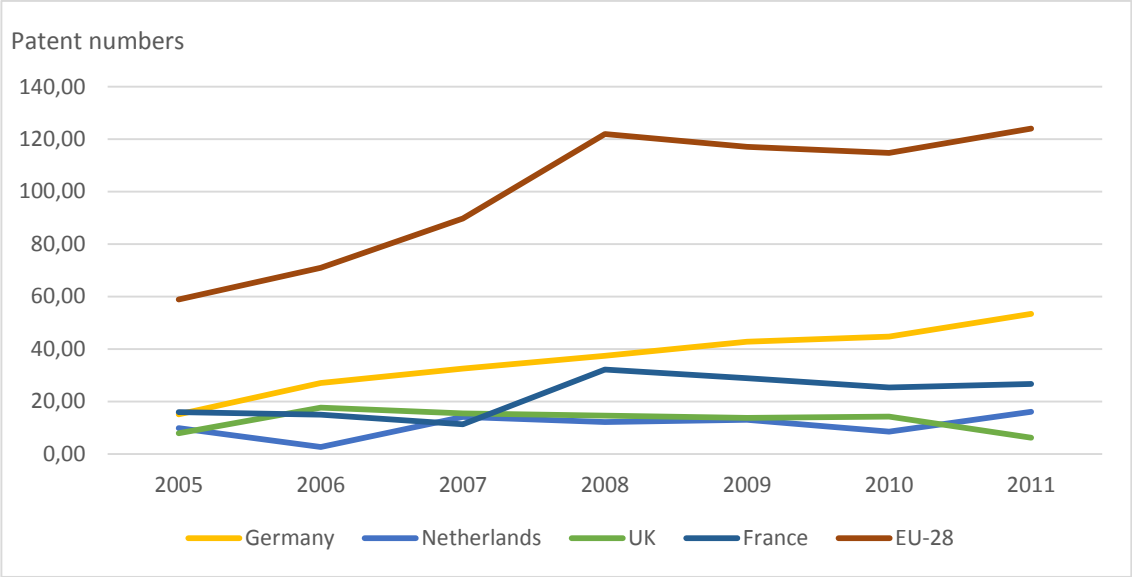

Figure 7. Patents of climate change mitigation (CCS) technologies in EU-28 countries and individual performance of selected member countries[16], numbers. (Created by the author. Data source: OECD Stat Extracts; http://stats.oecd.org/index.aspx?queryid=29068)

[16]Countries selected through their performance in EU's Innovation Union Scoreboard 2015. Selected countries are among the 11 countries which are above the average of EU-28 countries. Germany, Nedherlands, France and the United Kingdom have the most emission levels among these 11 countries.

Increasing trend in CCS is precious and promising in terms of future innovation based investment decisions and researches. Even the general notion in the literature indicates that the EU ETS has limited effect on companies' investment decisions, eco-innovation performance of Europe's leading innovative countries had increased substantially between 2005 and 2011 (see Figure 8). Increasing trend in environment related technologies share in all technologies is promising in the way of building low-carbon economy.

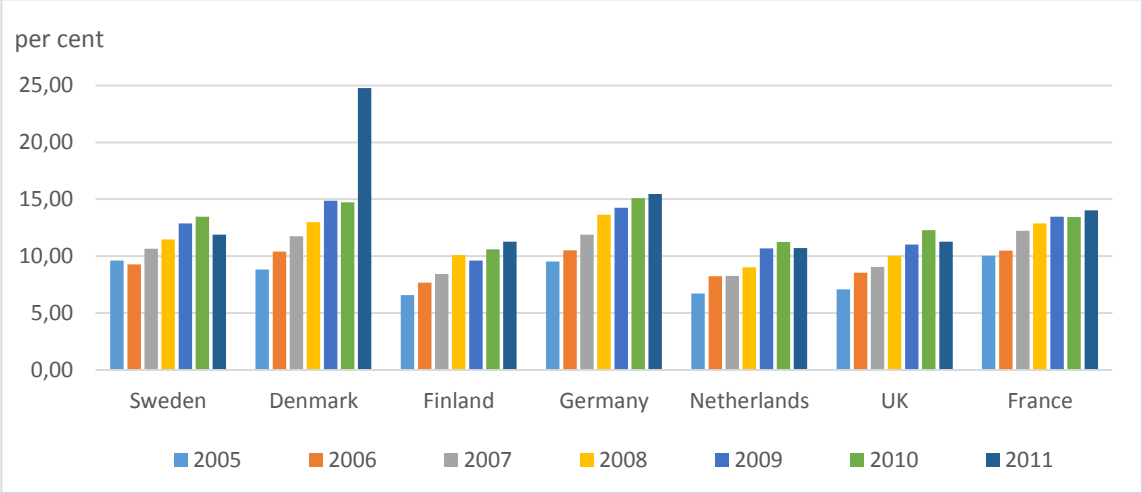

Figure 8. Diffusion of environment-related technologies, % of all technologies (OECD, 2015) (Created by the author. Data source: OECD Stat Extracts; http://stats.oecd.org/index.aspx?queryid=29068)

CHAPTER 4

A PRACTICAL ENQUIRY OF EU ETS CHALLENGES: THE CARBON FAT CATS CASE

4.1 Conceptual model of the study

Conceptual model which is developed for the study provides the construct for analyzing the challenges of the EU ETS. All of the challenges identified by this study are categorized in line with the findings retrieved from the literature and the reports published on the EU ETS, as provided in the previous chapter. It is seen that challenges of the EU ETS are related to each other. There are 6 main challenges identified; weak policies and targeting, international offsets, economic crisis, low carbon price, allowance surplus and insufficient applicability of innovative environmental technologies.

The conceptual model shows the relations of the given challenges with each other. Accordingly, allowance surplus is the main challenge that effects or affected by every other challenges. Allowance surplus results from weak targeting which derives from free allowances and economic crisis. Moreover, international offset credits increase their effect. Emitters buy offset credits even though they do not need them to meet their target. Many companies buy offset credits for two reasons: (a) to convert it to EUA and sell from higher price or (b) to store them to use in the near future. As a result of this process, allowance surplus increases extremely. Accordingly, companies do not buy any more allowances from the EU ETS (EUAs). Decreasing demand to the allowances also leads to the decrease of EUA prices (even hit the bottom). When the price is so low, it is insufficient to trigger companies to implement emission reduction policies or expect

them to invest in green technologies. In such a low price system emitters do not intend to reduce their emissions, they continue to trade permits forever and make profits. (see Figure 9)

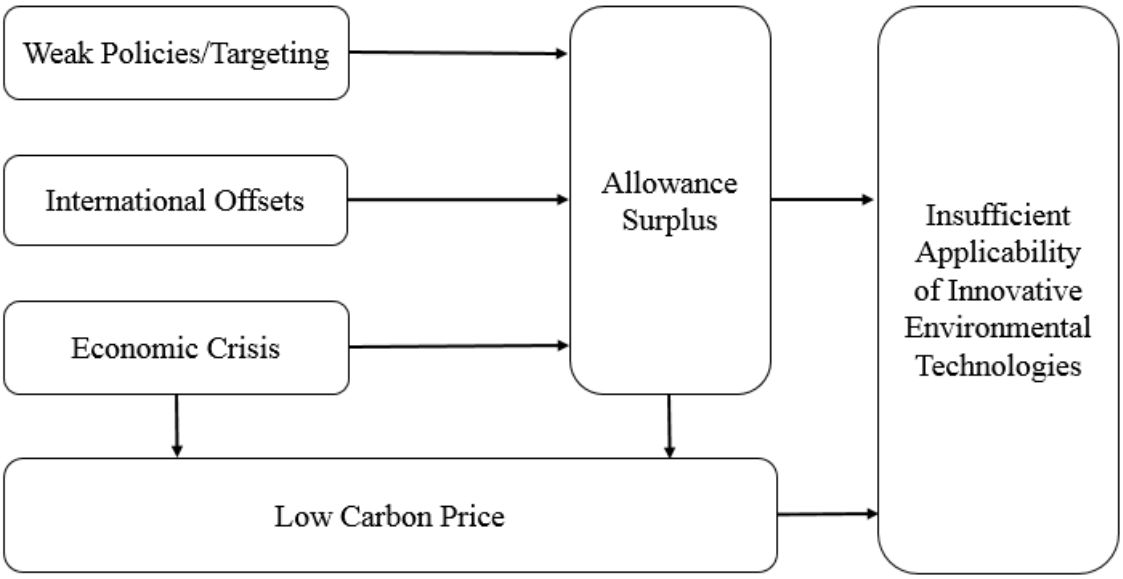

Figure 9. Conceptual model of the challenges in the EU ETS (Created by the author)

4.2 Methodology

The thesis offers a twofold methodology to utilize the conceptual model developed (see Figure 10). Firstly, it employs case study to provide a practical sample case of challenges in the EU ETS. This case is analyzed by the application of the conceptual model. Secondly in the light of the findings of the case, a possible policy scenario is built for Turkey and conceptual model is once more used as the intellectual basis for policy recommendations for Turkey.

