Tomas Bata University in Zlín
Faculty of Management and Economics

Doctoral Thesis

A Design of Pilot Emission Trading Scheme for Turkey under Evolution of Global Climate Regime

Schéma pilotního systému obchodování s emisními povolenkami pro Turecko v rámci vývoje globálního klimatického režimu

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ABSTRACT

A decade long climate negotiations under global climate regime since signature of Kyoto Protocol could not achieve to prolong the protocol on world scale for the second commitment of Kyoto Protocol. Contrary, the result has been limited both on scale of target and inclusiveness which triggered an evolution of climate regime towards more localization and interpretation of individual countries.

Although Turkey is listed under Annex I of the UNFCCC which means having responsibilities in emissions and expected to have ambitious target to reduce it, she has avoided having liabilities to reduce emission under Kyoto Protocol based on argumentation of being a developing country. However, the world climate policies are evolving from global perspective to more local reactions. It is now expected, regardless of development level, that all countries take steps to reduce emissions.

Under consideration of evolution of global climate regimes and stand point of the Turkey in it, the PhD work focuses on the question of *what is the best way for Turkey to introduce an emission trading scheme in her own economy and benefit from it?* The PhD thesis at hand is first of its kind in proposing for design of pilot emission trading scheme in Turkey which covers the fossil fuel energy generation in the period of 2016 to 2020. The objective of the thesis is manifold as a design of pilot emission trade scheme in fossil fuel electricity sector based on the pillars of emission intensity of electricity sector, auctioning of allowances through benchmarking of fossil fuel types of electricity generation and linking carbon market with emission trading scheme for cost effective emission reduction method.

Key Words: Emission trading scheme in Turkey, benchmarking, emission intensity of energy use, global climate regime ,voluntary carbon market

ABSTRAKT

Desetiletí trvající jednání o klimatu v rámci globálního klimatického režimu od podpisu Kjótského protokolu, kterým by se protokol ve světovém měřítku prodloužil na druhé období, nevedla k cíli; naopak, výsledek byl omezen jak z hlediska cíle, tak z hlediska účasti, což vyvolalo evoluci klimatického režimu směrem k lokalizaci a interpretaci jednotlivých zemí.

I když je Turecko uvedeno v příloze I UNFCCC, což znamená, že má odpovědnost za emise a že se očekává, že má ambiciózní cíl emise snížit, země odmítla se k povinnosti snížit emise podle Kjótského protokolu přihlásit s argumentací, že je rozvojovou zemí. Ovšem politika v oblasti klimatu ve světě se vyvíjí od globální perspektivy ke spíše lokálním reakcím. Nyní se očekává, že všechny země podniknou kroky ke snížení emisí bez ohledu na to, do jaké míry jsou rozvinuté.

S uvážením vývoje globálně klimatických režimů a stanoviska Turecka v tomto směru se tato doktorská práce zaměřuje na otázku, *jaká cesta je pro Turecko nejvhodnější při zavádění emisních povolenek do jeho národního hospodářství a jak z nich může stát mít prospěch.* Disertace je první svého druhu, kde se navrhuje schéma pilotního projektu emisních povolenek v Turecku, týkající se výroby elektřiny z fosilních paliv v období let 2016 – 2020. Cíl disertace je vícečetný – jedná se o schéma pilotního systému emisních povolenek v energetice fosilních paliv na základě pilířů emisní intenzity energetického odvětví, aukcí povolenek cestou benchmarkingu fosilních typů výroby elektřiny a provázání trhu s uhlíkem se systémem emisních povolenek za účelem dosažení finančně efektivní metody snížení emisí.

Klíčová slova: systém emisních povolenek v Turecku, benchmarking, intenzita emisí v energetice, globální klimatický režim, dobrovolný trh s uhlíkem

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LIST OF ABBREVIATIONS

AAU	Assigned Allowances Unit
CER	Certified Emission Reduction
CDM	Clean Development Mechanism
COP	Conference of the Parties
EC	European Commission
EIA	US Energy Information Administration
EIT	Economies in Transition
EMRA	Energy Market Regulatory Authority
ERU	Emission Reduction Unit
ETS	Emission Trading Scheme
EU-ETS	European Union Emission Trading System
GHG	Greenhouses Gas
GS	Gold Standard
IEA	International Energy Agency
ICAP	International Carbon Action Partnership
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
OECD	Organization for Economic Cooperation and Development
MENR	Ministry of Energy and Natural Resources
MEU	Ministry of Environment and Urbanization
NCCAP	National Climate Change Action Plan
PPM	Particular per million
TEIAS	Turkish Electricity Transmission Company
TURKSTAT	Turkish Statistical Institute
TBMM	Turkish National Assembly
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

VCS	Verified Carbon Standard
VER	Verified Emission Reduction
WEO	World Energy Outlook
RGGI	Regional Greenhouse Gas Initiatives

EXTENDED ABSTRACT

The establishment of United Nations Framework Convention on Climate Change (UNFCCC) in 1992 by leading countries of the world was a response to the trend of increasing rate of carbon emissions which cause negative impact on global climate [1];[2];[3]. As the foundation of UNFCCC, the binding feature of Kyoto Protocol and implementation of the protocol by the parties showed a characteristic of global climate regime, the conference of the parties (COP 15) in Copenhagen in 2009 could not sustain the feature of global climate regime and contrary to the expectation, no global treat could have been achieved [4]; [5]; [6]; [7]; [8]; [9]. That was the turning point of the hopes to sunk for global climate regime. While withdrawal of Canada and silence of Japan, Russia and Australia on commitment for second period of Kyoto Protocol gave a clear signal of evolution of global climate regime at Conference of the Parties in Doha, Kyoto Protocol was extended for the second commitment period on the shoulder of European Union making it more a regional climate scheme [10].

Being an important tool to internalize negative externality of carbon emissions, today, on worldwide there are seven functioning emission trading schemes and seven more is under consideration to be implemented [11]. The evolution of climate regime towards more localization has been an opportunity for some countries like Turkey to catch up with the others in regards of formation of emission trading scheme internally.

Under consideration of evolution of global climate regimes, the PhD dissertation researches a model of emission trading scheme for Turkey that can be applied in a sectoral base. While the position of Turkey under global climate regime was inappropriate and inconsistent with her development level, Turkey never accepted to be considered as developed country and has not declare any target both under UNFCCC and Kyoto Protocol yet [12]; [110]. However, as global climate regime is evolving towards more localized reactions, developing and developed countries turns inside to commoditize emission within their economies. China has been one of the first developing countries that moved towards implementing pilot emission trading scheme which can be considered for Turkey as a sample to follow [13].

Being first of its kind in offering a proposal for design to set up emission trading scheme in Turkey for a period from 2016 to 2020, the PhD dissertation aims to understand *the best way for Turkey to introduce an emission trading scheme in her own economy and benefit from it.* The question formulized in this thesis focuses on the climate policy of Turkey to price the carbon emissions and establish an emission trading scheme. Therefore, this thesis will analyze the evolution of global climate regime towards localized reaction and the situation of Turkey by means of climate-related data with aim to propose an appropriate approach for emission trading scheme for Turkey to reduce emissions.

In order to analyze the outlined question and reach the objectives of the thesis, the methodological approach used is quantitative which relies on the methodological tool of UNFCCC used to define benchmarks and the approach of Kaya Identity that sets a formulation of emission related to four indicators such as population, gross domestic product (GDP) per capita, energy intensity of GDP, and emission intensity of energy use [14];[29].

Being first research on the issue of evolution of global climate change and emission trading scheme in Turkey, the findings and consequently contributions of PhD work at hand are as follows:

1. Emission intensity of energy production in Turkey is high compared other developed and developing countries which is proposed as an emission reduction target.
2. Differentiated benchmarks are defined for each fossil fuel type by the help of methodological tool of UNFCCC. The benchmarks defined reflects emission intensity of energy production by each fossil type, thus they are expressing an average value for the first year of the period which is reduced by a linear decreasing rate of 5 percent by each year.
3. The setting of benchmarks forces installations above the defined benchmark to reduce emission by offsetting activities that creates national carbon market under emission trading scheme.
4. Besides benchmarking, the method of auctioning of allowances is introduced after the first year of free allocation of allowances. The aim of introducing auctioning is to price carbon emission gradually by the method of a linear increasing trend of 2.5 percent each year after first year. The method of auctioning has shown that emission trading scheme generates income for state and operationalize national carbon market.

The doctoral work opens a new gate for discussion on emission trading scheme in Turkey by introducing emission intensity of energy production as a reduction target with benchmarking and auctioning of allowances as tool to achieve this. Consequently, the PhD research introduces the topic for further academic works in the field of environmental economics by introducing emission trading scheme for the first time in Turkey with a target of pricing the carbon emissions, creating income for the state and linking the carbon market with the scheme.

ROZŠÍŘENÝ ABSTRAKT

Ratifikace Rámcové úmluvy OSN o změně klimatu (UNFCCC) předními státy světa v roce 1992 byla reakcí na trend zvyšující se rychlosti emisí oxidu uhelnatého s nepříznivým dopadem na globální klima [1];[2];[3]. Základem ratifikace UNFCCC bylo to, že závazný parametr Kjótského protokolu a implementace protokolu smluvními stranami vykazovaly charakteristiku globálního klimatického režimu, přičemž konference smluvních stran (COP 15) v Kodani v roce 2009 nebyla schopna udržet charakteristiku globálního klimatického režimu a oproti očekáváním nebylo možné dosáhnout žádné globální nápravy [4]; [5]; [6]; [7]; [8]; [9]. To bylo bodem zvratu z hlediska nadějí na pokrytí globálního klimatického režimu. Zatímco vystoupení Kanady a mlčení ze strany Japonska, Ruska a Austrálie vzhledem k závazkům pro druhé období Kjótského protokolu daly jasný signál o vývoji režimu globálního klimatu na konferenci stran úmluvy v Doha, Kjótský protokol byl pro druhé závazné období rozšířen na ramena Evropské unie, což z protokolu učinilo regionálnější klimatické schéma [10].

Jako důležitý nástroj internalizace negativní externality uhlíkových emisí existuje dnes v celosvětovém měřítku sedm funkčních systémů obchodu s emisemi a zavedení sedmi dalších se zvažuje [11]. Vývoj klimatického režimu směrem k větší lokalizaci je příležitostí pro některé země, jako je např. Turecko, srovnat krok s ostatními z hlediska interního vytvoření systému obchodování s emisemi.

Při uvážení vývoje globálních klimatických režimů zkoumá tato doktorská disertační práce model systému obchodování s emisemi pro Turecko, který by mohl být aplikován na bázi průmyslových odvětví. Zatímco pozice Turecka v globálním klimatickém režimu byla nepřiměřená a neodpovídala úrovni jeho rozvoje, Turecko nikdy neakceptovalo, aby bylo považováno za rozvinutou zemi, a dosud nedeklarovalo žádný cíl ani z hlediska úmluvy UNFCCC, ani z hlediska Kjótského protokolu [12]; [110]. Ovšem s tím, jak se globální klimatický režim vyvíjí směrem k lokálnějším reakcím, rozvojové a rozvinuté země se otáčí směrem dovnitř k obchodování s emisemi ve svých vlastních ekonomikách. Čína byla jednou z prvních rozvojových zemí, která se posouvá směrem k zavedení pilotního systému obchodování s emisemi, což může být považováno jako příklad k následování i pro Turecko [13].

Jelikož je tato doktorská disertační práce první svého druhu z hlediska nabídky návrhu uspořádání systému obchodování s emisemi v Turecku pro období 2016 až 2020, zaměřuje se na pochopení *nejlepší cesty pro Turecko při zavádění systému obchodování s emisemi ve vlastní ekonomice a při využívání této skutečnosti*. Otázka formulovaná v této disertační práci se zaměřuje na klimatickou politiku Turecka při stanovování ceny emisí a zavádění systému obchodování s emisemi. Proto tato disertační práce analyzuje vývoj globálního klimatického režimu směrem k lokalizované reakci a situaci Turecka pomocí údajů souvisejících s klimatem s cílem navržení vhodného přístupu k systému obchodování s emisemi pro Turecko za účelem snížení emisí.

Za účelem analyzování nastolené otázky a dosažení cílů této disertační práce je použitý metodický přístup přístupem kvantitativním, který je založen na metodickém nástroji UNFCCC používaném pro definování srovnávacích úrovní, a na přístupu Kayovy rovnosti, která stanoví formulaci emise vzhledem ke čtyřem ukazatelům, kterými jsou počet obyvatel, hrubý domácí produkt (HDP) na hlavu, energetická náročnost HDP a emisní náročnost využívání energie [14]; [29]. Jelikož jde o první výzkum problematiky vývoje globální změny klimatu a systému obchodování s emisemi v Turecku, zjištění a v důsledku toho přínosy předkládané doktorské práce jsou následující:

1. Emisní náročnost výroby energie v Turecku je vysoká ve srovnání s jinými rozvinutými a rozvojovými zeměmi, a navrhuje se proto jako cíl ke snížení emisí.
2. Pro každý typ fosilního paliva jsou pomocí metodického nástroje UNFCCC definována různá srovnávací kritéria. Definovaná srovnávací kritéria odrážejí emisní náročnost výroby energie podle každého typu fosilního paliva a vyjadřují tedy průměrnou hodnotu za první rok období, která se každý rok snižuje lineární rychlostí 5 procent.
3. Stanovení srovnávacích kritérií nutí instalace překračující definované srovnávací kritérium ke snížení emisí navržením aktivit vytvářejících národní uhlíkový trh pod systémem obchodování s emisemi.
4. Kromě srovnávacích kritérií se po prvním roce zavádí metoda aukčního obchodování s emisními povolenkami přidělením emisních povolenek zdarma. Cílem zavedení aukčního obchodování je postupné stanovení ceny uhlíkových emisí metodou lineárního zvyšování o 2,5 % každý rok po prvním roce. Tato metoda aukčního obchodování ukázala, že systém obchodování s emisemi vytváří příjem pro stát a umožňuje provoz národního trhu s uhlíkovými emisemi.

Tato doktorská disertační práce otevírá novou bránu pro diskutování systému obchodování s emisemi v Turecku tím, že představuje emisní náročnost výroby energie jako cíl snižování s porovnáváním a aukčním prodejem povolenek jako nástrojem k dosažení tohoto cíle. V důsledku toho předkládá tento doktorský výzkum námět pro další akademické práce v oblasti environmentálních ekonomik prvním zavedením prvního systému obchodování s emisemi pro Turecko s cílem stanovení ceny uhlíkových emisí, vytvoření příjmu pro stát a svázání trhu s uhlíkovými emisemi s tímto systémem.

INTRODUCTION

Global climate is changing due to human induced greenhouse gas (GHG) emissions. With the raise of industrial society, GHG emissions has increased rapidly causing greenhouse impact in the atmosphere that has a negative result on the Earth’s temperature [1]. The sentence below gives a clear picture of the observation and analysis done by Intergovernmental Panel on Climate Change (IPCC), [15]:

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level".

It was the only in the beginning of 1990s that the leading countries of the world came together to respond the trend of increasing rate of emissions [4]. Although the negotiation of climate change started in 1992 in Rio de Janeiro by foundation of United Nations Framework Convention on Climate Change (UNFCCC) [3], the result came out as a protocol assigning caps and giving responsibility of reducing emissions to developed countries [4]. As the last two decades has witnessed severe political and economical discussion on climate change and carbon emission related issues, all attempts through international discussion and negotiation has been on how to reduce emissions on a global scale. Kyoto Protocol, derived from UNFCCC, defines the role of reducing emission for developed world and the way of reducing emission [4]. Climate change negotiations, under Kyoto Protocol, offered a market-based solution to stop accumulation of GHG in the atmosphere based upon the idea of commoditization of emissions and exchange of these commodities under a regulated market [4].

The aim materialized under Kyoto Protocol was to reduce greenhouses gases concentration in the atmosphere in a cost effective manner. The philosophy of climate change negotiations relies on creating a cost of emitting of GHG, i.e. commoditizing carbon emissions and creating a tradable good [11]. The way of reducing emission came out as a solid market in 2005 based on exchanging emission rights by first phase of European Union Emission Trading Scheme (EU-ETS). Although carbon markets has reached to a considerable amount of carbon credits exchanged by market mechanisms of the first period of Kyoto Protocol, having the aim of promoting reductions of greenhouse gas emissions in a ‘cost-effective and economically efficient manner’, global carbon market has always been under serious consideration regarding burden sharing between developed and developing world [16]; [17].

The foundation of UNFCCC and binding feature of Kyoto Protocol showed a characteristic of global climate regime [5]. Moreover, Fischer [6] claims that it is implementation and enforcement of domestic laws that success or failure of the regime be judged. Although, Kyoto Protocol is signed in 1997, it was only possible to be operative after signature of Russia which made the emission of the parties of the Protocol more than half of the world total (Cirman, 2009). By the end of first commitment period of Kyoto Protocol, the number of the Annex I parties reached 192 which made the UNFCCC process and Kyoto Protocol one of the largest international treaty. Additionally, it was participation of extensive number of scientific institutions and NGO in to the process of climate change negotiations that strengthened the process of the regime [6]; [8].

At the conference of the parties (COP15) in Copenhagen, where all parties were hoping for a global agreement on emission reduction targets under a global climate regime, the conference could not realize a global deal [9]. What was the reason behind the failure of Copenhagen to reach a global climate deal? This was the turning point of the hopes to look somewhere else for the solution and new approaches. While global climate negotiations, which had started in Rio 1992 and continued with different stops such as Kyoto and Bali, failed to provide a global climate regime. The result have been towards more local policy approaches aiming to commoditize carbon emission and internalize the external effect of carbon emission [9].

Although Figueres and Ivanova [18] claim that “Climate change is one of the first truly global environmental challenges” based on the publicity of atmosphere as a good, the result of all years negotiations between national governments failed to provide a global solution. I will not define Kyoto process as a failure as many do but as a “shift/evolution” from global context to national level. National economical demands especially from developing countries are not identical to the demands from developed world and from island states. The differentiated standpoints was also a turning point for global carbon market to become localized and regionalized. Today, on worldwide there eight functioning emission trading schemes, two decided to be implemented in some years and five is under consideration to be implemented [11]. EU ETS is one of the successful of these local and regional policy approaches by taking the lead with its structure and the target [19]. However, EU ETS is also evolving from a global form to more regionalized one which is a counter reaction to the failure of the global climate regime [20].

Under such kind of developments and weaknesses of global climate regime, the Conference of Parties of UNFCCC gathered in Doha in 2012 for 18^{th} time to discuss for the future of Kyoto Protocol to limit global warming with 2 Celsius; however, it was clear from conference of parties in Copenhagen in 2009 that there would not be an international agreement for a second commitment period under Kyoto Protocol [9]. By withdrawal of Canada from Kyoto Protocol in 2012 and Japan's, Russia's and Australia's silence on commitment for second period of the protocol gave a clear signal of failure in global climate regime at Conference of the Parties in Doha [10]. The decision in Durban COP 17 was works on climate regime should continue under Durban Platform for Enhanced Action of UNFCCC for a global treaty where, regardless of developed and developing world, all countries take serious actions in 2015 that will be applied after 2020 [21]. The development on global climate regime has evolved as wished by Turkey where division between developed and developing countries will almost disappear by 2015. But a new development was that all countries expected to have contribution to emission reduction commitments regardless of development stage of the country as agreed in Durban COP 17 [21].

The position of Turkey under global climate regime has been under special circumstances and problematic, that is why the new situation of global climate regime which defines new roles under "common but differentiated responsibilities" is more appropriate for Turkey to take a better position [22]. Turkey was considered as a developed country under UNFCCC regime listed in both Annex I and Annex II [3]. The attempts of Turkey to be deleted from Annex II country list, which had emission reduction targets, resulted in success for Turkey in the Marrakesh, and Turkey was put in a place different than countries listed in Annex I [23]. Even though becoming a party of UNFCCC in 2004 and Kyoto Protocol in 2009, Turkey never accepted to be considered as developed country and still listed in Annex I of the UNFCCC [3]; [110]. Thus, Turkey has not declared any target both under UNFCCC and under Kyoto Protocol yet. The argumentation of Turkey is based on emission per capita which has been lower rate comparing the mean of OECD and world [24]. Consequently, Turkey has believed to be a developing country in sense of emission characteristics. The discussion stand point of Turkey is acceptable to some extent, however, the rest of world, as they do, expect Turkey to take some steps in regards of climate change more than business as usual. While global climate regime is evolving towards more local actions, developing and developed countries turns inside to commoditize emission within the economy. China has been one of the first developing countries that moved towards implementing pilot emission trading scheme which can be considered for Turkey as a sample to follow [13].

This PhD work is the first of its kind in offering a proposal for design to set up emission trading scheme in Turkey for a period from 2016 to 2020. The aim of the thesis is to provide policy makers a sample case of establishment and implementation of emission trading scheme by introducing cap setting through emission intensity of energy use, benchmarking and allocation of allowances.

The question formulized in this dissertation focuses on the climate policy of Turkey to price the carbon emissions and establish an emission trading scheme. *What is the best way for Turkey to introduce an emission trading scheme in its own economy and benefit from that?* The question is responded by defining the situation of Turkey by means of climate-related data showing that emission intensity could be one of the best point that Turkey can focus on to reduce emissions. The approach is based on Kaya Identity that set a formulation of emission related to four indicators such as population, gross domestic product (GDP) per capita, energy intensity of GDP, and emission intensity of energy use [14]. Although some developed and developing countries have already declared emission targets in relation to emission intensity of GDP, it is argued that a reduction in emission intensity of energy use is more appropriate for Turkey [25]; [26].

The first chapter of the thesis outlines the framework of the main problem that the thesis handle to provide solution. While the first two sub-chapters provide an analysis for the driving forces behind the "shift" from global climate regime to more localized ones. The main problem that PhD work focuses on described in the third sub-chapter of the first chapter as Turkey does not have a climate change policy under evolution of climate regimes [3]; [27]; [28]. Based on this finding, the thesis approach to handle this problem by providing a design of pilot emission trading scheme for Turkey.

The second and third chapter of the thesis focuses on formulization of the question and hypotheses that PhD work analyzes and provide solutions. The main research question of this doctoral thesis is *what is the best approach for Turkey to introduce an emission trading scheme in her economy and benefit from it?* The question of the thesis based on the problem defined in the first chapter. While the objectives of the thesis are also described under the second chapter, the third chapter go in details of the processing method to handle the problem and reach the objective of the thesis. As methodology used to process the problem and provide solution is composed of quantitative method, the methodology of UNFCCC and Kaya Identity is used to analyze the data and define the benchmark for different fuel type of the fossil fuel energy production.

The fourth chapter of the thesis is based on the experiences of developed and developing countries in applying emission trading scheme. As the EU ETS is one of the first emission trading scheme in the world and operated under Kyoto Protocol, the lessons that can be learned from EU will be presented in the first sub-chapter of fourth chapter. Then, China, as being one of the first developing countries having an attempt to establish pilot emission trading scheme (ETS), the second part of chapter fourth of the thesis will focus on the experiences of China in regards of different benchmarking and caps comparing with other parts of the world. The question raised here is that how Turkey can benefit from other ETS being established. In this sense, the intensity target of China has been an inspiration while analyzing emission intensity target of energy use for possible pilot scheme in Turkey.

While the sixth chapter presents results of the thesis for academic and practice by defining the benchmark to cap the emission from fossil fuel based energy sector and allocation of allowances to limit the level of emissions, chapter five focuses on the framework and policy approaches which suits best for Turkey. Thus, a cap for emission reduction in the energy sector is defined from "bottom-top " approach. For design of possible pilot scheme in Turkey, fossil fuel based energy generation is chosen due to having best available data and being less open to international competition. While definition of the policy approaches for emission reduction possibility in Turkey relies on Kaya Identity, the methodological tool of UNFCC is followed to define the benchmark in fossil fuel energy sector [29]. As the benchmark provides a method to reduce emission by introducing allocation of allowances, second part of the chapter focuses on the method of application of benchmark for allocation of allowances and emission reduction which can be linked with voluntary carbon market.

The last chapter of the dissertation provides a short analysis on the steps that have been taken so far by state of Turkey in sense of institutional framework needed for operation of emission trading scheme and provide an analysis on the ground of the question whether Turkey is ready for the ETS. The contributions of the dissertation to science, education and practice are presented also in this chapter.

The PhD research, all in all, tries to open a gate for further academic works by introducing emission trading scheme as a result of shift from global climate regimes. The special work is done on policy stand of Turkey in regards of climate regimes. In that regards, the thesis at hand is first of its kind in proposing a pilot design of emission trading scheme for Turkey.

CHAPTER 1. GLOBAL CLIMATE REGIMES

CO_2 emissions concentration in the atmosphere being around 280 particular per million (ppm) in pre-industrial revolution has risen from 310 (ppm) in 1960s to 390 ppm by 2010 according to the observation done at Mauna Loa Observatory where is the plots of the longest continuous record of atmospheric carbon dioxide [1]; [30]. The trend of rising emission concentration in the atmosphere is seen in *Figure 1* clearly, which is caused by human domination of the ecosystem through industrial revolution based on extensive usage of fossil fuels [31]. Vitousek [31] calculated concentration of emission by 30 percent in 1997 since the beginning of industrial revolution; however, today the increase shows 40 percent since the beginning of industrial revolution, which is an evidence for the increase in the rate of concentration of carbon dioxide in the atmosphere.

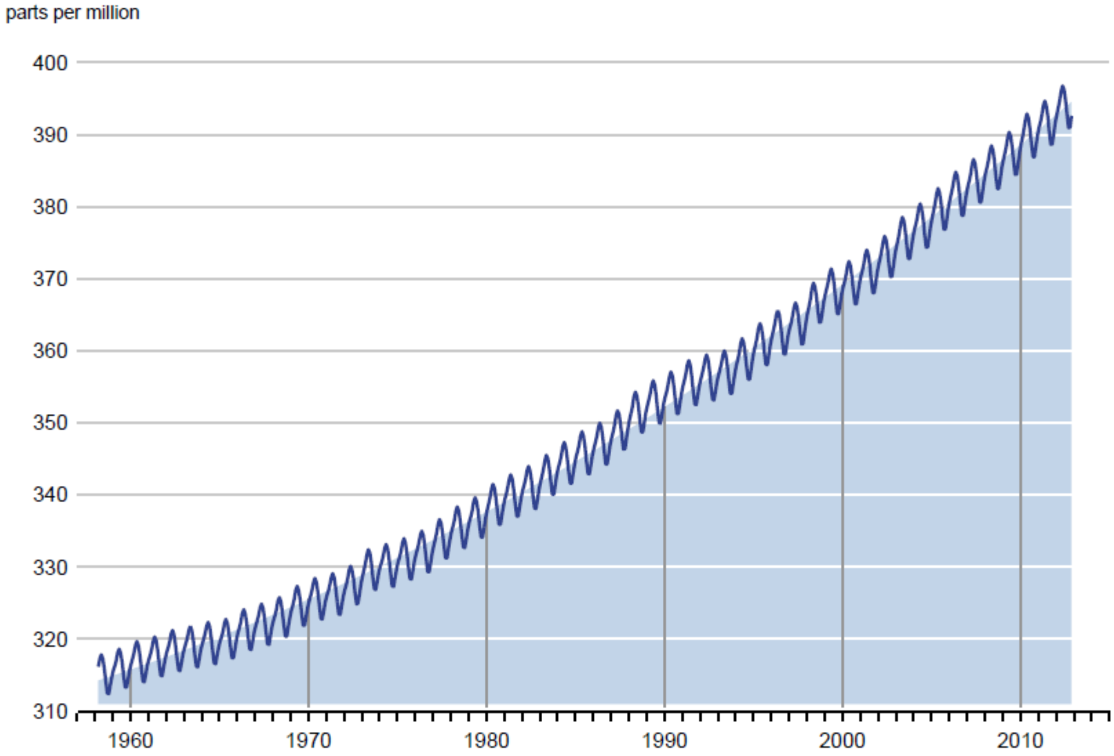

Figure 1: Monthly carbon dioxide concentration, Manua Loa Record [32]

According to OECD environmental outlook 2050, without any change of the way of economic development happens, the world is on a path for a rise in global temperature of up to 6°C, with catastrophic consequences for our climate [32]. To avoid the most severe weather and sea-level rise and limit the temperature increase to 2°C approximately, the greenhouse-gas concentration needs to be stabilized at around 450 ppm CO_2-equivalent, which is hard to achieve [33]. In the OECD's 450 Scenario, global energy-related CO_2 emissions need to peak just before 2020 at 30.9 gigatonnes (Gt) and decline thereafter to 39 Gt by 2050 (OECD, 2008). The 450 ppm target is achievable – but very challenging. It has to take into account different and various combinations of approaches such as cap-and-trade systems, sectoral agreements and national measures, with countries subject to common but differentiated responsibilities.

GHGs have roughly doubled since the early 1970s, and with current policies of development paths, they are subject to rise over 70% during 2010-2050 [35]; [34]. Historically, GHG emissions were predominantly from the developed countries of the OECD; therefore, the rise in GHG concentration from the industrial revolution to this day is largely accounted by economic activity in these countries. However, today, the picture is changing as it can be easily seen from ***Figure 2***, the share of developing countries is rising rapidly. Without new policies and shift to low carbon economic development, a catastrophic end will possibly welcome our children at the end of the century.