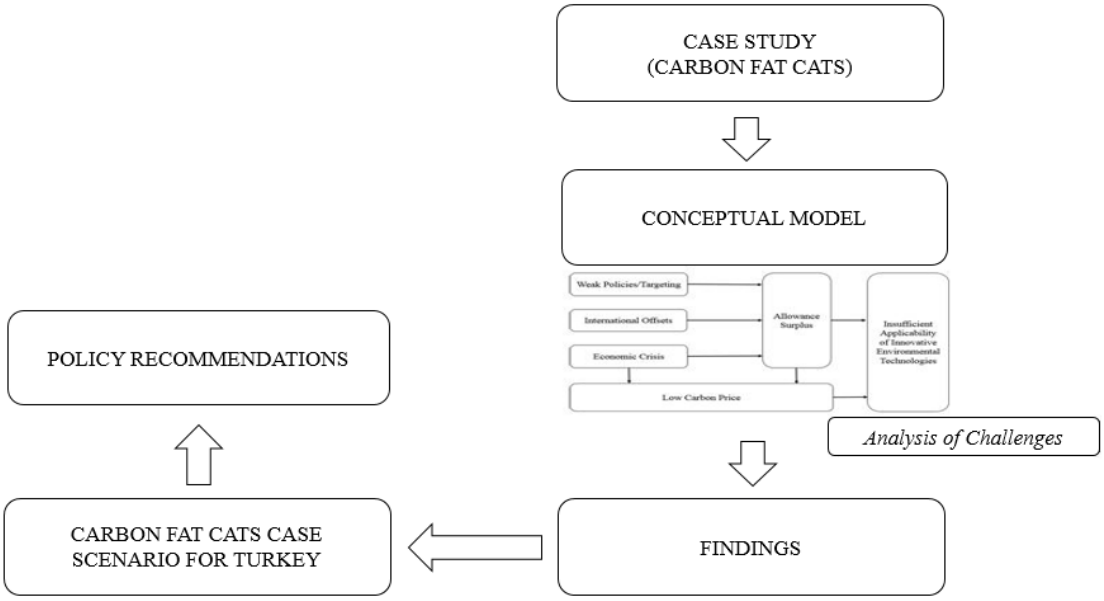

Figure 10. Methodology of the study (Created by the author)

Case study is a methodology of research using a variety of data sources and multiple lenses (Baxter & Jack, 2008). Tripathy (2009) describes the approach as a form of qualitative and descriptive research; it looks intensely at an individual, a group or event and draws conclusions in a specific context. The case study is used in many situations to contribute to our knowledge of individual, group, organizational, social, political and related phenomena. As a research strategy it is commonly used in psychology, sociology, political science, social work (Gilgun, 1994), business (Ghauri & Grønhaug, 2002), community planning and economics (Yin, 2003).

Despite having similar definitions, there are two key approaches that guide case methodology: one proposed by Robert Stake (1995) and the second by Robert Yin (2003). Both approaches are based on a constructivist paradigm and seek to ensure that

the topic of interest is well explored, and that the essence of the phenomenon is revealed (Baxter & Jack, 2008). Robert Stake points out that crucial to case study research are not the methods of investigation, but that the object of study is a case: "As a form of research, case study is defined by interest in individual cases, not by the methods of inquiry used" (Denzin & Lincoln, 2013). Robert Yin (1994), places more emphasis on the method and the techniques that constitute a case study.

Yin (2003) and Stake (1995) differentiates in describing a variety of case studies. While Stake (1995) identifies case studies as intrinsic, instrumental or collective, Yin (2003) categorizes case studies as explanatory, exploratory or descriptive. Yin (2003) indicates that descriptive case study describes an intervention or phenomenon and bears the real-life context in which it occurred. All determined challenges are cases in this study. Once the case has been determined and the boundaries placed on the case it is important to consider the additional components required for designing and implementing a rigorous case study (Baxter & Jack, 2008). These include: (a) propositions (Yin, 2003; Miles & Huberman, 1994); (b) the application of a conceptual framework (Miles & Huberman, 1994); (c) development of the research questions (generally "how" and/or "why" questions); (d) the logic linking data to propositions; and (e) the criteria for interpreting findings (Yin, 2003).

Policy scenario developed for Turkey is a hypothetical scenario that provides a prospective outlook for the dynamics, structures and conditions of a possible Turkish ETS with a special emphasis to the largest carbon consuming industries, namely the "Turkish Carbon Fat Cats". Garb et al. (2008) claims that scenarios have become an increasingly common, consequential, and complex approach for describing potential

environmental futures. The scenario bears a descriptive character, designating sets of possible events (Greeuw et al. 2000, 8) with the approach of "What-would happen-if". It takes the present case of EU ETS as the starting point and discusses the policy recommendations for a future Turkish trading scheme analyzed by the conceptual model. The scenario for Turkey is developed by qualitative narration employing secondary quantitative data as the basis of market insight.

4.3 The "Carbon Fat Cats" Case

Effectiveness of the EU ETS has been questioning due to the main challenges which are analyzed in the previous chapter. Indeed, criticisms are not groundless. Even the members of the EU ETS suggest urgent precautions to fix the broken scheme. Therefore, Commission takes steps to address and solve these problems such as back-loading allowances temporarily, implementing Market Stability Reserve and limiting offset usage.

Sandbag, a non-profit organization working on efficiency of the EU ETS, based their researches on this fact: broken cap and trade system in the EU. Their research shows this is down to two key problems: (a) Authorities gave too many permits to pollute to begin with, allowing industry to continue with business-as-usual emission levels: (b) There is an enormous glut of unused permits in the system, unused in the credit crunch because of the strong effect of global recession on European industry (Sandbag, 2014a). As a result of these problems, carbon price has crashed and therefore there is not any price incentive to use clean technologies or fuels or more environmental-efficient mechanisms (Sandbag, 2014a). To address these challenges with a tangible

case, Sandbag profiles ten companies operating in the EU ETS who have been afforded opportunities to profit from being in the scheme to address these main challenges. They choose ten companies from iron and steel and cement industries which have the largest share of allowance surplus. These companies called "Carbon Fat Cats" which came up with Sandbag in the literature in 2011.

Carbon Fat Cats[17], operating under EU ETS make profit over selling surplus allowances. For sure, the Commission does not directly create these fat cats, but they are created in the scheme affected by challenges. This case is also proves that ETS compliance does not cost by threatening heavy industries' international competitiveness as powerful industrial lobbies claim, but even provide large surpluses of free carbon allowances these companies were able to sell as a revenue stream, or retain to protect them from future compliance costs under the scheme (Sandbag & Bund, 2013).

Carbon Fat Cats spent estimated 315 million Euros for over 24 million offset use in spite of having already 240 million EUAs in 2010 (Sandbag, 2011b, p. 5) (see Table 3). More importantly, these companies spent 7 million Euros on credits from their direct international rivals (Sandbag, 2011b, p. 6). These numbers reveal the broken trading system in the EU. Namely, companies find it more profitable to finance their international rivals by buying unnecessarily offset credits (CERs and/or ERUs) against taking precautions to reduce their emissions. Afterwards, they convert CERs to more precious EUAs. They can either sell the EUAs at a profit or store them for future use at the expense of increasing EUA surplus. [18]

[17]Carbon Fat Cats in 2010: Arcelor Mittal, Lafarge, Tata Steel, Thyssen Krupp, Riva Group, Cemex, Holcim, Heidelberg Cement, Ital Cementi, Salzgitter.
[18]EUAs are transferrable between phase 2 and phase 3 under current legislation in the EU.

Table 3. International Offset Use of the Carbon Fat Cats in 2010, in numbers

Rank	Company	Current Phase 2 Surplus (mil. EUAs)	Value (mil. Euro)	Offsets Used
1	Arcelor Mittal	97.2	1,656	162,477
2	Lafarge	29.4	501	219,500
3	Tata Steel	23.1	393	4,549,619
4	Thyssen Krupp	19.9	339	7,395,336
5	Riva Group	16.6	283	0
6	Cemex	12.7	217	1,372,239
7	Holcim	12.5	213	2,881,549
8	Heidelberg Cement	12.5	216	1,149,638
9	Italcementi	8.9	151	1,163,476
10	Salzgitter	7.5	129	5,535,000
	Total	**240.3**	**4,093**	**24,428,834**

Source: (Sandbag, 2011c, p. 5)

However, share of Carbon Fat Cats'[19]surpluses sourced from international offset usage extremely increased to 40% of total 467 million allowance surplus hold by these companies in 2013 (see Table 4).

[19]Carbon Fat Cats consists of iron and steel and cement companies which have the largest share of permit surplus in 2013: Arcelor Mittal, Lafarge, Tata Group, Holcim, Heidelberg Cement, Cemex, Italcementi, CEZ, Italcementi, CEZ, Termoelectrica and Duferco.

Table 4. Total Surplus and International Offset Use Share of Carbon Fat Cats in 2013

Company	**2013 raw Surplus**	**Total offset use**	**2013 net surplus**	**Surplus increase due to offset use**
Arcelor Mittal	93.0	46.2	139.2	50%
Lafarge	45.6	12.6	58.1	28%
Tata Group	42.6	13.3	55.9	31%
Holcim	27.1	8.7	35.8	32%
Heidelberg Cement	25.4	13.4	38.8	53%
Cemex	23.6	6.5	30.0	27%
Italcementi	23.2	7.7	30.9	33%
CEZ	19.6	18.0	37.6	92%
Termoelectrica	19.5	5.5	25.0	28%
Duferco	16.1	0.2	16.3	1%
Total	**335.7**	**132.1**	**467.8**	

Source: (Sandbag, 2014b, p. 47)

In total, they held nearly 22% of the whole surplus under the ETS (over 483 Mt from a total of 2.2 billion tons), despite being responsible for nearly 10% of emissions (1.1 billion tons from a total of 11.6 billion tons) in 2013 (Sandbag, 2014b, p. 44) (see Table 5).

Table 5. Emissions and surpluses recorded during 2008-2013 to Fatcats (and manufacturing Fatcats, respectively), as a percentage of emissions and surpluses of all manufacturing sectors and the entire ETS

	Operators	**All 10 Fat Cats**	**Manufacturer Fat Cats**
	Emissions	**1.11 Gt****	**0.85 Gt**
Manufacturers*	3.10 Gt	35.9	
ETS total	11.61 Gt	9.6%	7.4%
	Surpluses	**0.48 Gt**	**0.41 Gt**
Manufacturers	1.19 Gt	40.3%	34.9%
ETS total (inc. auctions)	2.24 Gt	21.6%	18.5%

* Not aviation and not combustion European Union Transaction Log (EUTL) sectors.
** Gigatonne (Gt) = 1 billion tons.

Source: (Sandbag, 2014b, p. 45)

If we have a deeper look to Arcelor Mittal, the company handling the most surplus and performs the highest offset credit purchasing, has covered all of its phase 3 emissions and will continue to have almost 40 million surplus EUAs despite assuming phase 3 emission level grow 38% above 2011 levels until the end of phase 3 (Sandbag & Bund, 2013, p. 15) (See Figure 11).