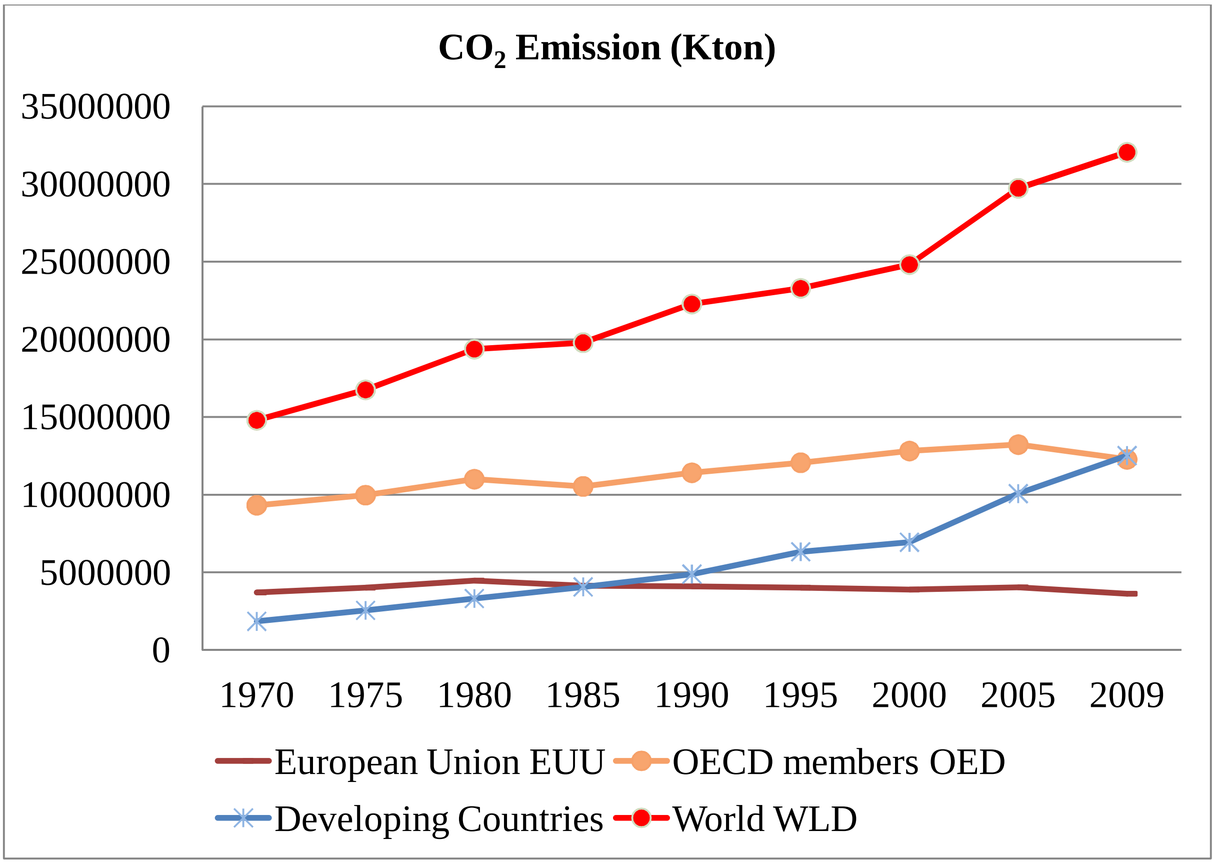

Figure 2: Share of GHG emissions by OECD, Developing Countries and The World [35]

Intergovernmental Panel on Climate Change, which receives contributions of several thousands of scientists, released a Summary for Policy Makers of its fourth Assessment Report concerning the Science of Climate Change [15]. The report concluded that: "Global GHG emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004 [...]Global atmospheric concentrations of CO_2, methane (CH_4) and nitrous oxide (N_2O) have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years[...] Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. It is likely that there has been significant anthropogenic warming over the past 50 years averaged over each continent". The reports prepared by IPCC have pointed out human responsibility in such a threat. Emissions of greenhouse gases are seen as cost-free and unrestricted while nobody owns the atmosphere. However, external cost of economics has been creating huge burden over human being and the economies, which has to be shared by everybody.

The increasing trend of global carbon dioxide emission which is scientifically evident gives a clear signal for politicians to act to reduce the rate increase of emission. However, even though the discussion on emission control started in early 1990s, today we still do not have a global comprehensive agreement to reduce or stabilize the carbon emission in the atmosphere. It is partly because of the atmosphere being global public good without a global climate governance. The first sub-chapter of this chapter focuses on the failure of global climate governance from global carbon market perspective. The magnitude of carbon market, the coverage of emission reduction targets and price development in the market are signaling for a failure and cause decrease of confidence in global carbon market to tackle with the issue of climate change. The second sub-chapter goes beyond the market and focuses on political economy of the countries not to bind themselves under a global treaty to reduce emissions. Development level of the countries is one of barriers for ambitious targets regarding climate change commitments. The last sub-chapter provides an analysis for climate policies in Turkey under global climate regime which is the forming part of question of the thesis. Under formation and evolution of global climate regimes, what was status of Turkey and how can be it be improved? The problem of climate policy in Turkey will provide a road map for main question of this PhD work.

1.1 Why not a Global Carbon Market: What was Missing?

United Nations Framework Convention on Climate Change is formed in June 1992, in Rio de Janeiro as a reaction to increasing concentration of carbon dioxide emissions in the atmosphere [3]. UNFCCC is further strengthened by legally binding Kyoto Protocol in 1997 which assigned emission reduction cap to developed countries [4]. Carbon dioxide emissions as externality of economies reached a level that necessitated global reaction to global problem. This sub-chapter provides a view over global climate action under UNFCCC and Kyoto Protocol that formed legal pillars of global climate regime. The analyses in the sub-chapter will be through the magnitude and price development of carbon market.

In a perfect competitive market, the demand price fully reflects the value of the goods produced, and the supply price fully reflects the value of goods not produced. At the equilibrium, which the demand price is equal to supply price, reflects the market price where the efficiency is achieved. For an analytical understanding, when markets are working well the price (P) of any good or service will equal both the marginal cost (MC) and the marginal benefit (MB) or marginal social benefit of that product [36].

Equation 1

$$P = MC = MB$$

However, the cost of using public goods may not be well reflected on who is using it. While climate (atmosphere) is public good, the cost of emitting GHG cannot be well reflected on the emitter, because of this reason climate change turns to be an economic externality for whole society. Public goods are commodities that are used by public, and the cost of extending the service to an additional individual is zero [37]. In common with many other environmental problems, human-induced climate change is at its most basic level an externality. Those who produce greenhouse-gas emissions are bringing about climate change, thereby imposing costs on the world and on future generations, but they do not face directly, neither via markets nor in other ways, the full consequences of the costs of their actions. That is to say, the features of non-rivalry and non-excludability apply to climate protection under the global climate regime [38]. This is the reason why climate issues should be treated globally or if possible, even under a global climate regime.

According to Stern [37], many economic activities involve in the emission of greenhouse gases, but they do not face the cost. The full costs of GHG emissions, in terms of climate change, are not immediately borne by the emitter, so they face little or no economic incentive to reduce emissions. Similarly, emitters do not have to compensate those who lose out because of climate change. In this sense, human induced climate change is an externality, one that is not ‘corrected’ through any institution or market, unless policy intervenes.

When a negative externality exists in an unregulated market, producers don't take responsibility for external costs that exist which are passed on to society. Thus producers have lower marginal costs than they would otherwise have and the supply curve is effectively shifted down (to the right) of the supply curve that society faces. Because the supply curve is increased more of the product is bought than the efficient amount which is, too much of the product is produced and sold. Since marginal benefit is not equal to marginal cost, a deadweight welfare loss results. In a situation where negative external effects exist the market allocation of resources will not be efficient.

One of the most common examples of negative externalities is the emissions of particular substances as a result of the industrial production processes across companies which pollute the air or cause other environmental problems thus precipitating costs that need to be covered by other people. The problem of global warming and climate change as a result of industrialization is one most challenging issues that earth faces. Negative externality of market namely carbon emission has increased volume of carbon significantly which in turn causes changes of climate. Moreover, the companies and industries are not held accountable for the cost of climate change. The individual state is unable to totally eradicate pollution and its main objective is reduced to directing the market towards seeking of a solution for the level of pollution that is effective from a public perspective by application of the respective tools [39].

UNFCCC was first crucial step towards forming in global climate in order to protect the climate system against the effects of greenhouse gases [3]. Currently, the numbers of United Nations Framework Convention on Climate Change ratifies has increased to 194 Parties (193 States and 1 regional economic integration organization) [40].

The Kyoto Protocol was the legal form behind the architecture of global carbon market to the issue of global climate issue which assigned developed countries with a cap of emissions and provided financial mechanism called as Clean Development Mechanism (CDM) for a tool to handle the cap in a more cost effective manner [5] ; [4]. The perception of developed and developing countries derives from United Nations Framework Convention on Climate Change (UNFCCC) which divides countries under Annex I to those that are developed and responsible for emissions and non-Annex I to those that are developing and need of financial and capacity building for reducing emission reductions [3]. The countries listed in Annex I of the convention committed to limit their greenhouse gases emissions to base year of 1990 level on a voluntary basis [3]. Being based on voluntary participation and commitment to reduce emissions, the specific economic and political sanction of such commitments of the Convention remained invalid.

To avoid the effects of GHG on climate much stricter agreement between countries regarding liabilities to the convention was needed. In this sense, the efforts towards binding commitments were realized under the Kyoto Protocol in December 1997 [4]. According to the protocol, the Annex I countries defined in the Convention agreed to reduce their gaseous emissions by 5.2% relative to 1990 levels over the period 2008–2012 [4]. After being ratified by the Russian Parliament on 16 February 2005, the Kyoto Protocol enacted as the first agreement bringing limitations to emissions and requiring a timetable for realization of the reductions. Before the end of first commitment period of Kyoto Protocol, the number of parties to the protocol reached to 192 and the total percentage of emissions of Annex I parties were more than half of total global emissions [7].

The main issue under the Kyoto Protocol, contained in Article 3, demands countries listed in Annex I to ensure that its total emissions from GHG sources over the commitment period do not exceed its allowable level of emissions [4]. The allowable level of emissions under the protocol is called the party's assigned amount and each party has emission reduction target listed under Annex B of the protocol, which is set relatively to its emission of GHGs amount in the base year [4]. The emission target in Annex B of the protocol and the party's emissions of GHGs in the base year determines the party's initial assigned amount unit (AAUs) for the Kyoto Protocol's five-year first commitment period(2008 – 2012) [41]. Each AAU represents an allowance to emit one metric tonne of carbon dioxide equivalent (t CO_2eq) to the parties of the protocol. Thus, emitting rights were created under Kyoto Protocol which could be traded between parties under emission trading mechanism. Under the first period of Kyoto Protocol, the countries that had to reduce emission and the targets and calculated assigned amount units are given below. The first column in the Table 1 shows the targets of the parties under annex B of the Kyoto Protocol while second column is for assigned amount of allowances based on the emission of target and emission data of 1990 which is calculated and assigned by UNFCCC. The total emission allowances counted around for 60 billion AAUs for the first commitment period. The third and fourth column is calculated by Point Carbon based on the historical data which is publically available and forecasted data. According to Point Carbon, surplus amount of allowance would be around 13,127 million AAUs excluding Canada [10].

Table 1: Target, AAUs, Surplus of Annex I Parties of Kyoto Protocol [41];[10]

Country/ region	Quantified emission limitation (percentage	Initial AAUs of Annex I Parties	Surplus AAUs	Shortfalls AAUs

	of base year)			
USA*	-7			
Canada**	-6	2.791.792.771		-502.500.000
Austria	-13	343.866.009	5.500.000	
Belgium	-7.5	673.995.528	48.000.000	
Denmark	-21	276.838.955	12.100.000	
Finland	0	355.017.545	20.500.000	
France	0	2.819.626.640	263.100.000	
Germany	-21	4.868.096.694	489.000.000	
Greece	25	668.669.806	85.400.000	
Iceland	10	18.523.847		-3.000.000
Ireland	13	314.184.272	22.600.000	
Italy	-6.5	2.416.277.898	16.600.000	
Luxembourg	-28	47.402.996	10.500.000	
Netherlands	-6	1.001.262.141	40.200.000	
Norway	1	250.576.797	20.100.000	
Portugal	27	381.937.527	61.800.000	
Spain	15	1.666.195.929	74.200.000	
Sweden	4	375.188.561	85.200.000	
Switzerland	-8	242.838.402		-8.500.000
United Kingdom	-12.5	3.412.080.630	513.700.000	
Australia	8	2.957.579.143	66.400.000	
Japan	-6	5.928.257.666	429.800.000	
New Zealand	0	309.564.733	28.100.000	
Bulgaria	-8	610.045.827	317.800.000	
Croatia***	-5		5.200.000	
Czech Republic	-8	893.541.801	132.100.000	
Estonia	-8	196.062.637	39.900.000	
Hungary	-8	542.366.600	204.500.000	
Latvia	-8	119.182.130	48.500.000	
Lithuania	-8	227.306.177	102.100.000	

Poland	-6	2.648.181.038	751.500.000	
Romania	-8	1.279.835.099	669.000.000	
Russian Federation	0	16.617.095.319	5.873.100.000	
Slovakia	-8	331.433.516	105.600.000	
Slovenia	-8	93.628.593	3.600.000	
Ukraine	0	4.604.184.663	2.593.500.000	
Lichtenstein	-8	1.055.623	100.000	
Monaco	-8	495.221	0	
Total Excluding USA Excluding Canada for Shortfalls.		**60.291.188.734**	**13.139.300.000**	**-11.500.000**

* USA refrained to ratify Kyoto Protocol

** Canada withdrew from Kyoto Protocol before the end of first commitment period [10].

*** AAUs for Croatia defined on Accession to the EU [42]

Table 1 gives a clear message why the global carbon market is so weak not to sustain carbon prices just even for a period. With regard to the emissions of the reference year of 1990, many countries on the list have surplus of AAUs without even counting other emission credits from Certified Emission Reductions (CER) of Clean Development Mechanism (CDM), and Emission Reduction Units (ERUs) of Joint Implementations. Parallel to AAUs prices, the surplus of allowances and credits caused prices in global carbon market to fall down almost to zero by January 2013 [43]. From another view, the demand created against supply of allowances and emission reduction credits was so low that the supply has been over flooding the market. This trend of prices and surplus of credits underlines the weakness of emission reduction targets by developed countries.

The first AAUs transactioned were in 2008 through green investment scheme by selling government and the volume of the year was low as above 20 million AAUs. The following year saw a more transaction and the volume reached 140 million AAUs [44]. 2009 was the peak year for the volume exchanged, following years showed a declining trend in the transactions.

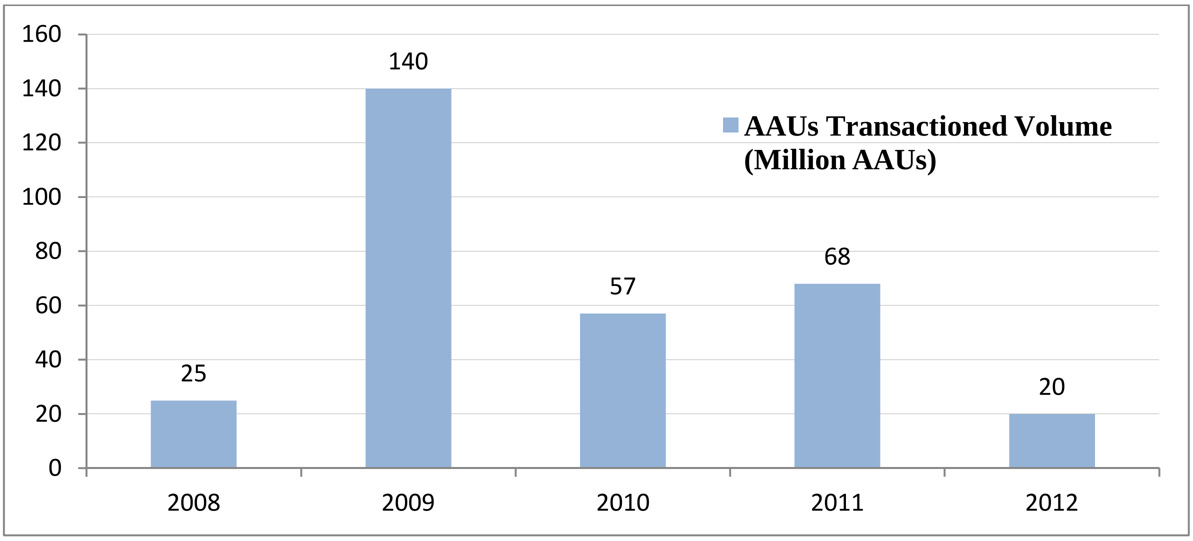

Figure 3: AAUs Transactioned Volume [44]

Figure 3 represents total volume of AAUs exchanged as 314 Million AAUs until September 2012 [44].As the volume exchanges, the prices also show a characteristic of declining starting from the very first year. *Figure 4* demonstrates the declining rate of prices over the years. Parallel to the over flooding of supply side, the reaction of the market has been crashing of the prices to zero.

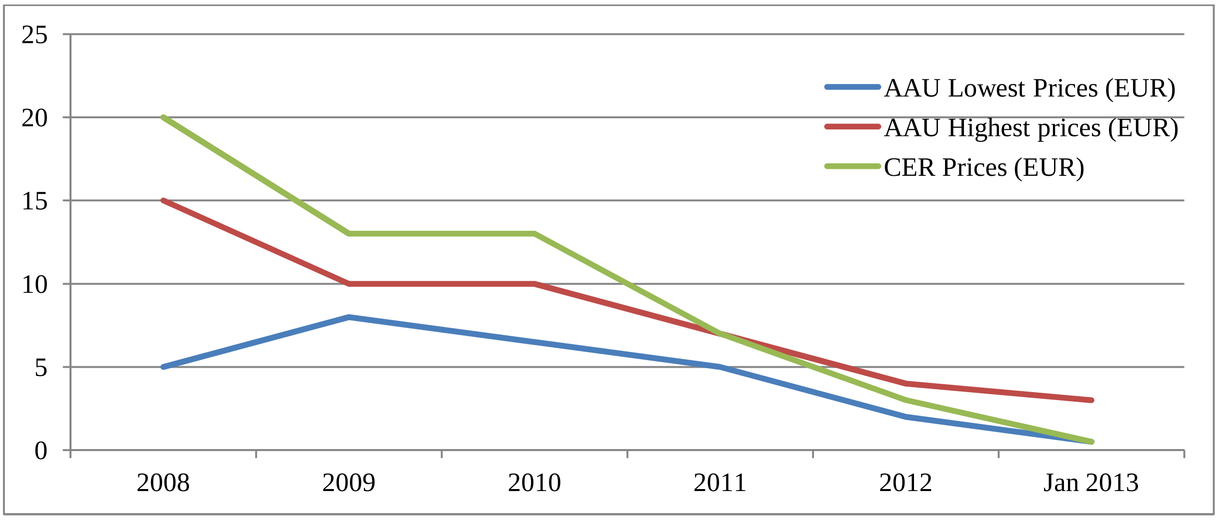

Figure 4: Prices of AAUs and CERs in EUR. [44]; [43]

The legitimacy question of Kyoto Protocol is raised as the prices go down to zero and surplus allowance floods the market. In phase II of Kyoto Protocol, there would not be any price for CDMs as well. Since there is surplus of allowance today and the banking of these surpluses allowed for the second commitment period, it is estimated by Point Carbon that there will already be surplus of allowances for second commitment period against the pledges taken by parties of second commitment period [10]. In such case of low demand where the curve meet supply at zero, can we talk about global carbon market?

There are many reasons for surplus of AAUs, CERs, ERUs and EUAs which could be counted as, firstly, the demand or cap was set so low that the supply has been more than needed. The cap or target in Annex B of the Kyoto Protocol, which was not ambitious enough, set based on the emission of the reference year of 1990 ignoring the mistakes in emission data. Secondly, the data for economies under transition was from the time of Soviet Bloc and with the collapse of the Soviet Union; these countries lived economic downwards which caused their emission to decline strongly. Apart from surplus of AAUs, credit from land-use activities, CER, ERUs could increase total amount of surplus even more [45]. In any case the first commitment of Kyoto Protocol ends with surplus of emission allowances that can even flood the second commitment period. Considering not only the withdrawal of Canada from Kyoto Protocol despite having a high volume of demand but also unwillingness of Japan, Russia, Australia and New Zealand to participate in the second commitment period increase the estimation of surplus volume for the second period. According to the calculation by Point Carbon, the surplus of second commitment period of Kyoto Protocol could be around 4,1 billion AAUs in case of Australia's and New Zealand's absence in second commitment period as in *Table 2* [10]. Once the surplus from first commitment period is added, the total surplus reaches 16.2 billion AAUs which mean that without any effort the parties of the protocol can reach the target easily.

Table 2: Second Commitment Period of Kyoto, Net Surplus (Billion AAUs) [10]

	Kyoto Target	**Emissions**	**ShortFall**	**Credit Usage**	**Net Surplus**
EU Members	37,2	37,3	0,1	2,5	2,4
Australia	3,8	4,8	1	0,6	-0,5
New Zealand	0,4	0,6	0,2	0,1	-0,1
Other	6,5	4,6	-1,8	0	1,8
Total	47,8	47,3	-0,5	3,1	3,6

The underlying reason for surplus of emission allowances is political more than being efficiency of the global carbon market to react. It can be clearly witnessed that global carbon market is the victim of political stand points of the countries in regard of conservation of the nature by emission reduction. The problem of free raiders who benefit from the atmosphere costless against the ones paying by curbing their emissions could not be solved by targets of Kyoto

Protocol because the protocol could not bind whole nations of the earth under a global climate regime. Thus, we can talk of an attempt to set global climate regime, but this regime could be established at any time. The reason behind such a decline and failure was neither crashed prices nor over allocated emission allowances. It is selfish political economy of the countries aiming to growth on ruins of ecosystem and unsustainable fossil fuel based resources. While there were low emission reduction caps for developed countries and high amount of AAUs assigned for parties to emit, the failure of the global carbon market is inevitable. Thus, unwillingness of the parties to reduce emissions dominates the market and causes it to fail.

While this sub-chapter of the thesis provides a picture of the failure of carbon market through demonstrating surplus of allowance and crashed prices based on lower level of emission reduction caps, the reason of the failure lies in political unwillingness of the countries to commit ambitious emission reduction targets. Main forces behind unwillingness of developed countries to commit targets is based on the nature of atmosphere to be not only public good but *global public good*. The countries having liabilities to reduce emission hesitate to have ambitious target while the remaining countries do not have commitments and continue to pollute. Thus, not having a common emission reduction regime for all over the world brings the failure itself.

The next sub-chapter of the PhD work will provide a closer look for unwillingness of the countries to commit themselves to reduce emission. While this unwillingness was main reason of the carbon market to fail, the analysis will be based on the political economy of the countries not to have ambitious targets.

1.2 From Rio to Durban: Global Talks of Climate Change

The number of parties and the binding articles of it makes the Kyoto Protocol one of the more comprehensive international agreements which was leading to Global Climate Regime if there would not have been a failure which started in Copenhagen 2009 and continued afterwards till Doha 2012. The parties of the Kyoto protocol could not succeed to bind themselves under an agreement for the second commitment period with an aim to reduce global emission trend that keeps the global temperature under $2^{o}C$ target. This subsection of the thesis analyzes the issue of sovereign states refraining from committing themselves for emission reduction targets from a view of ethical approach, selfish economical thinking and finally lack of confidence in global climate regime.

Regarding the sectors and capacity to reduce, the problem committing to reduce emission is economical as much as ethical. This case could be well illustrated by a sample of clean lake polluted by waste water of factories. Think that all villagers are working in the factories nearby and they benefit from clean lake as drinking water. If they do not make factories to stop polluting the lake, they will end up with no clean drinking water any more. If they make the factories stop, then they will lose their jobs. In this case, villagers have to either find other jobs to earn their livings or compel factories not pollute the lake. It is surely beyond doubt that the case of atmosphere and emission is not as simple as in this case, on the contrary, there are variety of players with different level of responsibilities and level of negative impact. Figueres and Ivanova [18] define the situation in their article named as “Climate Change: National Interest or a Global Regime: “The fact that the answers vary takes us into a perplexing ethical arena where many of the countries most affected are least able to act, and many of those most able to act are least willing. We will emerge from this quandary to the degree that countries are able to shift from narrowly defined national interests to an internalized notion of global interdependence.”

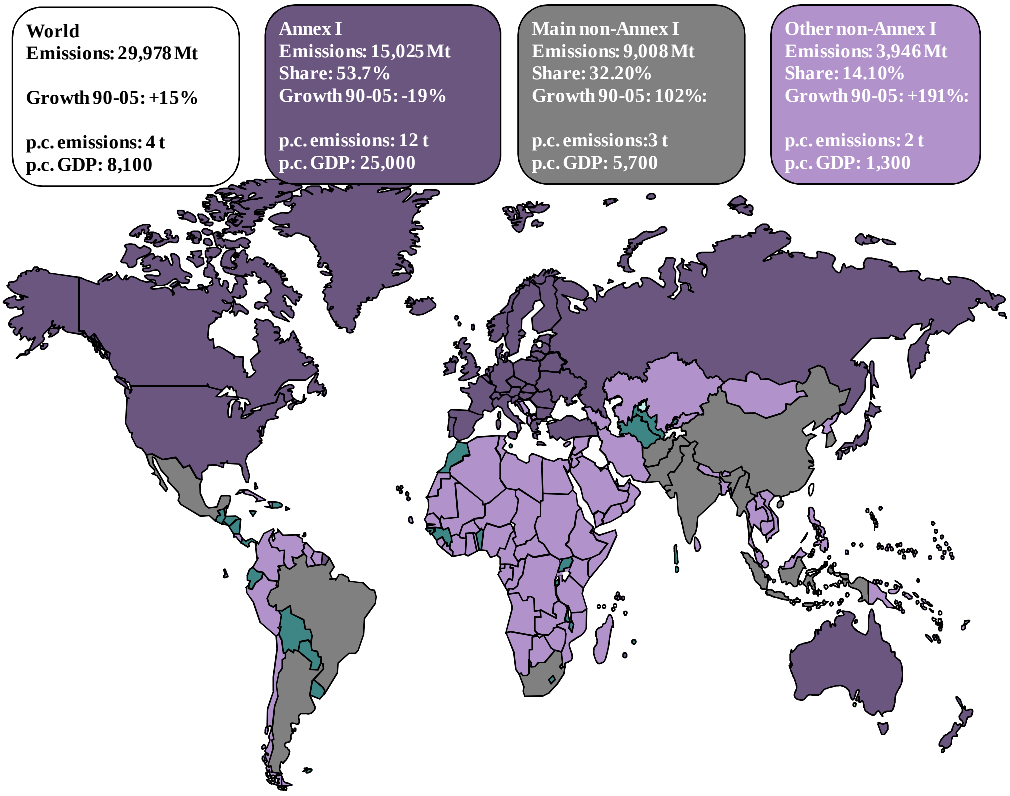

Figure 5: Map of the world with emission and development disparities. [46]

Annex I countries of UNFCCC emit 53.7% of total world emission, while non-Annex I countries emit 46.3% [46]. But none of them feel responsible for polluting the earth. Defining the responsibilities on development level cannot solve the problem of commitment since there will be many cases where Annex I countries escape from their responsibilities as it is already done in the case of surplus allowance and low caps. Instead of the map in *Figure 5*, Figueres and

Ivanova [18] state the responsibilities from a different point of view such as the responsibilities are embedded not only in North but also in South under two major trends that increase emission and reduce the sinks for carbon dioxide as population growth and increase of consumption. From such a view point, the responsibility changes for everybody. That is why, instead of a top-down approach which has already been tried to create a global climate regime and failed, there is a need for a local reaction which is organized at local level, carried to national governments and then to global scale. Agreeing with Figueres and Ivanova [18] who concentrate on ethical part of responsibilities to stop emitting and commit to reduce emission, I would say that economic stand point is the main reason of non-binding actions of the nations. Just consider a case of a product, for example cement, which is open to international competition. If country A has carbon tax on emission from cement production and country B does not have that tax, cement from country B could dominate the market with lower prices, assuming that the quality and the cost for both countries are identical. In this circumstance, any action against emitting carbon dioxide will have negative reaction from the sector backed by argumentation of international trade and budget deficit. Any government which would increase budget deficit may lose the election next time evidently. Thus, national and sectoral actions to reduce emission would have macro economical implication where there could be negative outcome for policy makers.

Assuming that states can behave ethically and economically free, in order to make binding international commitments, they also need to have confidence and trust in a regime as claimed by Bodansky and Diringer [47]. Generally speaking, trust emerges over time and over experiences. When we look back to the global reputation in global carbon market as it is discussed in pervious sub-chapter, there are surpluses of allowances, very low level of prices, withdrawal of states and non-committing of big emitters, how confidence be built over such system is questionable.

Under the existing problem of ethics, political economics and regime reputation, Copenhagen conference was organized in 2009. The conference was the largest summit in the history of international relations. One hundred and nineteen kings, presidents, and prime ministers in the same building constituted the highest concentration of robust decision-making power the world had seen [9]. Their presence on a highly visible political arena raised high hopes for a successful outcome and Copenhagen named as “Hopenhagen”. However, as stated above, existing problems of economics, ethics and reputation of climate regime were already powerful stresses on UN named term “differentiated responsibilities” of the states which caused Copenhagen to create a powerless paper instead of a binding agreement.

The failure of Copenhagen had impact on following Conferences as Cancun and Durban. Under very low expectations, conference of Parties (COP17) gathered for the 17th time in order to continue with climate change negotiations in Durban in 2011. The outcomes of Durban addressed elements of the Bali Action Plan in 2007, operationalized the Institutions established in Cancun in 2010, and created a 2nd commitment period under the Kyoto Protocol. However, the Kyoto Protocol is not the main mitigation instrument any more as it covers roughly 15% of global emissions [48].

The most important result of Durban negotiation was Durban Platform for Enhanced Action (ADP) which defined the next steps for the UNFCCC for a global treaty [49]. ADP started a new negotiating process apart from Kyoto Protocol to develop another legal instrument including all countries by 2015. The decision both recognizes a significant gap between current mitigation efforts and the 2 or 1.5 degrees target, and launches a work plan to close this gap [49]. Under Durban Platform, all countries agreed to subject themselves to some kind of international arrangement with legal force and to assess their current mitigation efforts within the new process.

Another important outcome of Durban negotiation was the decision to create new arrangements for international transparency of mitigation efforts and monitoring, reporting and verification (MRV) of the emission [50]. Developed and developing countries will submit biennial reports on their emissions starting in 2014 based on new guidelines adopted in the decision [50]. This was one of the important steps especially for developing countries to calculate and control their emissions. All the attempts by Durban aim for survival of global climate regime, and detailed steps are defined well for this survival. However, as it has been experienced in the past, by the deadline of Durban for next deal in2015, sovereign countries may refrain from committing themselves under new deal. It is not certain that we will see a global regime by 2015; instead it is clearer that there is a shift towards more localized reaction for climate change. While the climate change negotiations is departing from a global climate regime, the regimes continue on a more localized based interlinked through regions and nations, the idea of global climate regime still survives through.

This sub-chapter provided an analysis based on three determination of the behavior of state not to commit themselves to reduce emissions. The political economy of the countries are the most important determining factor blocking for commitment of emission reduction target. Unequal development level and priorities of countries for development is main the reason for developing and developed countries not to bind themselves with ambitious targets to reduce emissions. While there is no global governance to force sovereign countries to commit, global climate regime eventually faces failure. The second determining factor of failure of global climate regime was the bad reputation of the carbon market with high surpluses and low level of prices where the failure caused again by low level of emission reduction caps. Thus, the trust on carbon market which is highly regulated by the states is diminished sharply. The third factor defined in this sub-chapter is ethical behavior of the countries where responsible countries stand back to commit themselves to reduce emission. As there is no global governance to check ethical behaviors of the state in regards of emissions, free riders are unavoidable which cause the system to fail.

Consequently, global climate regime, after a successful start of first commitment period of Kyoto Protocol, seems to come an end by lack of strong global governance structure behind. The next sub-chapter of the thesis will focus on the policy approaches of Turkey under current developments of global climate regime. The problem that thesis handles will be defined there where solution will be detailed in following chapters.

1.3. The Position of Turkey Under Global Climate Regimes

Turkey is the only country that has been included in Annex I of the UNFCCC and member state of Kyoto Protocol with no emission reduction target. The special circumstances defined for Turkey raises many question regarding position of the country in relation to climate change. Under negotiation of climate change, what is position of Turkey and what would be the best for her? This sub-chapter of the thesis will analyze the policies of the country with an aim to understand stand point of Turkey related with climate change regimes. For this reason, her position through climate change negotiation will be discussed and emission characterise of her will be analyzed through the sub-chapter. The target is to define the framework of the policy problem of Turkey in a evolution of climate change regimes.

Turkey was originally included in Annex I and Annex II to the Convention signed in 1992 [3]. The parties in Annex I includes member of OECD and EC as well as economies in transition (EIT). At the time, the Convention was adopted EIT having some specific alleviations regarding commitments under the Convention, while Annex II lists member of OECD and EC with additional and stricter obligations. Although included in Annex I and Annex II of the Convention, which meant that Turkey had to reduce emission, she had always stressed that she was not a developed country by emphasizing its stage of economic development.

At UN 7th Conference of The Parties in Marrakech in 2001 with the decision "deleting the name of Turkey from Annex II and recognizing that Turkey is in a situation different from that of other parties included in Annex I" 26/CP.7 was formalized [23]. Under these new circumstances, Turkey became party to the Convention in 2004 as Annex I country without any emission target [27]. The main feature of Kyoto Protocol is setting binding emission reduction targets for Annex I countries which are listed in Annex B to the Protocol [4]. At the time the Kyoto Protocol was negotiated, Turkey was not a party to the Convention; therefore Turkey does not have any binding emission target under Annex B of Kyoto Protocol [4].

Through the years of negotiations, Turkey developed a strategy of refraining to express any emission target and to guarantee that special circumstance of Turkey was incorporated in the final documents of UNFCCC. What is clear regarding position of Turkey in regards of climate regime is that her willingness to stay away from any pledges, that is why Turkey refrained for a long time not to sign Kyoto Protocol [28]; [110]. It was only in Copenhagen that Turkey offered a decrease in comparison to the business-as-usual emission path in 2020 in course of a side event and presentation done by Ministry of Environment and Forestry on 12 December 2009, but this target never mentioned in any legal documents. Not declaring an official strategy of Turkey in COP has been interpreted that Turkey will take its position according to the possible agreement.

Ministry of Environment and Urbanization (MEU) is coordinating institution regarding negotiations of commitments for Republic of Turkey under Kyoto Protocol for post-2012. During COP 17, with over 100 delegations, negotiating committee of Turkey were involved in negotiations. Target was to strengthen Turkey´s position to get acceptance on "special circumstances", thus trying to differentiate Turkey from other countries in Annex 1 to the Convention which is achieved to some extend at Conference of Parties at Durban [50]. The decision taken at Durban underlying the different situation of Turkey, invites parties to negotiate for consideration of supports in paragraph one hundred seventy as below:

"Recalling decision 26/CP.7 and decision 1/CP.16, which recognized that Turkey is in a situation different from that of other Annex I Parties,
170. Agrees to continue with the discussion on modalities for the provision of support for mitigation, adaptation, technology development and transfer, capacity-building and finance to Parties whose special circumstances are recognized by the Conference of the Parties in order to assist these Parties in the implementation of the Convention"

Parallel to this decision which guarantees position of Turkey as different than rest of Annex I parties, Minister of Development, namely Cevdet Yılmaz, refrained to announce any commitment for post-2012 in COP17 in Durban [51].

Looking though climate change negotiation, the position of Turkey could be defined as “no target climate policy” which could be understand to some extend when emission data of Turkey is compared with other developing countries that do not have emission reduction targets. Having a “no target policy” cause Turkey refrain to develop any kind of climate policy with in the country to price the emissions which is defined as a core problem of the thesis. Additionally, the thesis goes beyond to provide a possible policy proposal for Turkey by analyzing the problem she has. To understand the position of Turkey in comparison with other developed and developing countries, it is better to analyze carbon dioxide emission per capita data of her. As per Figure 6 that is showing carbon dioxide emissions stemming from the burning of fossil fuels and the manufacture of cement, carbon dioxide emission per capita for Turkey is around 3.9 ton CO_2 which is at the bottom of figure with other developing countries compared to high per capita emission of OECD and United States [24].

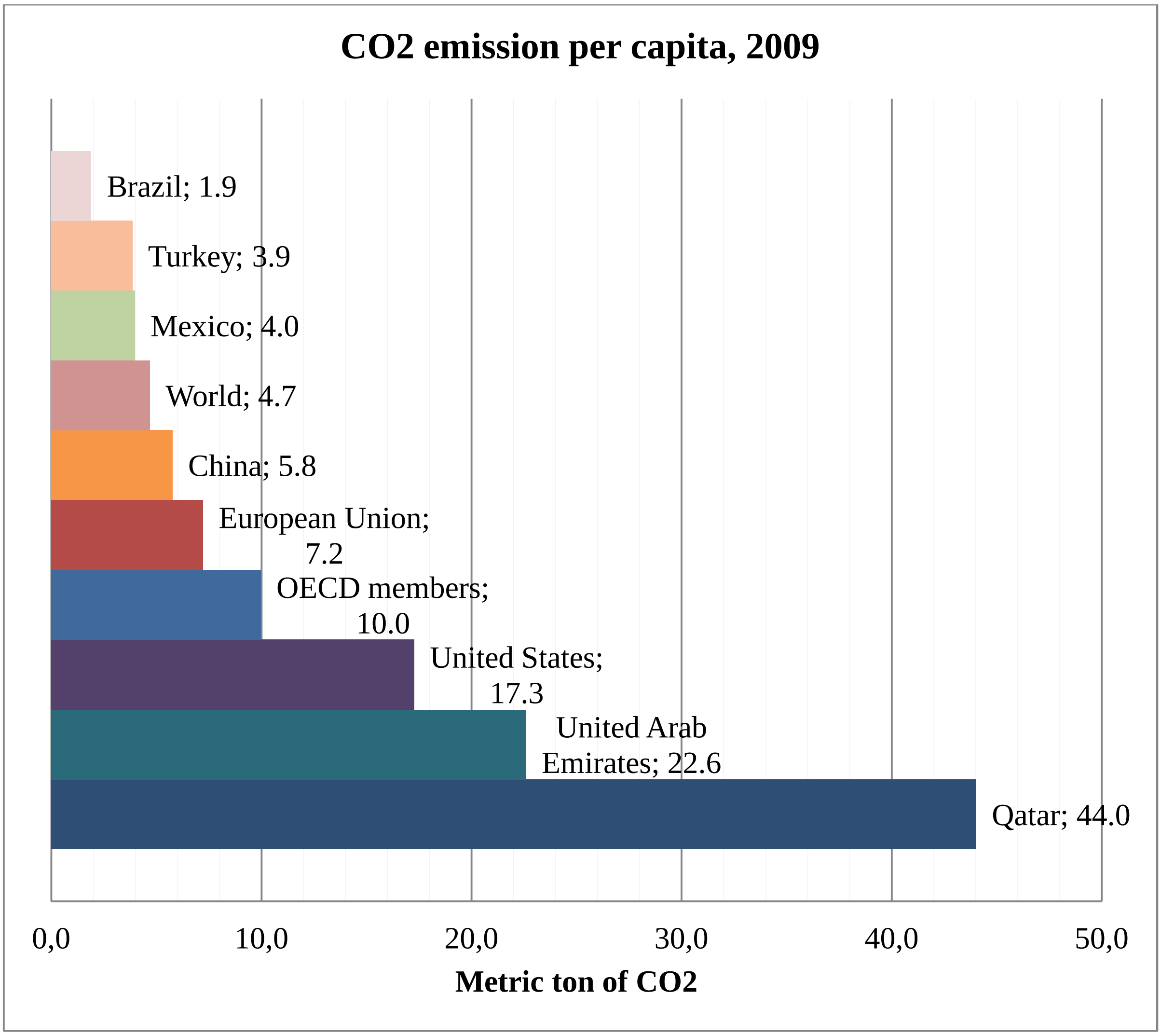

Figure 6: CO_2 emission per capita (metric ton of CO_2) [24]

Regarding the data in *Figure 6*, advanced developing countries like Brazil, Mexico, China and Turkey having identical emission per capita which is below world average except China [24]. In this sense, Turkey having an climate change policy close to Mexico, Brazil and China would be one of choices than having climate policy close to EU.

While thinking the status of Turkey under climate regimes, other roles that the country wants to play has to be considered. One of the role is that Turkey is a candidate of EU membership, where new environmental negotiation chapter between EU and Turkey demands a considerable actions to be taken in the relation to climate change from Turkey [112]. The other role that Turkey wants to play is as advance developing country to lead Arab World. Pursing a rapid development path, Turkey, on one hand, has to consider its environmental and energy policies in sense of high growth projection, on the other hand has to harmonize these policy with prospected ambitions of the EU and UNFCCC as Annex I country.

The sub-chapter at hand showed that Turkey followed a climate change policy based on refraining from declaring any climate policy and emission reduction target which is ended up having a “no target policy”. The carbon dioxide emission per capita of Turkey shows that Turkey is in a level comparable with other developing countries, thus her climate change policy could be defined as parallel as other developing countries under consideration of her growth priorities. The problem defined here is that Turkey needs a climate policy which is based not only on her position under UNFCCC as an Annex I country, but a policy that is based on her emission characteristics with considering her development level and growth priorities. Based on this problem, the PhD work will propose a policy which is defined through pilot emission trading scheme in next chapters.

1.4. Summary of The Chapter

Global climate regimes are evolving which has been triggered by the failure of compromise of the parties in Copenhagen in 2009. The development priorities, the failure of carbon market and ethical irresponsibility of emitting countries were the driving forces behind the failure. Although global climate negotiation continues under UNFCCC, and it is aimed to have global compromise in 2015 which can be binding after 2020, the motivation created by first phase of Kyoto Protocol was lost by the failure of comprehensive global treaty in 2009 [9];[21]. Instead of a global climate regime which is binding for all, we are now witnessing different emission trading schemes all over the world in developed and developing countries which are created as tool to handle externality of emission in a market based approach. Emission trading scheme will be the subject of next chapter where the proposal is defined for Turkey.

The first sub-chapter underlined main reasons of the failure of carbon market as low level of emission reduction target of the countries that caused surplus of emission right and crash of prices in the market. The second sub-chapter as the continuation of the first sub-chapter tried to get attraction on unwillingness of the countries to take responsibilities to reduce emissions. The reasons behind unwillingness of the countries counted as different development priorities, bad reputation of the carbon market and ethical irresponsibility to commit emission targets. All developments together caused evolution of the global climate regime that started in Copenhagen in 2009 from global context to more localised reactions. In this context, Turkey as a country refraining from taking any emission reduction commitment, but feeling the pressure from global area for more steps forwards, could use the chance of evolution of climate regimes to design a form of emission trading scheme and to benefit from it. The last sub-chapter formed the problem that PhD work aims to handle. The problem formularized as; Turkey as a developing country does not have a climate policy which considers her development and growth priorities. The PhD work at hand aims to provide a climate policy approaches which is proposed with a design of pilot emission trading scheme.

CHAPTER 2. HYPOTHESIS AND RESEARCH OBJECTIVES

As argued before that the discussion alongside of two decades on global climate regimes has resulted in failure of in Copenhagen in 2009 which was a sign of shift from global climate regimes to local reactions [5]; [6]; [7]; [8]; [9]. Developed and developing countries started to price carbon emission internally by emission trading schemes as in case of EU ETS, China, Australia…..etc. Being a developing country but listed as Annex I under UNFCCC which means having responsibility to reduce emission, Turkey has stayed away to declare any emission reduction target. However, while global climate regimes are evolving and more local regimes are taking place, there is more pressure on Turkey to take steps forward to price and regulate carbon emission.

Emission trading schemes emerged as a new form of local climate regimes with aim to price the carbon emission in domestic economies. EU ETS is one of the first forerunner of these systems that have positive impacts on other emission trading systems [19]; [25].

Therefore, **main research question** of this doctoral thesis is *what is the best approach for Turkey to introduce an emission trading scheme in her economy and benefit from it?* Thus, the main aim of this doctoral work is to understand principles of emission trading scheme that can be offered for Turkey for a period of piloting.

Under this question, there are two hypothesis generated as:

Hypothesis 1. Does benchmarking method lead emission reduction objectives?

One of four emissions of Turkey is caused by fossil fueled power sector. Carbon dioxide emission from electricity sector is 26.6 percent of whole emission in Turkey in 2010 [53]. Having the largest share in GHG emissions, fossil fuel based electricity production is one of the key sectors for climate change policy of Turkey. Additionally, electricity generation of Turkey rest on fossil fuel based plants by 74.62 percent which shows a higher rate of emission intensity of energy production. Thus, any reduction of emission intensity in electricity generation will have same reduction impact on overall emissions. That is why the first goal of climate change policy of Turkey shall target emissions from electricity generation. The benchmarking method used in the PhD dissertation aims an average emission intensity per MWh (Megawatt hour) produced which can be used as a level of cap for pricing the carbon dioxide emissions that passes over. By this method, plants above benchmark will choose to reduce emissions because of the cost of emitting one ton of carbon dioxide.

Hypothesis 2. Is Emission trading system an appropriate mechanism to price the carbon emission, create income for state and operationalize carbon market for offsetting emissions?

Emission trading system is base for pricing carbon emission in the country by introduction of benchmarking in targeted sector. Moreover, carbon market as a part of emission trading scheme could supply installation with cost effective emission reduction credits which operationalize the market with buyers and sellers. One of important aspect of emission trading scheme is auctioning of emission allowances where the state can generate income that can be directed for R&D or energy efficiency technologies.

In order to find response to above question and formulated hypothesis, the doctoral study set the following objectives:

1. To offer a design of emission trading scheme in Turkey based on Benchmarking of emissions and auctioning of allowances.

2. To define sector where emission reduction is possible and cost effectively based on formulation of Kaya Identity.

3. To link emission reduction objectives with voluntary carbon market so that emission reduction is achieved through cost effective method.

CHAPTER 3. SELECTED PROCESSING METHOD

The PhD work has a target to provide a design of emission trading scheme for Turkey that could be used as a tool to price the carbon emissions, create income for state for R&D and initiate a carbon market within the country. In order to provide proposal, this chapter outlines the framework of the way that the research is designed and offers the method which is used to prove the hypotheses and objectives of the PhD work. Through the chapter at hand, firstly, the objectives of the research are described and defined. Secondly, the methods that will be conducted to reach the targets are outlined.

3.1 Objects of Research

With an aim to prove the hypotheses and reach the aim of the work, the objects of the PhD is defined as fossil fuel electricity sector of Turkey and emission trading schemes in EU, China and regional greenhouse gas initiative (RGGI):

1) Emission trading scheme in EU, China and Regional Greenhouse Gas Initiative. The reason to select these three emission trading scheme to analyse their approaches are described below:

1.a) EU ETS has been under operation since 2005. Although EU did some mistakes regarding over allocation of allowances which caused the scheme to collapse during first phase and second phase, EU has played an important role to mobilize the world population towards taking action against climate change till 2009 [60]. Thus, EU emission trading scheme is an important sample for Turkey to follow due to determination of benchmarks in sectoral scopes and lessons that can be learned from over allocation of allowances.

1.b) China is one of the first developing countries to move forward to establish emission trading scheme. China creates a good sample for Turkey to follow both in the sense of emission reduction target which is a reduction in emission intensity of GDP and handling the establishment of ETS by a piloting phase [69].

1.c) The importance of RGGI for Turkey is implementation of emission trading scheme in fossil fuel power sector which is linked with emission reduction credits enabling installations to use offset allowances [73].

2) Fossil fuel electricity sector of Turkey: The reasons behind such kind of choice is as follow:

2.a) While electricity as a product does not face international competition, any burden by pricing of carbon do not hinder budget deficit of the country as far as electricity price control is done by government. This point is important for policy makers, because they are sensitive on any negative impact on competitiveness of the country. For this reason electricity sector which is a local market is chosen for a first sector that the pilot emission trading could be applied.

2. b) As Turkish electricity production relays on fossil fuel resources by 74.62 percent by the year of 2011, emission intensity of energy production is consequently high which gives room for emission reduction in this sector. Per *Figure 7*, electricity production in Turkey relies by 45 percent on natural gas, by 17 percent of lignite and by 12 percent on hard coal, renewable energy is mainly represented by hydro with 25 percent of energy generated [52]. As a result of high share of fossil fuel energy generation, emission percentage from electricity composes large part of total emissions.

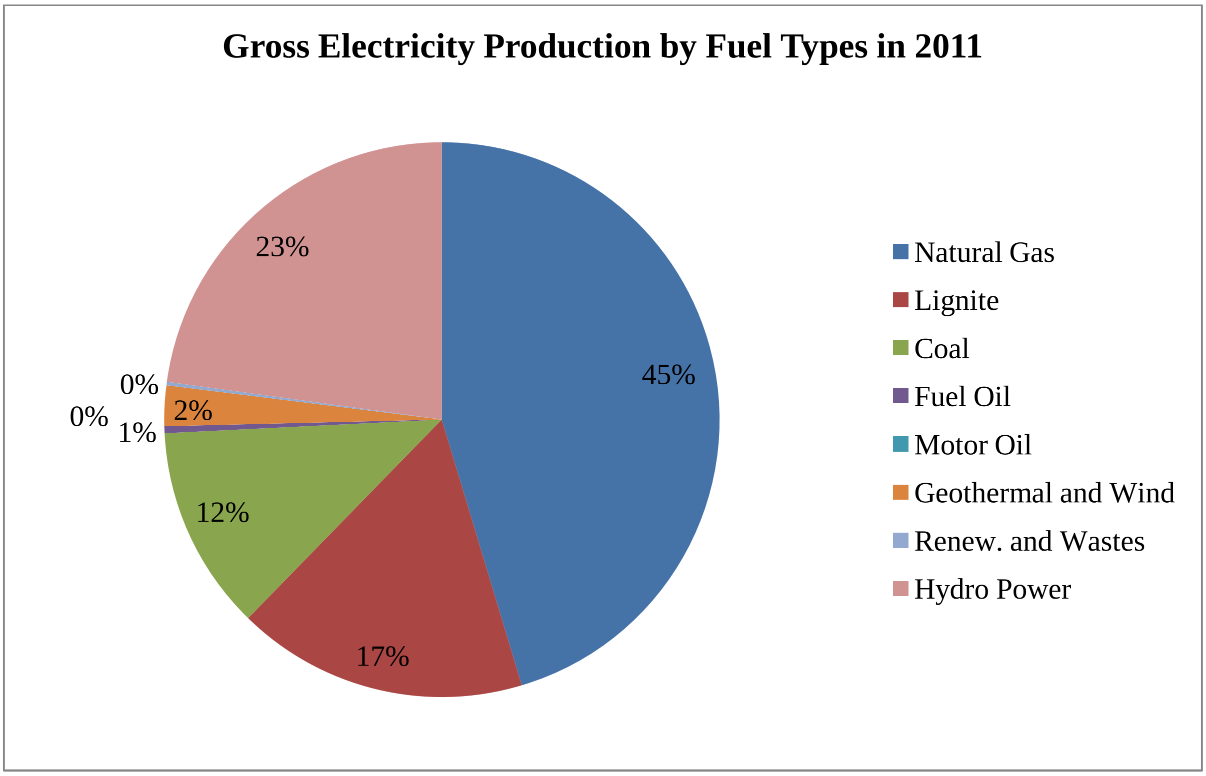

Figure 7: Gross Electricity Production by Fuel Sources 2011 [52]

2.c) Carbon dioxide emission due to electricity sector is around 107 million ton CO_2 which is 32.7 per cent of country's CO_2 emissions and 26.6 percent of whole GHG emissions by 2010 [53]. Having the largest share in GHG emissions, emitting part of electricity production is one of the key sectors for climate change context of Turkey. Any policy proposal offered here will have impact on one of four of whole country emission. Thus, having effective instrument for fossil fuel based energy sector might have a reducing impact on the emission of electricity sector which has been more than tripled in two decades.

Figure 8 represent a clear picture of emission raise due to energy sector. This increasing trend has two negative impacts on Turkish economy: one is an increasing rate of emissions, and the other one is a dependency of fossil fuel which has to be imported from other countries. Consequently, the policies that price the carbon emission of fossil fuel power sector will naturally have a positive impact on comparative advantages of renewable energy, assuming that cost of carbon price is not reflected on electricity prices.

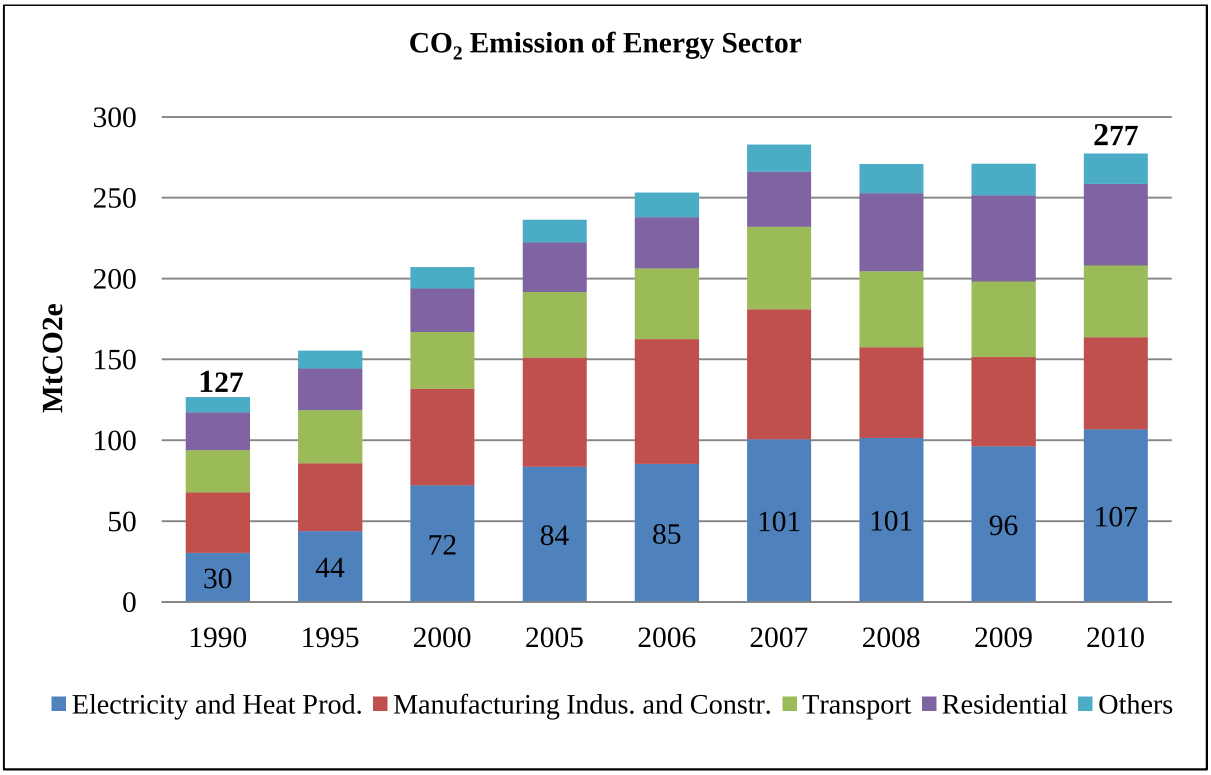

Figure 8: CO_2 emissions of Energy Sector, 1990-2010 [53]

The research aims to offer a design of pilot emission trade scheme in fossil fuel electricity sector based on the pillars of emission intensity of electricity sector, benchmarking of fossil fuel types of electricity generation, auctioning of allowances to emit and linking carbon market with emission trading scheme for cost effective emission reduction method. In this context the method for designing emission trading scheme is composed quantitative method of data analyzing and methodological tool of UNFCCC to calculate benchmark for different fuel types. The next sub-chapter gives the details of the methods.

3.2 Methodology

The methodology used in relation with defining climate policy approach and emission trading scheme for Turkey consists of **quantitative approach** which refers to the systematic empirical investigation of social and economical phenomena via statistical, mathematical or computational techniques [115]. While descriptive statistic method is used in chapter 5 with an aim to draw the framework of policy approach of Turkey based on formulation of Kaya Identity [14], the descriptive and mathematical modeling is used in chapter 6 to identify benchmarking and allocation of allowances based on linearity with the help of methodological tool of UNFCCC [29].

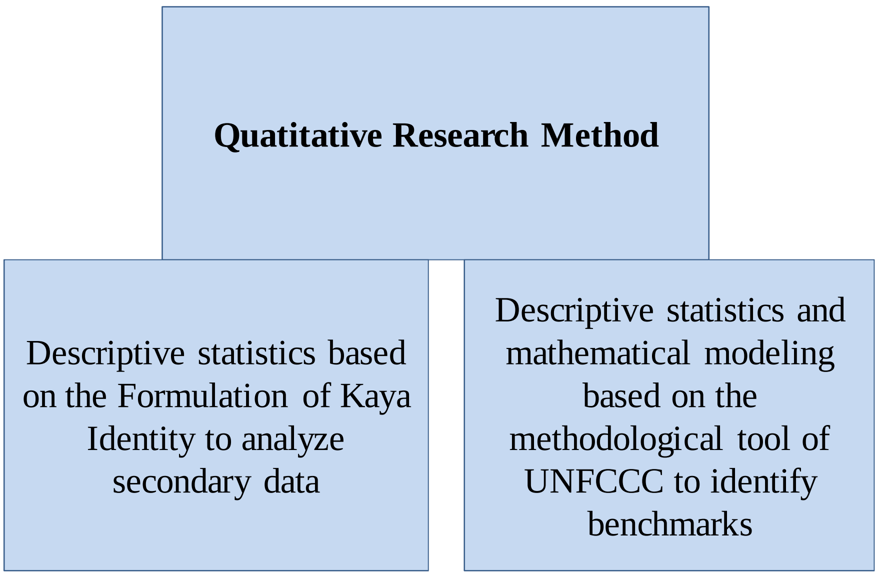

Figure 9: Applied research methods

Kaya Identity: In the context of quantitative data analysis of Turkey, descriptive statistics method is applied based on formulation of Kaya identity – an equation of relating factors determining the level of emissions– to understand the patterns of the emission growth. Equation of Kaya Identity states that total emission amount at any time is a result of population, GDP per capita, energy use per unit of GDP, carbon emissions per unit of energy consumed [14]. This simple equation can be used for estimation of future emission trends and the factors on total emission, which will be applied to analyze the impact factor of carbon intensity of energy use on total emissions in next chapters.