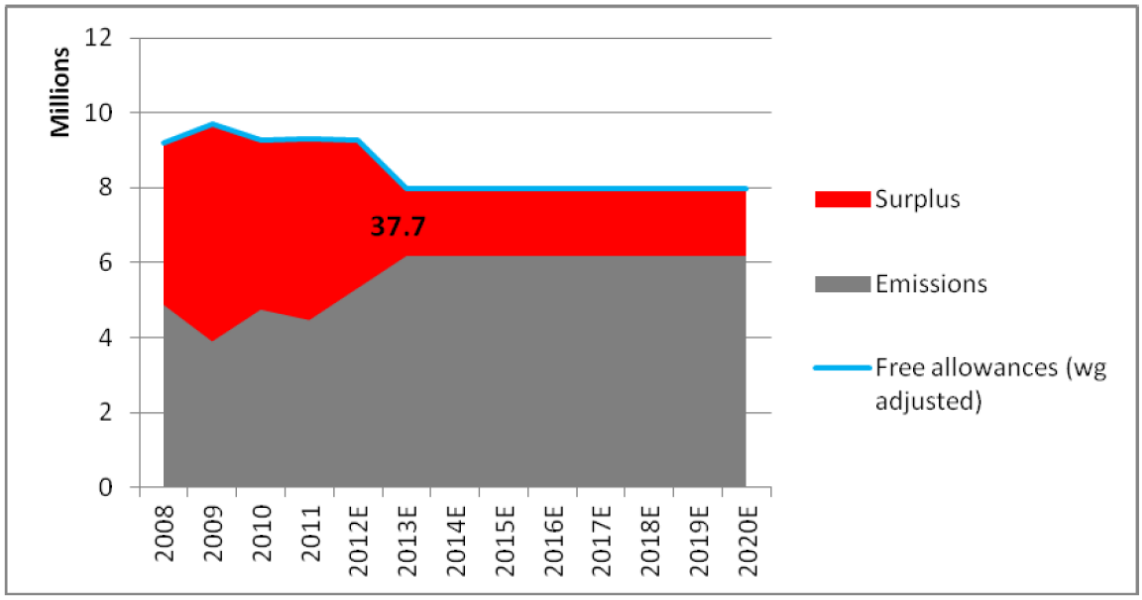

Figure 11. Arcelo Mittal forecast for existing German ETS installations assuming optimal growth (Sandbag & Bund, 2013)

These assumptions show that the company do not need to take any precautions to reduce its GHG emissions. For all that, they can even make profit over selling surplus allowances. Actual emissions of the company was 18 million tons while it held 19.4 million surplus allowances after even meeting its emissions (Sandbag & Bund, 2013). Under these circumstances emission reduction seems to be an obligatory regulation only in theory but optional in practice. Carrington (2013) also attract attention to Sandbag and Bund's (2013) findings by stating that Germany's manufacturing sector as a whole has accrued spare carbon allowances equivalent to the annual emissions of Austria while "German Fat Cats" profited 1.2 billion Euros worth windfall brought by the spare "hot air" permits. For example, Dr. Jean-Marie Chandelle, The Chief Executive of the European Cement Association (CEMBUREAU), has argued that "the European cement industry is highly vulnerable to carbon leakage" (CEMBUREAU, 2009). As a member

of the Alliance for Energy Intensive Industries (AEII), CEMBUREAU has backed a statement that "moving the existing 2020 targets would be unacceptable" and that "carbon leakage is a reality and leads to job, investment and growth losses in Europe and to substantial off shoring of carbon emission" (Greenpeace, 2011). This supposed vulnerability of the cement sector is valid for many sectors (primarily iron and steel and cement). Therefore, many of these industries' companies can take comfort in their current position in the scheme as the majority of them have a healthy surplus of permits at this stage (Sandbag, 2011b). As a result, their allowance surplus extremely increases and their incentive to burden the cost of reducing emissions decreases. While carbon fat cats enjoy shortages of the current system, challenges affect increases and the scheme gets even more ineffective.

The Greens[20] (2011) have also pointed Sandbag's appropriate findings about Carbon Fat Cats by attracting attention to the fact that several big companies have been profiting from the emission trading mechanism since the EU ETS established by receiving more Co2 allowances than they actually need to cover for their emissions. The most crucial point of their determination is that Carbon Fat Cats have been profiting from the scheme without even taking any action to reduce their CO2 emissions and could have made windfall profits of up to 3.8 billion Euros just by selling their surplus allowances that they got for free (The Greens, 2011). They also claim that quick and temporary EU policies (back-loading) against allowance surplus problem is not enough to put the ETS back on track (The Greens, 2011). They put forward that the European Commission takes rapid actions to tackle the problems of the non-functioning ETS

[20]The Greens/European Free Alliance is a European parliamentary group made up of Greens and representatives of stateless nations and disadvantaged minorities. The Greens counts with 50 members from 17 countries and 5 regions. It is the only group with a gender-balanced Co-Presidency.

because of the compulsion from the European Parliament[21](The Greens, 2011). However, they believe that permanent solutions must be applied to solve allowance surplus problems and prevent powerful industries to make unfair profits.

Chris Huhne, former Secretary of State for Energy and Climate Change, also believes in more permanent solutions than temporary solutions. Therefore, he indicated the urgent need for establishing definitive and strong policies for deeper emission cuts by proposing a coalition of countries to drive deeper emission cuts in Europe in the face of opposition from carbon-intensive sectors during EU environment ministers meeting in Luxembourg in 2011 (Energy and Environmental Management, 2011). His main objective was to create efficient policies and take stronger steps to reach targets of "Energy Roadmap 2050" which charges EU member states to reduce its emissions by 80 to 95% by 2050 (Energy and Environmental Management, 2011). His suggestion actually got full support from Germany, Spain, Sweden, Denmark, Portugal, Greece (Energy and Environmental Management, 2011). Moreover, major European companies[22] signed a declaration calling on the EU to extend to 30% its planned emission cuts to reach 2020 targets (Energy and Environmental Management, 2011). Towards anxieties of heavy industry, Huhne submitted that *"Heavy industry has little to*

[21]European Parliament called for a rapid fix of the ETS in order to stop the further collapsing price of CO2 during the negotiations on the Energy Efficiency Directive.

[22]List of businesses: Acciona, Adolfo Dominguez, Allianz, Alpro, Arjowiggins graphic, Arkadin, ASDA, Atkins, Aviva, Aviva Investors, Barilla, Better Place, BNP Paribas, Boralex, BSH Bosch Siemens Hausgeraete, British Telecom, BSkyB, Capgemini, Carrefour, Centrica, Climate Change Capital, The Coca-Cola Company, Coca-Cola Enterprises, Coca-Cola Hellenic, Credit Agricole, Danfoss, Danone, DHV Group, DONG Energy, Electrolux, Elopak, Eneco, Eurostar, F&C Asset Management, Ferrero, First Solar, Google, H&M, If P&C Insurance Company Ltd, IKEA, InterfaceFLOR, John Lewis Partnership, Johnson Controls Inc, Kingfisher, Lafuma, Mango, Marks and Spencer, National Grid, Nestl Nike, Nokia Siemens Networks, Novo Nordisk, Philips, PUMA, Rockwool, RSA, Scottish and Southern Energy, SKAI Group of Companies, Sony Europe, Standard Life, Sveaskog, Swiss Re, Thames Water, The Co-operative Group, Tryg, Unicredit, Unilever, United Biscuits, Velux, Vestas, Vodafone, WSP Group (Energy and Environmental Management, 2011).

fear and that employment throughout the bloc will be helped by increasing the pace of change towards a low carbon economy."(Energy and Environmental Management, 2011). Huhne's explanation and some major countries' and companies' support to precautions for deeper emission cut indirectly indicates the problem of "Carbon Fat Cats" since these companies are also heavy industries.

Carbon Fat Cats are being fed by allowance surplus challenge. It is the core challenge that causes carbon price and it is even increasing because of economic crisis, international offsets and weak policy making (see Figure 12)

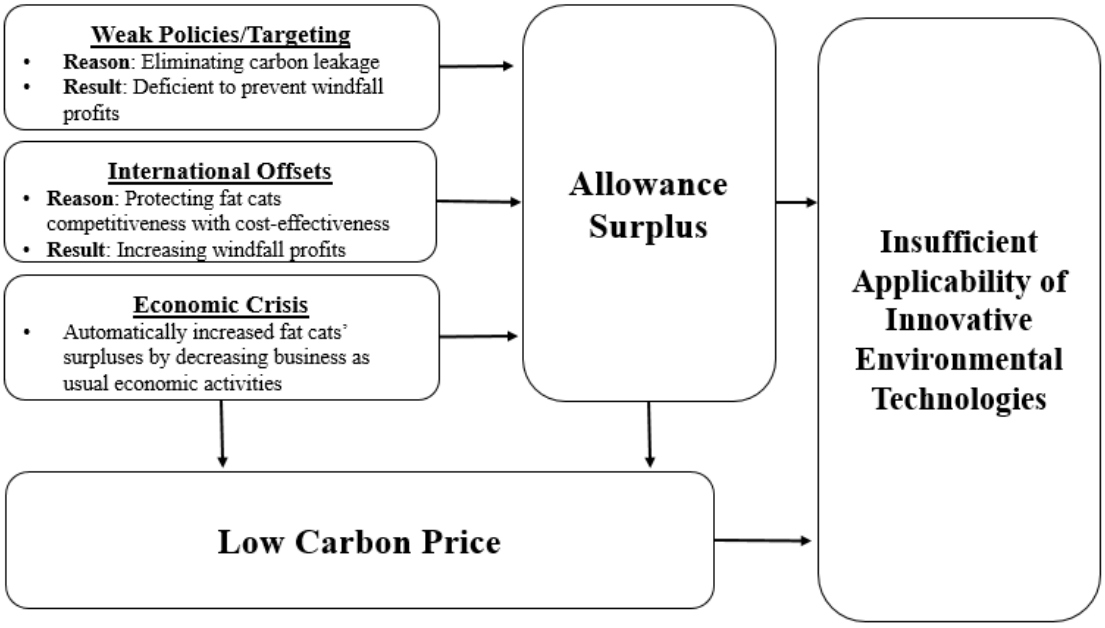

Figure 12. Analysis of challenges in Carbon Fat Cats Case by the Conceptual Model (Created by the author)

Also, Sandbag (2013) proved that combination of allowance surplus, international offsetting and desire of making profit under already decreasing emissions exposed an important challenge for EU ETS. If we propose solutions for this problem in the most

convenient way, removing free allowances and allowance surpluses would be a permanent solution. However, some industries are widely perceived as being at risk of carbon leakage. As a result, installations were issued generously free allocations from Member State governments in order to reduce the burden of a carbon price on industry and keep it internationally competitive (Sandbag, 2011b).

Further steps should contain direct precautions for increasing allowance surplus problem sourcing from over-supplied Carbon Fat Cats and redundant use of international offsetting credits. Since companies are able to store free-allowances and still able to buy credits over international offsetting with a very low cost, main dynamic of the EU ETS is being affected. In accordance with this, EUA price dramatically fells with the inclusion of low CERs and ERUs. Afterwards, the scheme fails to send a strong price signal and it cannot encourage companies to reduce emissions by investing in green technologies.

Enormous effect of the problem may begin to decrease with start of the Phase 3. Because the level of free allocation received by the Carbon Fat Cats began to reduce due to the moving away from the optional National Allocation Plans of Phase 2 to centralized benchmarks in Phase 3. Moreover, manufacturing industries' free allowances amount will be limited by the cross-sectoral correction factor which regulates linearly decreasing proportion of free allowance allocation to the manufacturing industry from 80 per cent in 2013 to 30 percent in 2020 (European Commission, 2015d). However, surplus allowance is so huge in Carbon Fat Cats, they might not even feel the effect of this regulation until the beginning of phase 4. As Eikeland and Skjærseth (2013) submits the EU ETS has not yet been able to provide significant economic incentives for change

in energy-intensive industries as brought out in “carbon fat cats” case. Even the advantageous position of “Carbon Fat Cats” began to change with the beginning of phase 3, regulatory mechanism should establish policies for earlier and more sufficient impact to reduce allowances, send strong price signals to the market and therefore encourage companies to make innovative efforts to reduce their emissions to meet their targets. Therefore, additional regulations needed to be established for a sufficient ETS.

CHAPTER 5

A SCENARIO FOR THE FUTURE TURKISH EMISSON TRADING SYSTEM (TETS)

5.1 Panorama of Turkey

Turkey has a complex history about environmental issues in international area. When United Nations Framework Convention on Climate Change was accepted in 1992, Turkey was included in both Annex 1 and Annex 2 countries as a result of being an OECD member country. Annex 2 countries are developed countries while Annex 1 countries are formed of Annex 2 countries plus countries with economies in transition. However, Turkey was accepted as a country with economy in transition and was removed from Annex 2 countries due to its own application With Decision 26/CP.7 of the Seventh Conference of Parties (COP7) in Marrakesh in 2001 Marrakech COP7 Conference (Republic of Turkey Ministry of Environment and Urbanization, 2009, p. 2). If Turkey would remain as an Annex 2 country, it would have extra responsibilities such as providing financial resources to enable developing countries to undertake emissions reduction activities under the Convention and to help them adapt to adverse effects of climate change. In addition, they have to take all necessary actions to promote the development and transfer of environmentally friendly technologies to the countries with economies in transition parties (EITs in Annex-1) and developing countries (non-Annex-1 countries) (UNFCCC, 2015a). Considering funding provided by Annex II Parties is channeled mostly through the Convention's financial mechanism, Turkey got rid of an important responsibility in COP7. Currently, Turkey is only a member of Annex 1 country list in UNFCCC. However, it is exclusively exempted from emission reduction

obligations differently from other Annex 1 countries. After this progression, Turkey became a part to the UNFCCC in 2004 and signed Kyoto Protocol in 2009 (Republic of Turkey Ministry of Environment and Urbanization: Kyoto Protocol (Turkish), 2010). Because of not being a part of Kyoto Protocol when it was accepted, Turkey did not get any emission reduction obligation in the first (2008-2012) and second period (2013-2020) of the Kyoto Protocol.(Republic of Turkey Ministry of Environment and Urbanization: Kyoto Protocol (Turkish), 2010)

Considering the position of Turkey in terms of welfare based on Gross Domestic Product per capita, it has a relatively lower level in comparison to all Annex I Parties that have adopted greenhouse gas emission reduction targets within the framework of the Kyoto Protocol, even some of the Non Annex-1 countries with developing economies.

Turkey's energy consumption based construction and production sector oriented economic development is reflected to its environmental performance. Moreover, public requirements such as drinking water, urban transportation, housing, infrastructure, health and education has been increasing in direct relation with increasing population, migration and urbanization. All these factors causes increasing GHG emissions and related environmental pollution. Current situation is so critical that Turkey ranked last among all Kyoto Protocol Annex-1 countries with 133.44% GHG increase rate from the base year (1990) to the end of first commitment period (2012) (UNFCCC, 2015b) (see Figure 13). Also, CO_2 emissions per capita has increased 2.5 tons during this period while it was 3.4 tons in 1990 and 5.9 tons for the year 2012 (Turkstat, 2014).

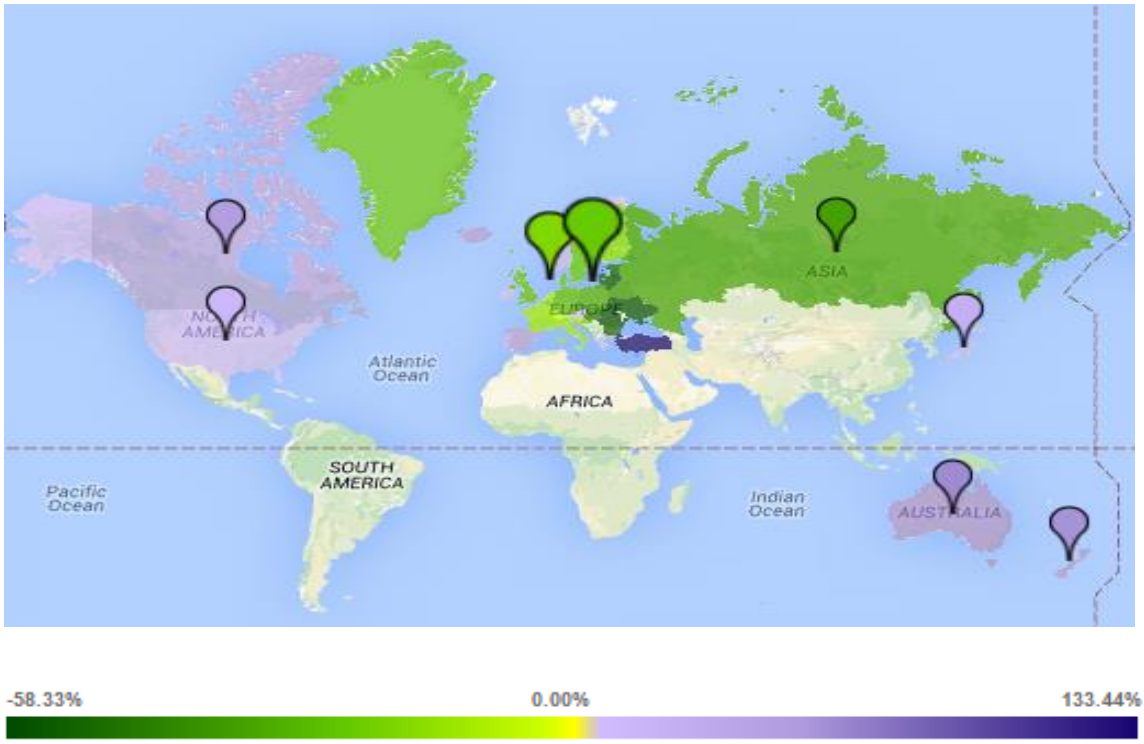

Figure 13. GHG reduction performance of Annex-1 countries in the end of Kyoto Protocol first commitment period in 2012 (base year: 1990, emissions and sinks from land use, land use change and forestry are not included.) (UNFCCC, 2015b)

Energy sector is the main reason for the 133% growth rate of Co2. Due to Turkstat, 70.2% of total GHG emissions derivate from energy production in 2012. Co2 emissions, the biggest proportion among the GHG emissions, was originated preponderantly from energy sector with 84.4% share in 2012 (Turkstat, 2014) (see Figure 14).

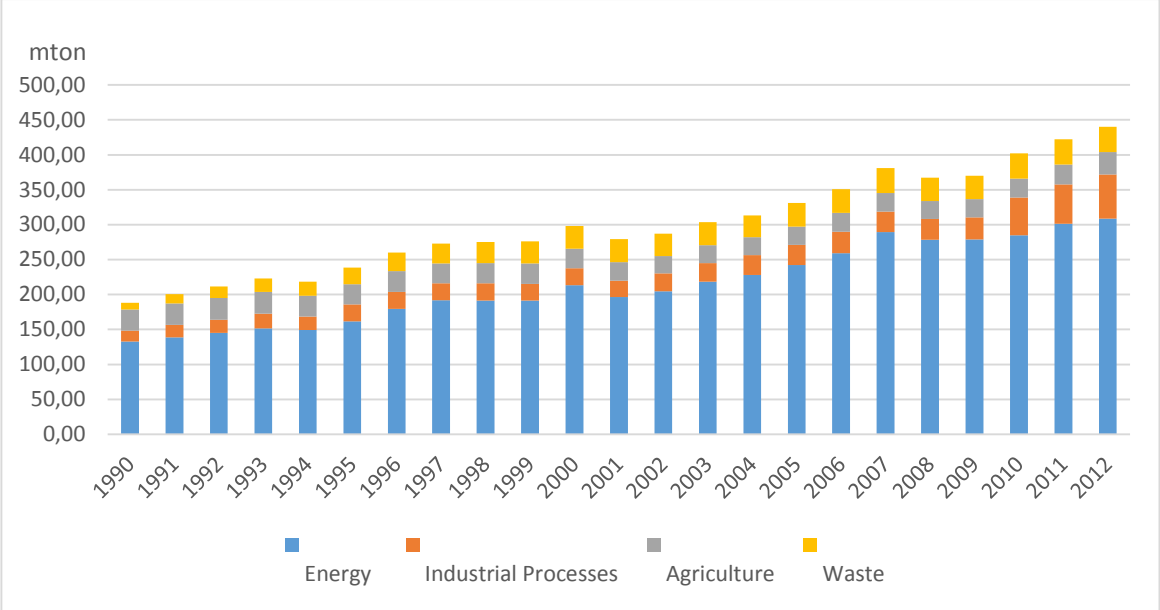

Figure 14. Greenhouse gas emissions by sectors (Co2 equivalent), 1990 – 2012 (Created by the author. Data source: http://www.turkstat.gov.tr, the emissions and sinks from land use, land use change and forestry are not included.)