Equation 2

$$C = POP\ x\ \left(\frac{GDP}{POP}\right) x \left(\frac{E}{GDP}\right) x\ \left(\frac{C}{E}\right)$$

Where:	
C	Total CO_2 emission at any given time, ton CO_2
POP	Population (million)
GDP/POP	Gross Domestic Product per capita ($ 2011)
E/GDP	Energy intensity of GDP (toe/$2005p)
C/E	Carbon intensity of Energy Consumption (t CO_2/toe)

Kaya identity is used as a method to test the secondary data in a way to understand the relation between four indicators as shown in Equation 2 [14]. The analysis of secondary data based on the data from credible sources such as World Bank data base [35];[24];[66];[74];[76];[77];[81];[82], International Energy Agency statistics [85], UNFCCC GHG Data [75], Turkish Statistical Institute [53];[80]. The aim to analyze secondary data from the window of Kaya identity is to find proper indicator where decrease in the indicator can lead emission reduction at the end. Thus, to design emission trading scheme for Turkey on proper indicator.

Methodological Tool of UNFCCC: With the help of descriptive and mathematical modeling the benchmarking in fossil fuel energy production types is derived based the methodological tool of clean development mechanism (CDM) of UNFCCC, namely “Tool to calculate the emission factor for an electricity system, version 03.0.0” [29]. Moreover, mathematical modelling of linearity is used to estimate amount of emission reduction and allocation of allowances.

Under CDM rules, renewable energy projects that supply the grid with electricity get emission reduction credits against a baseline line defined as continuation of current situation [54]. The logic behind emission reduction credit is that renewable energy generations do not emit against an emitting baseline, and so, should have emission reduction credits which could be sold under carbon market and create additional income for renewable energy projects. Hence, CDM rules provides tool to calculate emission factor of existing electricity system which could be interpreted as emission intensity of electricity generation. Methodological tool [29] determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system by calculating the “operating margin” (OM) and “build margin" (BM) as well as the "combined margin" (CM). While emission factor of OM calculates the average emission intensity of existing power plants, emission factor for BM calculates the average emission intensity of either the most recent built capacity addition which comprise 20 per cent of the total generation, or five power plant which has been most recently build, which ever comprise the largest generation [29]. Emission factor of CM is weighted average of OM factor and BM factor. Methodologies of UNFCCC use CM for calculation of baseline emissions which involves generation of renewable energy under BM factor, but for our proposal OM factor will be used to provide pure emission intensity of fossil fuel based power plants. Thus, with OM factor, an average emission factor of coal, lignite and gas power plants will be derived based on the data from TEIAS [52];[96];[97];[100];[101].

The aim with defining benchmark for fossil fuel types of energy production is to standardize emission factor of the plants and penalize the one whose above the benchmark. Benchmark forces emitting sector to be more efficient and more clean once the penalty which is pricing of emission creates high costs.

The methodological approach of UNFCCC will enable to define emission factor, thus, emission intensity of fuel types that is used for energy production. The defined benchmarks on the emission intensity of fuel types will be used as a tool to calculate amount of emission reductions and income generated by state.

CHAPTER 4. LOCALIZED CLIMATE RE-ACTIONS: NATIONAL CLIMATE REGIMES

The phrase "common but differentiated responsibilities" of United Nations Framework Convention on Climate Change Article 3, targeting for global climate regime, ended up with differentiated approaches of national governments [3]; [55]. Dimitrov [9] stated that with the failure of Copenhagen climate conference, global climate regime was weakened but the aggregate reaction in favor of climate governance was mobilized. Many countries saw this failure as an opportunity to emphasize their "differentiated responsibilities" in regards of fighting negative impact of climate change. There are many emission trading schemes supported by national climate strategies or international organization with aim to price the carbon internally. It is possible to see the trend of evolution from global climate regime to local reactions by analyzing the emission trading scheme flourishing all around world [25].

What is clear from climate negotiation since 1992 that externality of carbon emission has to be internalized by pricing of the emission. It can be seen from the map in that major developed and developing countries are moving towards first monitoring reporting and verification of their emissions, then pricing the carbon emission and finally creating local market for emission trading schemes as it has already been done under European Emission trading scheme. Dimitrov [25] expresses this situation as "Aggregate climate governance comprising regional, national, sub-national, and local policies as well as non-state initiatives worldwide is thriving" .

The map of emission trading scheme worldwide (ETS) in *Figure 10* shows that some developed countries are already ahead in regards of establishing their market mechanism locally and the other developing countries are following the path. As the color of dark blue represents the emission trading scheme in operation, light blue color shows emission trading scheme is under consideration and planning phase. There are some more countries where ETS is already scheduled such as Kazakhstan, South Korea and some provinces in China.

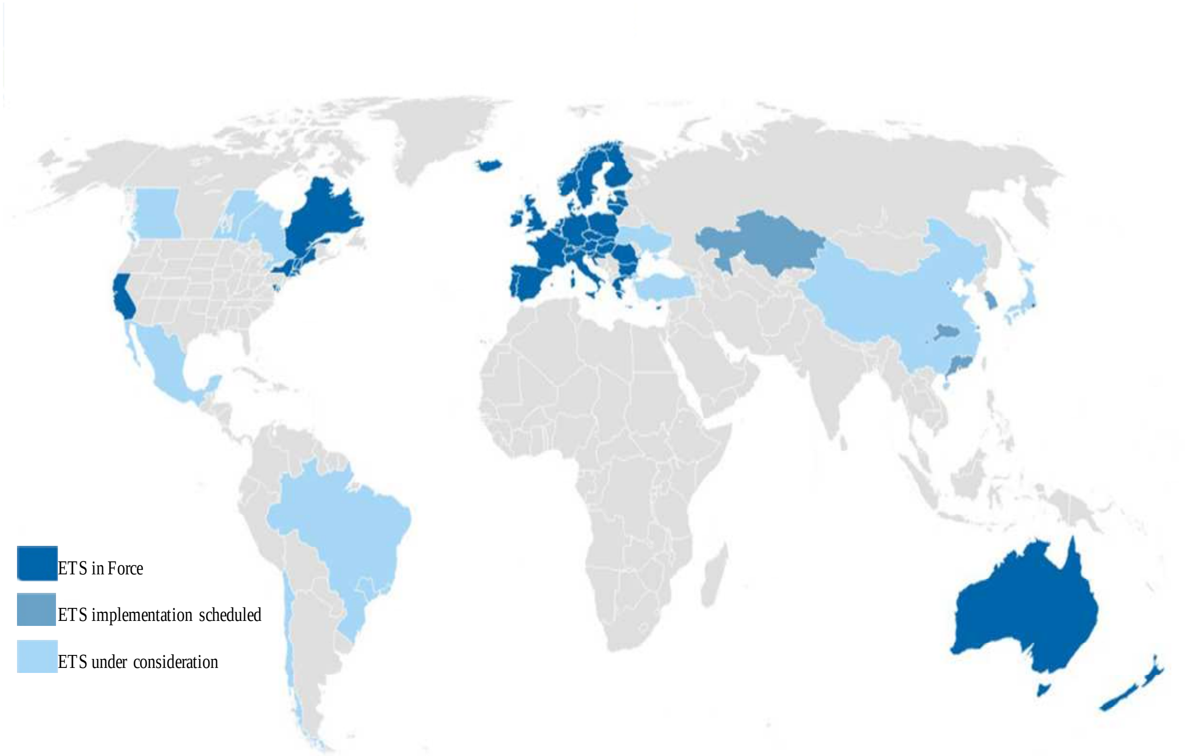

Figure 10: The map of ETS in Worldwide [26]

While Emission Trading Scheme of EU ETS, Swiss ETS, Québec Cap-and-Trade System, Regional Greenhouse Gas Initiative (RGGI), California Cap and Trade Program, Australia's Carbon Pricing Mechanism, New Zealand Emission Trading Scheme, Tokyo Cap and Trade Program and Kazakhstan Emission Trading Scheme were established and functioning as details are given in Table 3, South Korea, India and some provinces in China already decided to establish emission trading scheme for which the details are provided in Table 4. Other developed and developing countries such as Japan, Brazil, Mexico, Taiwan, Vietnam, Thailand and Chile are highly considering establishing ETS for pricing carbon and monitoring of the actual emissions [11]. Some of these emission trading scheme are presented in the Table 3.

Table 3: Emission Trading Schemes Under Operation [25];[26]

ETSs	Short description
European Union Emissions Trading Scheme (EU ETS)	EU ETS was established in 2005, and it is mandatory for all 27 EU members, plus Iceland, Liechtenstein and Norway, which covers about half of total EU carbon emissions. The EU community's wide target is reduction of GHG emissions by 21 per cent by 2020 below 2005 level. The scheme covers 11,000 industrial installations in which member states allocate a quota of emission allowances per installations. Industries that have international competitions get most

	permits free during the third phase with a linear decreasing trend based on benchmarking, but energy sector will have to pay for all permits in the third phase.
New Zealand emissions trading scheme (NZ ETS)	NZ ETS was launched on July 1, 2010, which is mandatory, with a target to cut greenhouse gas emissions between 10 and 20 per cent by 2020 on 1990 levels. Under the scheme, as the third phase of EU ETS emissions units are allocated based on an average of production across each industry which covers forestry, electricity, industrial process emissions and transport, waste, and agriculture.
Northeast U.S. Regional Greenhouse Gas Initiative (RGGI)	RGGI was established in January 2009, covering carbon emission from power plants in 10 states in the U.S. Northeast. RGGI has an absolute target to reduce emissions by 10 per cent below 2009 levels by 2018. The scheme also allows offsets from five different types of clean energy projects.
Tokyo Cap and Trade Program (TCTP)	Japan has a target of GHG emissions by 25 per cent by 2020 from 1990 levels. TCTP was launched in April 2010 covering around 1,400 top emitters in the metropolitan area. Under Tokyo Cap and Trade program, emission limits for large factories and offices were set which could be met by using technology such as solar panels and advanced fuel-saving devices
Australia's Carbon Pricing Mechanism (CPM)	Australia's national target is to cut emissions by 5 per cent below 2000 levels by 2020. CPM was launched in July 2012 which covers 300 of the biggest polluters from all sources except agriculture and land use, or the combustion of biomass, biofuel and biogas, which have to pay a tax of A$23 per tonne of carbon from July 2012. The installations under the mechanism are banned to use U.N carbon offsets until the system is replaced by nationwide emission trading scheme in 2015. It is also agreed by EU to link its ETS with Australia's scheme by 2018.
California Cap and Trade Program (CCTP) and Western Climate Initiative (WCI)	CCTP was launched in 2013 which covers emissions from power plants, manufacturing and transportation fuels under the target that is to cut the state's emissions to 1990 levels by 2020. Polluters receive 90 percent of permits they need to cover emissions for free at the outset and remaining permits to be offered at quarterly auctions, which began in November 2012. California Cap and Trade Program has been part of the Western Climate Initiative (WCI) since 2007, and is currently considering the links with Québec.

Québec's Cap-and Trade System (QCTS) And Western Climate Initiative (WCI)	QCTS was established in 2012 with a target to reduce greenhouse gas emissions in electricity and industry. The system enforceable compliance starts on January 1, 2013. Québec is a member of the Western Climate Initiative (WCI) since 2008, and intends to link its cap-and-trade program with California's.
Kazakhstan Emissions Trading Scheme (KAZ ETS)	Kazakhstan has an emission reduction target of 5 per cent by 2020 from the level of 1990. KAZ ETS was developed as Cap and Trade system in December 2011 by amendments and additions to its environmental legislation. Pilot phase of emission trading scheme started in January 2013 with an absolute cap and a decreasing linear trajectory.

Table 4 : Emission Trading Schemes Under Planning, [25]; [26]

ETSs	**Short description**
China: Pilot carbon trading schemes	China has an emission intensity target of 40 to 45 per cent reduction by year 2020 relative to 2005 level. In 12th five year plan, China approved pilot emission trading schemes in seven provinces and cities such as Beijing, Chongqing, Guangdong, Hunan, Shanghai, Shenzhen and Tianjin from 2013 or 2014 on. A national trading scheme is expected by 2016 to be operationalized.
India: Perform, Achieve and Trade system	Similar to China, India has pledged a 20 to 25 per cent reduction in emissions intensity from 2005 levels by 2020. India set emission trading scheme to begin in 2014 which is a mandatory energy efficiency trading scheme covering eight sectors responsible for 54 per cent of India’s industrial energy consumption. Under the scheme, annual efficiency targets will be allocated to firms. Tradable energy-saving permits will be issued depending on the amount of energy saved during a target year.

South Korea emissions trading scheme	Korea has an unconditional, voluntary target of 30 per cent reduction of GHG emission below BAU in 2020. Emission trading scheme is expected to start in 2015, covering about 470 companies from all sectors that together produce about 60 per cent of the country's emissions.

On the one hand, global climate talks continue under UNFCCC and its political institutions, on the other hand, more localized and regionalized based reactions are developing and improving by support of national and international politics. One of example of these international policies behind emission trading scheme is partnership for market readiness (PMR) which is supported by World Bank [56]. The PMR which is launched at the Conference of the Parties in Cancun on December 8, 2010, aims capitalization of $100 million for grant program that creates support to 15 implementing country participants in total. The idea of World Bank to build the partnership is to increase capacity in countries so that they can develop new market-based instruments to fight climate change. The form of market instrument recommended by world bank is to set up an emission trading system, where carbon emission could be priced. Each of the eight recipient countries, Chile, China, Columbia, Costa Rica, Indonesia, Mexico, Thailand, and Turkey already received an initial grant of $US350,000 in consideration to plan and prepare first documents how they will design and implement market-based instruments for greenhouse gas mitigation [57]. These countries are under process of developing their plans of emission trading scheme in aim to get further financial support from donor countries and Turkey is also one of these countries.

As in the example of World Bank's initiatives to expand emission trading scheme by country based getting support from international organization and developed countries. The aim is to set a climate regime which is organized first in local economy. But it is important to underline that what is offered is also a market based approach as planned by world bank.

This chapter of the thesis has an aim to analyze the experiences of different emission trading scheme for lessons that can be copied by the pilot emission trading scheme in Turkey. For this reason, the experiences of EU ETS which has been followed by others all around the world will be analyzed in the first subchapter. Having analyzing experiences of EU ETS are important in sense of defining the benchmarks for the sectors and auctioning allowances as a method of pricing the emissions, and also for the failure of in the first and second phase of emission trading scheme in sense of unsustainable prices and surplus of allowances. Pilot emission trading scheme in China will be the subject of second subsection, where the aim is to learn the target setting for the sector. While China is also a developing country as Turkey, any target set by China could be inspiration for Turkey to follow. Lastly, the emission trading scheme in The Regional Greenhouse Gas Initiative (RGGI) will be analyzed with a target of sectoral inclusiveness. RGGI is the first mandatory, market based program to reduce emissions of carbon dioxide in USA. The states participating in RGGI have established a regional cap on CO_2 emissions from fossil fuel based power sector and are requiring the plants to possess a tradable CO_2 allowance for each ton of CO_2 they emit [58].

4.1 EU ETS: Leadership of the Union

When greenhouse gases emitted, they become global simultaneously. That is why; there is a loose link between local actions and local impact in sense of emission of GHG. While local reaction may cause cost, the benefit can be shared by the other who never bears the cost [59]. EU has taken the leadership in UNFCCC process to establish an ETS in order to cut GHG emission. This could be seen as a risk of undertaking the cost of cleaning the atmosphere against non action of the most states. Before evaluating whether ETS creates cost or benefits for EU, it is important to consider that EU creates cost for emitting within the community. Once the pricing of externality of carbon dioxide has been done through whole major economies, then ETS established in different countries could be linked easily. This subsection of the thesis will focus on the experiences of EU ETS which could be a sample emission trading schemes for the other. Thus, it is important to see whether EU prices the emission correctly and creates incentives for non-emitting sector.

European Union started emission trading scheme in 2005 with the first phase of trading and leading other countries to follow and copy [60]. Schaik [60] claims that during this period, EU led climate regime and the negotiation under UNFCCC. Although EU did some mistakes regarding over allocation of allowance which caused the scheme to collapse during first phase, EU has played an important role to mobilize the world population towards taking action against climate change till 2009 [60]. Today, we can still talk about EU leadership in climate regime as the emission trading scheme in EU has been the most serious one and copied to some extended by the others.

EU ETS established through binding legislation proposed by European Commission [61] and designed on pricing of carbon, free trading of allowances and appropriate monitoring, reporting and verification of actual emissions of polluting sector. The important pillars of the emission trading scheme is well underlined by EU ETS as legislative body, monitoring, reporting and verification (MRV), price on carbon and free trade [61]. EU ETS works based on creation of CO_2 emission rights which could be auctioned and traded through the market created. EU ETS allows covered sector to have emission units (rights) to spare or to sell excess capacity to the other entities that have exceeded their targets. By this mechanism, a new commodity is created in the form of emission rights [11]. EU ETS provides an innovative solution for cost-effective emission reduction through trading mechanism.

The experiences of EU ETS from phase I and II is crucial to design phase III. In both phases, the market collapsed with over allocation where the emission cap was not set above business as usual scenario [62]. Moreover, most of European Union Allowances (EUA), the permit for emitting, were distributed free of cost which caused distortion and benefits for polluting sector especially when it was possible to reflect the price of carbon to end user as it is done in energy sector [63]. Allocation of allowances and the method used is one of the crucial points to avoid over allocation of allowances. During both first and second period, allocation was done by the method of grandfathering which is a static method based on the historical emissions generated [64]. That was the reason for a mistake in allocation because historical emission data was open to manipulation and misinterpretation. While business as usual scenario could not be estimated correctly causing the cap to be higher than business as usual, the financial crisis through 2007 and 2009 decreased overall production and economical activities which caused less emission, and surplus allocations [63]. Although national allocation plans (NAPs) were approved by the European Commission, decentralized manner of setting of caps through national allocation plans of member states raised the issue whether national caps has been set correctly [19].

In over allocation of allowances under emission trading the prices for EUAs went down very fast to zero in 2007 as in Figure 11 [10]. In phase II, the same mistake is done with over allocation and prices started to go down at the end of 2008-2012 period. Currently, the prices for EUAs are about 5 EUR/EUA [43]. The reason why the prices for 2013 is still around 5 EUR is that banking is allowed from phase II to phase III which may cause another surplus in phase III of EU ETS. According to the estimation of Point Carbon [10] and Neuhoff [63], surplus amount of allowance could be around 2.7 Billion.

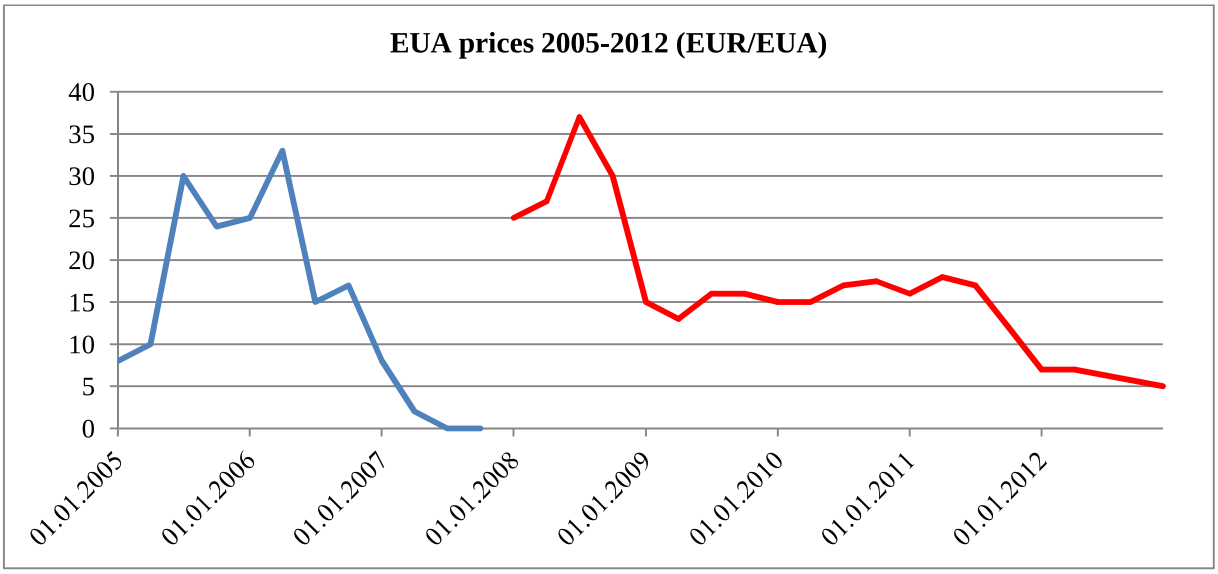

Figure 11: EUA Prices (2005-2012) [10]

In such a market, the confidence cannot be raised for either emission reduction policies or emission trading activities apart from speculative actions, but EU learns by doing. The reasons of over allocation such as grandfathering method will not be used for phase III; instead for estimation of emission benchmarking method will be used [64]. Benchmark is the amount of emissions per unit of production. This method enables to calculate actual emission and set the allowances accordingly while updating the emission cap when there is change in the production.

Currently, under EU ETS there are 31 member states with a centralized common cap of 2.040 Mt CO2e in 2013, reduced by 1.74% annually and GH reduction target of -20% below 1990 by 2020, which means a reduction of 21% below 2005 level [61]. Phase III went through severe changes to stabilize the price of carbon and trigger the real emission reduction. The most important lesson learned from first two phases are different national methods for allocating allowances to installations threatens fair competition in the internal market and cause over allocation of allowances and crash of the prices consequently.

There has been changes in EU ETS on regional implications to correct failures in first two phases. One of important implication in phase III is definition of sector wide benchmarks based on the performance of first 10 percent approach [65]. After trial of two phases with grandfathering, EU ETS defined 52 benchmarks for setting the caps in the sectors [65]. A benchmarking based method provides cap and allocates allowances based on a certain amount of emissions per unit of productive output. Benchmark method targets a harmonization of production process based on emission intensity per unit of production regardless of whether the cap is set as intensity target or as an absolute cap. Another change in design of third phase is a linear reduction of free allowances for each year and no free allowance for power sector [61]. EU ETS has also restricted number of emission reduction credits from CDM projects which can be read as a result of global climate regime, but EU ETS has possibility to be linked to national and regional ETSs.

Phase III of EU ETS is more promising for emission reduction and stabilization of carbon prices. The EU experiences will be a sample for everybody wanting to commit to reduce emission. However, it is clear that EU, in Phase III, aims to protect some sectors by free allocations which are open to international competition, but for some sector, such as power sector, there would not be free allocation at all which can reflect carbon cost to the end users [61]. EU ETS is a result of evolution from global climate regime with the mistakes for an aim to reduce emission.

This subchapter of the thesis analyzed EU ETS as regional reaction and continuation of global climate regime. The lesson learned from EU ETS is important for design of pilot emission trading scheme in Turkey. First of all, allocation of allowances that is based on grandfathering method caused surplus of allowances and consequently crashed of the prices in the market. Secondly, free allocation was one of the method used even in power sector where the emitters are trade off at the end. However, the method of benchmarking and a linear decreasing trend of free allocation aims stability of the market and emission reduction which is important to take in to consideration in design of pilot emission trade in Turkey.

4.2 Approach China in Emission Trading Scheme

China is the first developing country in reaction to climate change policies in sense of emission trading scheme. The reason behind moving forward has been pressure from international arena to commit targets of emission reduction. As an advanced developing country, growth rate of China is highly dependent on fossil fuel. Thus, China became the biggest carbon dioxide emitter that stems from the burning of fossil fuels and the manufacture of cement in 2006 and its emissions continue to rise rapidly in line with its industrialization and urbanization [66]. *Figure 12* shows the biggest contributors of increase in rate of carbon dioxide namely USA and China. Although for several decades, it was USA who was the leader of the contribution in emission, by 2006 the emission magnitude of China with high rate of growth passed the emission in USA [66].

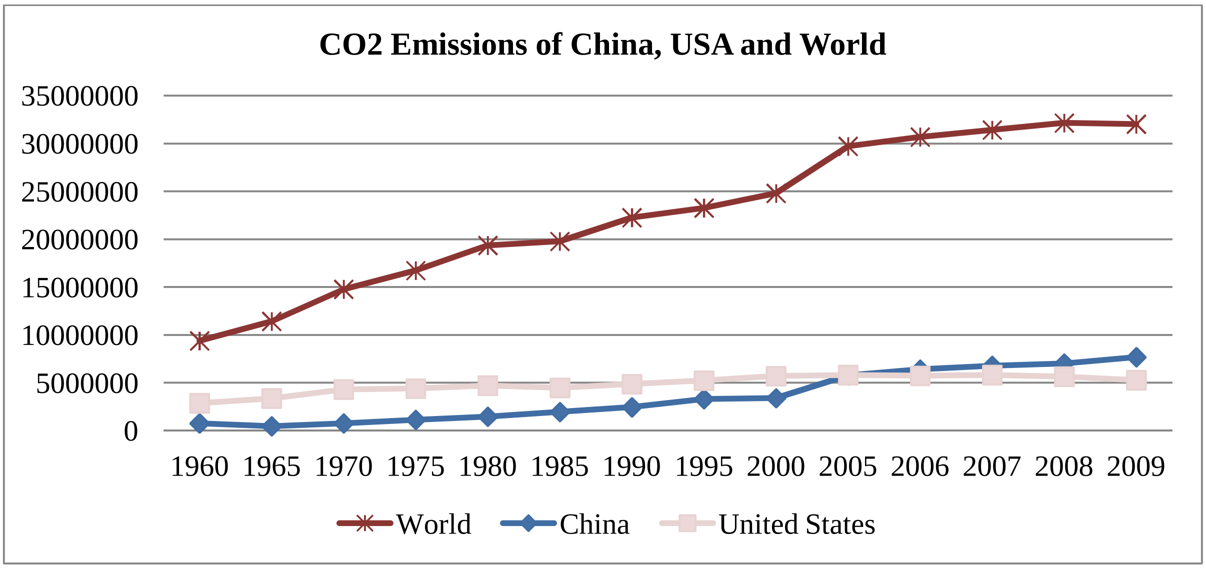

Figure 12: Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement for China, USA and World (kton CO_2 Equivalent) [66].

Under these conditions, China was facing heavy pressure from international arena to reduce emission or take steps to reduce emissions [13]. As a result, prior to United Nations climate change conference in Copenhagen (COP15) in 2009, China declared to reduce the carbon intensity of its GDP by 40 to 45 per cent by year 2020 relative to 2005 level voluntarily [67]. Following its voluntary action in international conference, China's climate action was included in the 12th five year plan (FYP) in order to reduce the carbon intensity by 17 per cent by 2015, relative to 2010 levels, and increase the share of non fossil energy with 11.4 percent by 2015 [67].

Government of China declared "gradually establishment of emission trading market" in the 12th FYP to catch up with the target of reduction in carbon intensity of GDP along side of statistical and auditing systems for GHG emissions, among many measures to reduce energy and carbon intensities (Yuan, J. Et al., 2012). To implement the target of local emission trading scheme in 2015, the 12th FYP issued *The Notice on Carrying Out the Work of Carbon Emission Trading Pilot Program* in November 2011, approving seven provinces and cities including Beijing, Tianjin, Shanghai, Chongqing, Shenzhen, Hubei Province and Guangdong Province to carry out pilot program of emission trading [68].

Consequently, how does China's ETS look like? Firstly, the country declared a voluntary emission reduction target which was a sign for national sector to be ready for emission trading and carbon pricing. Secondly, voluntary action is turned to be legally binding to all parties in the economy as declaration done in

12th FYP. Thirdly, a further action is taken by establishing pilot project that covers several cities and provinces. The last action, which has the most priority, is monitoring reporting and verification of GHG gases which was declared alongside of carbon intensity target of GDP in 12th FYP [68].

Although the sector that has to be covered by pilot ETS in China will be defined by local governments, it is estimated that power, iron and steel, ceramics, petrochemicals, textiles, non-ferrous metals, plastic and paper production would be included under the pilot ETS [25]. Besides the sectors that will be covered, emission reduction target is one of the most important parts of emission trading scheme. In spite of the fact that emission reduction of China is declared by intensity target at national level, many of the pilot regions and cities will set a target in absolute terms, which can be allocated through the exchanges already set [25].

One of the important steps towards emission trading scheme is monitoring, reporting and verification (MRV) of sectoral emissions. Without knowledge of emission from the sector, it cannot be possible to define the cap and allocate emission rights. When designing the ETS, either to set its scope, caps or allowance allocations, there is need of data for different types and different levels. A robust MRV system is a mandatory rule of emission trading schemes. That is why; China declared monitoring, reporting and verification alongside of emission trading scheme in FYP. It is MRV and sectoral studies on cost and benefits of the scheme which defined to be covered under emission trading scheme.

Another critical issues for China as other developing countries in setting up emission trading scheme is international competitiveness. While some of big emitters are also big exporters and drivers of the economy such as cement, steel and iron, ceramic, and petrochemicals, the cost of emissions on these sectors might trigger higher cost, and consequently, loss of international competitiveness. The dilemma expressed here is not only for China but also for other developing countries. As the growth in these countries are carbon dioxide embedded, any reduction of GHG emissions or pricing of carbon might cause the industries to lose power against competitive markets in international arena. This is the reason that makes climate regimes more complex than ever. The only solution is a fix global price on GHG emission, which seems far away to be achieved.

Given that China is the biggest emitter since 2006 and have pressure from international players, China declared an intensity target based on GHG emission intensity of GDP in 2009 instead of absolute target as EU and other Annex I countries which increased the concerns about reliability of energy intensity and

GDP data [69]. Prior to this declaration, China for the first time declared energy intensity target in her 11th five year plan which was 20 percent decrease during the period of 2006 to 2010 relative to 2005 level, which was seen as challenging target for Chinese industry [69]. The energy intensity target of 20 percent reduction in 2010 based on level of 2005 was ambitious for China while there had been intervention both in data and operation of industry to keep up with the target in 2010. First intervention was from state level to corrected GDP data showing that Chinese GDP grew faster and shifted more towards services than was previously estimated when it was seen that the reduction of energy intensity is not enough to keep the target [69]. Second intervention was more local to achieve the goal. Through the year 2010 when it is seen that the target cannot be reached, several factories required from province level to shut down 5 days for every 9 they operated [69].