5.2 "Carbon Fat Cats" scenario for Turkey

Establishment of emission trading system is proposed to implement a market-based and cost-efficient environment policy to Turkey. Increasing popularity and efficiency of emission trading schemes with Kyoto Protocol and European Union ETS as a policy for controlling and reducing greenhouse gas (GHG) mitigation is the major incentive on the proposition of the emission trading system. Moreover, EU ETS is accepted as the largest and the most advanced system among other emission trading systems. Because of this, success story of the system encourages other countries to implement similar emission trading systems and led create an incentive to integrate other schemes to the European system in a way of creating and be a part of larger and more effective system. Possibly, a unique global emission trading system will emerge from integration of regional/national

schemes. Therefore, Turkey might be the next country to establish its own emission trading system based upon the EU ETS. It is likely that Turkey would be harmonizing its ETS with that of the EU. In this situation, it would result in similar challenges as well in the light of carbon fat cats case considering the accession process of Turkey to the EU.

EU ETS is the most proper system to imitate in the process of establishing an emission trading system. However, even the most advanced ETS has major challenges as it is stated in the "Carbon Fat Cats" case. Turkey is likely to have its own Fat Cats. Turkish economy is mainly characterized by its dependency on carbon-intensive industries. Therefore, these industries are very powerful and the ability to influence policy makers in parallel with their own benefits. Besides, the economy had experienced a high increase in energy consumption in parallel with a high level of economic growth in the last decade (see Figure 15). Power sector, iron and steel industry, transportation sector and cement production became the major GHG emission sources in this uptrend. In parallel with increasing energy demand, consumption and GHG emissions, a power generation company (EÜAŞ), an iron and steel manufacturer company (Ereğli Demir ve Çelik), a refining company (Türkiye Petrol Rafinerileri A.Ş.) and an aviation company (Turkish Airlines) become prominent of being the most CO2 emitters (Sabuncu, 2012). Also, cement and chemicals industries shelter high emitter manufacturers even these sectors are relatively small compared to the biggest emitters. Also, the biggest companies in these sectors are extremely powerful in accordance with their emission levels, manufacturing capacities, contribution to economy and strong networking in bureaucracy (Some of those are even government controlled enterprises).

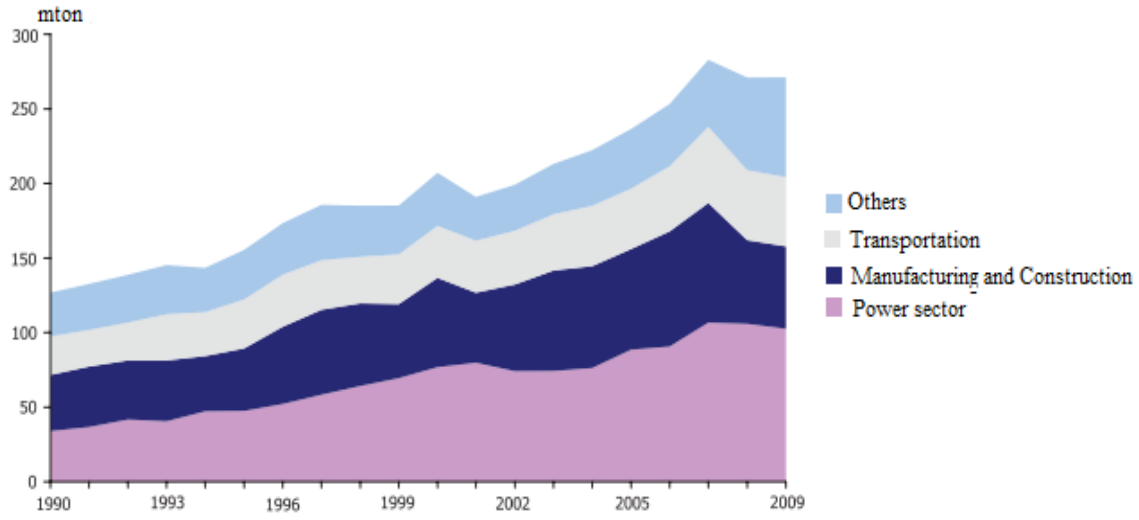

Figure 15. Co2 emissions in Turkey by sectors, 1990-2009 (Turkstat, 2011, p. 11)

The power of carbon-intensive industries is not seem to decrease in long term. Iron and steel industry aims to increase its export volume to 55 billion USD by the year of 2023 within the export targets of 100th anniversary of the Republic (Sabuncu, 2012, p. 11). The 5% iron and steel industry growth rate surpassed the GDP growth rate of 2.2% and became the 6th largest net exporter with 7.2 million tons in the world and second largest export share industry in Turkey in 2012 (Deloitte, 2013) (see Figure 16). According to the robust position in Turkey's export share, policy makers may not intend to burden carbon costs and iron and steel manufacturers may intend to use their power to get free allowances/take advantage of making windfall profits.

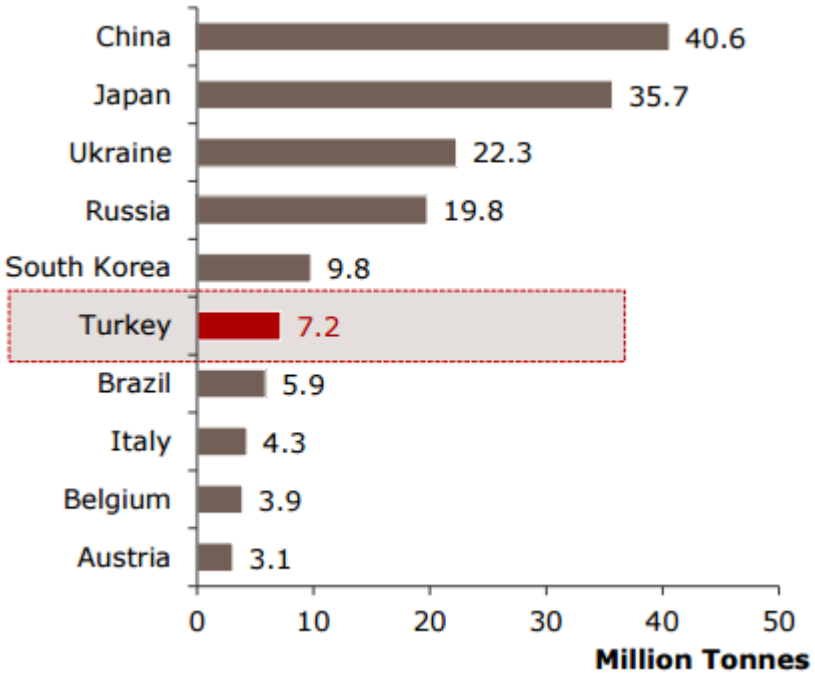

Figure 16. Net iron and steel exporter countries, 2012 (Deloitte, 2013)

Cement manufacturing is another important carbon-intensive industry just like steel and iron industry. Turkey ranked 6th among cement producer countries in the world with its cement output totaled 63.4 million tons in 2011 (Güzey, 2013). Since it is one of the most Co2 emitting industries, its environmental effect is quite negative. F. Özkan and Ö. Özkan (2012) indicates that the share of cement production in total CO2 emissions, which is on the order of 5% globally, is much higher at 8% in case of Turkey. The reason behind that cement production in Turkey is hugely influential on industrial production (Özkan & Özkan, 2012). For this reason, the industry has an important environmental burden. On the other hand, the industry may also burden a huge cost to producers. High energy costs create a competitive disadvantage for the sector, similar to any other energy intensive industry, especially against firms from countries where the energy costs are lower (Sabuncu, 2012). Therefore, a proper ETS might encourage

Turkish cement producers to invest in green technologies and remove or decrease the effect of high energy costs. Nevertheless, risk of being a Fat Cat is greater than probability of reducing costs by green investment. Industry's contribution to the export is not the unique importance of cement manufacturers. Since there is urban transformation all around Turkey, Turkey's Mass Housing Agency (TOKI) plans to build 500 thousand units between 2012 and 2022 with a mixture of urban transformation and new unit production (Bayar, 2013). Therefore, policy makers may not intend to burden carbon costs to cement producers in long term. Accordingly, cement producers may intend to use their power to get free allowances/take advantage of making windfall profits.

5.3 Discussion and recommendations

There is no emission trading system in Turkey. Since there is not any ETS established in Turkey, the policy recommendations proposed are based on assumptions deriving from the descriptive scenario provided for a possible Turkish fat cats case and for the challenges that are likely to be faced. This is the major limitation of this study. Further studies may focus on real effects of challenges to the fat cats if such a group of companies are formed under emission trading system in Turkey. As a result of projections and Turkey's ongoing process of integration to European Union, recommendations are based on establishing an ETS similar to the EU ETS in Turkey.

Considering the harmonization project of TETS (Turkish Emission Trading System) with the EU ETS, it would result in similar challenges as provided by the conceptual model. The recommended policies aim to overcome the challenges. So this

part provides a totally hypothetical environment. The recommendations are proposed upon the model developed for the construct of challenges (see Figure 17)

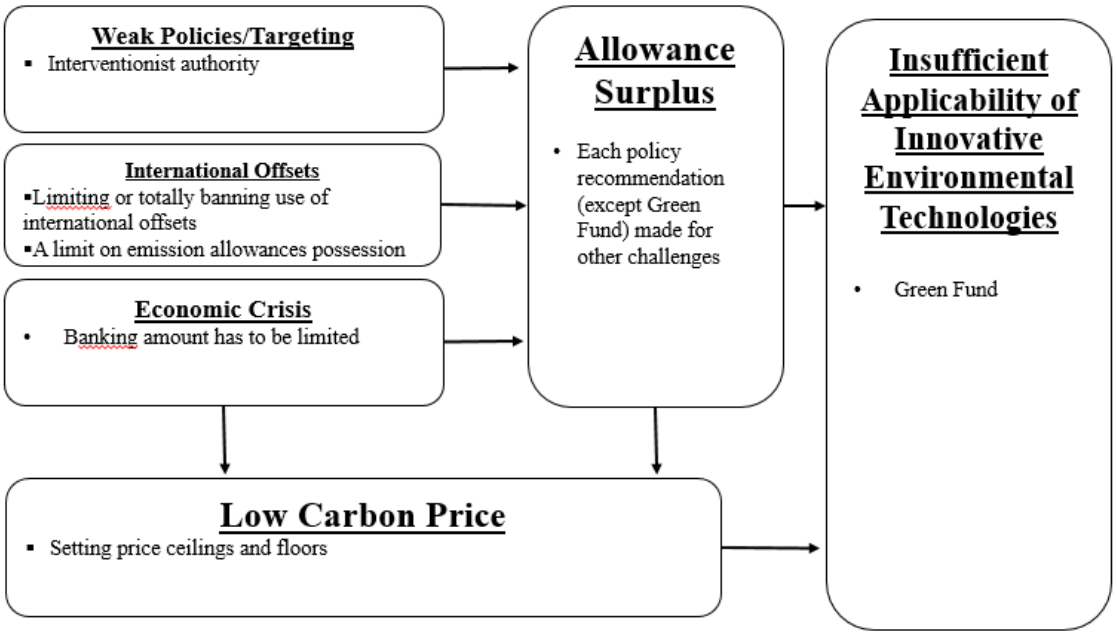

Figure 17. Policy recommendations proposed in line with the conceptual model based on a potential "Turkish Carbon Fat Cats" scenario (Created by the author)

In line with the EU ETS, Turkish system would also be implemented in several phases in order to give companies opportunities to experience the systems easily. Such a transitory application would encourage emitters to integrate their operations to the system. First phase is expected to be designed as an "experimental phase" which would allocate all allowances free. This experimental phase can be used to establish an operative monitoring mechanism for GHG emissions from each installation. Annual reporting of emissions must be submitted within three months from the end of a given compliance year to the Ministry of Environment and Urbanization. Emissions must be

verified by an impartial third-party verifier. This would provide strong statistics to make more policies in further phases. Also, strong statistics on GHG emissions provides tight monitoring of companies that have "Fat Cat" threat. Therefore, an early precautions system may be also initiated to prevent such companies to get advantage of windfall profits.