It is well captured from the paper of Zhang [69] stating that the target of 20 per cent energy intensity was too ambitious for China, even though there was intervention of state in calculation of GDP which cut the value of energy intensity of GDP by 2010. The trial of energy intensity target was better than a simulation for China to decide on emission reduction strategy. Hence, Chinese target of emission reduction formed as not only energy intensity but combination of energy intensity of GDP and carbon intensity of Energy which makes a target of carbon intensity of GDP. This target has a tricky way to hide business as usual scenario behind GDP number which could be manipulated with change of GDP numbers. In referring to Kaya Identity [14] and Equation 2, when energy per GDP cannot be lowered which shall be done, then, any reduction in GDP may result a reduction in energy intensity of GDP, therefore, reduction in carbon intensity of GDP.

Furthermore, alongside of steady social and economic development, the energy intensity defined as the energy use per unit of GDP declines generally. According to IEA, China's emission intensity which is a combination of energy intensity of GDP and Carbon intensity of energy use fell to 2.33 kgCO2/US$ (constant 2000 U.S. dollar) in 2009, as compared to 4.97 kgCO2/US$ in 1990, a 53% decrease [70]. For the same period, emission intensity of the world average dropped only 15% and that of the OECD countries dropped 25% [70].

China creates a good sample for Turkey to follow both in the sense of emission reduction target and in handling the establishment of ETS. However, I believe that Chinese emission intensity target has a tricky way to hide raise of emission behind increased number of GDP. As argued by Bruns and Gross [87], energy and GDP go hand in hand, thus, the energy intensity cannot be arbitrarily reduced, instead a reduction in emission intensity is encouraged by investment in clean energy technologies. In this context, I also believe that emission intensity of energy use is more important and more appropriate to reduce emissions than emission intensity of GDP if the country has real intention to control emission and reduce it.

The lessons learned from approach of China in handling emission trading scheme are as follows [68].

1. A voluntary emission reduction target which is not binding internationally

2. Announcement of related laws internally to be legally binding to all parties in the economy as declaration done in 12^{th} FYP.

3. Establishment of pilot emission trading scheme that aims to orient sectors, cities and provinces for upcoming emission trading scheme and pricing of carbon emissions.

4. Establishment of monitoring reporting and verification of GHG gases which was declared alongside of carbon intensity target of GDP in 12^{th} FYP

The next subchapter provides a short view on Regional Greenhouse Gas Initiative (RGGI) in relation with the inclusiveness of the sectors that can be useful for design of pilot emission trading scheme in Turkey. RGGI is one of unique example that regulate only power sector emissions which is important to analyze.

4.3 Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) having aimed a cap of fossil fuel power sector is one of good sample in sense of restricted sectoral approach. RGGI was launched in 2009 as the first initiative among 10 north-eastern states in USA to handle emission of carbon dioxide in the logic of emission trading scheme [71]. Important aspects of the scheme are as below [16]; [71]; [73].

- The coverage of the Initiative is restricted with fossil fuel power sector with 25 MW limit or greater where it enables the participants to trade allowance and reduce emission in a cost effective manner.
- States, determining RGGI as a regional cap on the amount of CO_2, auction nearly all CO_2 allowances. 93 percent of all emission allowances entered to the market through auctions
- Participating states aims to invest with the money of auctioning in consumer benefit programs to build a clean energy economy.

- It is allowed by participating states to use offset credits from emission reduction projects to comply with the emission reduction limit. The RGGI States limit the award of offset allowances to five emission reduction or sequester emissions of carbon dioxide (CO_2), methane (CH_4), or sulfur hexafluoride (SF_6) within the 10-state region.
- The use of offset allowances are limited with firstly 3.3 percent of a power plant's total compliance obligation during a control period which could be extended by 5 percent and 10 percent if certain CO_2 allowance price thresholds are reached.

The scheme is divided by three compliance periods such as first period of 2009 to 2011, second period of 2012 to 2014, and third period of 2015 to 2018 [16]. During the first period of the scheme with participation of 10 states and fourteen auctions, the total number of allowances auctioned was total of 411 million CO_2 and total amount of income created was 952 million USD [73].

The lessons learned from RGGI are vital in evaluating and designing pilot emission trading scheme for Turkey. Firstly, sectoral limitation on fossil fuel power sector gives flexibility for other sectors to orient. Secondly, auctioning of most of allowance prices the carbon emission from the fossil fuel power sector. Thirdly, the link is set between emission reduction credits and scheme that enables the installation to use offset allowances. Fourthly, the participating states directed the income from auctioning to renewable and energy efficiency projects. Fifthly, the cost of emission cap passed on end consumers but with a less amount which is accounted for 0.19% to 0.55% of average residential electricity bills across the RGGI region in 2011 [73].

Having these lessons in mind, the pilot emission trading scheme in Turkey can be designed on concrete foundation that priorities the growth objectives of the country.

4.4. Summary of The Chapter

Introduction of the carbon emission trading scheme in developing countries under consideration of “common but differentiated responsibilities” has to have some development considerations than just having an absolute target of emission reduction. For that reason, both reduction in greenhouse gas emission and stimulation of low-carbon development shall be considered in priority for design of emission trading scheme in developing countries. Thus, the factors that reduce greenhouse gas emission shall be considered well as not to hinder economic development and growth in developing countries. While most of developing countries have growth projection based on heavy industry, carbon intensity of energy use is very high in these countries [74]. That is why, for the developing countries, the greenhouse gas emission control need to be considered well in order to avoid any obstacles for industries that shall be covered under emission trading scheme. For industries open to international competitiveness, carbon pricing to reduce emission might cause to lose competitiveness against international market which might not have carbon cost. This factors shall be considered while identifying covered industries, or shall be addressed through design features of the ETS.

Under the consideration of growth priorities, the samples analyzed in this chapter put a clear picture forward for Turkey to follow in design of pilot emission trading scheme. The sample of EU ETS puts forwards the importance of benchmarking and a linear decreasing trend of free allocation which aims to stabilize the market and emission reduction. China’s approach on emission trading scheme underlined priority of announcement of related laws internally to be legally binding for all parties and establishment of monitoring reporting and verification of GHG. Finally, the lessons learnt from RGGI of USA could be defined as firstly, sectoral limitation on fossil fuel power sector, secondly, auctioning of most of allowances, thirdly, the linking emission reduction credits with the scheme, fourthly, re-directing the income from auctioning to renewable and energy efficiency projects, fifthly, pass over of the cost of emission on end consumer which has to be avoided.

All these lessons will be considered in the next chapter while proposing design of pilot emission trading scheme in Turkey. The chapter 5 starts with a detailed analysis on emission characteristics of Turkey in consideration to base the emission trading scheme on correct and appropriate pillar that will enable emission reduction and re-direct of the finance for low carbon technologies.

CHAPTER 5. DEFINITION OF POLICY APPROACHES FOR TURKEY

As a developing country, Turkey has high rate of emission increase between 1990 and 2010 during the period in which the emission magnitude is more than doubled by 114 percent [75]. Being Annex I party to UNFCCC, Turkey does not have any emission reduction commitment under Kyoto Protocol, but there are expectations from international arena that Turkey commit emission reduction targets or develop strategies towards pricing carbon emissions [23]. The trend of localised climate regimes after failure in Copenhagen in 2009 is more suitable for Turkey to regulate a carbon market internally. The growth trend of Turkey, which has an average rate of 4.3 percent over 22 years up to 2011, has some priorities as other developing countries in consideration of climate strategies [76]. That is the reason why a climate strategy that saves national industries in international competition and enable for a smooth transformation to low carbon development is crucial for Turkey.

Any policy proposing for emission trading scheme has to consider the graphic in Figure 13. Turkey has high rate of GDP growth with 4.25 and population growth with 1.71 over four decades in which both indicators contribute to the overall carbon dioxide emission per capita of Turkey [80]; [77]. While population growth of Turkey has a declining tendency since 1970, emission per capita increases steadily as a contribution of growth rate of GDP.

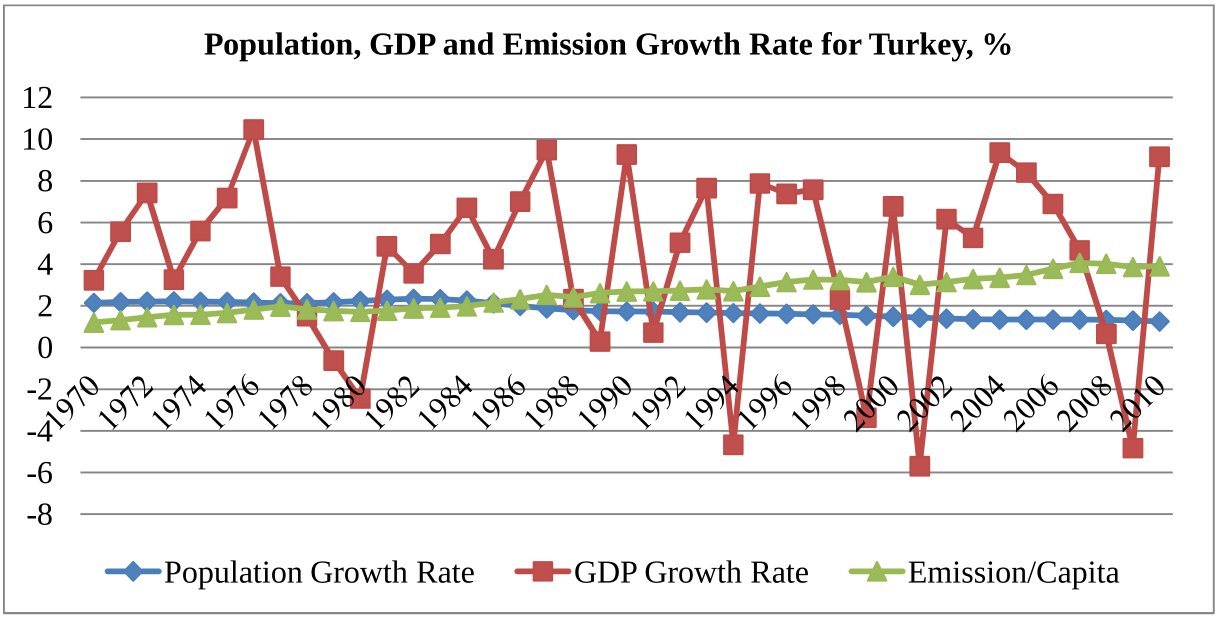

Figure 13: Population, GDP, Emission/Capita, Growth Rate of Turkey [77]

As presented by Kaya Identity in chapter 3, main contributors of total emissions are population, GDP per Capita, energy intensity of GDP and emission intensity of energy use. As population growth rate is more demographic then political and GDP per capita is sign of wealth, no policy can target to reduce GDP per capita and population for an aim of emission reduction target. Then policy choice for emission trading scheme has to focus on energy intensity of GDP and/or emission intensity of energy use. The statistical background of Turkey which defines the framework of the proposal for emission trading scheme will be the subject of next subchapter, where the focus will be on emission intensity of energy use and energy intensity of GDP.

Being as the first research on the issue of evolution of global climate change and emission trading scheme in Turkey, the policy approaches defined in this chapter has to consider the pillars as below.

1. To propose a design of pilot emission trading scheme based on fossil fuel power sector.
2. To propose emission intensity of energy use as an emission reduction target for Turkey
3. To define benchmarks with a linear decreasing trend for fossil fuel types based on the methodological tool on UNFCCC.

This chapter of the PhD work draws the line of the framework of the proposed pilot emission trading scheme with help of analyzed data sources that cause the emissions which is based on Kaya Identity. The aim in the first subsection is to find a point where emission reduction opportunity is possible and more economical for the country. The second subchapter provides a framework of design of emission trading scheme and underlines the necessities, derived from the data analysis and country samples that is analyzed in chapter 4. Overall target of this chapter is to draw the framework of pilot emission trading scheme with help of statistical data of Turkey and sample cases of ETS.

5.1 Statistical Pattern that Defines Possible Climate Policies of Turkey

One of important step in having concrete policies in climate change topic is to measure the emission data of industrial sector. As many believed that *if you cannot measure it, you cannot manage it*. The regulation on following up GHG in Turkey has been prepared with such kind of needs. The regulation on monitoring reporting and verification (MRV) was published on April 25, 2012 in official gazette with an aim to monitor and manage the emissions from industrial and energy sector of Turkey [78]. The regulation defined the year of

2015 as the start year of monitoring reporting and verification of emission from several sector and entities. This step was one of the important steps of Turkey for climate change negotiations beside signature of Kyoto Protocol in 2009 [27]. The aim of the regulation is to have concrete data of emission and emission sources which enables the ministry to control and manage them for a future emission trading scheme.

Before going in to details of design of emission trading scheme in Turkey, it is better to understand the country's situation by emission trend, emission intensity of GDP, emission intensity of energy production, emission per capita and GDP per capita. The subchapter of the thesis analyzes the emission related data of Turkey with a comparison of EU, developing country and rest of the world. The aim of the subchapter is to find a point where emission reduction for the country is more economical and effective. Therefore, the subchapter gives first clue of the design of emission trading scheme.

While analyzing the data of Turkey, Kaya identity as it is illustrated in chapter 3, Equation 2 will be applied to understand the patterns of the emission growth. Equation of Kaya Identity states that total emission amount at any time based on the pillar of population, GDP per capita, energy use per unit of GDP, carbon emissions per unit of energy consumed [14]. This simple equation can be used for estimation of future emission trends and the factors on total emission, which will be applied to analyze the impact factor of carbon intensity of energy on total emissions in next chapters.

Understanding and analyzing the magnitudes and patterns of the factors that influence CO_2 emissions in Turkey is a prerequisite to form the design of emission trading scheme. Following Kaya identity, one of the driver of increase of emission is population magnitude and growth where it contributes through increase of consumption and degradation of ecosystem. Thus, higher population magnitude results in higher rate of emission [79]. The population magnitude of Turkey is illustrated in *Table 5*.

Table 5: Population and Population growth rate of Turkey, [80]

	1990	**2000**	**2007**	**2008**	**2009**	**2010**	**2012**	**2015**	**2020**	**2025**
Population (millions)	56.47	67.80	70.59	71.52	72.56	73.72	75.62	77.60	81.78	85.41

The growth rate of population in Turkey has been declining since 1990 as shown in *Table 5*; however, the rate is still higher than the rest of the world. The population increase has been steady in Turkey with an almost stable growth rate which declining slowly [81]. In regards of Kaya Identity, population growth of Turkey may have an increasing trend on total emission of the country. Comparing the population characteristics of Turkey in *Table 6* with the rest of the world shows that Turkey is in between of the developing world where the characteristic of population growth rate is high with a declining trend [81].

Table 6: Population Growth of Selected Developing and Developed Countries [81]

Countries and Regions	**1990**	**1995**	**2000**	**2007**	**2008**	**2009**	**2010**	**2011**
East Asia & Pacific (developing only)	1.60	1.25	0.99	0.72	0.71	0.70	0.68	**0.67**
Europe & Central Asia (developing only)	0.65	0.07	0.20	0.23	0.33	0.45	0.48	**0.47**
Latin America & Caribbean (developing only)	1.86	1.67	1.48	1.19	1.16	1.14	1.13	**1.12**
Sub-Saharan Africa (developing only)	2.77	2.66	2.60	2.49	2.49	2.49	2.50	**2.53**
European Union	0.33	0.20	0.23	0.46	0.44	0.34	0.28	**0.27**
OECD members	0.86	0.80	0.72	0.74	0.75	0.68	0.63	**0.64**
World	172	1.49	1.32	1.18	1.18	1.17	1.15	**1.15**
Turkey	1.73	1.63	1.48	1.34	1.32	1.29	1.25	**1.21**

Another factor with reference to Kaya Identity and in search to define the place of Turkey for a better analysis and to form of emission trading scheme is gross domestic product per-capita (GDP/POP). GDP per-capita of Turkey is almost equal to mean of World and more than mean of developing countries as the *Figure 14* below [82]. While mean of GDP per capita of developing countries is round 6,160 USD with current prices, GDP per Capita of Turkey is 10,534 USD slightly higher than average of the world.

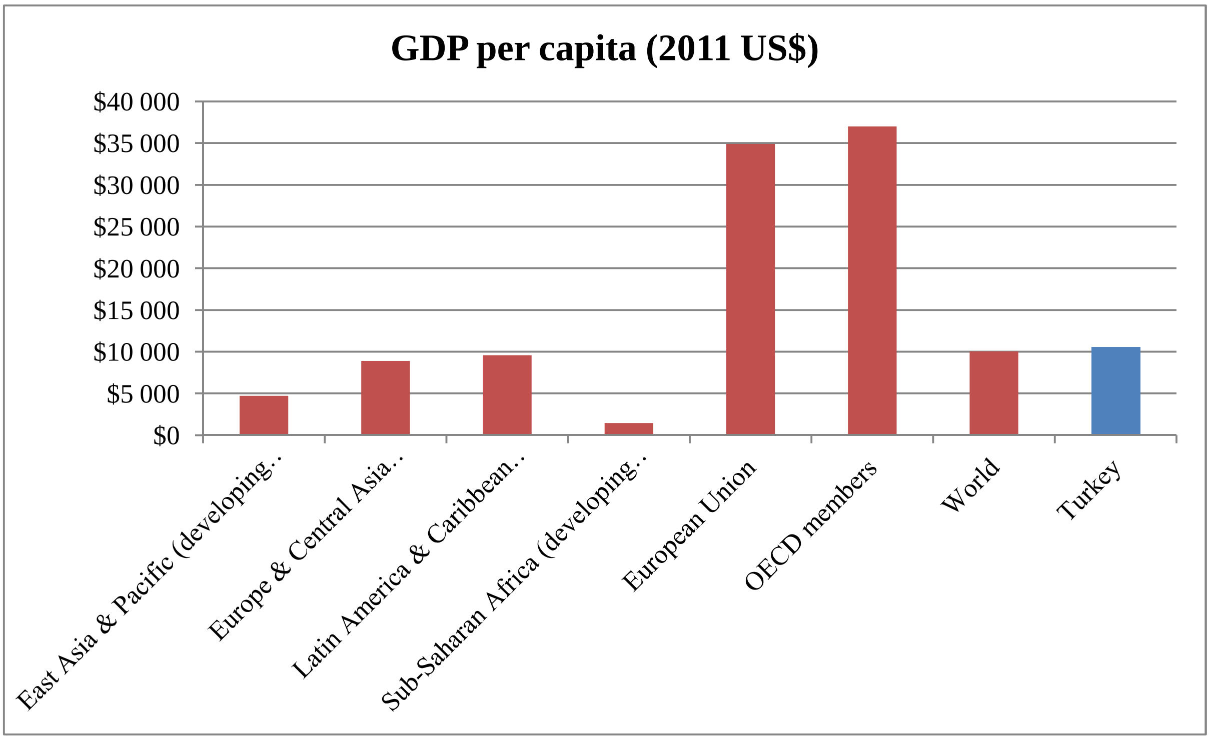

Figure 14: GDP per capita of developing and developed countries [82]

Based on this indicator, Turkey can be classified medium income country like other developing countries. Reference to Kaya Identity, higher income increases consumption power of the population which results in higher degradation of the environment and increases in carbon dioxide emissions [79].

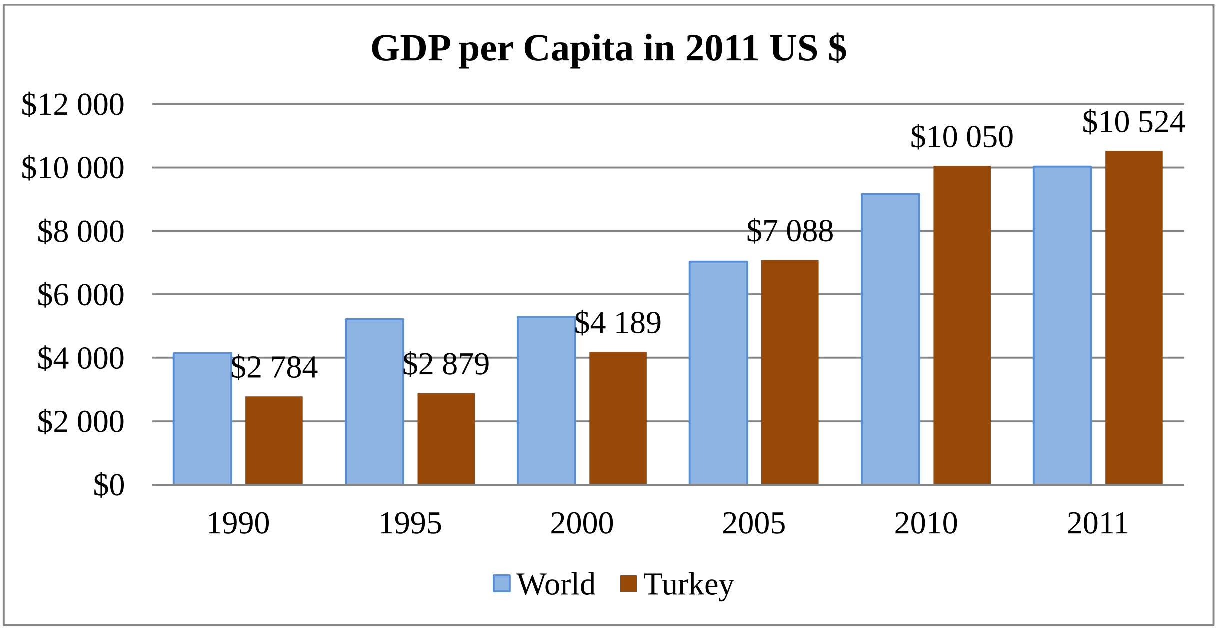

Figure 15 : GDP per capita over year, Turkey and mean of whole World [82]

Besides being a developing country, Turkey has been rapidly growing with a GDP per capita around 2,000 USD in 1990 to 10,000 USD in 2012 as in *Figure 15* [82]. The growth rate of the average of the world has been less than Turkey. The growth rate of Turkey has been volatile during period of crisis as *Figure 16* which showed that economy of Turkey is highly dependent on financial means of foreign investments. High rate of growth shows that the country will consume more and consequently cause more emissions. The growth rate of Turkey over 22 years has been 4.3 percent while the world has been grown by 2.7 percent [76]. The rate and patterns of growth shows a similarity with the rest of developing countries with a volatile trend of growth and openness to external crisis shocks.

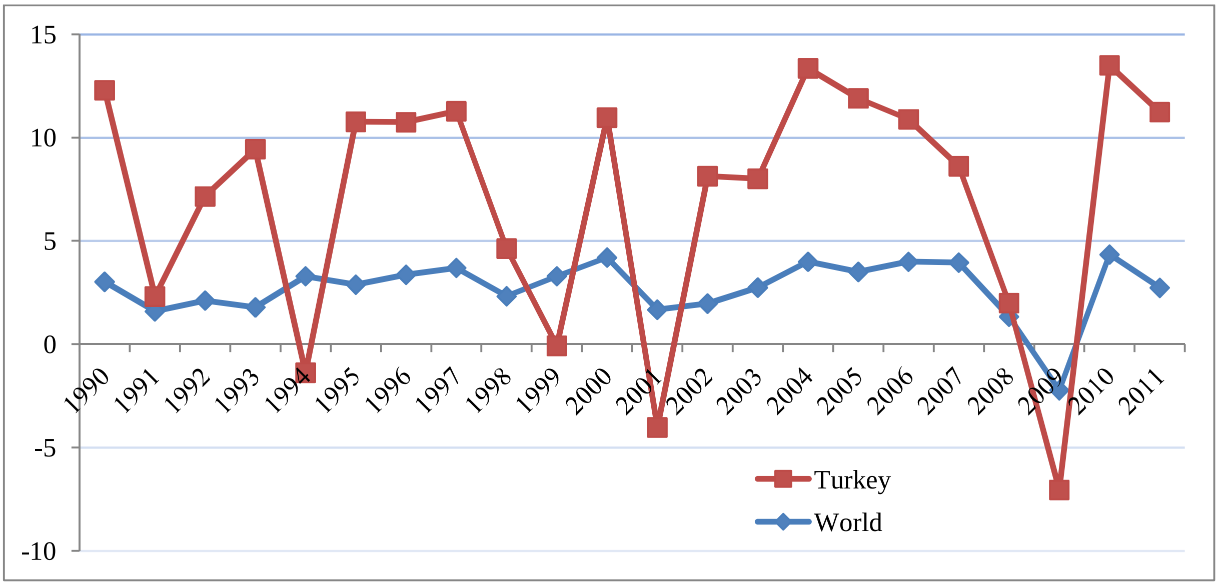

Figure 16: Growth rate of Turkey compared to World (%) [76]

As the factor of population and GDP per capita from Kaya Identity have direct impact on magnitude of emission of carbon dioxide, the policy instruments cannot easily handle these two indicators to reduce emissions. Firstly, governmental policies mainly targets to increase GDP per capita to raise the welfare and gain votes, which in turn increases emissions. In other words, increase in welfare results in more consumption and raises the level of emission. Secondly, the indicator of population has been more interlinked with social and demographic character that cannot be easily controlled by policies. As a result, any climate policies aiming to price carbon and reduce emission have to consider other two indicators, namely, energy intensity and carbon intensity, are two policy instruments to handle the issue of emission reduction.

Economic recovery leads to an increase in total energy consumption per unit of GDP, which is called as energy intensity of GDP. Energy intensity is the ratio of primary energy consumption to gross domestic product (GDP) measured in constant USD $ at purchasing power parities. *Figure 17* shows energy intensity in kilogram of oil equivalent per constant $2005 USD at purchasing power parity [83]. Turkey's energy intensity has remained relatively stable over the past decades around 0.11 kilogram of oil equivalent (koe) of primary energy while the energy intensity value for average world total has been around 0.20 koe/$ and decreasing constantly [83].

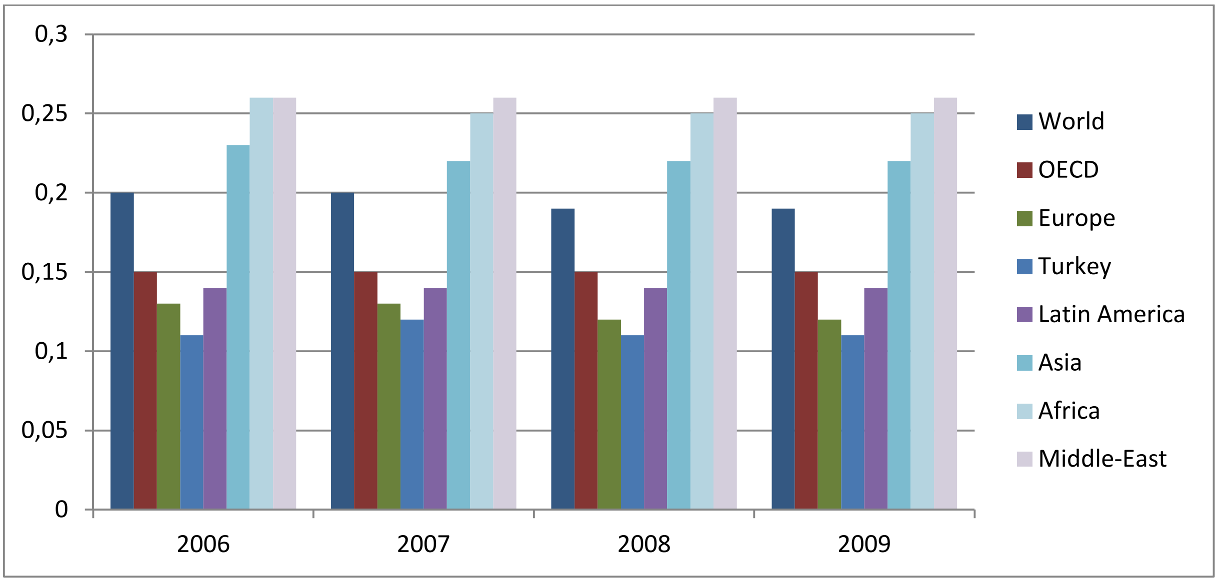

Figure 17: Energy intensity of GDP (koe/$2005p)[83]

Even though Turkey has a low level of energy intensity compared to rest of the world, strategic documents of energy efficiency prepared by Ministry of Energy and Natural Resources of Turkey [84] claims for 20 percent reduction in energy intensity by 2023 compared to base year 2011. Through this official document, the reduction is materialized over energy efficiency activities of the country and supplemented by policies. Once the target is achieved, that can contribute to over all emission reduction of the country. However, as it is raised by EIA [70], reduction in energy intensity might not accounted as there is energy savings, it can also be fostered by a faster growth in services than in the more energy-intensive industry. The tendency of energy intensity in Turkey for over 10 years has shown a stable character while for the world it has been diminishing as *Figure 18*. From this picture, the projection of Ministry of Energy and Natural Sources of Turkey aiming to reduce 20 percent of energy intensity seems to be challenging as indicator seems to be already very low compared to OECD and other developed countries.

Figure 18 is derived from the statistical data of IEA [85] which has very good correlation with *Figure 17*. According to both figures, it is clear that Turkey has a stable energy intensity trend that is lower than mean of World and mean of EU. The level of energy intensity value for Turkey is in parallel with other developing countries such as Mexico and Brazil, but lower than China and India [85].