Afterwards, more controlled phases may be implemented in order to avoid similar challenges as experienced in EU'S Carbon Fat Cats. In this point, it is recommended to limit the flexibility. First of all, authority must be strong enough to interfere to the market when it is necessary in order to implement following recommended policies in order to limit flexibility. This is a crucial recommendation as it offers to establish a powerful and interventionist authority. However, it should be noted that the power injected to the actor should only be used for to develop an environment-interest-oriented agency working for sustainability and efficiency. So, the authority in question, should serve for the best-interest of a carbon free economy, neglecting the competitive urges generated by the global economy.

High level of flexibility may distort the system. Since the core challenge is allowance surplus, the most important measure must be taken against this. On the other hand, free allocation of allowances should continue to protect competitiveness and ease international trade burdens on industries and companies operating in the sectors that are considered energy-intensive and at the risk of carbon-leakage.

Emission reduction target must be considered in depth to hinder the similar challenges with the EU ETS. There is a need to manage the volatility of the system.

Participants that emitted less than the given caps are allowed to sell to the other participants that emit in excess of their caps. Nevertheless, companies should not buy limitless allowances or use international offsets. This may work for the benefit of big companies, creating both a competitive and legal burden on small ones. There needs to be a limit on emission allowances possession to prevent allowances surplus problem. However, companies may still have huge number of allowance surpluses in times of economic crisis. Therefore, banking amount has to be limited. Since companies may not be able to use or bank surpluses allowances they may not intend to buy anymore.

The last proposal against allowance surplus may be limiting or totally banning the use of international offsets until the system begins to give strong price signal. This may hinder energy-intensive sectors' intention to take advantage of it. In case that the prices remain low and surplus allowance problem sustain, setting price ceilings and floors may also be considered as the last step to be taken. These strong price signals to the market may encourage emitters to meet their emission reduction targets by applying innovative environmental technologies.

Besides providing a strong price signal to the market, there is also a direct policy formulation to attract innovation in order to reduce emissions. TETS should primarily offer installations to meet their cap over green innovation before trading permits. If they reduce their emissions by reducing carbon intensity of their production, a reward mechanism put into use to encourage more green technologies to develop. Government can give tax and financial incentives to innovative companies. A "Green Fund" may be established to finance these incentives given to the innovative companies. This fund's purpose would be to support emission reduction based innovative facilities. However,

government support needed to be financed this fund at the beginning since all of the allowances will be given for free. Later, profits from allowance auctions, emissions exchanges and trading commission will combine to raise this fund in further phases.

CHAPTER 6

CONCLUSION

European Union Emission Trading System (EU ETS) is accepted as the largest and the most advanced system of the world. However discussions about effectiveness of the EU ETS show that even the most advanced emission trading system faces major challenges. This thesis explores the challenges of the EU ETS by employing a conceptual model developed through the findings gathered from literature and EU reports and policy papers. It is seen that even though the main characteristics of the system namely emission reduction orientation, cost-effectiveness and flexibility are somehow gathered in the EU system, it does not promise an optimum market structure. It creates its own grey areas which are open to torts and abuses by the largest emitters. The thesis uses the conceptual model to analyze the challenges in a milestone case. Carbon Fat Cats Case of Sandbag is a reference case showing the vulnerability of EU ETS. Based on the expectancies that a Turkish ETS would be very similar to the one in the EU, the thesis employs the conceptual model for a Turkish scenario of carbon fat cats.

In the framework of such a scenario, this study recommends an interventionist approach implement offering limiting the use of international offsets to eliminate negative effect of international offset credits; putting a limit on emission allowances possession to eliminate companies to have windfall profits; limiting banking amount to protect the system in case of an economic crisis; setting price ceilings and floors to give a strong price signal to the market if it is necessary and establishing a “Green Fund” to to support emission reduction based innovative facilities inside a reward system that may include also tax and financial incentives.

The policy recommendations proposed are based on assumptions and projections since there is not an emission trading system in Turkey. This is the major limitation of this study. Further studies may focus on real effects of challenges to the fat cats if such a group of companies are formed under emission trading system in Turkey.

REFERENCES

Adolf, C. (2012, October 18). *European Commission Climate Action* . Retrieved February 5, 2015, from http://ec.europa.eu/clima/consultations/docs/0016/organisation/green_budget_en.pdf

Aghion, P., Veugelers, R., & Serre, C. (2009). *Cold Start for The Green Innovation Machine.* Brussels: Bruegel.

Aldy, J. E., & Stavins, R. N. (2012). The promise and problems of pricing carbon: theory and experience. *The Journal of Environment and Development, 21*(2), 152-180.

Balat M., Balat C., Öz H. (2009, June 25). Applications of Carbon Dioxide Capture and Storage Technologies in Reducing Emissions from Fossil-fired Power Plants. *Energy Sources, Part A: Recovery,Utilization, and Environmental Effects*, pp. 1473-1486. doi: 10.1080/15567030802093138

Barde, J. P. (1994). *Economic Instruments in Environmental Policy: Lessons from The OECD Experience and Their Relevance to Developing Economies.* OECD.

Baxter, P., & Jack, S. (2008). *Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers.* Where The World Learns Qualitative Research. Retrieved from http://nsuworks.nova.edu/tqr/vol13/iss4/2

Bayar, L. (2013). *Turkish Cement: No Real Joy Before 2014.* İstanbul: HSBC Yatirim Menkul Degerler A.S.

Boom, J.-T. B., & Svendsen, G. T. (2000, December). The Political Economy of International Emissions Trading Scheme Choice: A Theoretical Analysis. *Journal of Institutional and Theoretical Economics (JITE) / Zeitschrift für die gesamte, 156*(4), pp. 548-566. Retrieved May 7, 2015, from http://www.jstor.org/stable/40752231

Borghesi, S., Cainelli, G., & Mazzanti, M. (2015). Linking emission trading to environmental innovation: Evidence from the Italian manufacturing industry. *Research Policy, 44*, 669-683.

British Petroleum (BP). (2014). *BP Statistical Review of World Energy.* Retrieved May 16, 2015, from British Petroleum: http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf.

Brohe, A., Eyre, N., & Howarth, N. (2009). *Carbon Markets: An International Business Guide.* London: Earthscan.

Bruyn, S. D., Markowska, A., Jong, F. D., & Bles, M. (2010, May 17). *Does The Energy Intensive Industry Obtain Windfall Profits Through The EU ETS?* Delft: CE Delft.

Cambridge Econometrics. (2009). *An Impact Assessment of the Current Economic Downturn on UK CO2 Emissions: A final report for the Committee on Climate Change.* London: The Committee on Climate Change.

Carbon Market Watch. (2014). *What's needed to fix the EU's carbon market.* Retrieved April 9, 2015, from Carbon Market Watch: http://carbonmarketwatch.org/wp-content/uploads/2014/07/ETS-POLICY-BRIEF-JULY-2014_final_1.pdf

Carbon Market Watch. (2015). (Carbon Market Watch) Retrieved April 9, 2015, from Offsetting in the EU: http://carbonmarketwatch.org/category/eu-climate-policy/offsetting-in-the-eu/

Carrington, D. (2013, February 14). *Carbon fat cats are killing the emissions trading mouse*. Retrieved May 16, 2015, from The Guardian: http://www.theguardian.com/environment/damian-carrington-blog/2013/feb/14/carbon-emissions-carbon-tax

CDC Climat Research. (2014). *The EU ETS Market Stability Reserve: a debate on its effectiveness.* CDC Climat Research.

CEMBUREAU. (2009, January). *CEMBUREAU highlights issue of carbon leakage*. Retrieved June 15, 2015, from The European Cement Association (CEMBUREAU): http://www.cembureau.be/newsroom/article/cembureau-highlights-issue-carbon-leakage

Christmann, P. (2000). Effects of "best practices" of environmental management on cost advantage: Role of complementary assets. *Academy of Management Journal, 43*(4), 663-680.

Cuellar-Franca, R. M., & Azapagic, A. (2014, December 19). Carbon capture, storage and utilisation technologies: A critical analysis and comparison of their life cycle environmental impacts. *Journal of CO2 Utilization*, pp. 82-102.

Davis, S. J., Peters, G. P., & Calderia, K. (2011). The Supply Chain of Co2 Emissions. *Proceedings of the National Academy of Sciences of the United States of America, 108*(45), 18554-18559.

De Jong, C., & Walet, K. (2004). *A Guide to Emissions Trading: Risk Management and Business Implications.* London: Risk Books.

de Perthuis, C., & Trotignon, R. (2013). *Governance of CO2 Markets: Lessons from the EU ETS.* Climate Economics Chair Working Paper, Paris.

Declercq B., Delarue E., D'haeseleer W. (2010). *Impact of the Economic Recession on the European Power Sector's CO2 Emissions*, TME Working Paper, Leuven.

Deloitte. (2013). *The Iron and Steel Industry in Turkey.* Retrieved June 15, 2015, from Investment Support and Promotion Agency of Turkey: http://www.invest.gov.tr/en-US/infocenter/publications/Documents/IRON-STEEL-INDUSTRY.pdf

Denzin, N. K., & Lincoln, Y. S. (2013). *Strategies of Qualitative Inquiry.*Thousand Oaks, CA: Sage Publishing.

Dijkstra, B. R. (1999). *The Political Economy Of Environmental Policy: A Public Choice Approach to Market Instruments.* Cheltenham: Edward Elgar Publishing.

Dirix, J., Peeters, W., & Sterckx, S. (2015). Is the EU ETS a Just Climate Policy? *New Political Economy*. 23 pp. doi:10.1080/13563467.2014.999758

Dudek, D. J., Margolis, J., Xiaolu, Z., Hanling, Y., & Hu, Q. (2014). *Emissions Trading and Institutional Innovation: Lessons Learned From China's Carbon Trading Pilots.* Beijing: China Council for International Cooperation on Environment and Development.

Eiadat, Y., Kelly, A., Roche, F., & Eyadat, H. (2008). Green and competitive? An empirical test of the mediating role of environmental innovation strategy. *Journal of World Business, 43*, 131-145.

Eikeland, P. O., & Skjærseth, J. B. (2013). *Corporate Responses to EU Emissions Trading: Resistance, Innovation or Responsibility?* Surrey: Ashgate Publishing.

Energy and Environmental Management. (2011, June 21). *News: Huhne leads battle in Europe against 'carbon fat cats'*. Retrieved June 12, 2015, from Energy and Environmental Management: http://www.eaem.co.uk/news/huhne-leads-battle-europe-against-carbon-fat-cats

Energy Market Regulatory Authority. (2013). *2013 Annual Report.* Ankara: Republic of Turkey Energy Market Regulatory Authority.

Eti Maden. (2015). Retrieved April 7, 2015, from General Information About Boron: http://en.etimaden.gov.tr/about-boron-62s.htm

European Commission. (2003, April). *Climate Action: European Climate Change Programme*. Retrieved May 31, 2015, from http://ec.europa.eu/clima/policies/eccp/index_en.htm

European Commission. (2013). *The EU Emissions Trading System (EU ETS).*Luxembourg: European Union Publications Office. doi:10.2834/55480

European Commission. (2014a). *Climate Action: 2030 framework for climate and energy policies*. Retrieved May 30, 2015, from http://ec.europa.eu/clima/policies/2030/index_en.htm

European Commission. (2014b). Report from The Commission to the European Parliament and the Council: *Progress Towards Achieving the Kyoto and EU 2020 Objectives.*Brussels: European Commission.

European Commission. (2014c). *Proposal for a Decision of The European Parliament and of The Council: Concerning the establishment and operation of a market stability reserve for the Union gas emission trading scheme and amending Directive 2003/87/EC.* Brussels: European Commission.

European Commission. (2015a). *Climate Action: 2050 roadmap: A sectoral perspective*. Retrieved May 31, 2015, from http://ec.europa.eu/clima/policies/roadmap/perspective/index_en.htm

European Commission. (2015b). *Climate Action: The 2020 climate and energy package*. Retrieved May 30, 2015, from http://ec.europa.eu/clima/policies/package/index_en.htm

European Commission. (2015c). *Climate Action: Structural reform of the European carbon market.*Retrieved April 8, 2015, from http://ec.europa.eu/clima/policies/ets/reform/index_en.htm

European Commission (2015d). *Free allocation based on benchmarks*. Retrieved May 28, 2015, from Climate Action: http://ec.europa.eu/clima/policies/ets/cap/allocation/index_en.htm

European Commission. (2015e, March 26). (European Commission Climate Act) Retrieved April 9, 2015, from EU Greenhouse Gas Emissions and Targets: http://ec.europa.eu/clima/policies/g-gas/index_en.htm

European Commission.(2011a). *Climate Action: EU ETS 2005-2012.* Retrieved April 8, 2015, from http://ec.europa.eu/clima/policies/ets/pre2013/index_en.htm

European Commission.(2011b). *Climate Action: Effort Sharing Decision.* Retrieved April 8, 2015, from http://ec.europa.eu/clima/policies/effort/index_en.htm

European Council, T. E. (2003). *Directive 2003/87/EC of The European Parliament and of the Council.*Brussels: European Commission.

Fankhauser, S., Hepburn, C., & Park, J. (2010). *Combining multiple climate policy instruments: how not to do it.* Retrieved April 6, 2015, from Climate Change Economics: http://www.cccep.ac.uk/Publications/Working-papers/Papers/40-49/WP48_climate-policy-instruments_Feb11.pdf.

Fogarty, J., & Michael, M. (2010, January 6). Health and Safety Risks of Carbon Capture and Storage. *The Journal of the American Medical Association, 303*, pp. 67-68.

Gagelmann, F., & Frondel, M. (2005). TheImpactofEmissionTradingonInnovation–. *EuropeanEnvironment, 15*(4), 203–211.

Garb, Y., Pulver, S., & VanDeveer, S. D. (2008). Scenarios in society, society in scenarios: toward a social scientific analysis of storyline-driven environmental modeling. *Environmental Research Letters, 3*, 1-8.

Ghauri, P., & Grønhaug, K. (2002). *Research Methods in Business Studies : A Practical Guide (2nd edition).* London: FT Prentice Hall Europe.

Giddens, Anthony. (2013). *İklim Değişikliği Siyaseti.* Ankara: Phoenix Yayınevi.

Gilgun, J. F. (1994). A case for case studies in social work research. *Social Work, 39,* 371-380.

Global CCS Institute. (2015). Retrieved April 6, 2015, from http://www.globalccsinstitute.com/projects/large-scale-ccs-projects

Global CCS Institute: CCS around the world. (2014, November 28). Retrieved April 25, 2015, from http://www.globalccsinstitute.com/sites/www.globalccsinstitute.com/files/content/page/119748/files/Status%20of%20CCS%20Project%20Database%20-%20New%20Version_0.xls

Goulder, L. H., & Schein, A. E. (2013). Carbon Taxes versus Cap and Trade: A Critical Review. *Climate Change Economics, 4*(3), 1-28. doi:10.1142/S2010007813500103

Greenpeace. (2011). *Energy Intensive Industries: why Setting CO2 Targets to 2050 Is Unrealistic.* Greenpeace. RetrievedFebruary12, 2015, from http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2011%20pubs/5/CO2UnreallisticMarch11.pdf

Greeuw, S. C. (2000). *Cloudy Crystal Balls: An assessment of recent European and global scenario studies and models.* Copenhagen: European Environment Agency.

Grosjean, G., Acworth, W., Flachsland, C., & Marschinski, R. (2014). *After Monetary Policy, Climate Policy: Is Delegation the Key to EU ETS Reform?* MCC Working Paper.

Güzey, G. (2013). *The Turkish Perspective.*İstanbul: Turkish Exporters Assembly.

Haszeldine, R. S. (2009). Carbon Capture and Storage: How Green Can Black Be? *Science 25, 325*(5948), pp. 1647-1652. doi:10.1126/science.1172246

He, Y., Wang, L., & Wang, J. (2012). Cap-and-trade vs. carbon taxes: A quantitative comparison from a generation expansion planning perspective. *Computers & Industrial Engineering*(63), 708-716.

Hintermann, B. (2010). Allowance Price Drivers in the First Phase of the EU ETS. *Journal of Environmental Economics and Management 59*, pp. 43-56.

Hoffman, V. (2007). EU ETS and Investment Decisions: The Case of the German Electricity Industry. *European Management Journal, 25*(6), 464-474.

IEA. (2014). *World Energy Outlook 2014.*Paris: IEA Publications.

IEA:*Greenhouse Gas R&D Programme.* (2015a). *CCS Resources: Co2 Pipelines.* Retrieved February 22, 2015, from http://ieaghg.org/

IEA:*Global energy-related emissions of carbon dioxide stalled in 2014*. (2015b). Retrieved April 22, 2015, from http://www.iea.org/newsroomandevents/news/2015/march/global-energy-related-emissions-of-carbon-dioxide-stalled-in-2014.html

IETA. (2015a). *Emissions Trading*. Retrieved May 24, 2015, from http://www.ieta.org/emissions-trading

IETA. (2015b). *Why Emissions Trading is More Effective Than a Carbon Tax*. Retrieved May 31, 2015, from http://www.ieta.org/index.php%3Foption%3Dcom_content%26view%3Darticle%26id%3D207:why-emissions-trading-is-more-effective-than-a-carbon-tax%26catid%3D54:3-minute-briefing%26Itemid%3D135

IETA. (2015c, March). *Benefits of Emissions Trading.* Retrieved May 31, 2015, from https://ieta.memberclicks.net/assets/OTF/101s/benefits-for-emissions-trading-101-mar15.pdf

IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the.* Geneva: IPCC.

Karakış, E. (2014). *Turkey Annual Energy Statistics Report 2013.* Ankara: Republic of Turkey Ministry of Energy and Natural Resources.

Karimi, F., & Khalilpour, R. (2015, February 1). Evolution of carbon capture and storage research: Trends of international collaborations and knowledge maps. *International Journal of Greenhouse Gas Control*, pp. 362-376.

Kenber, M., Haugen, O., & Cobb, M. (2009). *The Effects of EU Climate Legislation on Business Competiveness.* GMF Climate and Energy Paper Series 09, Washington DC.

Keohane, N. O. (2009). Cap and Trade, Rehabilitated: Using Tradable Permits to Control U.S. Greenhouse Gases. *Review of Environmental Economics and Policy, 3*(1), 42-62.

Koch, N., Fuss, S., Grosjean, G., & Edenhofer, O. (2014). Causes of the EU ETS Price Drop: Recession, CDM, Renewable Policies or a bit of Everyting? - New Evidence. *Energy Policy 73*, pp. 676-685.

Kutney, G. (2014). *Carbon Politics and the Failure of The Kyoto Protocol.* Oxon: Routledge.

Labatt, S., & White, R. R. (2007). *Carbon Finance: The Financial Implications of Climate Change.* Haboken, NJ: John Wiley & Sons, Inc.

Laing, T., Sato, M., Grubb, M., & Claudia, C. (2013). *Assessing the effectiveness of the EU Emission Trading System.* Centre for Climate Change Economics and Policy & Grantham Research Institute on Climate Change and the Environment.