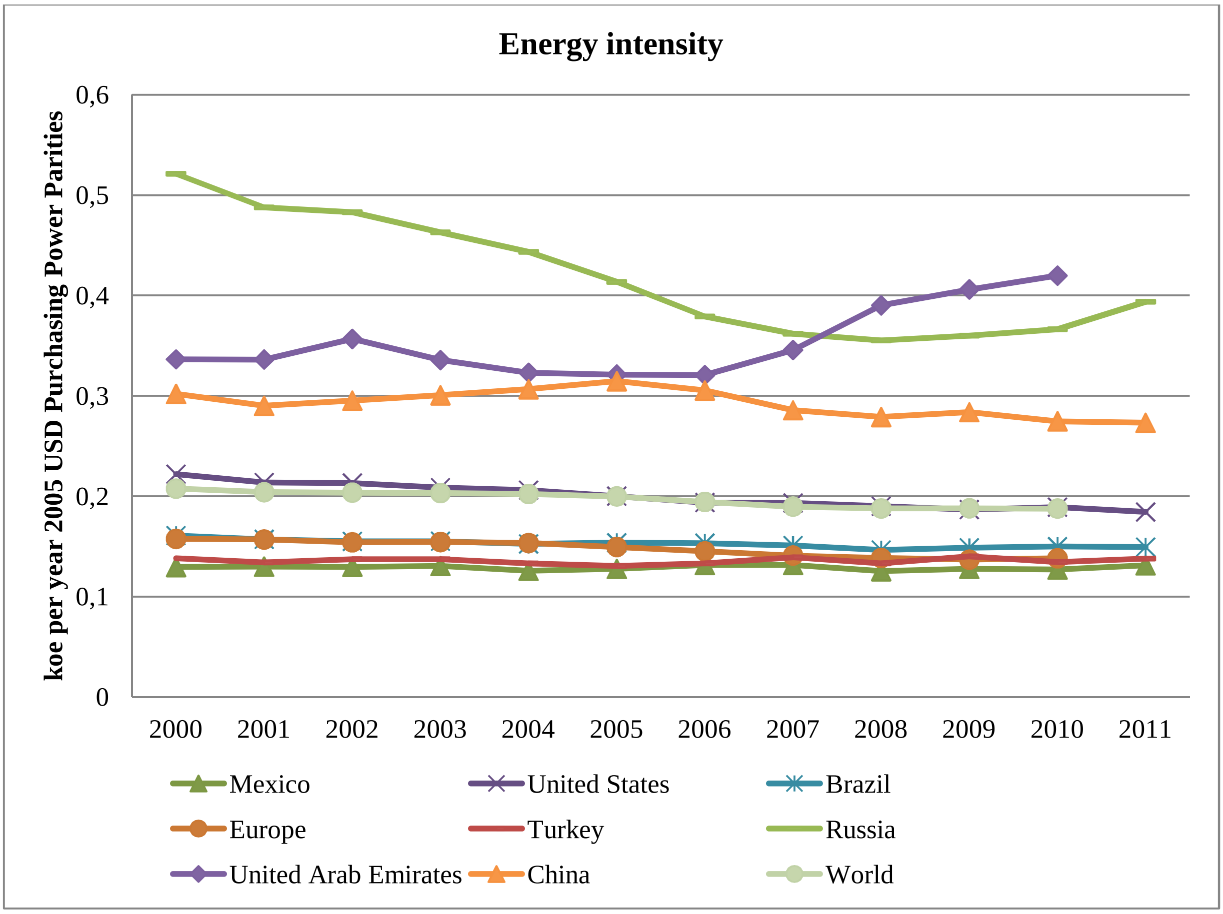

Figure 18: Energy Intensity, Total Primary Energy Consumption per Dollar of GDP (koe per year 2005 USD Purchasing Power Parities), [85]

Turkey's energy intensity per GDP (PPP-adjusted in constant year 2005 US$) has remained relatively steady over the last two decades, as for Europe, there is a much stronger downward trend over all of the last 20 years. Low level of energy intensity of Turkey, therefore, not only reflects its low GDP per capita relative to OECD Europe but also suggests that the economy is already relatively energy efficient, given the value of its output [86].

The last factor that Kaya identity uses to calculate emission magnitude is carbon intensity of energy consumption, which is also called as emission intensity. Carbon intensity indicates emission of grams per mega joule energy consumed [87]. The decreasing trend in carbon intensity regarded as decarbonization which could be a result of technological development or a shift to lower carbon emitting sectors, such as from coal to gas or from gas to renewable energy [88]. With regards to Raupach et al. [79], although Kaya Identity could be decreased to three factors deriving from Equation 2 and combining energy intensity of GDP and carbon intensity of energy under carbon intensity of GDP as the **Chyba! Nenalezen zdroj odkazů.**, carbon intensity of energy will be analyzed separately for better view of unit of carbon emitted per energy consumption.

Equation 3

$$\frac{C}{GDP} = \frac{E}{GDP} \times \frac{C}{E}$$

Combining energy intensity of GDP and carbon intensity of energy can well hide emission of the country when there is a shift of economy to less carbon intensity sectors such as services. Thus, once carbon emission is constant and GDP increases that causes the carbon intensity of GDP to go down, however, there is no real emission reduction. That is the reason not to combine both indicators in this PhD dissertation. The indicator of carbon intensity of energy consumption is calculated by carbon emission of the listed countries divided by primary energy use as kilogram of oil equivalent. That is carbon dioxide emissions from solid fuel consumption per energy consumed. As *Figure 19*, carbon intensity of Turkey has been stabile over 20 years around 2.8 kg/koe (kilogram per kilogram of oil equivalent energy use). Energy use of Turkey has been carbon intensive more than mean of World, OECD countries and major developing countries, such as Brazil and Mexico, but lower than China which has a carbon intensity of energy use around 3.1 kg/koe.

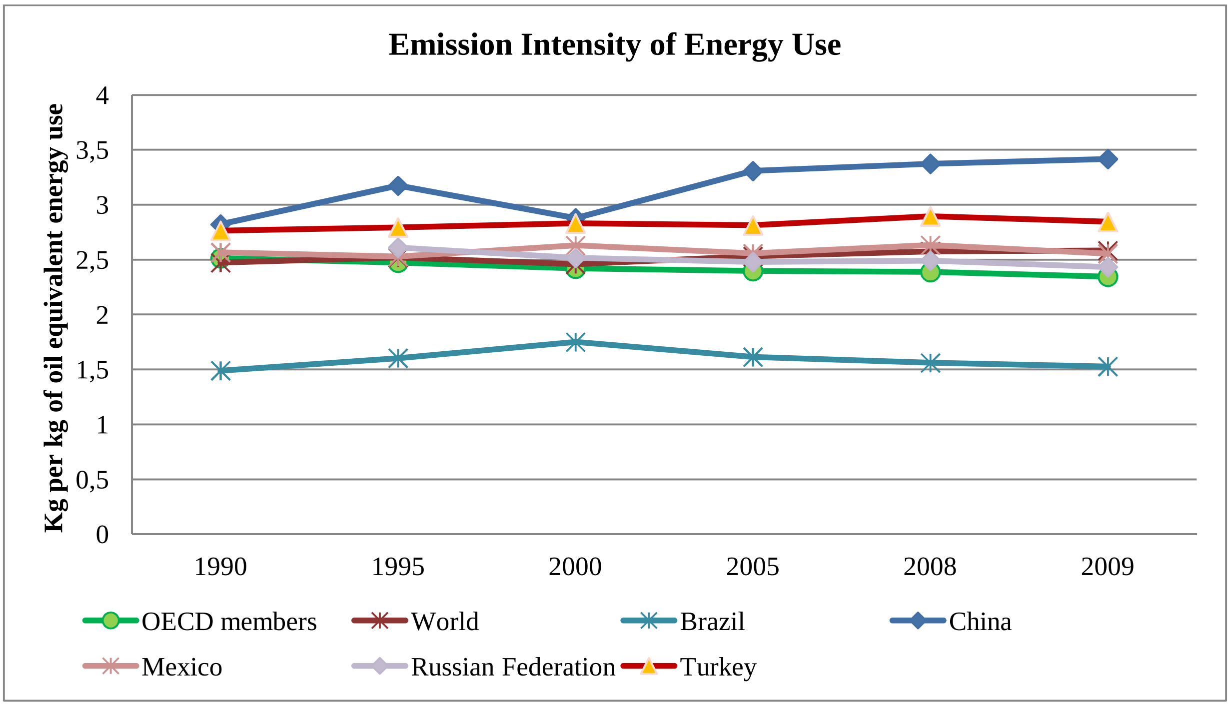

Figure 19: Emission Intensity of Energy Use (kg per kg of oil equivalent energy use) of selected countries [74]

In framework of Kaya identity, analyzed data of Turkey shows different characteristic in some of indicators. While GDP per capita shows a characteristic of developing country with a rising tendency, the growth rate of population for Turkey is identical to developing countries with a decreasing tendency as GDP per capita raises. While politicians tend to increase GDP per capita, it does not have a short run impact on tendency of population growth. There remain to indicators that policy instruments to reduce emissions has to rely on such as energy intensity of GDP and emission intensity of energy use [89]. Even though reduction of energy intensity is expressed as a policy of Ministry of Energy and Natural Resources as a target of the year 2023, the value of energy intensity of Turkey is very low compared to developing countries which do not leave any room for an emission reduction policy. Moreover, a climate policy based on energy intensity may have more aims than just targeting emissions reductions. In case of Turkey, the aim to reduce energy intensity declared in the context of energy efficiency independent from a climate policy [84]. As it has already been discussed in the previous section that Turkey has stayed away to declare any target in context of climate strategies and cut its emissions. Consequently, interpretation of target to reduce energy intensity with 20 percent by 2023 based on 2011 value could wrong in the context of this thesis.

Considering indicators of population, GDP per capita and carbon intensity, Turkey shows a characteristic of developing country. In this sense, the request of Turkey to be removed from Annex 1 of UNFCCC was a reaction to be considered by other parties. On the other hand, having a high carbon intensity of energy use, the emission magnitude of Turkey has accelerated over 20 years by an increase of 114 percent compared to the level in 1990 [53].

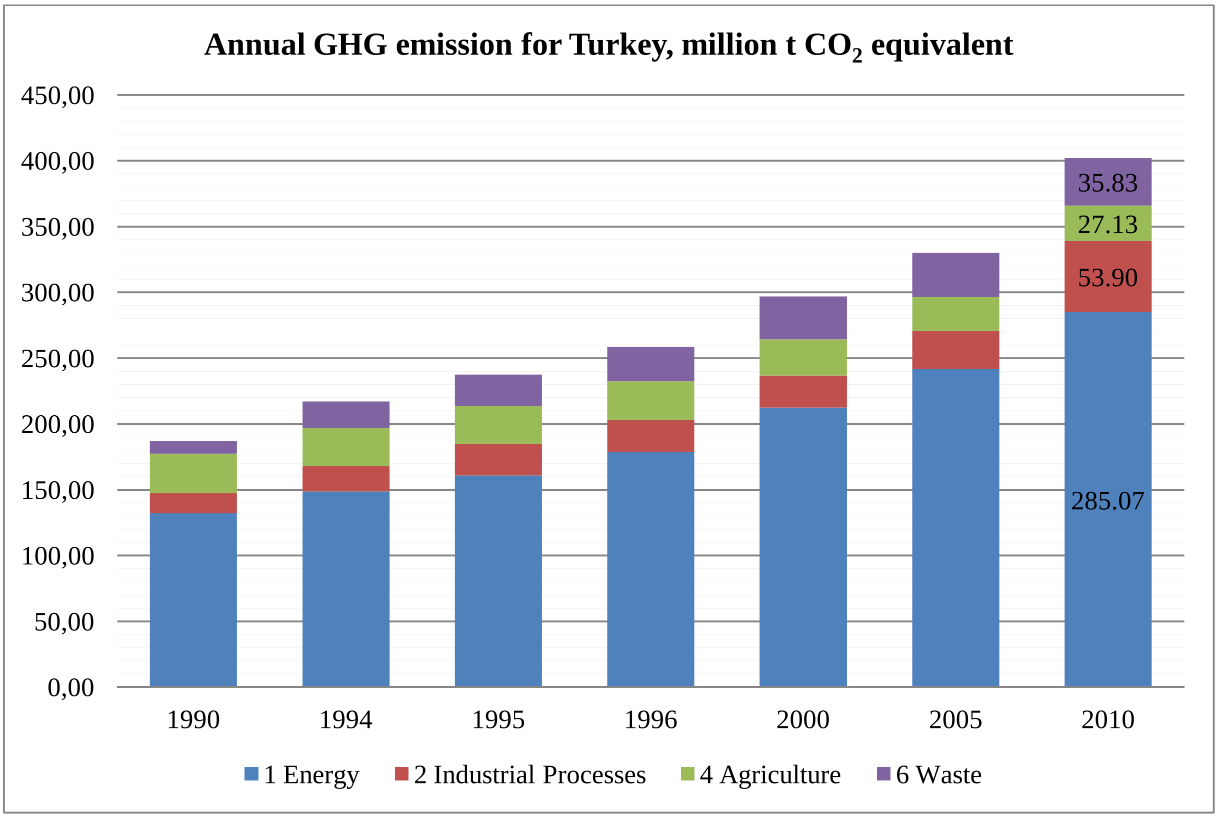

Figure 20: Annual GHG emission for Turkey, million ton CO_2 equivalent [75]

Figure 20 represents high growth of GHG emission of Turkey which is doubled in 20 years [53]. While increasing trend of emission is a characteristic of developing country, carbon dioxide emission per capita is still very low in these countries when compared to developed countries. As in *Figure 6* showing carbon dioxide emissions stemming from the burning of fossil fuels and the manufacture of cement, carbon dioxide emission per capita for Turkey is around 3.9 ton CO_2 which is at the bottom of figure with other developing countries compared to high per capita emission of OECD and United States [24].

For almost all indicators analyzed in this section except energy efficiency value, Turkey shows a characteristic of developing country in sense of GHG emissions. Per *Figure 20*, Turkey has a high rate of increase of emission, that is why, the pricing of carbon dioxide emission becomes crucial for Turkey and that has be done in way as the rest of developing countries are doing. The responsibility of developed countries in sense of emission reduction shall be differentiated while the development level of these countries are one stage that business as usual scenario of these countries already show a declining tendency of energy intensity of GDP, carbon intensity of energy use and population ([81]; [83]; [85]. So, without any serious emission reduction targets, developed countries can benefit from a decrease in emission due to the shift of their economies to more service sector than heavy industrial sector [75]. *Figure 21* clearly states the trend of GHG emissions for Annex I countries with a declining trend, which underlines the need for more ambitious target and leading position of developed countries in consideration climate policies.

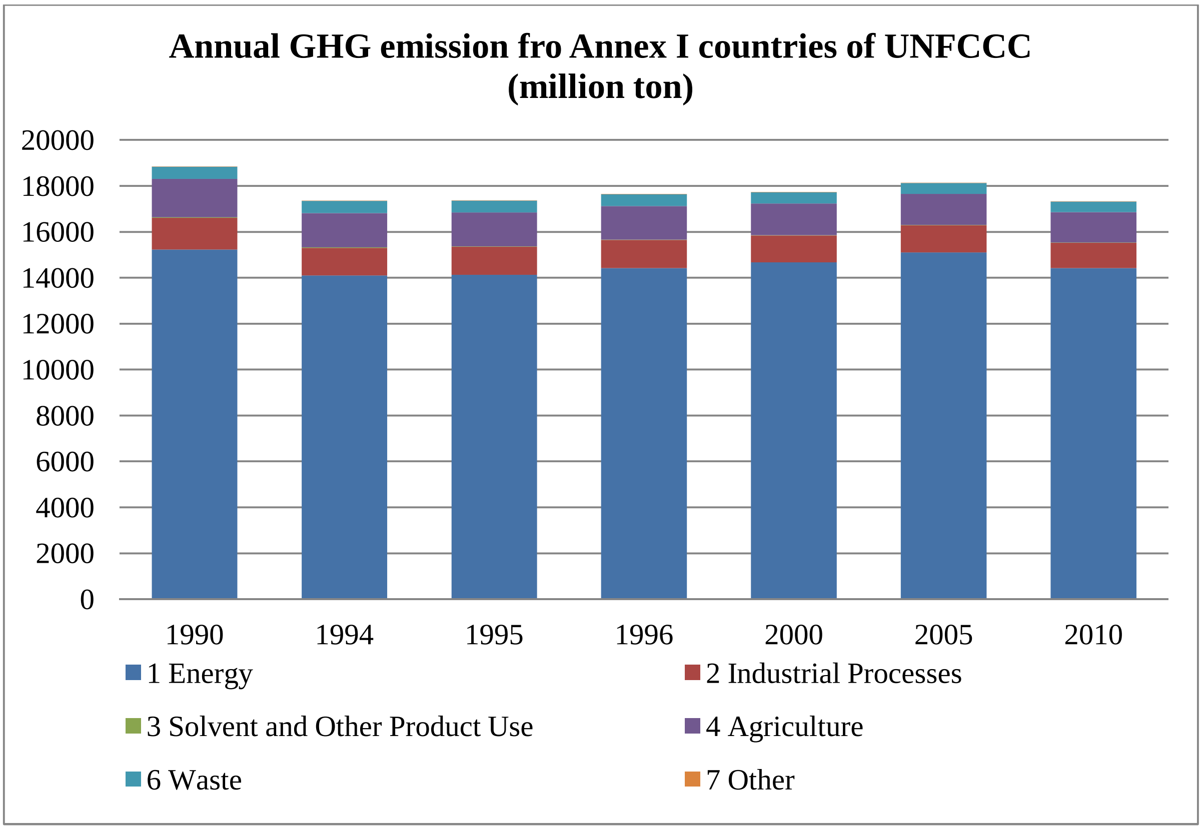

Figure 21: Annual GHG emission for Annex 1 countries of UNFCCC (in million of CO_2 equivalent) [75]

The main question of the thesis is stated as how can climate policy of Turkey be defined answered partly in this section by analysis of the data with help of quantitative methodology. It is found through this subchapter that Turkey has a characteristic of developing country with high growth rate of population, high and volatile rate of growth, high rate of emission intensity. The data which was contrary to other developing countries is energy intensity of GDP. This rate is low in Turkey as 0.11 kilogram of oil equivalent (koe) of primary energy while the energy intensity value for average world total has been around 0.20 kg/koe.

This subchapter also provides proofs for the first and second hypotheses which indicates emission from power sector and emission intensity as being high that gives room for further emission reductions. While one out of four emissions of Turkey caused by power sector, any policy target the sector can benefit by emission reductions. Moreover, being dependent of fossil fuel energy production by 74.62 percent, emission intensity of Turkey is around 2.8 kg/koe (kilogram per kilogram of oil equivalent energy use), which is higher than mean of World, OECD countries and major developing countries, such as Brazil and Mexico, but lower than China which has a carbon intensity of energy use around 3.1 kg/koe [74].

The indicators borrowed from Kaya Identity shows that policy makers in Turkey can focus on carbon intensity of energy use which is higher compared to values of other developing countries and the mean of the world. Having a higher value caused by higher dependency on fossil fuels which gives the room for a reduction. A reduction in carbon intensity of energy use can be formulated through pricing of carbon emission which has to be design in a way to reflect development characteristic of Turkey and do not hinder the growth trend of the country. As the analyze in the forth chapter, the lesson learned from RGGI were indicating fossil fuel based power sector for target of emission trading scheme, while lessons from China underlying the importance of an intensity target instead of absolute target. Both of these lessons will be discussed in the next sub chapter to form the framework of the pilot emission trading scheme.

5.2 Framework of The Proposal for ETS

The aim with this complementary subchapter is to draw the framework line of the proposal for design of pilot emission trading scheme based on the analyzed statistical data of Turkey and samples approaches of EU ETS, China and RGGI.

Carbon dioxide emission from electricity sector in Turkey is around 107 million ton CO_2 which is 32.7 per cent of whole CO_2 emissions and 26.6 percent of whole GHG emissions of Turkey by 2010 [53]. Having the largest share in GHG emissions, fossil fuel based electricity production is one of the key sectors for climate change policy of Turkey. Any policy proposal based on power sector will have impact on one of four of whole country emission. Thus, having effective instrument for fossil fuel based energy sector might have a reducing impact on the emission of electricity sector which has been more than tripled since 1990. This increasing trend has two negative impacts on Turkish economy: one is an increasing rate of emissions, and the other one is a dependency of fossil fuel which has to be imported from other countries. Consequently, the policies that price the carbon emission of fossil fuel power sector will naturally have a positive impact on comparative advantages of renewable energy, assuming that cost of carbon price is not reflected on electricity prices. Consequently, as in the case of RGGI the target sector to apply pilot emission trading scheme and reduce emission defined as fossil fuelled power sector.

As it has already been discussed in the previous sub-chapter of this PhD work, there are only two indicators except from population and GDP per capita that

Turkey can focus, such as energy intensity of GDP and carbon intensity of energy. Having in mind Kaya Identity as a formulation of emission calculation, possible emission reduction target of Turkey could be based on two indicators of this Identity such as energy intensity of GDP or emission intensity of energy consumption. It is stated by the data from Enerdata [83], EIA [70] and NERA [86] energy intensity value of Turkey is already low which does not provide room for more reduction. On the other hand, emission intensity of energy consumption for Turkey is one of the highest in developing countries [70]; [83]; [86]. While China is using combination of these two indicators as defining climate strategy and emission reduction target, the proposal defined in this work based on usage of carbon intensity of energy use as a base for emission reduction target for Turkey [87].

Explained by *Figure 18: Energy Intensity, Total Primary Energy Consumption per Dollar of GDP (koe per year 2005 USD Purchasing Power Parities), Figure 18* in previous subchapter, energy intensity of Turkey is so low that energy efficiency policies may not be effective enough to further lower it, although there is a target of 20 percent reduction by 2023 relative to 2011 of Ministry Energy and Natural Resources (MENR) [84]. Even though it is claimed by Ministry of Environment and Urbanization (MEU) [27] that energy intensity value is higher than many developing countries, the value provided for 1990 is 0.17 toe/$ 2000p and 2008 is 0.12 toe/$ 2000p which is lower than OECD value of 0.18 toe/ $ 2000p. Moreover, the same report in the next page expresses energy intensity value for the year 2008 of Turkey as 0.26 toe/$2000p, which shows the unreliability of the report.

The value of energy intensity is provided in first section under *Figure 17* and *Figure 18* by two sources providing a correlation. According to these data, energy intensity of GDP in Turkey is lower than OECD countries which could be interpreted as high share of GDP comes from non-energy intensity sectors. Additionally, energy intensity value of Turkey has shown a stable character over 20 years showing that any reduction could be hard to be achieved [85]. Based on the reason above, this subchapter focuses on emission intensity of energy use to be a base for climate strategy of Turkey.

Besides the definition of the target as emission intensity of energy use, another important pillar of the scheme is to definition of the method for reducing the emission intensity which is benchmarking method. There are two approaches to set a cap such as grandfathering which is based on historical emissions as it is done in the first two phases of EU ETS, and the other one is benchmarking as it is proposed for the third phase of EU ETS [64]. Grandfathering necessitates not only correct emission data of the sector but also a precise emission projection that enables the cap to be set below the business as usual. EU ETS, after trial of two phases with grandfathering, defined 52 benchmarks for setting the caps in the sectors [65]. Contrary to grandfathering, a benchmarking based method provides cap and allocates allowances based on a certain amount of emissions per unit of productive output. Benchmark method targets a harmonization of production process based on emission intensity per unit of production regardless of whether the cap is set as intensity target or as an absolute cap. The benchmarking method of EU ETS is an inspiration to approach fossil fuel power sector in Turkey. Starting from beginning to auction all allowances might cause a heavy burden on power sector to adopt. For this reason benchmarking based on emission intensity mean of the sector defined by methodological tool of UNFCCC is used to put burden on inefficient power plants for the first year, then decreasing the benchmark by a linear trend for auctioning of allowances. The method of auctioning and offsetting of emissions are defined and illustrated in subchapter 5.4.

Under the circumstances defined above, the proposal of pilot emission trading scheme in Turkey shall be formulated on the pillars as below:

1. Defining fossil fuel based power sector as a target of pilot emission trading scheme
2. Targeting to reduce emission intensity of energy production instead of a national absolute cap by setting a linear benchmark for different fuel types in fossil fuel energy plants,

The methodology to be used in order to define benchmark for the sector belongs to UNFCCC which partially modified by the author for pilot scheme and political acceptance of the benchmark. The aim of the proposal of pilot scheme is manifold as to offer policy makers a pilot scheme to start emission trading mechanism and introduce carbon pricing in the energy sector, to make inefficient power plant to pay for emitting carbon dioxide, to create a tax income for government that can be spent on capacity building for climate change.

The subchapter at hand provided a framework of the proposal for design of pilot emission trading scheme which is based on six pillars. It is important to keep in mind that for operation of these six pillars based on institutional and statistical data availability. Thus one relies on related laws and regulations and the other relies on monitoring reporting and verification of the emission related data from the sector targeted, which is going to be discussed in the last subchapter. The following chapter will focus on the design of pilot emission trading scheme to deliver contribution of the thesis.

5.3 Conclusion of the Chapter

Over all emission of Turkey has a high rate of increase since 1990s which is caused the total emission to double. The contributions of the emission is based on the high growth rate and relatively high rate of population over the same decades. Moreover, the dependency rate of growth on fossil fuel power sector is one of determining indicator in high rate of emissions. Turkey has been growing with 4.3 percent over past decade, while her emission doubled with rate of 114 percent over past two decades [76]; [53].

Carbon dioxide emission from electricity sector is 26.6 percent of whole emission in Turkey in 2010 [53]. Having the largest share in GHG emissions, fossil fuel based electricity production is one of the key sectors for climate change policy of Turkey. With parallel to approach of RGGI in northeast of USA, the policy proposal based on power sector will have impact on one of four of whole country emission in Turkey. Being dependent of fossil fuel energy production by 74.62 percent, emission intensity of Turkey is around 2.8 kg/koe (kilogram per kilogram of oil equivalent energy use), which is higher than mean of World, OECD countries and major developing countries, such as Brazil and Mexico, but lower than China which has a carbon intensity of energy use around 3.1 kg/koe. Alongside of approach developed in China which is based on emission intensity of GDP, the proposal defined in this chapter offer a target of emission intensity of energy use which can be targeted by definition of benchmark in fossil fuel based power sector.

Analysis of the statistical data and the samples of ETSs defines the framework and pillars of pilot emission trading scheme in Turkey. These pillars consist of firstly, definition of fossil fuel based power sector as a target of pilot emission trading scheme, secondly, targeting to reduce emission intensity of energy production by setting a linear benchmark for different fuel types in fossil fuel energy plants. This offer based on the lessons learned from EU ETS, RGGI and approach of China, while considering growth priorities of Turkey. The inclusiveness of the sector as fossil fuel power generation is chosen based on the approach of creating minimum negative impact on international competitiveness of the country. As in the case of RGGI, cost of pricing the emission reflected on retail price counted up to 0.19% to 0.55% of average residential electricity bills, this can also be controlled in Turkey with related institutional control over retail prices.

Under the framework and pillars of emission trading scheme, the next chapter aims to provide the results of the thesis for theory, policy makers, academics. The next chapter, said shortly, targets to price the carbon emissions by defining a linear decreasing benchmarks for fuel types of electricity generation to reduce emission intensity of power generations.

CHAPTER 6. MAIN RESULTS: A PROPOSAL OF DESIGN FOR PILOT EMISSION TRADING SCHEME IN TURKEY

Being as the first research on the issue of evolution of global climate change and emission trading scheme in Turkey, the target of the chapter is to price the carbon emission in power generation sector with an orientation year. The chapter of the thesis provides a form of design for pilot emission trading scheme for Turkey based on the pillars defined in pervious chapter which is the inclusiveness of fossil fuel based power sector as a target of pilot emission trading scheme and reduction of emission intensity of energy production by setting a linear benchmark for different fuel types in fossil fuel energy plants. The pillars defined in previous chapter will be supported by the method of auctioning of allowances as a way to price the carbon emission and linking of voluntary carbon market for offsetting possibility. Having a period from 2016 to 2020 for pilot emission trading scheme, the methods supporting pillars are as below:

1. To allocate allowances free for the first year and decrease with a linear trend of 2.5 percent for the following years with an aim to auction allowances, thus, price carbon dioxide emission.
2. To link the voluntary carbon market with the established system which gives room for cost effective emission reduction.

With a target of defining a linear decreasing benchmark, the first subchapter works on the benchmarks for fuel types of electricity sector with the help of methodological tool of UNFCCC [29]. The aim of the fourth subchapter is crucial while it analyze the impact of benchmark on the emitting sector by applying the benchmark through auctioning. Projection of energy production will be analyzed and both benchmarking and allocation of allowances will be designed on projected data for energy production. The last subsection of this chapter will raise the question for institutional needs of emission trading scheme. The step that have been taking so far by Turkey will be analyzed with an aim to underlying the missing institution in need.

Overall target of this chapter is to define the design of pilot emission trading scheme with an aim of reducing emissions in fossil fuel based energy generation by providing a benchmarking method for inefficient power plants to pay the cost through a mechanism of auctioning allowances and emission trading.

6.1. Defining Benchmark for Pilot Emission Trading Scheme (2016-2020): Methodological Approach

The aim with defining a benchmark is to set an emission standard per electricity production in regards of fuel types. Besides emission reduction, for design of emissions trading scheme, one of the most important prerequisite is to set emission caps for the covered emitters, which can be possible only when the total emission of the covered sector is known which necessitate monitoring, reporting and verification (MRV) in the sector. The emission cap is like an insurance for the value of allowances that permits the emitter to emit. That is why; setting of the cap which determines the amount of allowances is the key issue to be determined for a better functioning of the market. Any cap set higher than business as usual will definitely cause the failure of emission trading scheme with surplus allowances as it has been done in the first and second phase of European Emission trading scheme [10]. The benchmark defined in this PhD work could be translated as a cap while it will be used as tool to allocate allowances, thus pricing the carbon emissions.

Benchmarking in fossil fuel energy production will be derived by the methodological tool of clean development mechanism (CDM) of UNFCCC, namely “Tool to calculate the emission factor for an electricity system, version 03.0.0” [29]. Under CDM rules, renewable energy projects that supply the grid with electricity get emission reduction credits against a baseline line defined as continuation of current situation [54]. The logic behind emission reduction credit is that renewable energy generations do not emit against an emitting baseline, and so, should have emission reduction credits which could be sold under carbon market and create additional income for renewable energy projects. Hence, CDM rules provides tool to calculate emission factor of existing electricity system which could be interpreted as emission intensity of electricity generation. As it is discussed in chapter 3, for our proposal Operating Margin (OM) will be used to provide pure emission intensity of fossil fuel based power plants.

A stepwise approach of tool to calculate the emission factor for an electricity system (2007) is used to determine the emission factor of OM. The required steps by methodological tool is listed and justified as below:

Step 1: Identification of the relevant electric systems**:** Although there are 21 regional distribution regions in Turkey, Article 20 of license regulation [90] defines only one transmission system which is national transmission system and Turkish Electricity Transmission Company (TEIAS) in charge of all transmission system related activities. Therefore, the national grid is used as electric power system for all power plant activities that are connected to the grid. However, the national grid of Turkey is connected to the electricity systems of neighbouring countries. Complying with the rules of the tool, the emission factor for imports from neighbouring countries is considered zero (0) tCO_2/MWh for determining the OM.

Step 2: Choosing whether to include off-grid power plants in the project electricity system: According to tool for calculation factor of OM, only off-grid systems were excluded from calculation due to lack of data.

Step 3: Selection of method to determine the operating margin (OM): *Table 7* illustrates the share of low cost resources (LCR) which has to be less than 50 per cent of total energy production to be able to select simple OM method according to the tool [29]. According to *Table 7*, the Turkish electricity mix does not comprise nuclear energy resource yet, and there is no obvious indication that coal is used as must run resources. Therefore, the only low cost resources in Turkey, which are considered as must-run, are hydro power, renewable and waste, geothermal power and wind power [91].

Table 7: Share of Low Cost Resource (LCR) Production 2007-2011 (Production in GWh) [91].

	2007	**2008**	**2009**	**2010**	**2011**
Gross production	191,558.1	198,418.0	194,812.9	211,207.7	229,395.1
TOTAL LCR Production	36,575.6	34,498.6	38,229.6	55,837.6	58,226.0
Hydro	35,850.8	33,269.8	35,958.4	51,795.5	52,338.6
Renewable and Waste	213.7	219.9	340.1	457.5	469.2
Geothermal and Wind	511.1	1,008.9	1,931.1	3,584.6	5,418.2
Share of LCRs	19.09%	17.39%	19,62%	26.44%	25.38%
Average of last five years	**21.58%**				

Based on the methodology of the tool, average share of low cost resources for the last five years is far below 50% with 21.58%, thus, the Simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$) [29]. For the simple OM method, the emissions factor will be calculated using ex-ante option with a 3-year generation weighted average based on the most recent data available.

Step 4: Calculating the operating margin emission factor according to the selected method**:** Following the tool [29], the Simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all fossil fuel based generating power plants serving the system, excluding low-cost/must-run power plants. The calculation of the simple OM emission factor will be based on total net electricity generation of all power plants serving the system, the fuel types and total fuel consumption of the project electricity system (Option B), contrary to the option (Option A) provided by the tool which was offering installation based approach. The tool offer **Chyba! Nenalezen zdroj odkazů.** for calculation of OM emission factor .

Equation 4

$$EF_{grid,OMsimple,y} = (\sum_{i} FC_{i,y} \times NCV_{i,y} x EF_{CO2,i,y}) \div EG_{i}$$

Where:	
$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, excluding low-cost / must-run power plants / units, in year y (MWh)
i	All fossil fuel types combusted in power sources in the project electricity system in year y
y	three most recent years for which data is available

Step 4.1: The first step to calculate Simple OM emission factor is to find Net calorific values fuels by Equation 5 as below:

Equation 5

$$NVC_{i,y} = (FC_{i,y} \times HVF_{i,y}) \div 4.1868 \times 1000$$

$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$HVF_{i,y}$	Heating Values for fossil fuel type i in year y (Tcal)
4.1868	1 Tcal/TJ
i	All fossil fuel types combusted in power sources in the project electricity system in year y
y	three most recent years for which data is available

For calculation of Net calorific Value per fossil fuel type, the data from Turkish electricity transmission company [92] is used as illustrated in *Table 8* and *Table 9.*

Table 8: Heating Values of Fuels (Tcal) [92]

Energy Sources	**2009**	**2010**	**2011**
Hard Coal + Imported Coal	35,130	39,546	57,567
Lignite	97,652	96,551	107,210
Fuel Oil	15,160	8,569	5,280
Diesel Oil	1,830	209	155
LPG	1	0	0
Naphtha	84	105	0
Natural Gas	186,266	194,487	202,064

Table 9: Fossil Fuel Consumption Amounts (ton, 1000 m3 for Natural Gas) [93]

Energy Sources	**2009**	**2010**	**2011**
Hard Coal + Imported Coal	6,621,177	7,419,703	10,574,434
Lignite	63,620,518	56,689,392	61,507,310
Fuel Oil	1,594,321	891,782	531,608
Diesel Oil	180,857	20,354	15,047
LPG	111	0	0
Naphtha	8,077	13,140	0

Natural Gas	20,978,040	21,783,414	22,804,587

As a result of Equation 5 with the help of heating values of fuel type and amount of fuel consumed, the NVC of fuel type is provided in *Table 10*. The last column of the *Table 10* provides value of $EF_{CO2,i,y}$ based on the data of IPCC [94] and State Development Organization [95].

Table 10: Net Calorific Values of Fuels and Emission Factor (EFi)

Energy Sources	**NCV_i 2009 (TJ/Gg)**	**NCV_i 2010 (TJ/Gg)**	**NCV_i 2011 (TJ/Gg)**	**$EF_{CO2,i}$(kg/TJ)**
Hard Coal+Imported Coal	22,21	22,32	22,79	89,50
Lignite	6,43	7,13	7,30	90,90
Fuel Oil	39,81	40,23	41,58	72,60
Diesel Oil	42,37	42,99	43,13	72,60
LPG	0,00	0,00	0,00	61,60
Naphtha	43,54	33,46	0,00	69,30
Natural Gas	37,17	37,38	37,10	54,30

Step 4.2: Second step to calculate Simple OM emission factor is to follow **Chyba! Nenalezen zdroj odkazů.** by multiplying amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit), net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit) and CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ) as per methodological tool of UNFCCC [29]. The result is 109,963 kilo tonnes of carbon dioxide emission amount per fossil fuel used for electricity generation for the year period 2009, 2010 and 2011 as *Table 11*, which is correlated with TurkStat [53] data of emission in *Figure 8*.

Table 11: Total CO_2 Emission Due to Fossil Fuels for Electricity Generation ($ktCO_2$)

Energy Sources	**2009**	**2010**	**2011**
Hard Coal + Imported Coal	13,164	14,819	21,571
Lignite	37,164	36,745	40,802
Fuel Oil	4,608	2,605	1,605
Diesel Oil	556	64	47

LPG	0	0	0
Naphtha	24	30	0
Natural Gas	42,346	44,215	45,938
TOTAL	97,863	98,478	109,963

Table 12 below presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermal and biomass do not emit fossil CO_2, and thus, are not taken into account in calculations of OM emission factor.

Table 12: Gross electricity production by fossil energy sources 2009-2011 (GWh) [96]

Energy Sources- Fossil Fuel Type	**2009**	**2010**	**2011**
Natural Gas	96,094.7	98,143.7	104,047.6
Lignite	39,089.5	35,942.1	38,870.4
Coal	16,595.6	19,104.3	27,347.5
Fuel Oil	4,439.8	2,143.8	900.5
Motor Oil	345.8	4.3	3.1
Naphtha	17.6	31.9	0.0
LPG	0.4	0.0	0.0
Total Generation	156,583.4	155,370.1	171,169.1

Table 13 shows gross and net correlation data of whole electricity production in which the correlation can help to find net electricity generation by fossil fuel energy sources, as the **Chyba! Nenalezen zdroj odkazů.**, EG_y value requires net value. Therefore, following help to derive net data by calculating the net/gross proportion on the basis of overall gross and net production numbers.

Table 13: Net/gross electricity production 2009-2011 (GWh) [97]

	2009	**2010**	**2011**
Gross Production [GWh]	194,812.90	211,207.70	229,395.10
Net Production [GWh]	186,619.30	203,046.10	217,557.70
Relation	95,79%	96.14%	94.84%

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount in *Table 12* does, in fact, provide an approximated net value for fossil fuel based energy production. However, this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. *Table 14* shows the resulting net data for fossil fuel generation with the help of correlation provided in *Table 13*. The third row in *Table 14* represents imported value which shall be added to the net value according to the tool of UNFCCC [29]. The result in last row provides pure value supplied to the grid.

Table 14: Electricity supplied to the grid, relevant for OM (GWh)

	2009	**2010**	**2011**
Net El. Prod. by fossil fuels	149.997,7	149.366,2	162.336,3
Electricity Import	812,0	1.143,8	4.555,8
Electricity supplied to grid by relevant sources	150.809,7	150.510,0	166.892,1

Step 4.3: The last step is to calculate $EF_{grid,OMsimple,y}$ derived from Equation 4 which represent amount of carbon dioxide emission as in *Table 11* divided by amount of fossil fuel electricity production as in *Table 14: Electricity supplied to the grid, relevant for OM (GWh)Table 14*. The result is 0.6542 tCO_2 per MWh as in *Table 15*.

Table 15: Calculation of Weighted $EF_{grid,OMsimple,y}$ ($ktCO_2$/GWh)

OM Emission Factor 2009-2011 [tCO_2/MWh]			
OM Emission Factor	0,6489	0,6543	0,6589
3-year Generation Weighted Average OM	**0,6542**		

Energy generation from fossil fuel in Turkey causes 0.6542 tCO_2 per MWh which is a mean of three year value and average of all fossil types. OM Emission factor calculation is based on CDM methodological tool of UNFCCC called Tool to calculate the emission factor for an electricity system [29]. Based on data of fossil fuel energy resources, heating value and emission factor of these resources, the tool provides method to find carbon dioxide emission of fossil fuel fired power plants. Once having electricity production data of these plants, it is possible to find OM emission factor of fossil fuel energy production which is the emission intensity of energy production in this sector. While methodology offers a weighted combination of OM emission factor and BM emission factor, in this article BM emission factor is excluded due to the involvement of renewable energy which lessens the emission factor.

Remembering Kaya Identity in **Equation 2**, the OM emission factor which can be called as emission intensity of energy production is part of emission intensity of energy use, thus, any decision on level of benchmarking will define a possible cap for the sector simultaneously, and help to decrease emission intensity of energy use. The issue of allocation of allowances, then, can be done accordingly. What is proposed here is to have OM emission factor as a benchmark that defines amount of allowances for electricity sector regardless of being allocated as free of auctioned. While there is big difference in between emission factors for natural gas, lignite and coal as in *Table 16*, any benchmark defined has to be adjusted for fossil fuel type.

Table 16: OM emission factor for Fuel Types (calculated by author;)

Type of Energy Resources	**Mean of 2009, 2010 and 2011 (t CO_2/MWh)**
Natural Gas	0,444
Lignite	1,008
Coal	0,786
Fuel Oil	1,038
Diesel Oil	1,609
Naphtha	1,385

Considering the differences in OM emission factor of natural gas and coal in *Table 16*, as it is done by Germany under EU ETS in *Table 17*, it is proposed to have three benchmarks for electricity sector in Turkey for natural gas, coal and lignite.

Table 17: Electricity Benchmarks in II Phase of EU ETS [98]

Country	**Benchmark Level**
Austria	0.350 t CO_2/MWh
Belgium Wallonia	0.400 t CO_2/MWh
Belgium Flanders	0.359 t CO_2/MWh
Bulgaria	0.350 t CO_2/MWh
Czech Republic	0.430 t CO_2/MWh
Germany	0.750 t CO_2/MWh coal generated

	0.350 t CO_2/MWh natural gas generated
Denmark	1.185 t CO_2/MWh
France	0.950 t CO_2/MWh coal generated
Luxembourg	0.365 t CO_2/MWh
Slovenia	0.350 t CO_2/MWh
Sweden	0.337 t CO_2/MWh

Table 17 represents benchmarks defined by National Allocation Plan of EU under EU ETS for second phase and many of them is under the benchmark defined for Turkish electricity sector as in *Table 18*. Having an OM emission factor (Benchmark) of 0.6542 and related electricity and emission data for different fossil fuel types, it is proposed to have OM emission factor for each fuel type with a linear decreasing tendency. Having considerable differences in emission factor of fossil fuels is a reason to have different benchmarks for each fossil fuel type. This approach was developed by EU ETS in phase II for some countries that rely on coal and gas power for electricity production [98]. Another approach proposed in this thesis is the linear decreasing tendency of benchmarks by 5 percent each year. While the definition of benchmark in the proposal is calculated on OM emission factor which is a mean of emission intensity of energy production and do not represent best available technologies, the benchmark decreasing tendency aims to enable the sector to orient with the system in the first years of pilot scheme.

Table 18: Benchmarks offered for Electricity sector in Turkey for period of 2016-2020 (calculated by author)

Type of Energy Sources	**2016**	**2017**	**2018**	**2019**	**2020**
Natural Gas	0,444	0,422	0,401	0,381	0,362
Lignite	1,008	0,958	0,910	0,864	0,821
Coal	0,786	0,747	0,709	0,674	0,640

Although EU ETS defined benchmark level for third phase based on the average performance of the 10% most efficient installations in the community (interpreted in this context as the European Economic Area) in 2007 – 2008, it is proposed to have benchmarks as much close as to average rate of emission of related fossil fuels under possible pilot scheme in Turkey in the first years [98]. This approach is justifiable considering development level of Turkey and priority of electricity sector for development.

The linear decreasing benchmarks in this subchapter were defined by methodological tool of UNFCCC which called as operating margin (OM) and calculated the mean of emission intensity for the sector. Different benchmarks were defined in accordance with fuel types as it is done by Germany under I and II phase of EU ETS. While the usage of the linear decreasing benchmarks as cap defines the limit of emissions that can be allocated free, the difference between benchmarks and linear decreasing rate will be auctioned allowances. The next subchapter will focus on the justification of caps for the related sector and propose a method of allocation of allowances and linking the voluntary carbon market with proposed emission trading scheme.

6.2 Estimation of Cap, Emission Reductions and Allocation of Allowances

In case of cap setting, whether it is absolute as done in EU which is 21 percent emission reduction in 2020 based on 2005 level of emission or intensity target as done by China which is 40-45 percent of reduction in emission intensity of GDP in 2020 based on 2005 level, the benchmarking or grandfathering provides a method to reach the target of cap [98]. The approach proposed in previous section as benchmarking the electricity sector in Turkey aims to decrease emission intensity of energy use and support energy intensity target of Ministry of Energy and Natural Resources [84] as 20% decrease in energy intensity by 2023 based on 2011 level.

The decision of setting a national cap is political process, therefore, the offer in this proposal does not include a national cap, but offers a bottom up approach to set a benchmark for the sector and analyze the following effects:

1. The impact of ex-ante benchmarking on fossil fuel energy sector in the proposed period of 2016 – 2020,

2. Income of the state through auctioning,

3. The impact on carbon reduction projects in Turkey.

The proposal of benchmarking of carbon emission is offered for fossil fuel based energy sector as done in previous section because electricity sector is one least international than any other comparative sector in regards of international competition [99]. Thus, once the policy makers in energy sector can control the price of electricity so as not to be reflected to the end consumer, which is possible under Turkish energy law numbered 4628, the cost of emissions of fossil fuel based energy production can have burden on the producer [90]. With this approach, emissions are aimed to be priced for fossil fuel based installations, and so, comparative advantages of fossil fuel to renewable energy are lessened. *Figure 22: Projection of Turkish Electricity Generation, 2012-2021 ([100]; adjusted by Author)Figure 22* provides electricity projection for Turkey in which fossil fuel based electricity production dominates with 80 percent [100]. While the data by TEIAS provides a forecast of fossil fuel energy production capacity over the year 2012-2021, the data of the organization assumes that there is no increase in natural gas, lignite and coal consumption for electricity production after the year 2017. This is the reason why forecast was adjusted by author based upon the correlation between table 25 on page 50 and table 31 on page 70 of TEIAS report on Turkish electrical energy 10-year generation capacity projection [100]. Electricity production of fuel oil and diesel oil is ignored due to negligible usage and unreliable data.

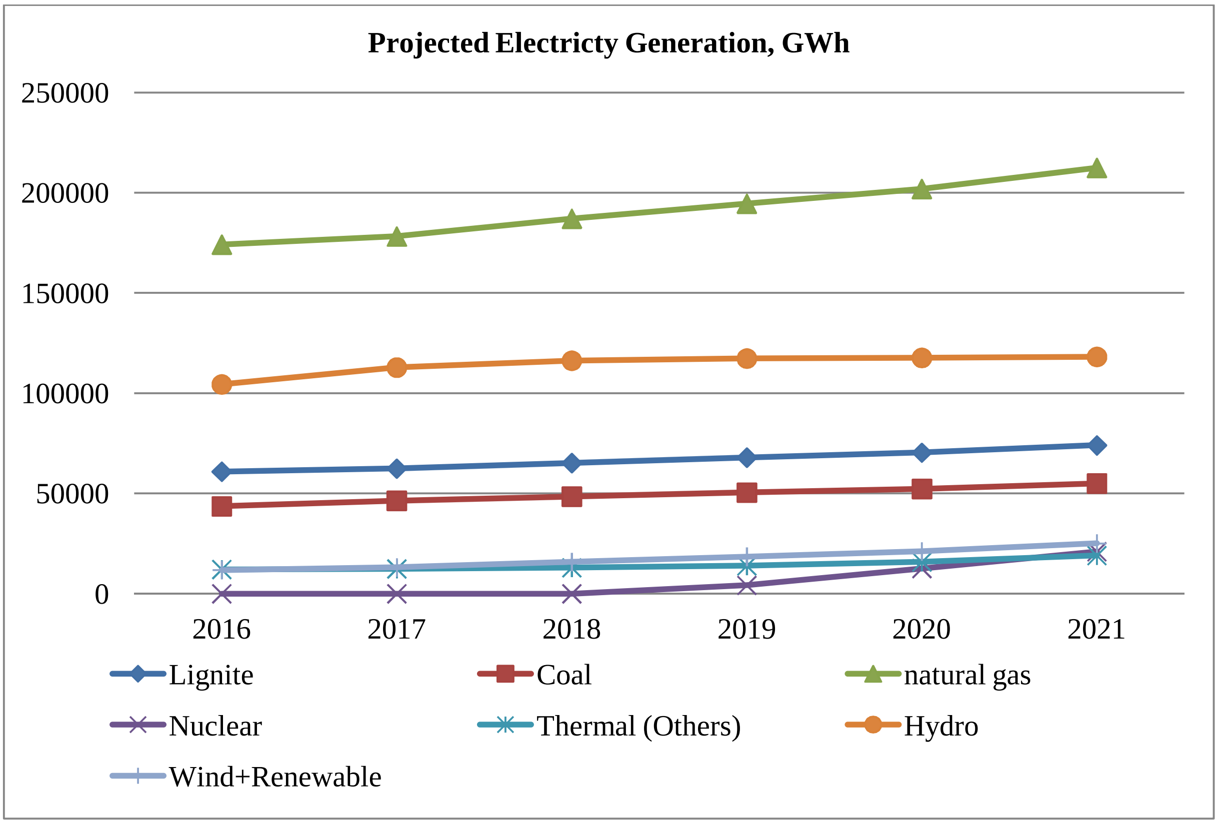

Figure 22: Projection of Turkish Electricity Generation, 2012-2021 ([100]; adjusted by Author).

Benchmarks defined in the previous subchapter can serve as a sectoral cap once permitted emission of installation is calculated as activity data multiplied by benchmark (BM) which is defined ex-ante as done in EU ETS. With a perspective under Kaya Identity, the proposal defined for ETS in Turkey bases on the reduction of emissions from fossil fuel energy generation by defined ex-ante benchmark which will have a linear declining tendency. As projected emission of all fossil fuel type is expected to reach 201 million t CO_2 by 2020, a linear declining rate of benchmark enables an emission reduction of 37 million t CO_2, which is 18 per cent of emission in the last year of the pilot scheme. Within the period of 4 years from 2016 to 2020, emission reduction will amount to 92 million t CO_2 in total for all types of fossil fuels that is 9 percent of business as usual aggregate emission of the period. *Figure 23* represents the deviations from forecasted emissions by redline once the benchmark is introduced into the system which enables emission reduction of 37 million t CO_2 by the year of 2020. The third line belongs to free allocation where the difference between benchmark line and free allocation constitutes 16 million allowances that have to be auctioned for the year of 2020.

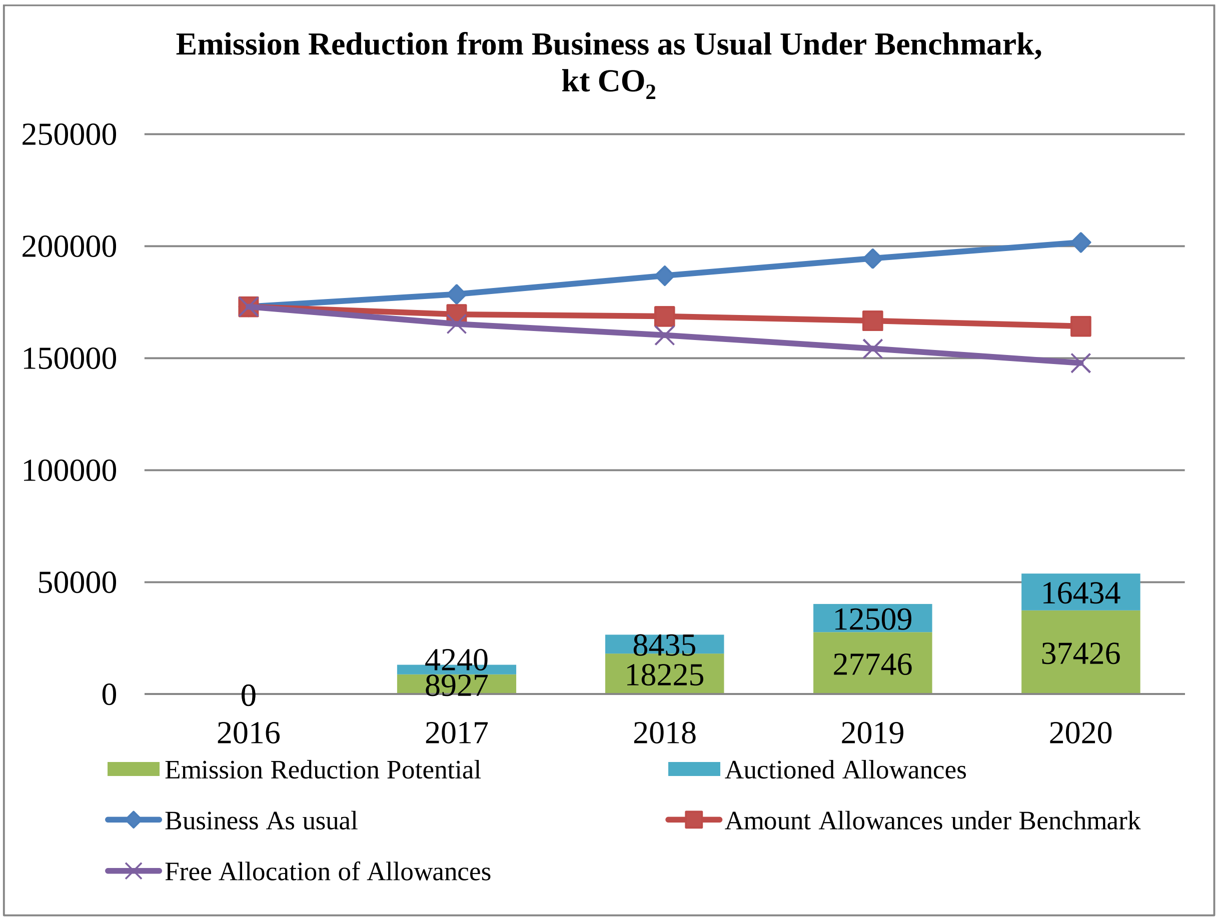

Figure 23: Emission reduction from Business as usual under proposed ETS for Turkey, ([100]; Author)

A detailed calculation of projected emissions, benchmark application and emission reduction potential of the proposed ETS is provided in *Table 19*. By 2020, carbon dioxide emission from natural gas reach to 89 million t CO_2 while lignite and coal follow with 70 million and 41 million t CO_2, as a result, it is so important to take precautions to prevent such increase. With the proposed pilot ETS and a linear decreasing rate of benchmark, besides 92 million of emission reduction, there will be 43 million of allowances auctioned through the pilot scheme.

Table 19: Projected, Benchmark and Emission Reduction of Proposed ETS, kt CO_2 ([100]; Author)

	2016	2017	2018	2019	2020	TOTAL
Forecasted (Natural Gas)	77,359	79,167	83,094	86,415	89,690	415,726
Benchmark (Natural Gas)	77,359	75,209	74,993	74,090	73,053	374,704
Emission Reduction (Natural Gas)	0	3,958	8,102	12,325	16,637	41,022
Forecasted (Lignite)	61,430	62,936	65,736	68,451	70,954	329,506
Benchmark (Lignite)	61,430	59,789	59,327	58,688	57,793	297,026
Emission Reduction (Lignite)	0	3,147	6,409	9,763	13,162	32,480
Forecasted (Coal)	34,271	36,436	38,096	39,670	41,120	189,593
Benchmark (Coal)	34,271	34,614	34,382	34,012	33,493	170,772
Emission Reduction (Coal)	0	1,822	3,714	5,658	7,628	18,822

While electricity production generate 1/3 of emission intensity of energy use as illustrated in *Figure 8: CO_2 emissions of Energy Sector, 1990-2010 Figure 8*, any decrease in emission intensity of energy production will cause proportional decrease in emission intensity of energy use. Having in mind Kaya Identity as in *Figure 24*, the opportunity for Turkey to reduce emission rely on focusing on emission intensity of energy use. While population and GDP per capita increases gradually and it is preferred to be so, and energy intensity of GDP is constant in the case of Turkey, there is only opportunity that relies on emission intensity of energy use. The proposed pilot scheme, enabling 92 million t CO_2 emission reduction over 934 million t CO_2 business as usual emission, is expected to have a 4 per cent decrease in emission intensity of energy use. Such a pilot scheme designed and implemented carefully might help to reduce rate of emission increase in Turkey.

$$C = \overset{+1.32\%}{POP} \; x \; \overset{+4.3\%/1.32\%}{\left(\frac{GDP}{POP}\right)} \; x \; \overset{\text{Constant}}{\left(\frac{E}{GDP}\right)} \; x \; \overset{-4\%}{\left(\frac{C}{E}\right)}$$

Figure 24: Illustration of Development of Emissions ([14]; Author)

Proposed pilot emission trading scheme introduces carbon pricing in the system by putting a benchmark and reducing it over the years. By this method, emissions over the benchmark are aimed to be compensated from the emission reduction market which called today as “voluntary carbon market”. This market could be well integrated under emission trading scheme through the registry system that is introduced by Ministry of Environment and Urbanization [101]. The number of projects under process of development of verified emission reduction project has reached 218 and volume of emission reduction is respectively 16 million annually, once assumed that all these 218 projects are registered and issued credits as illustrated in *Table 20*. The number of projects and data of emission reduction amount are tracked from the registry system of Standards under voluntary carbon market [102]; [103].

Table 20: Projects and respective emission reduction values under Gold Standard and VCS

Project Type	**Number of Projects**	**Annual GHG Reduction Potential (tCO2e)**
Hydropower	124	7,181,723
Wind power	64	5,603,468
Bio-gas	6	514,789
Geothermal	6	405,309
Energy Efficiency	5	151,432
Landfill Gas	13	2,473,093
TOTAL	**218**	**16,329,814**

As can be seen in *Table 20*, there is really high potential of projects that are registered under voluntary carbon market standards such as Gold Standard and VCS or any standard that can be defined by policy makers to supply the system by credits which can create an additional income for renewable energy and energy efficiency project. Voluntary carbon market and exchanges in this market called “over-the-counter” (OTC) which do not have any compulsory registry system [104]. For this reason, it is impossible to track the exact volume of the market. The report of Stanley and Hamilton [104] is based on the questionnaires and feedbacks from the market players. According to the report, the total volume of the market reached to 95 million t CO_2 with value of average 6 USD per credits [104]. Same untraceable issue is also valid for Turkish emission reduction project while there is no compulsory registry to follow the project and transaction of the emission reduction credits. Although MEU has launched a registry system in 2010, up to now this registry system could not be operationalized due to lack of incentive for project developer to register their projects under the system [101]. The proposal defined for voluntary carbon market is that emission reduction credits shall be used for compensation of the level above the benchmark of the sector. Thus, the installations which have emission over the benchmark will pay for credits of the project which is registered under registry system established by Ministry. The exchange of the credits could be well designed over the environmental stock exchange which is already mentioned to be established in Istanbul in 2015 [84]; [29]; [95]. While based on polluters-pay principle, renewable energy and energy efficiency or any other carbon reducing projects registered under the system get additional incentive which in long run increases the comparative advantages of these projects.