Löfgren, A., Wrake, M., Hagberg, T., & Roth, S. (2013). *The Effect of EU-ETS on Swedish Industry's Investment in Carbon Mitigating Technologies.* Gothenburg: School of Business, Economics and Law at University of Gothenburg.

Luo, L., & Tang, Q. (2014). Carbon tax, corporate carbon profile and financial return. *Pacific Accounting Review, 26*(3), 351-373.

Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded source book (second edition).* Thousand Oaks, CA: Sage Publishing.

Neuhoff, K. (2011). *Carbon Pricing for Low-Carbon Investment: Executive Summary.* Climate Policy Initiative and Climate Strategies.

Neuhoff, K., Schopp, A., Boyd, R., Stelmakh, K., & Vasa, A. (2012). Banking of Surplus Emissions Allowances: Does the Volume Matter? *DIW Discussion Papers, 1193*, 1-21.

Newell, R., W.A., P., & Raimi, D. (2012). *Carbon Markets: Past, Present, and Future.* Washngton, DC: Resources For The Future.

Nussbaumer, P. (2007). Working of Carbon Market. *Economic & Political Weekly, 42*, 3081-3085.

OECD. (2015). *Patents by technology: Patents in environment-related technologies*. Retrieved May 8, 2015, from OECD Stat Extracts: http://stats.oecd.org/index.aspx?queryid=29068

Özkan, F., & Özkan, Ö. (2012). An Analysiz of Co2 Emissions of Turkish Industries and Energy Sector. *Regional and Sectoral Economic Studies*, *12*(2), 65-85.

PBL Netherlands Environmental Assessment Agency; European Commission Joint Research Centre. (2014). *Trends in Global Co2 Emissions 2014 Report.*Den Haag

Petsonk, A., & Cozijnsen, J. (2007). *Harvesting the Low Carbon Cornucopia: How the European Union Emissions Trading System (EU ETS) Is Spurring Innovation and Scoring Results.*Washington DC: Environmental Defense Fund

Reinaud, J., & Philibert, C. (2007). *Emissions Trading: Trends and Prospects.* Paris: International Energy Agency.

Rennings, K., Ziegler, A., Ankele, K., & Hoffmann, E. (2006). The influence of different characteristics of the EU environmental management and auditing scheme on technical environmental innovations and economic performance. *Ecological Economics, 57*, 45-59.

Republic of Turkey Ministry of Energy and Natural Resources. (2014). *2015-2019 Strategic Plan.* Ankara: Acar Basım ve Cilt Sanayi.

Republic of Turkey Ministry of Energy and Natural Resources. (2015a). Retrieved April 20, 2015, from http://www.enerji.gov.tr/en-US/Mainpage

Republic of Turkey Ministry of Energy and Natural Resources. (2015b). Retrieved March 20, 2015, from Coal: http://www.enerji.gov.tr/tr-TR/Sayfalar/Komur

Republic of Turkey Ministry of Environment and Urbanization. (2009). *Republic of Turkey Climate Change Strategy 2010-2023.* Retrieved March 20, 2015, from Ministry of Environment and Urbanization: http://www.csb.gov.tr/db/iklim/editordosya/iklim_degisikligi_stratejisi_EN.pdf

Republic of Turkey Ministry of Environment and Urbanization. (2015). *UNFCCC and Turkey's Position (Turkish)*. Retrieved April 19, 2015, from http://www.csb.gov.tr/projeler/iklim/index.php?Sayfa=sayfa&Tur=webmenu&Id=12442

Republic of Turkey Ministry of Environment and Urbanization: Kyoto Protocol (Turkish). (2010). Retrieved April 18, 2015, from http://iklim.cob.gov.tr/iklim/AnaSayfa/Kyoto.aspx?sflang=tr

Rogge, K. S., & Volker, H. (2010). The impact of the EU ETS on the sectoral innovation system for power generation technologies – Findings for Germany. *Energy Policy, 38*, 7639-7652.

Sabuncu, T. B. (2012). *Opportunities and Risks for CO2 Intense Sectors in Turkey.* İstanbul: Sabancı University.

Sandbag & Bund. (2013). *Der Klimagoldesel 2013: Carbon Fatcat Companies in Germany.* Retrieved June 15, 2015, from Sandbag: https://sandbag.org.uk/site_media/pdfs/reports/Klimagoldesel2013_English_1.pdf.

Sandbag. (2011a). *Buckle Up! Tighten the cap and avoid the carbon crash The 2011 Environmental.* Retrieved June 15, 2015, from Sandbag: https://sandbag.org.uk/site_media/pdfs/reports/Sandbag_2011-07_buckleup.pdf

Sandbag. (2011b). *Carbon Fat Cats 2011: The companies profiting from the EU Emission Trading Scheme.* Retrieved June 16, 2015, from Sandbag: https://sandbag.org.uk/site_media/pdfs/reports/Sandbag_2011-06_fatcats.pdf.

Sandbag. (2011c). What is emissions trading? Guardian News and Media Limited. Retrieved June 16, 2015, from http://www.theguardian.com/environment/2011/jul/05/what-is-emissions-trading

Sandbag. (2014a). *About: Not quite...* Retrieved June 15, 2015, from Sandbag: http://www.sandbag.org.uk/notquite/

Sandbag. (2014b). *Slaying the dragon: Vanquish the surplus and rescue the ETS.* Retrieved June 15, 2015, from Sandbag: https://sandbag.org.uk/site_media/pdfs/reports/Sandbag-ETS2014-SlayingTheDragon.pdf

Sanden, B. A., & Azar, C. (2005). Near-term technology policy for long-term climate targets - economy wide versus technology specific approaches. *Energy Policy, 33*(12), 1557-1576. doi:10.1016/j.enpol.2004.01.012

Scharlemann, J. P., & Laurance, W. F. (2008, January 4). How Green Are Biofuels. *Environmental Science,* pp. 43-44.

Schmidt, T. S., Schneider, M., Rogge, K. S., Schuetz, M. J., & Hoffmann, V. H. (2012). The effects of climate policy on the rate and direction of innovation: A survey of the EU ETS and the electricity sector. *Environmental Innovation and Societal Transitions, 2*, 23-48.

Sijm, J., Neuhoff, K., & Chen, Y. (2006). CO2 cost pass-through and windfall profits in the power sector. *Climate Policy, 6*(1), 49-72.

Stake, R. E. (1995). *The Art of Case Study Research.*Thousand Oaks, CA:Sage Publications.

Talberg, A., & Swoboda, K. (2013). *Emissions trading schemes around the world.* Parliament of Australia Department of Parliamentary Services.

The Greens. (2011, March 06). *Publications.* Retrieved May 14, 2015 from The Greens: http://www.greens-efa.eu/documents/67-publications.html

Tietenberg, T., Grubb, M., Michaelowa, A., Swift, B., & Zhang, Z. (1999). *International Rules for Greenhouse Gas Emission Trading: Defining the principles, modalities, rules and guidelines for verification, reporting and accountability.*New York & Geneva: United States.

Tripathy, M. R. (2009). Case Methodology in Teaching & Research: A Critical Review. *Indian Journal of Industrial Relations, 44*(4), 660-671.

Turkstat. (2014). *Greenhouse Gas Emissions Inventory, 2012*. Retrieved January 9, 2015, from http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=16174

Turkstat. (2011). *National GHG Inventory Report: 1990*2009 (Turkish).* Ankara: Turkstat Publishing.

U.S. Energy Information Administration. (2013, February 14). Retrieved December 2, 2014, from Carbon Dioxide Emissions Coefficients: http://199.36.140.204/environment/emissions/Co2_vol_mass.cfm

UK Department of Energy & Climate Change. (2015, May 8). *2010 to 2015 government policy: low carbon technologies.* UK Department of Energy & Climate Change. Retrieved May 8, 2015, from https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/carbon-capture-and-storage-ccs

UNFCCC. (2015a). Retrieved April 14, 2015, from Parties&Observers: http://unfccc.int/parties_and_observers/items/2704.php

UNFCCC. (2015b). Retrieved February 19, 2015, from UNFCCC: Global Map-Annex 1: http://maps.unfccc.int/di/map/

UNFCCC. (2015c). *International Emissions Trading*. Retrieved May 24, 2015, from http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php

UNFCCC. (2015d). *The Mechanisms under the Kyoto Protocol:Emissions Trading, the Clean Development Mechanism and Joint Implementation*. Retrieved May 14, 2015, from UNFCCC: http://unfccc.int/kyoto_protocol/mechanisms/items/1673.php

United Kingdom Department of Energy & Climate Change (DECC). (2014). *DECC Fossil Fuel Price Projections.* London: DECC.

United Kingdom Government. (2014, October 20). Retrieved April 8, 2015, from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/364992/UK_MSR_position_gov.uk.pdf

United Nations. (1992). *Report of The United Nations Conference on Environment and Development: Rio Declaration on Environment and Development.* Rio de Janerio: United Nations.

United Nations. (1998). *Kyoto Protocol to the United Nations Framework Convention on Climate Change.*United Nations.

US Environmental Protection Agency. (2015a). *Cap and trade.* Retrieved May 24, 2015, from http://www.epa.gov/captrade/documents/ctessentials.pdf

US Environmental Protection Agency. (2015b). *Cap and Trade*. Retrieved May 31, 2015, from http://www.epa.gov/captrade/

Van den Bergh, K., Delarue, E., & D'haeseleer, W. (2013). Impact of renewables deployment on the CO2 price and the CO2 emissions in the European electricity sector. *Energy Policy, 63*, 1021-1031.

Wara, M. (2007, February 7). Is the global carbon market working? *Nature, 445*, pp. 595-596.

Weigt, H., Ellerman, A., & Delarue, E. (2013). CO2 abatement from renewables in the German electricity sector: does a CO2 price help? *Energy Economics, 40*, 149-158.

Weyant, J., & Hill, J. (1999). The Costs of the Kyoto Protocol: A Multi-Model Evaluation, Introduction and Overview. *The Energy Journal*.

Yin, R. K. (2003). Case Study Research: Design and Methods (3rd edition). Thousand Oaks, CA: Sage Publishing.

Zakeri, A., Dehghanian, F., Fahimnia, B., & Sarkis, J. (2015). Carbon pricing versus emissions trading: A supply chain planning perspective. *International Journal of Production Economics, 164*, 197-205.