An additional step to be considered under emission trading scheme is allocation of allowances. Depending on whether it is priced or not, the initial allocation methods are divided into two categories such as auctioning or free allocation [99]. For free allocation, after calculation of allowances per installation, the right to emit is distributed free of cost, but under auctioning government bids allowances per price to the market. Although EU ETS auctions full allowances for electricity market in III phase of EU ETS, the method for free allocation of allowances is proposed to be introduced in ETS in Turkey with a declining rate over the period starting with 100 percent free allocation, then with 2.5 percent reduction for subsequent years [98]. Auctioning is an important part of ETS. While introducing the aspect of "polluter-pays" principle, auctioning avoids windfall profits for installations that pass on the opportunity costs of the freely allocated allowances to clients, and more importantly auction revenues could be used for other purposes such as funding capacity increase in climate change or R&D in energy-efficient technologies, renewable technologies [99]. When allowances are freely allocated to firms, Hepburn [99] claims that it is inevitable that some installation will make profit out of free allowances as it is done in EU ETS in electricity sector where electricity installation benefitted from free allowances and also passed cost of carbon to end users. In the proposed ETS in Turkey, a pass over the cost is offered to be avoided by end user price by regulatory body of electricity market which is possible by the existing law in Turkey.

The proposal for auctioning in pilot scheme in Turkey is offered based on 100 per cent free allocation of allowances for the first year of implementation and 2.5 per cent reduction over the following years which makes 41 million allowances can be auctioned out of 842 million as in *Figure 25***Chyba! Nenalezen zdroj odkazů.**. With the proposal and auctioning method in ETS, government can earn over 400 million EUR during the pilot scheme which can be directed for R&D on adaptation of climate change or incentive for renewable energy, assuming that carbon price is 10 EUR per t CO_2 which is a reasonable and low price comparing other ETSs such as Australia and EU ETS.

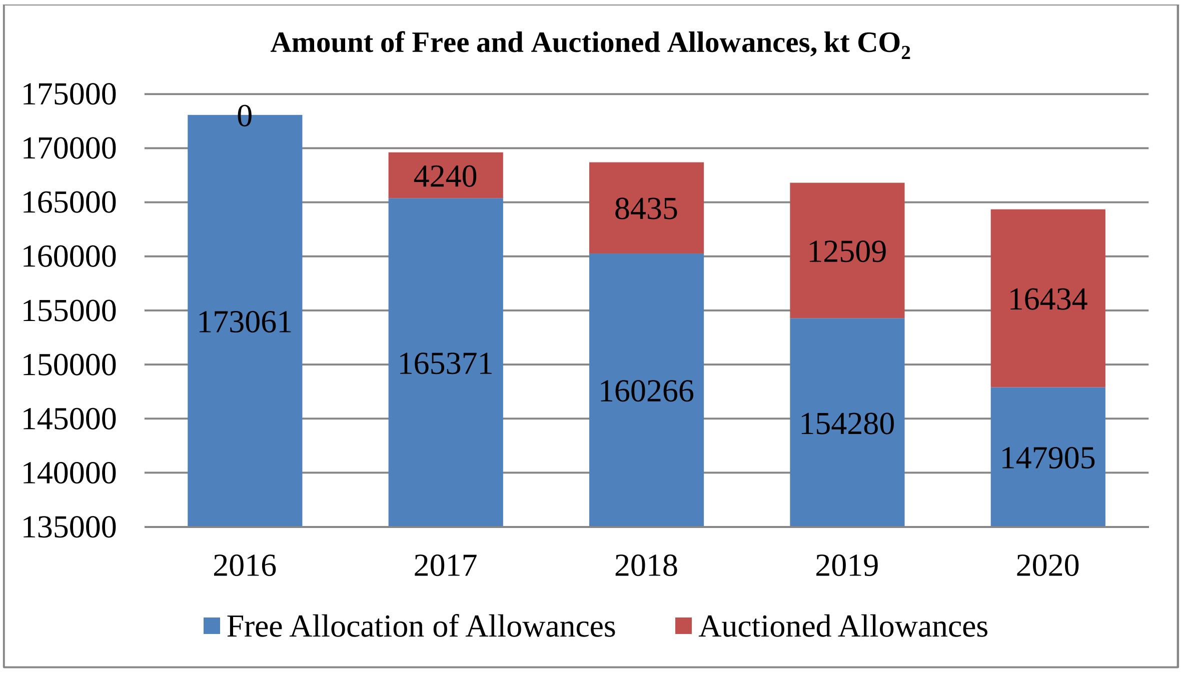

Figure 25: Amount of Free and Auctioned Allowances for the period of 2016-2020, (Calculated by Author)

While setting a cap for the ETS, the target should be considered from both the "top-down" as having a national target or a cap and "bottom-up" methods which considers to begin with allocating allowances to the covered entities in a prescribed manner, and gets the aggregates by adding all the allocated allowances together. Thus, the design of pilot ETS is proposed to have a bottom up method where the design begins with allocating allowances for electricity sector based on a linear decreasing benchmark. A linear decreasing benchmark targets to enable adaptation of sector to commoditization of carbon dioxide emissions, where the definition of benchmark is the OM emission factor calculated with methodological tool of UNFCCC. A linear decreasing benchmark and decreasing of free allocation of allowances is expected to force the sector to take precautions for reducing emissions by energy efficiency projects.

This subchapter has firstly provided a cap which is defined from bottom up approach based on a benchmark with declining tendency. Linear decrease of benchmark, on one hand, aims to reduce emission intensity of energy production by commoditization of emission rights, on the other hand, enables scheme participants to orient with the system. As second aspect of ETS, auctioning is introduced in the system by starting with 100 percent free allocation in the first year, then declining with 2.5 percent over following years. Although auctioning has many positive impact on ETS, pricing of carbon emission and income for government to invest in renewable energy are two important aspect of auctioning. The last important aspect underlined in this subchapter is conjunction of voluntary carbon market into the system by enabling installation in order to buy emission reduction credits from voluntary carbon market in Turkey to be used to compensate for their emission over the cap.

6.3 Summary of Results and Proofs of Hypothesis

The chapter at hand provided results of the thesis which are defined in the framework of the design of pilot emission trading scheme that aim to reduce emissions in fossil fuel based energy generation by providing a benchmarking method for inefficient power plants to pay the cost through a mechanism of auctioning allowances and emission trading.

The results of the thesis could be listed as:

1. Different benchmarks are defined for each fossil fuel type by the help of methodological tool of UNFCCC as listed under *Table 18*. The benchmarks defined reflects emission intensity of energy production by each fossil type, thus they are expressing an average value for the first year of the period which is reduced by a linear decreasing rate of 5 percent by each year. Defining a benchmark based on emission intensity for each fuel types creates cost of emission for the one which emits above the benchmark. This situation is well illustrated by the *Figure 23*, where the red line is benchmark level with a decreasing trend. The gap between blue and red line represents the amount where plants continue to emit because of their inefficient activities. This amount of emissions has to be offset by credits from emission reduction projects that are registered under the emission trading system. The offsetting activities creates national carbon market which could be regulated under carbon exchange that is established for emission trading scheme. Thus, the amount of emission reduction which is the gap between blue and red line is calculated for the period in the *Table 19* as 92 million ton CO_2. By this result, the hypothesis 1 which is *"Does benchmarking method lead emission reduction objectives?"* has been proofed.

2. Besides benchmarking, the method of auctioning of allowances is introduced after the first year of free allocation of allowances. Although, carbon dioxide emissions of any plants are below the benchmark, the aim of introducing auctioning is to price carbon

emission gradually. By the method of auctioning which has a linear increasing trend of 2.5 percent each year after first year, government can auction 43 million of allowances and can generate over 400 million EUR once the price is estimated around 10 EUR per assigned allowances unit. The method of auctioning has shown that emission trading scheme generates income for state and operationalize national carbon market which is proof for the hypothesis 2.

As a consequences, the method of auctioning and benchmarking under emission trading scheme which is designed for a 5 years period in power sector proof the hypothesis 1 and the hypothesis 2 by creating emission reductions, generates income for state and operationalize national carbon market.

The results of the PhD dissertation show that emission reduction could be an important mechanism to reduce emission by pricing carbon dioxide emission and create a national carbon market.

CHAPTER 7. CONTRIBUTION OF THE THESIS TO SCIENCE AND PRACTICE

The PhD dissertation at hand contributes to science, practise and education through the results it provides. Most of the contribution is for practice where policy makers can benefit from the design of pilot emission trading scheme in formulization of national climate change policies. The dissertation contributes to science of environmental economics by focusing on emission intensity of energy production as a method of emission reduction. The contribution of academics and education is manifold through whole design of pilot emission trading scheme.

While this chapter of the dissertation presents contribution of the thesis to science, practice and education, it focuses on the practical consequences and contributions by analyzing the steps that have already been taken so far in relation to climate change. The contribution of the thesis on practice will be listed after analysis on steps that have been taken by the state so far.

The contribution of the thesis to practice: Although Turkey, as annex I party to UNFCCC, has stayed back to declare any emission reduction target under global climate regime, it has been performing several steps forward establishment of carbon market which in turn increases the capacity building in the country. Besides formation of Coordination Board on Climate Change (CBCC) and activities of voluntary carbon market in Turkey which has increased human capacity and awareness about climate change and carbon market, there are some steps taken by related ministries towards establishment of a possible emission trading scheme, such as publication of regulation on monitoring reporting and verification, announcement of energy intensity target and possible carbon exchange under action plan for Istanbul financial center that underlines establishment of carbon exchange, usage of carbon tax and carbon market for environmental protection [84]; [28]; [95]; [111].

One of the important steps was the formation of Coordination Board on Climate Change (CBCC) which was established by the Prime Ministerial

Circular No. 2001/2 and was restructured in 2004, following Turkey's accession to the UNFCCC [105]. The Coordination Board on Climate Change (CBCC) is the main policy making body on climate change related issues in Turkey. CBCC, as an official body, is responsible for ensuring the coordination and distribution of responsibilities among public and private sectors, and designing national and international climate change policies by taking into consideration the national circumstances of Turkey.

Another step taken by Ministry of Environment and Urbanization was the publication of regulation on monitoring reporting and verification which aims to reach exact data of emissions from related sectors and enforce the requirement of UNFCCC on annual inventories of emissions and removals of greenhouse gases (GHG) by using the Intergovernmental Panel on Climate Change (IPCC) methodology [78]. The framework regulation on monitoring, reporting and verification (MRV) published in official gazette in 2012 is a copy of EU ETS, and covers the same installations as in EU ETS [78]. Installations having capacity over a certain limit will be required to submit their GHG emission report by April 2016 to related Ministry, which means that works on monitoring plan of 2015, has to be approved by mid-2014 [78]. The work on MRV is under process within the responsibility of Ministry of Environment and Urbanization which is the core and serious step taken by state in relation with climate related works up to now. The target of energy efficiency declared by Ministry of Energy and Natural Resources aims to reduce the ratio of energy consumed per GDP at least 20% by 2023 compared with the level of 2011 [84]. This is another crucial step towards emission reduction target, but cannot be purely formulized as pillar of emission trading scheme as far as the sectoral projection and target is not defined.

There are more steps of government in strategic papers of energy efficiency, national climate change action plan (NCCAP) and environmental law in relation to EU accession process [84]; [28]; [95]; [114]. However, any of these strategic papers neither put a form of design for emission trading scheme nor draw a road map to design such scheme. Even though there are counter reaction for work on climate change as closure of Climate Change Department in Ministry of Environment and Urbanization, there is willingness and awareness in the level of policy making as it is stated in strategic papers and actions taken to implement the instrument of carbon market in a beneficial way to profit from it [106].

The strongest climate change reaction as a market instrument is developed under voluntary carbon market which was not under control or supervision of the state [107]. Voluntary carbon market in Turkey is one of the serious and widely recognized instruments parallel to Kyoto Protocol Clean Development mechanism, which has increased awareness and capacity building in tackling climate change issues. Voluntary carbon market has been an instrument set up for corporations and individual to offset their emission from emission reduction credits generated by projects that reduce emissions or do not emit carbon dioxide and registered under a standard of voluntary carbon market [108]. The aim of voluntary carbon market which is the same as clean development mechanism (CDM) under Kyoto Protocol to create additional income for the Project cannot be otherwise realized. Turkish renewable energy market was introduced with carbon market in 2006 enabling the sector to benefit from an additional income [107]. Since then, there has been a rush from renewable energy projects such as wind, hydro, geothermal, landfill power projects to benefit from voluntary carbon market which in turn increased human capacity in regards of carbon market and climate change issues [102];[103].

Ministry of Environment and Urbanization (MEU) prepared an online registry system for projects that are registered under any voluntary carbon standard to ensure a more effective monitoring system of the project developed in Turkey, which is published in the Official Gazette No. 27665 in 2010 [101]. Even though the registry system is seen attractive by project developers, it is aimed by registering these projects to increase the credibility of carbon certificates that are developed in Turkey. Turkey aims to link current voluntary carbon market projects with any future market-based mechanisms as declared in national climate change plan in order to let emission reduction project continue to benefit from new market(s) [27]. There is a capacity in Turkey in regards of development of emission reduction projects and intention of ministry of environment and urbanization to link these projects with a possible emission trading scheme.

As it is underlined before, an emission trading system requires several axes to function smoothly, such as setting the total emission limit i.e. a cap, allocation of allowances (permit to emit), MRV of greenhouse gas (GHG), trading infrastructure, e.g., registries and exchanges. Out of these four axes, Turkey has already announced the second one namely MRV of GHG, the others need to be defined in case of a plan for emission trading scheme.

The contribution of the thesis on practice fulfill missing steps that has not been taken so far such as setting the total emission limit and allocation of allowances. The first contribution is the benchmarks identified for each fuel types for an emission limitation of the plants. Although the benchmarks were identified as an average emission intensity of energy production for each fuel type, these benchmarks provide upper limit of emissions for related fuel type in energy production. Any emission above the benchmark has to be reduced by energy efficiency projects or by purchase of credits from proposed carbon market. Thus, benchmarks for each fuel types creates an emission limitation or cap from a bottom up approach.

The second contribution for practice is the proposal that is offered for linking voluntary carbon market with the emission trading system so that any carbon dioxide emission above the benchmark could be compensated by offsetting. Any emission above the benchmark has to be offset by purchasing of emission reduction credits which in turn creates a national carbon market based on the exchange of emission reduction credits.

The third contribution of the dissertation for the practice and thus, for policy makers is allocation of allowances that is auctioned after the first year of the period. While allocation of allowances provides the amount that can be emitted, under the pilot emission trading scheme, allowances are allocated free for the first year. For the following years of emission trading scheme, allowances are auctioned with a linear decreasing rate by government in an attempt to price emission even though they are below the benchmark. Governments can create income by auction of allowances which can be redirected for R&D or incentive in renewable energy.

The contribution of the thesis to environmental economics: Based on Kaya Identity [14], the thesis offer a reduction in emission intensity for Turkey. Through the analysis of the energy data, emission intensity of Turkey is high compared other developing countries because of high dependency rate on fossil fuel for energy production. Although, Ministry of Energy and Natural Resources [84] put a target based on reduction of energy intensity of GDP, the thesis discusses that reduction cannot happen in energy intensity of GDP because of having a low and a stable value for over 20 years. Contrary, the PhD dissertation offers emission intensity indicator as a target to be focused on which is inspired from Kaya Identity and can be used for environmental economics. Emission intensity value in Turkey can be reduced by setting benchmark as cap of emission limitation and forcing the plants to reduce their emission which is above the benchmark.

The contribution of the thesis to education: The PhD dissertation provides a design for pilot emission trading scheme for Turkey with a background of evolution of global climate regimes which has to be addressed in academics for educational proposes. Contributions of the dissertation for educational proposes can be listed in three categories.

Firstly, educational teaching on the topic of climate change is limited to some universities in Turkey with a general approach. However, pricing carbon dioxide emissions is a key element to internalize negative externalities. Thus, the dissertation at hand provides materials and methods to handle the cost of emission through a design of emission trading scheme. In this sense, the PhD dissertation can also be used for educational proposes in universities especially for departments of economics and process engineering to show the students how the cost of emission could be introduced in an economy.

Secondly, emission trading schemes, all around the world, provides sample cases in regards of handling emissions with a target of emission reduction. With the introduction of cost of emission, the installations has to consider how to reduce emission to avoid emission costs. Thus, the teaching on emission trading schemes in universities will provide students with a broader view for consideration of more efficient processes based on energy efficiency projects.

Thirdly, the dissertation provides a method that links the voluntary carbon market with the emission trading scheme for a national carbon market that can be controlled in carbon exchanges. The issue of national and international carbon market provides a subject that can be taught in department of economics and management with an aim of increasing human capacity and providing an academic platforms for discussion and innovation for better trading system.

In conclusion, while the contributions of pilot emission trading scheme designed in PhD dissertation to practice can be listed as benchmarking, auctioning of allowances and linking of carbon market to the designed system, the contribution to environmental economics can be mentioned as the approach developed to reduce emission intensity of energy production. Finally the contributions to education are listed as providing methods to handle the cost of emission through a design of emission trading scheme, consideration of energy efficiency projects under cost of carbon dioxide emissions, and teaching on national and international carbon markets.

CONCLUSION

Global climate regimes which were built to respond increasing rate of carbon dioxide concentration in the atmosphere are evolving from global context for more localized and national actions. After the conference of parties in Durban in 2011, it became clear that global climate regime failed to prevent 2 Celsius increase in the global temperature. While Canada announced her withdrawal from Kyoto Protocol in 2011, Japan, Russia, Australia and New Zealand did not express their willingness for second commitment period of Kyoto Protocol (Point Carbon, 2012). EU stayed as one of the important player that decided to continue with the second phase of Kyoto in order to avoid gab on global climate process. As a result, the parties of Kyoto protocol for second phase of commitment only consist of 15 per cent of total global emission contrary to what was 55 per cent global emission in the beginning of first commitment period [109].

The fortune of global climate regime is embedded in economical, ethical stand point of states and practices of global carbon market as expressed in the first chapter already. That is why it is hard to bind sovereign states under one umbrella that can put sanction on them. Economical interests of states conflict when the usage of public good, the atmosphere, became the subject while everybody wants to have benefit but not to bear the cost. As there is no global governance to sanction unethical behaviors of the states, there will always be free riders who would like to benefit while others pay for the cost.

Another reason of the failure of global climate regime was very much related with the failure of global carbon market, which could not provide a reputation regarding prices stability, incentives for clean energy and technologies and clues regarding emission reduction amount. The market has failed with over supply of allowances for the emitters. Because the caps is not defined ambitious enough to boost the market and reduce the emission. The caps were unfortunately set above business as usual. The result was frustrating for the clean energy investors who related on carbon prices. The market could not gain a reputation in sense of incentives and emission reduction. These were the reasons for a shift from global climate regime to more localized reactions for emission trading scheme. Most important achievement of UNFCCC process is the pricing of the carbon, and this is very well translated into emission trading schemes. Governments read the development well in order to put tax and caps on emission of polluting sector.

Even though international politics on climate change has been weakened since the failure of Copenhagen in 2009, there is still global pressure for developed and developing countries to take action to reduce emissions. Not only for reaction to this pressure but also with concerns on carbon emissions, there are now many emission trading scheme all over the world following the way that has been drawn by EU ETS. Some states have even found it practical to tax carbon emission and create income for governments as in the case of Australia's Carbon Pricing Mechanism. The principle of "common but differentiated responsibilities" interpreted as differentiated policy reactions in emission trading schemes all over the world. Although many emission trading scheme in developing countries are under consideration or planning phase, it is clear that these emission trading scheme will start a process of pricing the carbon internally.

The first chapter of the PhD thesis at hand provided an overlook through the reasons of the shift towards more localized climate reactions which is embedded in international political economics of the states. The second reason of the shift has been constructed on the failure of global carbon market in responding the needs of emission reduction and encouraging low carbon technologies. All in all, international climate regime started to evolve from global context to more localized ones.

In this sense, carbon markets are essential to price the emissions, and these markets are expanding both locally and regionally. There are many lessons learned from experiences over the past eight commitment period of Kyoto Protocol and experiences of EU ETS. Firstly, better evaluation of the caps on emissions should result in fewer free allowances and stable prices on carbon, secondly appropriate management of market may require intervention and adjustments, thirdly and finally confidence has to be created in carbon market for emission reduction and incentives for renewable energy. Once all lessons are applied in an appropriate manner, than it would be possible to witness a functioning carbon market which helps to reduce emissions and direct investments toward low carbon technologies.

Under these circumstances, the position and climate policy of Turkey is analyzed in the first chapters as to define the problem that PhD thesis handles. Being listed under Annex I of the UNFCCC which means having responsibilities in emissions and expected to have ambitious target to reduce it, Turkey has avoided having liabilities to reduce emission based on argumentation of being a developing country. However, the world is changing as emission rate of developing countries is increasing rapidly. It is expected, regardless of development level, from all countries to take steps to reduce emissions. One of the important steps that Turkey has taken is the publication of regulation on monitoring reporting and verification which is announced to take place in 2015 as the first year of monitoring. Additionally, there are some more steps of government in strategic papers of energy efficiency, national climate change action plan (NCCAP) and environmental law in relation to EU accession process which aims an energy efficiency target of 20 percent reduction till 2023 based on 2011 level, an establishment of carbon exchange under action plan for Istanbul financial center [84]; [28]; [95]. However, none of these strategic papers put a form of design for emission trading scheme and draw a road map to design such scheme. It is only Partnership for market readiness (PMR) that push Turkey to do some additional steps forward establishing emission trading scheme by support of knowhow and funds. Thus, the stand point of Turkey in respect of climate change could be defined as “no target policy”.

In this context, this PhD work at hand aimed to provide Turkish policy makers a road map towards pricing the carbon emissions without having any burden on international competitiveness. That is why, the proposal for pilot emission trading scheme is based on reduction of emission intensity of energy production for a pilot period over 2016 to 2020. The proposal of pilot emission trading scheme offered a market based approach on the basis of the pillars and methods as below:

1. Defining of fossil fuel based power sector as a target of pilot emission trading scheme
2. Targeting to reduce emission intensity of energy production by defining a linear decreasing benchmark for different fuel types of fossil fuel energy production

The methods:

1. To allocate allowances free for the first year and decrease with a linear trend for the following years with an aim to auction allowances, thus, price carbon dioxide emission.
2. To link the voluntary carbon market with the established system which gives room for cost effective emission reduction.

While electricity production is less international than any other industrial polluters, the proposal of pilot scheme which targets fossil fuel based energy sector will not have a sharp negative impact on the trend of country’s international competitiveness. Moreover, carbon dioxide emission from electricity sector is 26.6 percent of whole emission in Turkey in 2010 [53]. Thus, fossil fuel based electricity production is one of the key sectors to handle emission reduction targets in Turkey. With parallel to approach of RGGI in northeast of USA, the policy proposal based on power sector will have impact on one of four of whole country emission in Turkey. In the case of RGGI, cost of pricing emission has been negligible in regards of retail bills. Thus, RGGI is one of good example for pilot emission trading in Turkey to show minimum impact on comparative advantages.

The second point of the pilot emission trading scheme is emission intensity of Turkey is high compared other developing countries. The rate of dependency on fossil fuel energy production is 74.62 percent which cause emission intensity of Turkey to be around 2.8 kg/koe (kilogram per kilogram of oil equivalent energy use), which is higher than mean of World, OECD countries and major developing countries, such as Brazil and Mexico. Thus, the proposal of pilot emission trading scheme is based on the reduction in emission intensity of energy production.

Benchmarking provided a method to introduce the cap by bottom up approach for aim of emission reduction in the fossil fuel based sector. The benchmark value for fossil based energy generation is defined in the proposal by the methodological tool of UNFCCC with aim to be reduced in a linear trend for the pilot scheme period. The aim with having a relatively high benchmark and being reduced over the years is to give the sector the responsibility to orient with carbon pricing mechanism. That is the reason for having OM emission factor as a benchmark differentiated for each fossil fuel types. The proposal offered a linear reduction in the benchmark over the years through the period of 2016 to 2020.

One of the important parts of pilot emission trading scheme offered in the thesis is the auctioning of the allowances which starts with 100 percent free and decrease with 2.5 percent each year of the pilot emission trading scheme. One of the aims with this offer is to target an income for the state which can be mobilized for R&D in adaptation of climate change and incentives for renewable energy projects. The other target of auctioning is to price high portion of carbon emissions for the sector.

Besides auctioning of the allowances along side of free allocation, emission reduction in the sector happens as the installation above benchmark has to reduce their emissions by energy efficiency project or offset their emissions by purchasing emission reduction credits for compensation which can in turn mobilize the carbon market. The offer made in this thesis is the integration of voluntary carbon market in the pilot emission trading mechanism through the registration process under Ministry of Environment and Urbanization.

What is most important for emission trading scheme is the determination of climate policies within the country which is another missing part in Turkey. Although there are some serious steps towards establishment of the scheme, policy makers in Turkey search how to benefit but not to bear the cost which is not possible. As a macroeconomic policy, it is possible within the country to benefit from emission trading scheme once the income from auctioning is effectively directed for new technologies. Since the determination of climate policies is weak, the legal and institutional steps taken forward emission trading scheme in Turkey stay short of the target. The proposal done in this PhD work aims to show policy makers that emission trading scheme could be used as an effective mechanism to create income for the state and introduce carbon pricing in the system.

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Journal Submissions

1. Taşdan, F., Kubík, J. Evolution of Climate Regime: From Global Action to Local Reaction. *Submitted to Review of Environment, Energy and Economics.* Under review process.

2. Taşdan, F., Kubík, J. A Proposal for Design of Pilot Emission Trading System in Turkey. *Submitted to Business and Economics Research Journal, 2013*. Under review process.

Conference Proceedings

3. Taşdan, F., Kuchinsky, O. Is Feed in Tariff Models Effective Enough to Encourage Investment in Renewable Energy Sources? A Comparative Study of Renewable Energy Policies of Turkey and Belarus. *Central European University (CEU)*, 2011. Adaptation and Adaptive Governance of Ecosystems. Budapest, Hungary. 27 Jun- 09 Jul 2011

4. Taşdan, F. The efficiency of carbon markets to promote low carbon economic development. *Dissertation Workshop,* 2011. KlimaCampus Hamburg University: Carbon Markets and their Future: A Social Science Perspective. Hamburg, Germany. 10-11-12 November 2010.

5. Taşdan, F. Clean Development Mechanism – A Real Life Example (Voluntary Carbon Market). *Dissertation Workshop,* 2010. 2nd MIDE Summer School, 'Climate Change and Development' Hochschule für Technik und Wirtschaft Berlin. Berlin, Germany. 29 – 31 July 2010.

6. Taşdan, F. Turkish Voluntary Carbon Market in the Framework of Flexible Market Mechanism of Kyoto Protocol. *Conference Proceedings. 1st National Energy Efficiency Conference,* 2010. Istanbul, Turkey. 15-16 January 2010.

7. Taşdan, F. Voluntary Carbon Projects in Turkey and Possible Impact in Post Kyoto. *Conference Proceedings: International Energy and Environment Conference, ICCI,* 2009. Istanbul, Turkey, 13-14-15 May 2009.

8. Taşdan, F. Overcoming Barriers and Managing Risks for Wind Farm Projects. *Conference Proceedings*, 2009. Carbon Markets Turkey, South Caucasus & Central Asia. Istanbul, Turkey. 29 – 30 September 2009.

CURRICULUM VITAE

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<tr><td>Education</td><td>

2007 – Continuing: PhD Student
PhD Degree (Continuing): Tomas Bata University in Zlin, Department of Management and Economics, thesis theme “A Design of Emission Trading Scheme for Turkey Under Evolution of Global Climate Regime”, Zlin, Czech Republic.
2003-2004: Master of Art in International and Development Economics
FHTW-Berlin, , Berlin, Germany, (2003-2004)
Master Thesis :”Regional Disparities in Turkey and Decentralisation as an Approach of Regional Economic Development”
1997 – 2002: Bachelor Degree in International Relations
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<tr><td>Employment Record and
Key Qualifikation</td><td>

Since 2009 with FutureCamp Turkey.
* Is Co-Founder of FutureCamp Turkey and responsible for all services on emissions trading and Voluntary Carbon Market
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	* Collaborates in the development of climate strategies and Carbon Offset Management * Collaborates in communication of the emissions trading and climate project activities at FutureCamp Turkey * Has knowledge of the project based mechanisms CDM & JI * Has knowledge of UNFCCC regulations and project based mechanism. * Regularly participates in conferences and workshop concerning Kyoto Mechanisms and climate change. • Before: ➢ 2006-2009 Project Manager, Emission Trading and Climate Projects, ERRA Energy Consulting and Investment Ltd. ➢ 2005-2006 Purchasing Officer, Denizli Cement T.A.Ş ➢ 2001 Election Supervisor, OSCE, Kosovo.
Language Skills	• Turkish and Kurdish (mother tongue), English (fluent), German (good)
Skills	• Playing folk instrument, chess and volleyball